United States District Court,
S.D. New York.

ASTRA AKTIEBOLAG, et al,
Plaintiffs.
v.
ANDRX PHARMACEUTICALS, INC,
Defendant.
Astra Aktiebolag, et al,
Plaintiffs.
v.
Cheminor Drugs, Ltd., et al,
Defendants.
Astra Aktiebolag, et al,
Plaintiffs.
v.
Genpharm Inc,
Defendant.
Astra Aktiebolag, et al,
Plaintiffs.
v.
Kremers Urban Development Co., et al,
Defendants.
In re Omeprazole Patent Litigatio,
In re Omeprazole Patent Litigation.

No. 99 Civ. 8926 (BSJ), 99 Civ. 9887 (BSJ), 99 Civ. 8927 (BSJ), 00 Civ. 4467 (BSJ), 98 Civ. 3657 (BSJ), 98 Civ. 8094 (BSJ), 99 Civ. 8928 (BSJ), 99 Civ. 9888 (BSJ)

Oct. 16, 2002.

Owner of patents for pioneer drug to treat gastrointestinal disorders brought infringement action against applicants for approval to market generic versions. The District Court, Jones, J., held that: (1) plaintiff's expert testimony was generally admissible; (2) patents for formulation of drug to control gastric acid production were literally infringed by all but one defendant; (3) formulation patents were neither obvious nor anticipated; and (4) method of use patent was invalid as anticipated.

Two patents infringed; one patent invalid.

5,093,342. Invalid.

Errol B. Taylor, Fredrick M. Zullow, Robert L. Baechtold, Charles P. Baker, Gregory B. Sephton, John D. Carlin, Simon D. Roberts, Tara A. Byrne, Joshua I. Rothman, David M. Conca, Ha Kung Wong, Rachel A. Repka, P. Jason Hadley, Edward J. Callaghan, Rekha Ramani, Fitzpatrick, Cella, Harper & Scinto, New

York City, for AstraZeneca, et al.

Louis M. Solomon, Margaret A. Dale, Colin A. Underwood, Solomon, Zauderer, Ellenhorn, Frischer & Sharp, James V. Costigan, Martin P. Endres, Hedman & Costigan, P.C., New York City, for Andrx Pharmaceuticals, Inc.

Andrew J. Miller, Brian Moriarty, David Novack, Bruce Radin, Frank D. Rodriguez, Budd Larner Gross Rosenbaum Greenberg & Sade, P.C., Short Hills, NJ, for Cheminor Drugs, et al.

Edgar H. Haug, Jeffrey A. Hovden, Charles J. Raubicheck, Christian M. Smolizza, Frommer Lawrence & Haug LLP, New York City, for Genpharm, Inc.

Brian M. Poissant, F. Dominick Cerrito, Ronald M. Daignault, Leo Merken, Pennie & Edmonds LLP, New York City, for Kremers Urban Development Co., et al.

Opinion and Order

JONES**, District Judge.**

I. Introduction FN1

FN1. The following citation forms are used:

Trial Testimony:	"[Witness Name] Tr. [Page:Line]"	
Trial Exhibits:	Astra:	"P_"
	Andrx:	"A_"
	Genpharm:	"G_"
	Cheminor:	"C_"
	KUDCo:	"K_"
Depositions:	"[Witness Name] Dep. Tr. [Page:Line]"	
Patents:	"[Exhibit No.], col. [Column]:[Line]"	

During the course of the trial, multiple versions of the trial transcript were disseminated. It has become apparent to the court that there are minor discrepancies between the transcripts relied on by various parties. Some parties have relied on "corrected" and updated transcripts while others have not; moreover, differences appear in the transcript between the full page text and Min-U-Script versions of each day. In order to clarify the proof relied on for this opinion, the court notes that the court has relied on the following transcripts:

December 6, 2001-January 4, 2002	(Vol. 1-12)	Corrected, Min-U-Script
January 14, 2002-February 20, 2002	(Vol. 13-27)	Uncorrected, Full Page Text
February 21, 2002-April 9, 2002	(Vol. 28-38)	Uncorrected, Min-U-Script
April 15, 2002	(Vol. 39)	Corrected, Min-U-Script
April 17, 2002-May 6, 2002:	(Vol. 40-	Uncorrected, Min-U-Script

	46)	
May 24, 2002	(Vol. 47)	Uncorrected, Full Page Text
May 30, 2002-June 13, 2002	(Vol. 48-52)	Uncorrected, Min-U-Script

Pursuant to 28 U.S.C. s. 1407, the Judicial Panel on Multidistrict Litigation consolidated for pre-trial purposes before this court the patent infringement suits filed by Astra Aktiebolag, Aktiebolaget Hassle, Astra Merck Enterprises Inc., Astra Merck Inc., KBI-E Inc., KBI Inc., Astra Pharmaceuticals L.P., and AstraZeneca L.P. in response to various pharmaceutical companies' requests for permission from the Food and Drug Administration ("FDA") to market generic versions of Prilosec(R), Astra's highly profitable gastric acid inhibiting drug. At various points in this litigation, Plaintiffs have asserted as many as eight different patents against Defendants. At the time of trial, five of those patents remained in the suit. This consolidated trial resolves claims raising issues of infringement and validity asserted in eight different lawsuits involving four groups of Defendants. FN2 The case was tried to the court sitting without a jury for fifty-two trial days between December 6, 2001, and June 13, 2002. The court has considered over six thousand pages of trial testimony, volumes of deposition testimony, thousands of exhibits, and pre-trial and post-trial briefing submitted by all parties. The court has made determinations as to the relevance and materiality of the evidence and assessed the credibility of each witness. Upon the record before the court, pursuant to Federal Rule of Civil Procedure 52(a), the court finds the following facts to have been proven by the appropriate standard of proof and sets forth its conclusions of law.

FN2. This opinion does not address the claims relating to the '281 patent that were the subject of proof in Phases II and IV of the trial and were asserted against only Defendant Andrx. The court will issue a separate opinion resolving the issues remaining as to the '281 patent.

For the reasons stated below, the court finds the following: Defendant Genpharm literally infringes claims 1, 5, 6, 8, 9, 10, 12, and 14 of the '505 patent and claims 1, 6, 7, 10, 11, 12, and 13 of the '230 patent. Defendant Genpharm does not infringe claim 11 of the '505 patent or claim 15 of the '230 patent. Defendants Cheminor literally infringe claims 1, 5, 10, and 14 of the '505 patent and claims 1, 6, 12, and 13 of the '230 patent. Defendants Cheminor do not infringe claim 9 of the '505 patent or claim 11 of the '230 patent. Defendant Andrx literally infringes claims 1, 5, 6, 8, and 10 of the '505 patent and claims 1, 6, 7, 10, and 13 of the '230 patent. Defendant Andrx does not infringe claims 3 or 11 of the '505 patent or claim 15 of the '230 patent. Defendants KUDCo do not infringe the asserted claims of the '505 and '230 patents. The asserted claims of the '505 and '230 patents are valid. Claim 1 of the '342 patent is invalid as anticipated.

A. The Parties

Plaintiff Astra Aktiebolag is a company organized and existing under the laws of Sweden, having its principal place of business at Sodertalje, Sweden. Plaintiff Aktiebolaget Hassle ("Hassle") is a company organized and existing under the laws of Sweden, having its principal place of business at MoIndal, Sweden. Plaintiff Astra Merck Enterprises, Inc. is a Delaware corporation, having its principal place of business at Wilmington, Delaware. Plaintiff Astra Merck, Inc. is a Delaware corporation, having its principal place of business at Wayne, Pennsylvania. Plaintiff KBI-E, Inc. is a Delaware corporation, having its principal place of business at Wilmington, Delaware. Plaintiff KBI, Inc. is a Delaware corporation having its principal place of business at Whitehouse Station, New Jersey. Plaintiff Astra Pharmaceuticals, L.P. is a limited partnership organized under the laws of Delaware having its principal place of business at

Wayne, Pennsylvania. Plaintiff AstraZeneca, L.P. is a limited partnership organized under the laws of Delaware having its principal place of business at Wayne, Pennsylvania. Plaintiffs are referred to collectively as "Astra."

Defendant Andrx Pharmaceuticals, Inc. ("Andrx") is a Florida corporation, having its principal place of business at Davie, Florida. Defendant Cheminor Drugs, Ltd. is a public, limited-liability company incorporated and existing under the laws of India and having a principal place of business in Hyderabad, India. Defendant Reddy-Cheminor, Inc. is a New Jersey corporation, having its principal place of business at Ridgewood, New Jersey. Defendant Schein Pharmaceutical, Inc. is a Delaware corporation, having its principal place of business at Florham Park, New Jersey. These three Defendants are referred to collectively as "Cheminor." Defendant Genpharm Inc. ("Genpharm") is a Canadian corporation, having its principal place of business in Ontario, Canada. Defendant Kremers Urban Development Co., a wholly-owned subsidiary of Schwarz Pharma, Inc. ("Schwarz"), is a Wisconsin corporation, having its principal place of business in Mequon, Wisconsin. Defendant Schwarz is a Delaware corporation, having its principal place of business at Mequon, Wisconsin. These last two Defendants are referred to collectively as "KUDCo."

B. Development of Omeprazole and Astra's Formulations

Omeprazole was the first of a class of medicines called "proton pump inhibitors." (Carlsson Tr. 157:14-19.) FN3 Omeprazole is used in formulations to treat many acid-related diseases, including peptic ulcer disease, reflux disease, and Zollinger-Ellison syndrome. (Carlsson Tr. 159:13-19.) Astra's Prilosec(R) formulation is the result of more than twenty years of research by scientists at Astra's predecessor company, Hassle, in Sweden. (Carlsson Tr. at 219:9-13.) The research that resulted in Prilosec(R) began in 1967 with the start of Project 826. The goal of Project 826 was to develop a drug that could inhibit gastric acid secretion. (Carlsson Tr. at 161:9-13; P656.) In January of 1979, twelve years after the start of Project 826, Astra scientists first made the compound omeprazole. (Carlsson Tr. at 160:11-12, 161:9-13, 171:1-2.) Omeprazole inhibits the production of gastric acid through a unique mechanism. It is taken up and concentrated within the acid-producing parietal cells that line the stomach. In the parietal cell, omeprazole is transformed to its active species, which binds to the proton pump, the enzyme that produces acid, thereby inhibiting acid production. (Carlsson Tr. at 167:16-168:19.)

FN3. Dr. Enar Carlsson began his career at Astra in 1969. In 1980, he was appointed head of pre-clinical pharmacology and project leader for the development of omeprazole. In 1985, he was appointed Vice President of all gastrointestinal research. As project leader, Dr. Carlsson had overall responsibility for the development of omeprazole. (Carlsson Tr. 158:10-24, 159:6-12, 170:10-16.)

Even once the compound itself had been developed, the task of turning the compound omeprazole into a viable medicine proved to be formidable. (Carlsson Tr. at 170:10-171:20.) Before omeprazole could be used as a medicine, Astra had to establish the compound's safety and efficacy in animals and in human beings. In addition, Astra's scientists needed to develop a formulation or dosage form that would deliver the compound to the proper site of action in the body and remain stable both in the body and on the shelf. (Carlsson Tr. 171:8-20.) A group of Astra scientists set out to develop an oral dosage form for omeprazole and its related compounds, (Pilbrant Tr. 1587:2-5), and their work ultimately culminated in the patents at issue in this case. Drs. *Ake Pilbrant FN4 and Kurt Lovgren FN5 were a part of that team, and they are two of the named inventors on Astra's '505 and '230 patents. (Lovgren Tr. 1741:8-18; Pilbrant Tr. 1317:12-14, 1318:21-22; P1, P2A.) Omeprazole proved to be a particularly difficult and challenging molecule to formulate.

Omeprazole is an exceptionally acid labile compound, which means that it degrades quickly in acidic environments like the stomach. (Langer Tr. 295:1-23; Pilbrant Tr. 1587:6-15.) FN6 Omeprazole is also sensitive to heat, moisture, organic solvents, and, to some degree, light. (Carlsson Tr. 172:19-22, 179:14-21; Pilbrant Tr. 1323:25-1324:9, 1641:11-15; Lovgren Tr. 1747:4-11; P916 at 114.) Overcoming omeprazole's multiplesensitivities proved to be a substantial challenge, and Astra considered a number of different approaches to make an oral formulation. (Pilbrant Tr. 1328:12-20.)

FN4. Dr. *Ake Pilbrant began his career at Astra in 1979. He is a scientific advisor in the pharmaceutical and analytical department. During his time at Astra, he has worked in formulation development. Dr. Pilbrant was the sub-project leader for the development of omeprazole. (Pilbrant Tr. 1316:10-1318:7.)

FN5. Dr. Kurt Lovgren began his career at Astra in 1974. He is a scientific advisor in the pharmaceutical formulation department. During his time at Astra, he has worked as a chemist in the chemistry department. Before his current position, which he has held since 1992, he was a research scientist in the pharmacy department. Dr. Lovgren was involved in all phases of omeprazole formulation development. (Lovgren Tr. 1739:20-1741:4, 1748:7-9, 1751:14-1752:3.)

FN6. Dr. Robert Langer is a well-known formulation scientist and a professor at the Massachusetts Institute of Technology. He has published approximately 700 articles and is the inventor on approximately 400 patents. (Langer Tr. 284:22-285:6.) He has more than 90 significant national or international awards and is the only active member of the three national academies: the National Academy of Science, the Institute of Medicine, and the National Academy of Engineering. (Langer Tr. 286:2-287:7.) Dr. Langer's research interests concern drug delivery and biomaterials. Dr. Langer has consulted for over 100 companies, including research and generic pharmaceutical companies. (Langer Tr. 284:25-285:15, 289:3-8.)

First, Astra's formulation scientists tried dissolving omeprazole in oil to protect the omeprazole from gastric juice, but this approach did not work because omeprazole is unstable in oil. (Pilbrant Tr. 1328:21-1329:11.) A very rapidly dissolving dosage form was investigated on the theory that the rate of absorption of omeprazole into the body would be faster than the rate of degradation in the stomach. That also did not work; more than 50% of the drug was lost due to degradation. (Pilbrant Tr. 1329:12-1330:8.) Omeprazole was administered with food on the theory that food would increase the pH in the stomach and allow the omeprazole to survive long enough to be absorbed. This approach also failed; almost 90% of the dose was lost. (Pilbrant Tr. 1330:9-1331:2.) Studies to determine the target point in the digestive system for omeprazole release were undertaken, and Astra's formulation scientists concluded that omeprazole should be released in the proximal part of the small intestine. (Pilbrant Tr. 1326:25-1328:7; 1587:16-21.)

When Astra first tested omeprazole in humans, a buffered suspension was used to make the highly acidic stomach environment more alkaline. (Carlsson Tr. 172:4-13.) Although this buffered suspension was not practical for commercial use, it was used in initial studies in humans, the "Phase I" studies. (Carlsson Tr. 172:14-18.) Drs. Pilbrant and Lovgren decided to try enteric-coated formulations to see if an enteric coat would protect the omeprazole from gastric acid in the stomach. (Pilbrant Tr. 1331:3-1332:4, 1587:25-1588:5.) An enteric coating is typically a polymer film that is insoluble in stomach acid, but soluble in the intestine, (Pilbrant Tr. 1331:8-22, 1332:5-11), so the enteric-coating protects material that degrades in the acidic environment of the stomach until it reaches the small intestine. Drs. Pilbrant and Lovgren did a

number of pre-formulation studies to determine whether enteric coatings, which are polymeric polyacids, would have a deleterious effect on omeprazole. The results of the studies showed that the enteric coating materials had approximately the same interaction as most other common pharmaceutical excipients if these excipients did not contain a lot of water. Astra determined that an enteric coating was a viable approach to explore further. (Pilbrant Tr. 1331:17-1333:9.)

The Astra scientists studied a number of different types of cores to be used in formulation, including tablet and pellet-type cores. (Pilbrant Tr. 1333:21-24.) Astra also tried a number of different processes for making pellet-type cores. First, Dr. Pilbrant and his group tested cores formed by compressing omeprazole together with pharmaceutical excipients. The Astra scientists also experimented with melt granulations, in which omeprazole was dissolved or dispersed in material that had been heated to its melting point and then cooled down to form a solid core. Dr. Pilbrant and his group constructed cores by depositing an active drug layer of omeprazole onto an inert sugar sphere. Finally, the Astra scientists experimented with extrusion spheronization. Astra eventually settled on that extrusion spheronization process for preparing its cores. (Pilbrant Tr. 1333:25-1335:4.) In Astra's extrusion spheronization work, water was added to a powder mixture to make a dough. When the plasticity was suitable, the dough was pressed through a machine to make spaghetti-like strings. These strings were then sectioned in small parts that were put on a rotating plate where the small parts were rounded. (Pilbrant Tr. 1335:5-14.)

After making and testing numerous formulations, Astra eventually arrived at a formulation used in Phase II clinical experiments. The Phase II formulation consisted of a core containing omeprazole mixed together with some excipients and alkaline reacting compounds ("ARCs") and an enteric coating that covered the core and included hydroxypropyl methylcellulose phthalate ("HPMCP"). (Pilbrant Tr. 1339:6-11; Lovgren Tr. 1747:22-1748:6.) While the Phase II formulation was adequate for conducting short term Phase II clinical trials, it did not solve all the issues related to omeprazole formulation. (Carlsson Tr. 174:6-11.) For example, Dr. Pilbrant and other Astra scientists realized that the Phase II formulation would discolor on long term storage. Also, although Phase II formulations were ordinarily colored off-white to light beige, Dr. Pilbrant and others observed that sometimes the formulation would become discolored during the enteric coating process. (P1, col. 1:52-56; Pilbrant Tr. 1339:18-1340:22, 1591:15-25; Lovgren Tr. 1751:3-13.) The Astra scientists were also concerned because the Phase II formulation had limited gastric acid stability. Gastric acid resistance is a measure of how effective the formulation is in resisting attack by acidic solutions. (Pilbrant Tr. 1341:18-1342:14.) The Phase II formulation had inferior gastric acid resistance and often proved to be below Astra's requirement of greater than 85% gastric acid resistance. (Lovgren Tr. 4941:14-4942:2.) An orally-administered formulation can remain in the patient's stomach for as long as two hours. If the enteric coating fails during that time, the omeprazole will be destroyed. Testing for gastric resistance is, therefore, a requirement. If, as with the Phase II formulation, only 75% of the production batch passes the test, a very large percentage of the production cannot be sold. (Pilbrant Tr. 1341:9-1342:20.) Thus, Astra was not satisfied with the Phase II formulation's gastric resistance (too much of it degraded in the stomach) or with its long-term storage stability (the omeprazole degraded and became discolored) and concluded that the formulation would not be suitable for marketing as a dosage form. (Pilbrant Tr. 1339:21-1340:22, 1341:8-17, 1342:10-14; Carlsson Tr. 174:10-12, 183:20-21, 213:1-7.) The shelf-life of the Phase II formulation would be no more than about 18 months. (Lovgren Tr. 1732:24-1733:5.) There were also concerns expressed by foreign regulators about discoloration. (Carlsson Tr. 216:14-20, 217:13-16; Pilbrant Tr. 1381:6-10.) Accordingly, even after developing the Phase II formulation, Astra sought to solve these problems.

To develop a new formulation that could be used in Phase III long term clinical trials and sold

commercially, Astra tested many potential formulations. Some had good stability in the gastric juice in the stomach, but inadequate shelf-life stability. Others had adequate shelf-life stability but inadequate stability in the stomach. (Carlsson Tr. 183:20-184:10; P609.) Drs. Pilbrant and Lovgren and the other Astra scientists tried numerous approaches to solve the dual, and apparently conflicting, problems of long term stability and adequate gastric acid resistance. (Pilbrant Tr. 1344:3-1345:23.) Including certain alkaline substances in the core as with the Phase II formulation solved the problem of the chemical stability of omeprazole by stabilizing the omeprazole during manufacturing and storage, but it exacerbated the problem of gastric acid resistance. (Pilbrant Tr. 1344:9-23.) During development, the Astra scientists learned that if the amount of alkaline material in the core was increased, this could weaken the enteric coat and decrease gastric acid resistance. This would increase the risk that water would leak in through the enteric coating and promote a reaction between the acidic enteric coating and the alkaline material in the core, which in turn would cause degradation of the enteric coating and worsen gastric acid resistance. (Pilbrant Tr. 1344:24-1345:23, 1610:1-5.) Water permeation has a deleterious effect on the omeprazole core because, if sufficient water diffuses in, it may cause an alkaline solution inside the coating to dissolve the enteric coating from the inside, which, in turn, will worsen gastric acid resistance. (Pilbrant Tr. 1345:12-23.)

To solve the gastric resistance problem without sacrificing stability, Astra tried numerous modifications to the formulation. (*See* Pilbrant Tr. 1345:24-1349:15.) For example, Drs. Pilbrant and Lovgren tried to make the enteric coating tighter-less permeable to gastric juice. (Pilbrant Tr. 1345:24:-1346:4.) Dr. Pilbrant tried a thicker enteric coating, and he tried to make the enteric coating more hydrophobic, or water-repellent, by adding hydrophobic plasticizers of different kinds. (Pilbrant Tr. 1346:5-1347:4.) Dr. Pilbrant tried adding a water insoluble polymer within the enteric-coating itself to see if that would improve diffusion tightness. (Pilbrant Tr. 1347:5-18.) He tried mixing different enteric coating materials. He even tried putting one enteric coating on top of another to see if that would improve tightness. (Pilbrant Tr. 1347:19-1348:4.) Dr. Pilbrant tried putting an outer coating with a hydrophobic substance on top of the enteric coating, and he tried this with different amounts of the hydrophobic substance. Astra found, however, that if they used only a small amount of hydrophobic substance, it did not improve gastric acid resistance. On the other hand, if they used a large amount of hydrophobic substance outside the enteric coating, this improved gastric acid resistance, but it caused reduced omeprazole release. (Pilbrant Tr. 1348:5-17.) None of these things worked to improve gastric resistance, and repeated attempts to improve the tightness of the enteric coat had failed. (Pilbrant Tr. 1345:9-1349:15.)

Ultimately, Drs. Pilbrant and Lovgren decided to try to use a subcoating between the omeprazole-containing core and the enteric coating. (Pilbrant Tr. 1348:18-22; Lovgren 1786:7-25.) It was thought that a hydrophobic coating, one which would be impermeable to water, might solve the problem, but Astra did not try that approach because they had already experimented with a hydrophobic outer coating and found that it did not work. (Pilbrant 1348:18-1349:11.) Eventually, the Astra scientists decided to experiment with a water soluble subcoat, but it was thought that the approach would not keep water from leaking in through the enteric coating. (Pilbrant Tr. 1349:16-1350:2.) Experimenting with the water soluble subcoat, however, revealed that it actually increased both gastric acid resistance and long term stability. (Pilbrant Tr. 1349:16-1350:6.) The Astra scientists also noticed that the subcoat reduced the sporadic discoloration that could occur during the enteric-coating process as well as the discoloration upon long term storage, which had been observed in the Phase II formulation. (Pilbrant Tr. 1592:6-22.) A formulation that included omeprazole with an alkaline reacting compound ("ARC") in the core, a water soluble subcoat, and an enteric coating was selected for Phase III clinical trials. (Pilbrant Tr. 1339:6-11, 1351:5-10; Lovgren Tr. 1747:22-1748:6.) After testing its Phase III formulation, Astra patented its invention and obtained FDA approval to market Prilosec(R). The Phase III formulation proved to be more stable than the Phase II formulation. (Pilbrant Tr.

1720:22-1721:16, 1731:16-19.) The Phase III formulation is the same as the one that Astra ultimately has used on the market, except that the amount of the enteric-coating polymer is slightly increased in the market formulation. (PilbrantTr. 1597:5-12.) There are no differences in long term stability between the Phase III formulation and the market formulation. (Pilbrant Tr. 1600:6-20.)

The gastric acid resistance data for the Phase II (not subcoated) omeprazole pellets formulation were typically in the 82%-89% range. (P934; Lovgren Tr. 4937:7-11.) This level of gastric acid resistance was considered unacceptable because, with an 85% gastric acid resistance test limit, many batches would fail the test and have to be discarded. (Lovgren Tr. 4938:12-4939:22.) The formulation ultimately claimed in the '505 patent, the Phase III formulation, typically exhibited gastric acid resistance of about 96%. (P907; Lovgren Tr. 4940:12-4941:13.) This improved gastric acid resistance was considered important because it greatly reduced the risk of discarding borderline batches. (Lovgren Tr. 4941:14-4942:7.) The Phase III formulation proved to have consistent gastric acid resistance that was well above Astra's 85% requirement and remained stable for over three years on storage. (P907 at AA00075815; Lovgren Tr. 4941:3-4942:2, 4942:10-16.) The first application for omeprazole was filed with the FDA in 1986, and Prilosec(R) was finally approved for use in the United States in 1989. (Carlsson Tr. 186:12-17.) Astra filed patent applications for its omeprazole formulation inventions in 1986. The formulation described in U.S. Patent Nos. 4,786,505 (the " '505 patent") and 4,853,230 (the " '230 patent") includes the three main elements that Drs. Pilbrant and Lovgren employed to make the Phase III formulation. (Pilbrant Tr. 1321:2-16; P1; P2A.) The commercial Prilosec(R) formulation is covered by the '505 and '230 patents and is substantially identical to Example 2 of the '505 patent.

C. Patent Litigation Under the Hatch-Waxman Act

These infringement actions arise out of Abbreviated New Drug Applications ("ANDAs") filed by Defendants. The Drug Price Competition and Patent Term Restoration Act, Pub.L. No. 98-417, 98 Stat. 1585 (1984) (codified as amended at 21 U.S.C. s. 355 and 35 U.S.C. s. 271(e) (1994)), also known as the Hatch-Waxman Act, amended the Federal Food, Drug, and Cosmetic Act ("FDCA"), Pub.L. No. 52-675, 52 Stat. 1040 (1938) (codified as amended at 21 U.S.C. s.s. 301-397 (1994)), to permit filing of an ANDA to expedite FDA approval of a generic version of a drug previously approved by the FDA. *See* Bayer AG v. Elan Pharm. Research Corp., 212 F.3d 1241, 1244 (Fed.Cir.2000). Under the Hatch-Waxman Act, an applicant may file an ANDA with the FDA requesting approval to market a generic drug without undergoing the same expensive and time-consuming FDA approval process undergone by the maker of the branded version of the drug, often called the pioneer drug, by (1) demonstrating that the generic drug is the bioequivalent of the branded drug and (2) certifying that manufacturing, marketing and selling the drug will not infringe the patent rights held by the patentee of the pioneer drug.

The statute prescribes a precisely defined four-step procedure for litigating patent disputes between the innovator drug company and the generic applicant. *See* 21 U.S.C. s. 355(j)(2)(A)(vii) *et seq*. The holder of the New Drug Application for the pioneer drug lists all of its patents that claim the drug or a use of the drug in the book entitled *New Drug Products with Therapeutic Equivalence Evaluations* (referred to as the "Orange Book") published by the FDA. *See* 21 U.S.C. s. 355(b)(1). In its ANDA, a generic applicant must certify one of the following four statements with respect to the patents listed under the pioneer drug in the Orange Book: no patent information has been filed ("Paragraph I" certification), the patent has expired ("Paragraph II" certification), the patent soon will expire on a specified date ("Paragraph III" certification), or the patent "is invalid or will not be infringed by the manufacture, use, or sale of the new drug" covered by the ANDA ("Paragraph IV" certification). 21 U.S.C. s. 355(j)(2)(A)(vii)(I)-(IV). Only one type of

certification is pertinent here: a so-called "Paragraph IV" certification. In a Paragraph IV certification, the generic manufacturer seeks to obtain FDA approval before a listed patent expires and asserts that the patent listed in the Orange Book is either not infringed or invalid. Following the issuance of a Paragraph IV certification, the Hatch-Waxman Act requires the generic company to give notice of the Paragraph IV certification to the innovator who listed the patent with the FDA. 21 U.S.C. s. 355(j)(2)(B). The FDA can approve an ANDA containing a Paragraph IV certification unless the patent holder files suit within forty-five days of receiving notice of a Paragraph IV certification having been filed with the FDA. 21 U.S.C. s. 355(j)(5)(B)(iii); 21 C.F.R. s. 314.107(f)(2). If a patent infringement action is timely brought, final marketing approval of the ANDA cannot occur before expiration of thirty months or a decision of a court. *See* 21 U.S.C. s. 355(j)(5)(B)(iii).

The term of Astra's basic omeprazole patent covering the chemical formula for omeprazole and its administration for gastric acid inhibition, U.S. Patent No. 4,255,431 (the " '431 patent") expired on October 5, 2001. FN7 The '431 patent is not, however, the only patent Astra has listed for omeprazole in the Orange Book. The other patents at issue in this litigation were also listed. Defendants have each issued Paragraph IV certifications against the patents-in-suit. Defendants certified in their ANDA submissions for generic omeprazole that the patents-in-suit are "invalid or will not be infringed by the manufacture, use, or sale" of their generic products. *See* 21 U.S.C. s. 355(j)(2)(A)(vii)(IV). Based on those ANDA filings, Astra filed a patent infringement suit pursuant to 35 U.S.C. s. 271(e)(2)(A), alleging that the generic omeprazole formulations for which Defendants seek approval will infringe or induce infringement of the asserted claims.

FN7. U.S. Patent No. 4,255,431 expired on April 5, 2001. However, the FDA granted Astra a six-month pediatric exclusivity extension of the patent term pursuant to 21 U.S.C. s. 355a.

Although no actual infringement has taken place because Defendants' omeprazole products have not been released in the market, section 271(e)(2)(A) "define [s] a new (and somewhat artificial) act of infringement for a very limited and technical purpose that relates only to certain drug applications." Eli Lilly & Co. v. Medtronic, Inc., 496 U.S. 661, 676, 110 S.Ct. 2683, 110 L.Ed.2d 605 (1990). Section 271(e)(2)(A) provides a patentee with a cause of action for patent infringement based solely upon the filing of an ANDA containing a Paragraph IV certification implicating a plaintiff's patent rights. The artificial infringement arising by operation of law is an integral part of a statutory scheme designed to allow pharmaceutical manufacturers to market, and the public to purchase, generic drugs as soon as possible after the expiration of patents covering the pioneer drug. The infringement suit under section 271(e)(2) permits the patentee, in this case Astra, "to challenge the certification-i.e. to assert inter alia that the commercial manufacture, use or sale of the new drug *would infringe* its patent." Glaxo, Inc. v. Boehringer Ingelheim Corp., 954 F.Supp. 469, 473 (D.Conn.1996) (emphasis added). The patentee's challenge to the certification provides the court with a justiciable controversy, permitting it to efficiently resolve patent issues in advance of the generic drug's release.

[1] As an initial matter, Defendants challenge Astra's standing to assert any method of treatment claims against Defendants on the grounds that there has been no direct infringement, so Astra cannot prove actual intent to induce infringement on Defendants' part. In response, Astra argues that no proof of intent is required because the infringement claims are all cognizable under 35 U.S.C. s. 271(e)(2)(A). The question of whether a pioneer drug company holding a patent covering a method of using a drug may sue a generic manufacturer based solely on an ANDA filing is a novel issue of law. *See* Allergan, Inc. v. Alcon Labs., Inc., 200 F.Supp.2d 1219, 1225 (C.D.Cal.2002). This court knows of only two other cases dealing squarely

with this issue. *See* Allergan, 200 F.Supp.2d 1219; Warner-Lambert Co. v. Apotex Corp., No. 98 C 4293, 1999 WL 259946 (N.D.Ill. Apr. 8, 1999).

"Statutory interpretation begins with the plain language of the statute. If the text of the statute is clear, this Court looks no further in determining the statute's meaning." United States v. Mendoza, 244 F.3d 1037, 1042 (9th Cir.2001). When the language of the statute is plain, the duty of interpretation does not arise, and the court is limited to enforcing the statute according to its own terms. Manley v. Secretary of HHS, 18 Cl.Ct. 799, 813 (1989). Consequently, this court looks to the plain language of section 271(e)(2)(A) to determine whether Astra has alleged infringement properly. Section 271(e)(2)(A) states that "it shall be an act of infringement to submit an [ANDA] for a drug claimed in a patent or the use of which is claimed in a patent." 35 U.S.C. s. 271(e)(2)(A). The plain language of section 271(e)(2)(A) makes clear that the contemplated act of infringement is the submission of an ANDA for a drug, the use of which is claimed in a patent. Here, Astra filed suit pursuant to section 271(e)(2)(A) alleging that the generic omeprazole products for which Defendants were seeking approval would infringe Astra's patents because Defendants were seeking approval for uses of omeprazole falling squarely within the scope of the asserted method of use claims. Thus, Astra claims that Defendants directly infringed the method of use claims by filing their ANDAs.

At least one other court has concluded that a pioneer drug company may properly bring suit for direct infringement of a patent when an ANDA filed by a generic drug maker directly covers a method of use claimed in the pioneer drug company's patent. In *Allergan,* the patent at issue covered the drug which was the subject of the ANDA, but it did not cover the particular method of use for which the generic drug company sought approval. In concluding that section 271(e)(2) did not apply, the *Allergan* court noted that under the Hatch-Waxman statutory framework, it is "the filing of a Paragraph IV certification that puts into process the notice to the patentee allowing it to bring suit under Section 271(e)(2)." Allergan, 200 F.Supp.2d at 1230. When a generic drug company seeks approval for an indication that *is not* protected by the patent, that generic should not be required to file a Paragraph IV certification, so section 271(e)(2) is not implicated. *See* Allergan, 200 F.Supp.2d at 1230. Conversely, where a generic drug company seeks approval for an indication that *is* covered by a patent, a Paragraph IV certification is required, and section 271(e)(2), which entitles a pioneer drug company to bring suit for direct infringement, is implicated. Allergan, 200 F.Supp.2d at 1229-30 ("Infringement actions under Section 271(e)(2) must therefore be limited to the Controlling Use Patents," which that court defined as "all use patents which claim an indication for the drug which the applicant is seeking approval.") (quoting H.R.Rep. No. 98-857(II) at 13, 1984 U.S.C.C.A.N. at 2697). Since the method of use claims for which the court considers infringement proof in this case are controlling use claims, Astra has properly brought suit under section 271(e)(2)(A) for direct infringement. As such, the court need not consider issues related to a claim for inducement under section 271(b), and Astra need not establish any inducement or intent on the part of Defendants to establish infringement of either claim 10 of the '505 patent or claim 13 of the '230 patent, both methods of treating gastrointestinal disease.FN8

FN8. Contrary to the *Allergan* court's characterization, this court did not squarely address in its summary judgment opinion the issue of whether s. 271(e)(2) or s. 271(b) was the appropriate section under which Plaintiff's method of treatment infringement claims should be analyzed. The briefing submitted by the parties with respect to these claims focused on whether intent had been or could be demonstrated in this case. As such, this court found a question of fact was raised as to whether Defendants had the requisite intent to induce. However, this court now finds that intent is not the relevant inquiry, as these infringement claims arise under s. 271(e)(2), rather than s. 271(b).

II. Claim Construction

A. Legal Standards

[2] [3] [4] [5] [6] [7] In the first of the two steps necessary to the infringement analysis, the court construes the allegedly infringed patent claims to establish their meaning and scope. *See* Markman v. Westview Instruments, Inc., 52 F.3d 967, 976 (Fed.Cir.1995), *aff'd,* 517 U.S. 370, 116 S.Ct. 1384, 134 L.Ed.2d 577 (1996); Graco, Inc. v. Binks Mfg. Co., 60 F.3d 785, 791 (Fed.Cir.1995). The interpretation of patent claims through claim construction is a determination made as a matter of law. Markman v. Westview Instruments, Inc., 517 U.S. 370, 384, 116 S.Ct. 1384, 134 L.Ed.2d 577 (1996). The court construes the claims of each patent according to the hierarchy of evidence articulated in *Markman,* looking first to the intrinsic evidence of the patent. 52 F.3d at 979 ("To ascertain the meaning of claims, we consider three sources: The claims, the specification, and the prosecution history.") (internal citations omitted). The court begins with the language of the disputed claims, which define the scope of the invention and the rights of the patentee. Markman, 517 U.S. at 373-74, 116 S.Ct. 1384; Johnson Worldwide Assocs., Inc. v. Zebco Corp., 175 F.3d 985, 989 (Fed.Cir.1999); Bell Comms. Research, Inc. v. Vitalink Comms. Corp., 55 F.3d 615, 619 (Fed.Cir.1995). It is the claims that define the invention. *See* Autogiro Co. v. United States, 181 Ct.Cl. 55, 384 F.2d 391, 395-96 (1967). They are the measure against which validity and infringement are gauged. *See* SRI Int'l v. Matsushita Elec. Corp. of Am., 775 F.2d 1107, 1121 (Fed.Cir.1985). The court may consider not only the language of the disputed claims themselves, but also the language of the unasserted claims. Claims should be construed as they would by a person of ordinary skill in the art. Ekchian v. Home Depot, Inc., 104 F.3d 1299, 1302 (Fed.Cir.1997). Moreover, the court must construe the words of the claim as of the time of the invention or when the application was first filed. Leggett & Platt, Inc. v. Hickory Springs Mfg. Co., 285 F.3d 1353, 1357 (Fed.Cir.2002). Thus, the focus in construing disputed claim terms is not the subjective intent of the inventor or examiner; rather, it is the objective test of what one of ordinary skill in the art at the time of the invention would have understood a claim term to mean. *See* Markman, 52 F.3d at 977.

[8] [9] [10] [11] Each and every word in a claim must be construed to have meaning. Exxon Chemical Patents, Inc. v. Lubrizol Corp., 64 F.3d 1553, 1557 (Fed.Cir.1995). The terms of a claim are generally given their ordinary and customary meaning as of the date of the application for the patent. *See* Kopykake Enters. v. Lucks Co., 264 F.3d 1377, 1383 (Fed.Cir.2001). They must also be read in accordance with the precepts of English grammar. In re Hyatt, 708 F.2d 712, 714 (Fed.Cir.1983). This strong presumption "in favor of the ordinary meaning of claim language as understood by one of ordinary skill in the art" may be overcome where: "1) the patentee has chosen to become his or her own lexicographer by clearly and explicitly defining the claim term; or 2) where a claim term would deprives the claim of clarity such that there is no means by which the scope of the claim may be ascertained from the language used." Bell Atl. Network Servs., Inc. v. Covad Communications Group, Inc., 262 F.3d 1258, 1268 (Fed.Cir.2001) (quotations omitted). When a patentee chooses to be his own lexicographer and uses terms in a manner other than their ordinary meaning, the intended definition of the term must be "clearly stated in the patent specification or file history." *Vitronics,* 90 F.3d at 1582; *see also* Novo Nordisk of N. Am. v. Genentech, Inc., 77 F.3d 1364, 1368 (Fed.Cir.1996); Intellicall, Inc. v. Phonometrics, Inc., 952 F.2d 1384, 1387 (Fed.Cir.1992).

[12] [13] In that respect, resort to the specification provides guidance. *See Vitronics,* 90 F.3d at 1582. The court must look to the specification and the file history to see if the inventor varied the ordinary meaning of particular claim terms or if a claim term is unclear. Phonometrics, Inc. v. N. Telecom Inc., 133 F.3d 1459, 1466 (Fed.Cir.1998). Specifications can be the "single best guide to the meaning of a disputed term" and,

therefore, are "always highly relevant to the claim construction analysis." Novo Nordisk A/S v. Becton Dickinson & Co., No. 96 Civ. 9506, 2000 WL 294852, at (S.D.N.Y. Mar. 21, 2000); *see* Comark Communications, Inc. v. Harris Corp., 156 F.3d 1182, 1187 (Fed.Cir.1998) (using specifications to ascertain the meaning of the claim term as it is used by the inventor in the context of the entirety of his invention); Amhil Enters. Ltd. v. Wawa, Inc., 81 F.3d 1554, 1559 (Fed.Cir.1996) (recognizing that the "entire specification" should be considered in interpreting claim language). A patentee need not deliberately or precisely define a term in a lexicographical manner, but may provide a definition by implication. *Vitronics,* 90 F.3d at 1582. Thus, the Court of Appeals for the Federal Circuit has "specifically held that the written description of the preferred embodiments can provide guidance as to the meaning of the claims" that are to be construed, "even if the guidance is not provided in explicit definitional format." Bell Atlantic Network Servs., Inc. v. Covad Communications Group, Inc., 262 F.3d 1258, 1268-70 (Fed.Cir.2001) (citing SciMed Life Sys., Inc. v. Advanced Cardiovascular Sys., Inc., 242 F.3d 1337, 1344 (Fed.Cir.2001)).

[14] This court must be careful when turning to the specification for guidance during claim construction. Examples may aid in the proper construction of a claim term; however, the scope of a claim is not necessarily limited by the examples. Ekchian v. Home Depot, Inc., 104 F.3d 1299, 1303 (Fed.Cir.1997). Similarly, preferred embodiments like those often present in a specification are not claim limitations. Laitram Corp. v. Cambridge Wire Cloth Co., 863 F.2d 855, 865 (Fed.Cir.1988). It is improper either to limit the claim to preferred embodiments or examples in the specification or to broaden the scope of a claim to include embodiments not covered by the claim language. *See* Novo Nordisk of N. Am. v. Genentech, 77 F.3d 1364, 1369 (Fed.Cir.1996); Transmatic, Inc. v. Gulton Indus., Inc., 53 F.3d 1270, 1278 (Fed.Cir.1995); *compare* Ekchian, 104 F.3d at 1303, *with* Philip v. Mayer Rothkopf Indus., Inc., 635 F.2d 1056, 1061 (2d Cir.1980). This is not to say that resort to the specification should be avoided. The court can and should use the specification to define claim terms. *See* Phonometrics, Inc. v. Northern Telecom, Inc., 133 F.3d 1459, 1466 (Fed.Cir.1998) ("[Patentee] of course argues that additional limitations cannot be imported into a claim from the written description. We may, however, construe a specifically claimed limitation in light of the specification, which is all we do here."); Ethicon Endo-Surgery, Inc. v. United States Surgical Corp., 93 F.3d 1572, 1578 (Fed.Cir.1996) ("Here, the district court did not import an additional limitation into the claim; instead, it looked to the specification to aid its interpretation of a term already in the claim, an entirely appropriate practice.").

[15] As noted, aside from the claim language and the specification, a proper claim construction analysis requires consideration of the patent prosecution history. Markman, 52 F.3d at 980 ("The court has broad power to look as a matter of law to the prosecution history of the patent in order to ascertain the true meaning of language used in the patent claims."). The specification and prosecution history are both important evidence of "the problem the inventor was attempting to solve," which is critical to properly construing the scope and meaning of the claims of the patent. CVI/Beta Ventures, Inc. v. Tura LP, 112 F.3d 1146, 1160 (Fed.Cir.1997) (citing Applied Materials v. Advanced Semiconductor Materials, 98 F.3d 1563, 1573 (Fed.Cir.1996)). Like the specification, the prosecution history is intrinsic evidence and is "often of critical significance in determining the meaning of the claims." *Vitronics,* 90 F.3d at 1582; *see Alpex Computer Corp. v. Nintendo Co. Ltd.,* 102 F.3d at 1220. In addition, prior art considered by the United States Patent and Trademark Office ("USPTO") during prosecution of a patent comprises intrinsic evidence for claim construction. *Vitronics,* 90 F.3d at 1583. These three items-the claim language, the specification, and the prosecution history-are the intrinsic evidence and are the primary evidentiary sources for claim construction.

[16] In most situations, a thorough consideration of the intrinsic evidence will resolve any ambiguity in a

disputed claim term. *Vitronics,* 90 F.3d at 1583. When the meaning cannot be determined by intrinsic evidence, a court may turn to extrinsic evidence to construe the claims in a patent. *Vitronics,* 90 F.3d at 1584. Extrinsic evidence "consists of all evidence external to the patent and prosecution history, including expert and inventor testimony, dictionaries, and learned treatises" and may be useful to show the state of the art at the time of the invention. Markman, 52 F.3d at 980. "The court may, in its discretion, receive extrinsic evidence in order 'to aid the court in coming to a correct conclusion' as to the 'true meaning of the language employed' in the patent." Markman, 52 F.3d at 980 (internal quotations omitted); *see also* Key Pharms. v. Hercon Labs. Corp., 161 F.3d 709, 716 (Fed.Cir.1998) (holding that trial court can hear extrinsic evidence to educate itself about patent and relevant technology, but may not use extrinsic evidence to vary or contradict claim terms). When consideration of extrinsic evidence is necessary to understand the meaning of claim terms, the court may consider testimony on how people skilled in the art would understand technical terms in the claims. Cybor Corp. v. FAS Techs., Inc., 138 F.3d 1448, 1475 (Fed.Cir.1998) ("The objective of claim interpretation is to discern the meaning of the claim terms to one of ordinary skill in the art at the time of the invention.") Where the intrinsic evidence unambiguously describes the scope of the patent, however, it is improper to rely on extrinsic evidence to alter the meaning of the claims. *See Vitronics,* 90 F.3d at 1584. Thus, in most instances, a thorough consideration of the intrinsic evidence alone will resolve any ambiguity in a disputed claim term, and the court may not rely on extrinsic evidence to construe the scope of a claim term unless the court first finds that the term is ambiguous even in light of the intrinsic evidence. *See Vitronics,* 90 F.3d at 1583-85.

B. The '505 and '230 Patents FN9

FN9. Prior to the commencement of trial, the court ordered all parties to exchange claim construction charts and to submit claim construction briefing. In connection with those orders, several parties who are Defendants in later-filed actions that are part of this Multidistrict Litigation, *In re Omeprazole Patent Litigation,* M21-81 (S.D.N.Y.), also provided claim construction charts to Astra and provided the court with briefing containing arguments on claim construction issues relevant to the '505 and '230 patents. Defendants Lek, Impax, Mylan, and Eon Labs (collectively the "Second Wave Defendants"), provided claim construction briefing to the court on November 5 and November 13, 2001. The Second Wave Defendants point out, and the court agrees, that each of the eight defendants, First and Second Wave, has a somewhat different formulation or ANDA product that makes the construction of certain claim terms more relevant than others for that party. Moreover, the various Defendants in this litigation are competitors with each other. Any Defendant, whether First or Second Wave, might be severely prejudiced by the incentive, or lack of incentive, for other Defendants to contest certain of Astra's proposed constructions that would prejudice the other Defendants, their competitors. However, the cases involving the Second Wave Defendants have not been consolidated with the cases currently under consideration for purposes of trial. Therefore, while allowing participation by the Second Wave Defendants is consistent with the Judicial Panel for Multidistrict Litigation's transfer of these actions to this district for inclusion in coordinated or consolidated proceedings, it is fair only to the extent that no party to this action is prejudiced by the court's consideration of the Second Wave Defendants' arguments. Where appropriate, the court has considered the arguments raised by the Second Wave Defendants in the interests of addressing the claim construction disputes in this Multidistrict Litigation fully and comprehensively; however, the court has incorporated references to their arguments only where doing so would not, in any way, prejudice any party currently on trial before the court.

Astra filed the patent application that led to the '505 patent in the USPTO on April 20, 1987. Astra also filed

the patent application that led to the '230 patent on April 20, 1987. Both applications claim priority based on a United Kingdom patent application filed on April 30, 1986. There are no substantive differences between either the '505 patent application or the '230 patent application and the British priority document. (Lovgren Tr. 1742:24-1743:3, 1745:3-8; *compare* P1, and P2A, *with* P1056 and P8A.) FN10 The '505 patent discloses particular oral pharmaceutical formulations for the drug molecule omeprazole, processes for making those formulations, and methods of treating gastrointestinal disease using those formulations. (P1, col. 1:5-11.) The '505 patent also describes some of the difficulties involved in making an omeprazole formulation. (*See, e.g.,* P1, col. 1:21-34.) The problems discussed in the specifications of the '505 and '230 patents include the very same problems identified in the development history described above. (*See* P1, cols. 1-15; P2A cols. 1-4.) For example, omeprazole is unstable in stomach acid, where it degrades rapidly unless special precautions are followed. (*See, e.g.,* P1, col. 1:17-39.) The omeprazole molecule is also sensitive to moisture and organic solvents. (P1, col. 1:33-34.) Despite that sensitivity to solvents, omeprazole is not very soluble in the water found in bodily fluids. (Pilbrant Tr. 1325:1-3.) Consequently, the drug is difficult to handle and formulate.

FN10. One difference is worthy of note: claim 1 of the '230 patent is different from the original claim 1 of the '230 patent filed in the priority document. Specifically, the language "wherein the subcoating layer isolates the alkaline reacting core from the enteric coating layer such that the stability of the preparation is enhanced" was added to the '230 patent. (P8A, '230 Patent File History, Original Claim 1 at p. 21 of original application; amended claim 1 at p. 2 of Amendment 12/19/98.) This language was added in an attempt to overcome an obviousness objection. (P8A, Amendment of 12/19/98, at 4.)

The '505 patent claims a new formulation that, among other things, permits the omeprazole drug molecule to pass unharmed through the stomach's acidic environment and to dissolve rapidly in the upper portion of the small intestine. (P1, col. 3:14-18, col. 5:19-58.) The '505 patent inventors were faced with multiple problems of improving manufacturing stability, storage stability, and stability of the formulation in the stomach while maintaining the bioavailability of the omeprazole molecule.FN11 (P1, col. 1:40-col. 2:13, col. 14:64-col. 16:40.) The solution to the multiple stability problems associated with omeprazole devised by the inventors was a formulation that comprises (1) a core region containing omeprazole and an ARC or an alkaline salt of omeprazole optionally mixed with an ARC; (2) an inert subcoating that is water soluble or rapidly disintegrating in water and disposed on the core region; and (c) an outer enteric layer disposed on the subcoating. (*See, e.g.,* P1, col. 3:20-32.) As a result, the omeprazole in the patented formulation is available for absorption into the bloodstream, while, at the same time, possessing superior stability. (P1, col. 3:14-20.)

FN11. Bioavailability is the extent to which, and the speed at which, the drug enters the blood stream.

Like the '505 patent, the '230 patent relates to particular oral pharmaceutical formulations, processes for making those formulations, and methods of treating gastrointestinal disease using those formulations. (P2A, col. 1:5-12.) The '230 patent differs from the '505 patent in that it covers a class of benzimidazole compounds, including omeprazole, and their salts, not just omeprazole. (P2A, col. 1:28-col. 2:33.) The intrinsic evidence for both patents overlaps. The '505 and '230 patent claims share much common language, common background provided by their specifications, and prosecution histories that overlapped both in time and in substance. Not surprisingly, because the '505 and '230 patents have the same inventors and their inventive and claimed subject matters overlap, the claim language for those two patents also overlaps. The court acknowledges that the claims in each of these patents must be construed independently. Lemelson v.

TRW, Inc., 760 F.2d 1254, 1267 (Fed.Cir.1985) ("[T]he scope of each individual claim must be examined on its own merits, apart from that of other claims, even in the same patent."). However, the claims of the '505 and '230 patents that have been asserted against Defendants often are directly paired together with no material differences between the corresponding claims in the two patents; moreover, the parties' claim construction arguments are, for the most part, identical for the paired claims of the '505 and '230 patents. Therefore, the court will analyze the disputed terms within the '505 and '230 patents by first addressing the terms occurring within corresponding claims in both patents. The court will then address the few remaining claim construction issues that are pertinent to the '230 patent alone.

Astra asserts claims 1, 5, 6, 8-12, and 14 of the '505 patent against all Defendants. Astra also asserts claim 3 of the '505 patent against Defendant Andrx alone. Claims 2 through 9 and claims 11 through 13 of the '505 patent are product claims that depend on claim 1, but then add other features. In contrast to product claims like claim 1, claim 10 of the '505 patent is a method of treatment claim, and claim 14 is a process claim. Astra asserts claims 1, 6, and 13 of the '230 patent against all Defendants. Astra also asserts claims 7, 10-13, and 15 of the '230 patent against various Defendants. Dependent product claims add features to claim 1 of the '230 patent. Claim 12 of the '230 patent is an independent process claim.

The first claim of the '505 patent specifies a pharmaceutical product that includes three elements:

1. An oral pharmaceutical preparation comprising

(a) a core region comprising an effective amount of a material selected from the group consisting of omeprazole plus an alkaline reacting compound, an alkaline omeprazole salt plus an alkaline reacting compound and an alkaline omeprazole salt alone;

(b) an inert subcoating which is soluble or rapidly disintegrating in water disposed on said core region, said subcoating comprising one or more layers of materials selected from among tablet excipients and polymeric film-forming compounds; and

(c) an outer layer disposed on said subcoating comprising an enteric coating.

(P1, col. 16:42-54.) Claim 1 of the '230 patent, also a product claim, specifies:

1. A pharmaceutical preparation comprising:

(a) an alkaline reacting core comprising an acid-labile pharmaceutically active substance and an alkaline reacting compound different from said active substance, an alkaline salt of an acid-labile pharmaceutically active substance, or an alkaline salt of an acid-labile pharmaceutically active substance and an alkaline reacting compound different from said active substance;

(b) an inert subcoating which rapidly dissolves or disintegrates in water disposed on said core region, said subcoating comprising one or more layers comprising materials selected from the group consisting of tablet excipients, film-forming compounds and alkaline compounds; and

(c) an enteric coating layer surrounding said subcoating layer, wherein the subcoating layer isolates the alkaline reacting core from the enteric coating layer such that the stability of the preparation is enhanced.

(P2A, col. 13:1-20.)

The preamble of both claims 1 calls for a "pharmaceutical preparation," which must be oral in the case of the '505 patent. This simply means any dosage form taken via the mouth. (*See, e.g.,* P1, Ex. 2, col. 7:55-col. 8:34 (pellets); P1, Exs. 9, 10, col. 11:43-col. 12:36 (tablets).) "Comprising" is a transitional term used in patent claims to mean that the claim includes, but is not limited to, the elements thereafter presented. Crystal Semiconductor Corp. v. TriTech Microelectronics Int'l, Inc., 246 F.3d 1336, 1348 (Fed.Cir.2001) ("In the parlance of patent law, the transition 'comprising' creates a presumption that the recited elements are only a part of the device, that the claim does not exclude additional, unrecited elements."). In the context of the preamble of claims 1 of the '505 and '230 patents, then, "comprising" means that parts (a), (b), and (c) of claims 1 must be present, but that other elements may also be present. Thus, claims 1 contain three common structural components that are recited in subparagraphs (a), (b), and (c) in both the patents. Subparagraphs (a) and (b) of each claim contain the claim limitations that are strongly contested by the parties.

C. Part "(a)" of Claims 1

1. The Terms "Core" and "Core Region"

[17] The court finds that the terms "core" and "core region" are synonymous in the context of the '505 and '230 patents; thus, the court construes the term "core region" to have the same meaning as the term "core." This construction is apparent from the language of the claims themselves. The term "core region" does not appear anywhere in either patent except in certain claims, including claims 1 of the '505 and '230 patents. In those claims of the '505 and '230 patents where the terms "core region" and "core" appear, they are used interchangeably. For example, claim 1 of the '505 patent requires "[a]n oral pharmaceutical preparation comprising (a) a *core region*." (P1, col. 16:42-43 (emphasis added).) Claim 5 of the '505 patent, however, requires "[a] preparation *according to claim 1* wherein the alkaline *core* comprises ...." Claim 5 depends from claim 1 and references "the alkaline core." (P1, col. 16:65-66 (emphasis added).) Thus, the term "core" in claim 5 must be referring to the "core region" in claim 1. Claim 12 of the '505 patent also refers back to the "core region" in claim 1 when it requires "[a] preparation according to claim 1, wherein the *core* comprises ...." (P1, col. 18:4-5 (emphasis added).) Similar examples occur in the claims of the '230 patent. Indeed, the only place where the term "core region" appears in the '230 patent is in element (b) of claim 1, where the term "core region" is preceded by the word "said," which in patent claim drafting indicates that the specific claim term "core region" has been previously introduced. Manual of Patent Examining Procedure, 7th ed., s. 2173.05(e), at 2100-168. Since the phrase "said core region" in claim 1(b) has no antecedent basis and refers back to the term "alkaline reacting core" in element (a), the term "core region" in element (b) must be referring to the term "core" in element (a). Finally, there is no language in the specification or the claims of either patent to suggest what, if anything, beyond the core region would be encompassed by the term "core"; accordingly, "core region" must be defined to be synonymous with the term "core" because "a patent claim may be interpreted only as broadly as its unambiguous scope." Ethicon Endo-Surgery, Inc. v. U.S. Surgical Corp., 93 F.3d 1572, 1581 (Fed.Cir.1996) (citations omitted).FN12

FN12. Although the court need not address extrinsic evidence to determine whether the terms "core" and "core region" are synonymous, the court notes that the extrinsic evidence confirms the court's construction. Dr. Lovgren, one of the inventors of the two patents, testified that the term "core region" as used in claim 1 of the '505 patent refers to "the core." Indeed, Dr. Lovgren stated that the term "alkaline reacting core" in the claims of the '230 patent means the same thing as the term "core region" in the claims of the '505 patent. (Lovgren Tr. 1862:5-18, 1863:20-1864:3.)

The court defines the terms "core" and "core region" to mean the portion of the patented preparation that lies beneath the subcoating and contains the active ingredient and, in the case of omeprazole as the active ingredient, an ARC. The claim language itself expressly states that the "core region" is the portion of the formulation that lies beneath the inert subcoating, which is "disposed on" the core region. (P1, col. 16:48-50; P2A, col. 13:10-11.) Also, the discussion of the subcoating in the patents makes it clear that the entire mixture, whether called the "alkaline core" or the "alkaline reacting core" is the core to which the subcoating is applied. (P1, col. 4:3-58, *see particularly* col. 4:4, 13, 31; P2A, col. 8:66-col. 9:52, *see particularly* col. 8:67, col. 9:6-8.)

The court's construction of the terms "core" and "core region" includes cores made by conventional pharmaceutical procedures. (*See* P1, col. 3:1-11, col. 16:43-47.) The primary dispute concerning these terms is whether they encompass cores wherein the active substance is coated or sprayed onto a sugar seed. Based on the briefing submitted on claim construction as well as the evidence introduced at trial, the court finds that, in the abstract, a person of ordinary skill in the art could consider the sugar sphere itself to be a "core," but that same person could also consider the sugar sphere plus the active layer sprayed onto it to be a "core." FN13 Defendant Genpharm's construction for the term "core," which would exclude cores made by layering onto sugar spheres, incorrectly focuses attention on this abstract situation and away from the meaning a person of ordinary skill in the art *reading these two patents* would attach to the term "core." For example, Genpharm cites to a definition for the term "core" in a non-technical dictionary. *Cf.* Hoechst Celanese Corp. v. BP Chemicals Ltd., 78 F.3d 1575, 1580-81 (Fed.Cir.1996) (finding general dictionary definition secondary to specific meaning of technical term as used and understood by those of ordinary skill in the art). Even though the term "core" when applied to coated sugar spheres might be limited to the sphere itself in the abstract, the court finds that in the context of these two patents a person of ordinary skill in the art would understand the term "core" to encompass not only the sugar sphere but also the active layer sprayed or coated onto the sugar sphere.

FN13. A summary review of patents in this field demonstrates this point. *Compare* U.S. Patent No. 4,808,416, at 1 (Astra's Resp. to Defs.' Cl. Constr. Briefs, Ex. 41) (identifying cores as including the sucrose granule, or sugar seed, and the active layer), *with* EP 0 013 262 (G707, at 3) (describing the use of a "core made up of pharmaceutically indifferent material" that is then coated with the active drug).

The patent specifications expressly state that cores may be made "by conventional pharmaceutical procedures," (P1, col. 3:66-68; P2A, col. 8:62-64), and some of the conventional pharmaceutical procedures that may be used to prepare cores are expressly disclosed in the patent specifications and file histories. Conventional pharmaceutical procedures for making cores may include, but are not necessarily limited to, cores formed by extrusion and spheronization, cores made by layering on sugar seeds, and cores made by tabletting techniques. (*See, e.g.,* P1, col. 1:57-col. 2:4, col. 3:1-col. 4:2, col. 16:43-47 (the powder mixture is formulated into pellets, tablets or capsules, which are used as *cores* for further processing, such as applying the subcoat) (emphasis added); *see also* Story Tr. 3737:10-13 (testifying that the technique of layering active drug on sugar sphere seeds was known prior to 1986); P921 at 12:3-4, 14:20-15:3.) Tablet cores are found in Example 1 of the '505 patent. (P1, col. 6:29-65.) Extruded and spheronized cores are described in Example 2. (P1, col. 7:55-col. 8:34.) The '505 patent specification also expressly references active-coated sugar seeds as "cores. " The '505 patent specification states that WO No. 85/03436 (the " '436 application") describes pharmaceutical preparations containing cores, (P1, col. 3:1-2), and the '436 application, a part of the prosecution history, acknowledges that active coated sugar seeds are a type of core

"widely used in the known art." (Astra's Cl. Constr. Mem., Ex. 4, '436 application at 12:4-19; App. 1, '505 Prosecution History at 166.)

Contrary to arguments made by Second Wave Defendants Mylan and Eon, Astra's citation to the '436 application in the '505 and '230 patents and their file histories does *not* serve as a disclaimer of a sugar core with a layer of the active ingredient. The '505 and '230 patents never explicitly adopt an active-coated sugar core as part of one of the examples or preferred embodiments for the claimed invention described in the specification; however, the specification need not describe every possible way of making the product. SRI Int'l v. Matsushita Elec. Corp. of Am., 775 F.2d 1107, 1121-22 (Fed.Cir.1985). Far from expressly disclaiming the method of laying the active ingredient on a sugar sphere that is described in the '436 application cited in the patents, Astra claimed cores formed by that method in its patent by claiming any formulation with cores made by conventional pharmaceutical techniques.

Defendant Genpharm would graft onto the claims a requirement of homogeneity in order to exclude a core that is built on a sugar seed. (*See* Story Tr. 3712:4-18, 3719:7-3720:5, 3725:2-13, 3720:12-3721:5 (testifying that one of ordinary skill in the art would conclude that "core" as used in the '505 and '230 patents is a homogenous mixture of omeprazole, alkaline compounds, and excipients, with the omeprazole uniformly distributed throughout the core).) For intrinsic support within the '505 patent, Genpharm relies on the sentences bridging columns 3 and 4 of the '505 patent, which describe using a mixture of omeprazole and other materials to form "small beads" by conventional procedures, which are "used as cores for further processing." (*See* P1, col. 3:66-col. 4:2; *see also* P2A, col. 8:62-65.) The flaw in Genpharm's logic is reading the reference to a powder mixture "formulated into small beads" as excluding a mixture coated onto sugar seeds. There is no question that coating a sugar seed with an active substance is a conventional procedure, and nothing in the language Genpharm highlights excludes coating the mixture onto sugar seeds to form the small beads.

Genpharm also relies on references in the patents to the subcoating as the "first layer." (*See, e.g.,* P2A, col. 8:1-3.) Those references, however, concern the first layer of the invention-the subcoating. They do not exclude making small beads using the conventional sugar seed process before applying the "first layer" of the invention, which is the subcoating.FN14 Genpharm's definition is also based on consideration of a subset of the examples included in the '505 patent specification. By requiring a homogenous core, Genpharm adopts a definition for "core" and "core region" that is limited to those cores made by particular processes, which do not include cores made by spraying active ingredients onto a sugar seed. Since it is improper to read a limitation from the specification into the claims or to limit the claims to examples in the specification, *see* Tate Access Floors, Inc. v. Maxcess Techs., Inc., 222 F.3d 958, 966-67 (Fed.Cir.2000); Ekchian v. Home Depot, Inc., 104 F.3d 1299, 1303 (Fed.Cir.1997), the court will not limit the definition of the terms "core" and "core region" to exclude cores made by spraying or coating a sugar seed. The claims themselves do not contain any process limitations, and, as such, cores produced by any "conventional pharmaceutical procedure" are covered by claim 1.

FN14. This misreading infects Genpharm's arguments based on the testimony of the inventors-the court finds that the inventors' testimony does not support Genpharm's claim construction.

Genpharm's construction is not only inconsistent with the intrinsic evidence but also with the testimony of those skilled in the art, who testified, both at the trial and throughout discovery, that the terms "core" and "core region" mean the portion of the pharmaceutical preparation that lies beneath the subcoat. Dr.

Auslander, KUDCo's expert, understood the term "core region" to refer to "everything under the subcoat ... [I]t contains all the omeprazole plus the alkaline-reacting compound." (Auslander Tr. 2687:23-2688:14.) Likewise, in an opinion based on his experience as a formulator for the past thirty years, Cheminor's expert Dr. Porter recognized that the term "core region" refers to the "material under the sub coating." (Astra's Resp. to Defs.' Cl. Constr. Briefs, Ex. 34, Porter Dep. Tr. 45:4-14.) Cheminor's formulators identified the core of a formulation in its development reports as "core (sucrose, drug and meglumine)." (Astra's Resp. to Defs.' Cl. Constr. Briefs, Ex. 39, Omeprazole Capsules-Development Report at 5; *see also* Ex. 40, portion of Development Report of Omeprazole Capsules 10, 20 & 40 mg at CD-V-00065-68, 70, 75, 77.) Andrx's former President and Chief Formulator, Dr. Chen, similarly referred to his layered sugar seed pellet as a core. FN15 (P1312, Chen Dep. Tr. 347:7-18.)

FN15. Dr. Chen testified as follows at his deposition, which was admitted into evidence and watched on video tape during the trial:
Q. Is it your understanding that the term "core" means the sugar sphere with the omeprazole on it?
A. Two together it is a core. The carrier is meaningless because it's just a carrier, inactive.
Q. So the core means the active material on the pellet?
A. Together.
Q. Sir, is that definition your understanding of the common meaning of a core?
A. That's my understanding, yes.

(P1312, Chen Dep. Tr. 347:7-18.)
Genpharm's own Development Report refers to the nonpareil sugar seed together with the active, omeprazole-containing drug layer and HPMC subcoating as the "protected core." (P20 at G13549; P19 at G13038.) Even Dr. Story, Genpharm's expert, admitted at trial that he had used the word "core" to refer to a sugar seed that is layered with active ingredients during his testimony in Australia concerning a foreign counterpart to the '505 patent. (Story Tr. 3736:2-4, 3805:12-3806:12.) The process Dr. Story was describing in his Australian testimony is the process used by Genpharm to build up the active material on its sugar seeds. (Story Tr. 3805:12-3806:12.) Dr. Story agreed that formulation scientists, including those who worked with him, would interpret the term "core" to mean an inner seed *with* an active coating. (Story Tr. 3803:13-18.) Dr. Story further agreed that the term "core" in column 3 of the '505 patent refers to the portion of the formulation where the omeprazole is mixed with the ARC, (Story Tr. 3800:20-3801:2; *see* P1, col. 3:20-26), and that the reference to a "powder mixture" in that same column is a mixture of omeprazole and the ARC and other excipients, which can be formulated into, among other things, "pellets," (Story Tr. 3801:6-19; *see* P1, col. 3:66-68). In the context of the '505 patent, "pellets" means "cores." (Story Tr. 3801:20-22.) Finally, Genpharm's own purported person of ordinary skill in the art, Dr. Marshall, when preparing the expert reports Genpharm submitted, identified the ingredients of a "Formulation of cores/granules" to include both "Omeprazole" and the "Sucrose [sugar] spheres." (P1299, Marshall Report No. 3, at 4.) In summary, Dr. Story's testimony at trial in support of Genpharm's claim construction is outweighed by the intrinsic evidence and the testimony of those skilled in the art, including Dr. Story himself. Accordingly, the court declines to adopt Genpharm's proposed claim construction, which would graft onto the core a requirementfor complete homogeneity and unnecessarily limit the conventional pharmaceutical processes by which the core could be created by excluding the process of layering the drug substance onto sugar spheres.

2. The Term "Alkaline Reacting Compound"

[18] Subparagraph (a) of claim 1 of the '505 patent requires that the core contain a "material selected from the group consisting of omeprazole plus an alkaline reacting compound, an alkaline omeprazole salt plus an alkaline reacting compound and an alkaline omeprazole salt alone." (P1, col. 16:43-47.) That claim language presents alternatives any one of which may be present to meet the claim requirement. *See* In re Driscoll, 562 F.2d 1245, 1249 (C.C.P.A.1977). Claim 1 of the '230 patent presents a similar set of three options for the core: an acid labile pharmaceutically active substance and an ARC, an alkaline salt of an acid labile pharmaceutically active substance, or an alkaline salt of an acid labile pharmaceutically active substance and an ARC. (*See* P2A, col. 13:2-9.) The acid labile compound and the ARC must be different substances. (P2A, col. 13:2-9.) Astra asserts infringement by all Defendants only under the first of the three options: omeprazole, which is an acid-labile pharmaceutically active substance, plus an ARC.

The term "alkaline" standing on its own represents a concept that is well understood by those skilled in the arts of formulation and chemistry. It is fundamental chemistry that an "alkaline" substance is a basic substance-a non-acidic, non-neutral compound having a pH greater than 7.FN16 (*See* Auslander Tr. 2515:4-2516:9; Pilbrant Tr. 1459:24-1460:4.) While the ordinary meaning of the word "alkaline" may be clear, the court finds that without resort to the specification the meaning of the phrase "alkaline reacting compound" is not clear now and was not clear at the time of the patent. *See* Bell Atlantic Network Servs., Inc. v. Covad Communications Group, Inc., 262 F.3d 1258, 1268 (Fed.Cir.2001). Rather, the phrase "alkaline reacting compound" is a shorthand term that the patentees created for use in the '505 and '230 patents, and one of ordinary skill in the art would not understand what is meant by this phrase prior to issuance of the '505 and '230 patents. (*See* Auslander Tr. 2513:14-2514:9; Story Tr. 3759:13-18; *see also* Langer Tr. 386:17-24 (analyzing meglumine in terms of disclosure in specification).) Since the phrase "alkaline reacting compound" has no unambiguous meaning outside the '505 and '230 patents, it must be defined in the context of those patents. Since the patentees chose to act as their own lexicographer, the court must rely on the intrinsic evidence, particularly the specification, to determine the meaning of the phrase *See* Itron, Inc. v. CellNet Data Systems, Inc., 34 F.Supp.2d 1135, 1141 (D.Minn.1999) (If the inventors choose to be "their own lexicographers" with regard to a particular claim term, "the court must adopt their definition."), *aff'd per curiam,* 243 F.3d 563 (Fed.Cir.2000). Here the patentees' own testimony leaves no doubt that the specifications of the '505 and '230 patents are the "single best guide" to the meaning of the term "alkaline reacting compound." *See* Bell Atlantic, 262 F.3d at 1268 (quoting *Vitronics,* 90 F.3d at 1582). Kurt Lovgren, one of the inventors, testified that the terms "alkaline reacting compound" and "alkaline buffering compound" mean the same thing in the '505 and '230 patents. (Lovgren Dep. Tr. 548:2-11.) He further testified that the definition of those terms was to be found in the specifications of the patents. (Id. at 543:11-18 ("The meaning of alkaline buffering compound is a meaning and an understanding that is obtained in the specification of the patent.").)

FN16. The pH of a material is a numerical index of acidity, based on the hydrogen ion concentration of that material. (Carr Tr. 2361:9-23.) pH is measured on a numerical scale of 1 to 14. (Carr Tr. 2362:1-10, 2363:22-2364:9.) A pH of 7 is neutral, a pH of below 7 is acidic, and a pH of greater than 7 is alkaline. (Pilbrant Tr. 1459:24-1460:4.)

The clearest indication of what the phrase "alkaline reacting compound" means in the '505 and '230 patents is found in the detailed description of the invention under the subheading "Cores." (*See* Auslander Tr. 2520:1-9; Langer Tr. 653:24-654:6.) The term "alkaline reacting, otherwise inert pharmaceutically acceptable substance (or substances)" is characterized in the patent specifications. Specifically, the patents state:

Omeprazole is mixed with inert, preferably water soluble, conventional pharmaceutical constituents to obtain the preferred concentration of omeprazole in the final mixture and with an alkaline reacting, otherwise inert, pharmaceutically acceptable substance (or substances), which creates a "micro-pH" around each omeprazole particle of not less than pH = 7, preferably not less than pH = 8, when water is adsorbed to the particles of the mixture or when water is added in small amounts to the mixture.

....

The stabilizing, high pH-value in the powder mixture can also be achieved by using an alkaline reacting salt of omeprazole such as the sodium, potassium, magnesium, calcium etc. salts of omeprazole, which are described in e.g. EP-A2-No. 124 495, either alone or in combination with a conventional buffering substance as previously described.

(P1, col. 3:38-47, 59-65; *see also* P2A, col. 8:33-42.) This portion of the specifications defines the ARC-namely, an alkaline or basic compound that must create a micro-pH around the omeprazole particles of not less than pH 7. (Auslander Tr. 2520:1-2521:13; Langer Tr. 652:18-654:22.) *See Vitronics Corp.,* 90 F.3d at 1582; Itron, Inc., 34 F.Supp.2d at 1141. This description of the ARC is recited in the patent "as being the invention itself and not only one way of utilizing it;" therefore, the scope of the claims, which would otherwise be utterly unclear, must be limited to the definition of the ARC provided here. *See* Modine Mfg. Co. v. U.S. Int'l Trade Comm'n, 75 F.3d 1545, 1551 (Fed.Cir.1996), *abrogated on other grounds,* Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., 234 F.3d 558 (Fed.Cir.2000). Because the proper definition is found only in the specification, the scope of the term "alkaline reacting compound" is limited by the disclosure in the specification. Had Astra wanted broader disclosure, they should have used terms that would have been understood more broadly. *See generally* Superior Fireplace Co. v. Majestic Prods. Co., 270 F.3d 1358 (Fed.Cir.2001).

After defining the term "alkaline reacting compound," the specifications of both patents then proceed to list numerous substances that the inventors considered to be ARCs. (*See, e.g.,* P1, col. 3:47-59.) Alkaline reacting compounds

can be chosen among, but are not restricted to substances such as the sodium, potassium, calcium, magnesium and aluminium salts of phosphoric acid, carbonic acid, citric acid or other suitable weak inorganic or organic acids; substances normally used in antacid preparations such as aluminium, calcium and magnesium hydroxides; magnesium oxide or composite substances, such as $Al_2 O_3$->6MgO->CO_2->12H_2O ($Mg_6Al_2 (OH)_{16}CO_3$->4H_2O), MgO->Al_2O_3-> 2SiO_2->nH_2O or similar compounds; organic pH-buffering substances such as trihydroxymethylaminomethane or other similar, pharmaceutically acceptable pH-buffering substances.

(P1, col. 3:47-59; *see also* P2A col. 8:43-55.) Based on the claim language, these and other disclosures in the specifications of the patents, the statements Astra made about the prior art in the patents themselves and during the prosecution history, and the admissions of Astra's own experts, the court finds that an alkaline reacting compound is (1) a pharmaceutically acceptable alkaline, or basic, substance having a pH greater than 7 that (2) stabilizes the omeprazole or other acid labile compound by (3) reacting to create a micro-pH of not less than 7 around the particles of omeprazole or other acid labile compound.

a. The ARC Must Be Alkaline

Numerous dictionaries and treatises confirm that the word "alkaline" refers to a basic substance having a pH of greater than 7. (*See* Auslander Tr. 2515:13-2516:9.) The court is free to consult dictionaries at any time to help determine the meaning of the claim terms, provided that the dictionary definition does not contradict any definition found in or ascertained by a reading of the patent documents. *Vitronics,* 90 F.3d at 1584 n. 6; *see also* Interactive Gift Express, Inc. v. Compuserve, Inc., 256 F.3d 1323, 1332 n. 1 (Fed.Cir.2001). So, assuming that the patentees' definition does not contradict the plain meaning of the word "alkaline" as revealed in dictionaries and technical treatises, the claimed ARC in the '505 and '230 patents must be a non-acidic, non-neutral compound having a pH greater than 7. Various disclosures in the specifications of the '505 and '230 patents confirm that an alkaline reacting compound is, first and foremost, an alkaline or basic compound. The patent specifications indicate that omeprazole is susceptible to degradation in acid media and that the degradation reaction "proceeds rapidly" in neutral media, like pH 7, "while at higher pH values the stability in solution is much better." (P1, col. 1:21-29; P2A, col. 8:11-17.) Thus, the patent teaches one of ordinary skill in the art that the ARC, which is in direct contact with the omeprazole, cannot be acidic or neutral, but must be a basic compound with a pH of greater than 7. (Auslander Tr. 2516:10-2517:10.) Indeed, the specifications of the '505 and '230 patents distinguish a prior art invention, British Patent GB-A-No. 1,485,676 (the " '676 patent"), from the invention of the '505 and '230 patents, by explaining that the prior art formulation could not be adapted for use with omeprazole because "the presence of an acid *in contact with omeprazole* in the cores would give a result that omeprazole [would be] degraded." (P1, col. 2:59-68 (emphasis added); *see also* P2A, col. 5:25-35.) Thus, this portion of the patent specification emphasizes to one of ordinary skill in the art that the formulation cannot contain an acidic compound in contact with omeprazole. (Auslander Tr. 2517:17-2519:4.) Moreover, the Outline of the Invention section of each patent emphasizes that the ARC is, first and foremost, an alkaline compound. (P1 col. 3:13-21 ("Cores containing omeprazole mixed with alkaline compounds"); P2A col. 7:61-66; *see* Auslander Tr. 2519:5-25). The '505 and '230 patent specifications go on to list various types of compounds as examples of ARCs within the meaning of the patents. (*See* P1, col. 3:47-59; P2A, col. 8:43-55.) All of the examples listed in the specifications are well recognized alkaline substances. (Auslander Tr. 2521:23-2522:12.) Even further light is shed on the fact that "alkaline reacting substances" must be basic when it is considered that the claims of the '505 and '230 patents both allow for the absence of such a substance only when omeprazole is formulated as an " *alkaline* omeprazole salt. " The '505 patent, for example, references a European Patent, EP-A2-No. 124,495 to describe those salts-all of which are basic. (P1, col. 3:59-65.) Thus, this disclosure in both patents teaches one of ordinary skill in the art that an ARC must be alkaline, and cannot be acidic or neutral.

[19] The prosecution history of each patent confirms the court's construction of the term "alkaline reacting compound" to require alkalinity. During the prosecution of the application that issued as the '505 patent, the patent examiner rejected the application based on several references. (G2, Office Action of 12/1/87, at 2-3.) One of those references was the '676 patent. (Id.) As discussed in the '505 patent specification, this reference describes the use of a core containing "pharmaceutically acceptable acid" with the active drug in the core. (P1, col. 2:59-69.) In response to the rejection, Astra amended the claims in its application and, while referring specifically to the core containing omeprazole and the ARC, argued that "[a]ccording to the invention, the omeprazole is either in the form of an alkaline salt, or is compounded with an *alkaline* material." (G2, Amendment of 3/1/8, at 5 (emphasis added).) This discussion, in the context of the claimed invention, unambiguously states that the omeprazole is compounded with an alkaline material and confirms that the ARC must be an alkaline material with a pH greater than 7. (Auslander Tr. 2530:6-13; *see generally* Auslander Tr. 2528:25-2530:13.) In that same amendment, Astra further stated that "an acid containing core would be unsuitable for use with omeprazole because the acid would degrade the omeprazole." (G2, Amendment of 3/1/88, at 8.) This strongly teaches one of ordinary skill in the art that the

ARC, which is in direct contact with the omeprazole in the formulation, must not be acidic. (Auslander Tr. 2530:14-2531:11.) Astra is correct that this last statement, in isolation, might be considered a general description of the invention in the prosecution history that would not be understood to limit the invention. *See* York Prods., Inc. v. Central Tractor Farm & Family Ctr., 99 F.3d 1568, 1575 (Fed.Cir.1996) ("Unless altering claim language to escape an examiner rejection, a patent applicant only limits claims during prosecution by clearly disavowing claim coverage."). The entire March 1, 1988, amendment, however, makes it clear that Astra was explaining the meaning of claim language to escape the examiner's rejection, thereby disavowing claim coverage. Arguments and amendments made during the prosecution of a patent application must be examined to determine the meaning of terms in the claims. Southwall Techs., Inc. v. Cardinal IG Co., 54 F.3d 1570, 1576 (Fed.Cir.1995). The prosecution history limits the interpretation of the claim terms so as to exclude any interpretation that was disclaimed during prosecution. *Id.;* ZMI Corp. v. Cardiac Resuscitator Corp., 844 F.2d 1576, 1580 (Fed.Cir.1988). Simply put, claims may not be construed one way in order to obtain their allowance and in a different way when asserted against an accused infringer. Southwall, 54 F.3d at 1576; Unique Concepts, Inc. v. Brown, 939 F.2d 1558, 1562 (Fed.Cir.1991); Lemelson v. General Mills, Inc., 968 F.2d 1202, 1206 (Fed.Cir.1992) ("[T]he prosecution history gives insight into what the applicant originally claimed as the invention, and often what the applicant gave up in order to meet the Examiner's objections."). In a December 18, 1988 amendment made during the prosecution of the '230 patent that occurred simultaneously with that of the '505 patent, the Astra applicants attached the identical amendment, which included the same arguments for patentability as discussed with respect to the '505 patent. Accordingly, these unambiguous statements in the prosecution histories of the '505 and '230 patents further support the interpretation that the ARC must be alkaline. *See, e.g.,* Southwall Techs., Inc., 54 F.3d at 1576; *see also* Desper Products, Inc. v. QSound Labs., Inc., 157 F.3d 1325, 1335-36 (Fed.Cir.1998). Indeed, having affirmatively relied on this interpretation during prosecution to obtain allowance of the patent claims, Astra is estopped from asserting a contrary claim interpretation at trial. *See* Senmed, Inc. v. Richard-Allan Medical Indus., 888 F.2d 815, 820 (Fed.Cir.1989).

Although extrinsic evidence may not be used to vary or contradict the claim language, it is worthy to note that in this case, the extrinsic evidence directly confirms the claim construction gleaned by the court from the intrinsic evidence. *Vitronics,* 90 F.3d at 1585. One of the named inventors of the patents admitted at his deposition that to achieve a micro-pH around each omeprazole particle of not less than 7, as required by the specification, (*see* P1, col. 3:38-47; P2A, col. 8:33-42), the ARC must necessarily be alkaline-a non-acidic, non-neutral, basic substance having a pH greater than 7. (*See* Pilbrant Tr. 1465:6-1466:8.) FN17 Additional extrinsic evidence shows that during the development of Astra's omeprazole formulation, Astra determined that to achieve sufficient stability, it needed to include an alkaline material in the core with omeprazole, and it chose disodium hydrogen phosphate dihydrate FN18 as the alkaline compound. (Carlsson Tr. 228:25-230:5, 231:21-232:3; G148 at 9612106-07.) Dr. Enar Carlsson, who was Astra's project leader for the development of Prilosec(R), did not recall Astra ever trying materials of pH less than 7 in the core to solve the stability problem. (Carlsson Tr. 232:4-15.) Thus, a person of ordinary skill in the art would understand that an ARC, as that term is used in the '505 and '230 patents, must be an alkaline or basic compound.

FN17. Dr. Pilbrant changed his testimony at trial, stating that he had discussed the matter with others subsequent to his deposition, reaching a new and different scientific conclusion, namely that it was at least hypothetically possible to create a micro-pH environment around omeprazole of greater than 7 by adding a compound having a pH of less than 7. The court finds Dr. Pilbrant's new theory to be implausible and finds his deposition testimony to be more credible. Therefore, the court rejects Dr. Pilbrant's *trial* testimony on this point. *See* Markman, 52 F.3d at 983 (finding that self-serving inventor testimony on claim construction adduced at trial is entitled to no deference).

FN18. This substance is also known as dibasic sodium phosphate, a chemical that has numerous synonyms. (*See* P17.) Dibasic sodium phosphate may also be called disodium hydrogen phosphate, disodium phosphate, sodium phosphate, and several other names. (*Id*.) During the trial, several witnesses and numerous documents referred to the chemical by different names. The court will generally refer to this chemical as "disodium hydrogen phosphate" or "DHP."

b. Stability Through Micro-pH

As discussed above, based on the disclosures in the specification, a person of ordinary skill would also understand that the ARC must stabilize the omeprazole or acid labile compound in the core by creating a micro-pH of not less than 7 around the particles of the active ingredient. (*See* P1, col. 3:38-47; P2A, col. 8:33-42.) The ARC must be understood to stabilize the active ingredient in the formulation through creation of a micro-pH of not less than seven around the particles of the active ingredient not only because the specifications say so, but also because it makes sense in light of the goals this invention sought to achieve. As a practical matter, the goal is to stabilize and protect the omeprazole in the core. (Auslander Tr. 2520:24-2521:8; *see also* Langer Tr. 682:5-18.) Indeed, Astra's experts Dr. Langer and Dr. Davies FN19 candidly admitted that the ARC claimed in the patents is an alkaline or basic compound that must create a micro-pH of not less than pH 7 around the omeprazole particles, thereby stabilizing the omeprazole.FN20 (Langer Tr. 653:8-654:23, 5106:1-13; Davies Tr. 1209:18-1210:16, 1221:19-1222:8.)

FN19. Dr. Martyn Davies is a highly qualified expert in testing, analysis and characterization of drug formulations. Dr. Davies has worked in this area for about fifteen years. (Davies Tr. 784:2-7.) Dr. Davies is the head of the pharmacy school at the University of Nottingham, a highly respected school in Great Britain. (Davies Tr. 784:19-785:6.) In addition, Dr. Davies is the chairman of Molecular Profiles, a company that takes advantage of the expertise Dr. Davies has acquired in the testing of drug formulations. (Davies Tr. 787:3-25, 789:12-22.) Dr. Davies designed and supervised the testing conducted by Plaintiffs in this litigation. In addition, Dr. Davies observed much of that testing. (Davies Tr. 788:1-789:11.)

FN20. The testimony provided by Plaintiffs' experts is quite telling. Even Astra's experts reject the argument that a microenvironment pH greater than 7 is a preferred embodiment. Specifically, on more than one occasion, Astra's experts admitted that the definition of an alkaline reacting compound is a substance that must be alkaline and that must create a micro-pH around the omeprazole particles in the core of not less than 7. The testimony was as follows:
Q. (By the court): Then that would mean [the alkaline reacting compound] wouldn't have to be a base, right?
A. I think probably it will.

(Langer Tr. 756:18-19; *see generally* Langer Tr. 756:8-758:1.)
Q. (By the court): Then you are saying [the compound of interest] doesn't have to be alkaline, it just has to raise the pH. That's what I am trying to find out.
A. To be fair to them, *it has to raise it above 7*.

(Langer Tr. 759:19-22; *see generally* Langer Tr. 756:8-763:17.)
Q. So is it your opinion that it has to be at least [pH] 7 for it to be an alkaline reacting compound?
A. Yes, I think that's what I testified to earlier in the trial.

(Langer Tr. 5106:8-11.)
Q. Do you agree with Dr. Langer's testimony that the purpose of the alkaline-reacting compound, according to the '505 patent, at least, is to create a microenvironment, micro-pH around each omeprazole particle of not less than pH 7?
A. My view of the micro environment, as I've read the '505 patent, is that there is a pH which is not less than 7 around the omeprazole particles, yes.

(Davies Tr. 1210:17-1210:23.)
Q. Again, I have to ask you, its important it's around each omeprazole particle?
A. That would be-I guess, yes, it would be important if you could attain that. It would be important.

(Davies Tr. 1211:14-17.)

Astra attempts to construe this trial testimony to refer to a mere "hope" or desire for the invention, as opposed to a requirement. Having heard all of the testimony referred to by both parties, the court does not credit Astra's reading of the transcript. Instead, the court finds that KUDCo has accurately represented not only the bare words, but the import of the testimony as well. As explained in more detail below, the court agrees with Astra that it would be *desirable,* though not necessary, for the micro-pH around *each and every* omeprazole particle to be not less than 7. That is, the court acknowledges that the patent does not require perfection. However, the court finds that the alkaline reacting compound must render a micro-pH of at least 7 to sufficient omeprazole particles such that the omeprazole in the core is stabilized.
Astra has taken the position that claims 1 simply have no micro-pH range limitation whatsoever. (*See, e.g.,* Astra's Cl. Constr. Mem. at 17.) The court finds, however, that the creation of a micro-pH of not less than 7 around the omeprazole particles is *not* merely a preferred embodiment of the invention, as Astra argues. The disclosure in the patents teaches that this is a required element in the definition of an ARC, and nothing elsewhere in the patents teaches or suggests otherwise. (Auslander Tr. 2521:9-13; *see* P1, col. 3:38-47; P2A, col. 8:33-42.) Astra's suggestion that the creation of the micro-pH as set forth in the specifications is a "preferred embodiment" is based on a misreading of the patents. The words "preferred" and "preferably" are used in the specifications only to modify the "desired concentrationof omeprazole in the final mixture" and the micro-pH value of "not less than 8." (P1, col. 3:38-47; P2A, col. 8:33-42.) Recognizing that those two features are preferred embodiments, Defendants do not argue that either of those features form part of the proper claim interpretation of the term "alkaline reacting compound."

[20] Astra also argues that Defendants are improperly trying to read the micro-pH claim limitation from dependent claim 5 of the '505 patent into claim 1, and that the legal theory of claim differentiation precludes Defendants' proposed construction. (*See* Astra's Cl. Constr. Mem. at 17.) Under claim differentiation, a limitation contained in a dependent claim may not be imported into the independent claim from which it depends. Karlin Techn., Inc. v. Surgical Dynamics, Inc., 177 F.3d 968, 972 (Fed.Cir.1999); Transmatic, Inc. v. Gulton Indus., 53 F.3d 1270, 1277-78 (Fed.Cir.1995). There is presumed to be a difference in meaning

and scope when different words or phrases are used in separate claims. To the extent that the absence of such difference in meaning and scope would make a claim superfluous, the doctrine of claim differentiation states the presumption that the difference between the claims is significant. Tandon Corp. v. U.S. Int'l Trade Comm'n, 831 F.2d 1017, 1023 (Fed.Cir.1987). Astra's argument misses the point, however, that the relevant narrowing limitation in claim 5 is the specific numerical pH range of 7 *to 12,* which includes an upper bound. Claim 5 of the '505 patent is narrower than claim 1 because it has a narrower numerical pH range. The "alkaline reacting compound" of claim 1 must create a micro-pH of not less than 7, but there is no specified upper limit on pH in claim 1, which covers a range of pH from 7 to 14. Claim 5, however, explicitly specifies a narrower pH range. (P1, col. 16:43-47, 16:65-68; Auslander Tr. 2535:13-2536:15.) The difference, and what may *not* be read into claim 1, is the specific numerical range of pH 7 to 12 recited into claim 5. Excluding the pH range from 12 to 14 in claim 5 is not insignificant. There are medical concerns involved with the use of formulations containing caustic, or very high pH, substances. For example, the use of omeprazole salts, which are very basic, may cause etching lesions or other gastrointestinal problems. (Lovgren Tr. 4930:3-4931:1; Langer Tr. 5148:4-5149:11.) Claim 6 of the '230 patent is narrower than claim 1 of that patent for the same reasons that claim 5 of the '505 patent is narrower than claim 1 of the '505 patent. (P1, col. 16:42-68; Lovgren Tr. 1864:4-1865:13; *compare* P1, col. 16:43-47, 16:65-68, *with* P2A, col. 13:2-9, 14:4-8.) Thus, narrowed claims 5 and 6, which set a maximum pH value of 12, clearly satisfy the presumption of claim differentiation; they are different from claim 1 because they have an upper limit for micro-pH. *See* Mantech Envtl. Corp. v. Hudson Envtl. Servs., 152 F.3d 1368, 1372 (Fed.Cir.1998) (finding the patentee's argument based on claim differentiation "unavailing" given that the narrowing language of the dependent claim alone distinguished its scope from that of the independent claim); Manchak v. Chem. Waste Mgmt., Inc., No. 98-1530, 217 F.3d 860, 1999 WL 1103364, at (Fed.Cir. Dec. 6, 1999) (unpublished opinion) (holding that the doctrine of claim differentiation "is inapplicable where one or more added limitations distinguishes the allegedly superfluous dependent claim from its parent independent claim"). Moreover, the doctrine of claim differentiation cannot override the clear statements of scope in the specifications and prosecution histories, which overcome any presumption arising from the doctrine. Toro Co. v. White Consol. Indus., Inc., 199 F.3d 1295, 1302 (Fed.Cir.1999). Simply put, claim differentiation cannot broaden claims beyond their correct scope. Toro Co., 199 F.3d at 1302.

[21] Astra's arguments against the micro-pH requirement fail for another reason. It is a fundamental concept in patent claim drafting that each element of a claim must have an antecedent basis; otherwise, the claim would be rejected as indefinite under 35 U.S.C. s. 112. Manual of Patent Examining Procedure ("MPEP") s. 2173.05(e), Lack of Antecedent Basis. Section 2173.05(e) of the MPEP states that

"[a] claim is indefinite [under 35 U.S.C. s. 112] when it contains words or phrases whose meaning is unclear. The lack of clarity could arise where a claim refers to 'said lever' or 'the lever' where the claim contains no earlier recitation or limitation of a lever and where it would be unclear as to what element the limitation was making reference."

In claim 5 of the '505 patent and claim 6 of the '230 patent, each of which covers a preparation "according to claim 1," the term "micro-environment" is preceded by the word "the." The use of this definite article mandates that the term "micro-environment" was previously used in claims 1. Indeed, the antecedent basis for this term is derived from the fact that the phrase "alkaline reacting compound" of claims 1 includes, by definition, the element of micro-pH. If this were not true, then the term "micro-environment" would lack antecedent basis, rendering claim 5 of the '505 patent and claim 6 of the '230 patent invalid due to indefiniteness. Therefore, the court must construe the term "alkaline reacting compound" to require the creation of a micro-pH of at least 7 around the particles of the active ingredient. *See* Digital Biometrics, Inc.

v. Identix, Inc., 149 F.3d 1335, 1344 (Fed.Cir.1998) ("[I]f the claim is susceptible to a broader and a narrower meaning, and the narrower one is clearly supported by the intrinsic evidence while the broader one raises questions of enablement under s. 112, [the court must] adopt the narrower of the two."). Whenever a claim is susceptible to one construction that would render it valid and another construction that would render it invalid, the claim will be construed to sustain its validity. Rhine v. Casio, Inc., 183 F.3d 1342, 1345 (Fed.Cir.1999).

Astra's proposed definition of the term "alkaline reacting compound," a substance that when added to omeprazole can increase pH, is not only unsupported but also contradicted by the disclosures of the '505 and '230 patents. For example, if a substance with a pH of 6.8 is added to omeprazole, which Astra contends has a pH of 6.4,FN21 and the resulting pH is increased, the substance would be within Astra's definition of ARC. The substance, however, would be acidic, and, therefore, its use would be completely inconsistent with the disclosures of the '505 and '230 patents. (*See* P1, col. 3:26-28, 38-47, col. 5:29-33.) There is no disclosure in the patents that the ARC can be acidic or a substance that simply increases pH when added to an acid labile compound, like omeprazole. (*See generally* P1; P2A.) Astra's argument that an ARC is anything that can raise the pH when added to omeprazole is directly contradicted by the numerous teachings in the patents that the alkaline compound must be truly alkaline, with a pH of not less than 7.

FN21. For evidence that pure omeprazole by itself has a pH of about 6.4, see Astra's Resp. to Defs.' Cl. Constr. Briefs, Ex. 42, 48:14-22; Ex. 43.

c. The Entire Core Need Not Be Alkaline

The court does not agree with Defendants' argument that the core as a whole, as opposed to simply the ARC, must also be alkaline.FN22 That aspect of Defendants' definition improperly requires the *entire* core to have a pH greater than 7 even though the claims themselves contain no such limitation and the specification expressly permits otherwise. In support of this argument, KUDCo cites to the portion of the '505 patent file history where Astra distinguished the invention over the teachings of the '676 patent. KUDCo misinterprets what Astra said about the '676 patent. Astra explained in its amendment to the PTO that "[t]he formulation [described in the '676 patent] cannot be adopted for a pharmaceutical dosage form containing omeprazole, as the presence of an acid *in contact with* omeprazole in the cores would give a result that omeprazole was degraded." (P1, col. 2:64-68 (emphasis added).) The '505 patent does not teach that the core must not contain any acidic components or that the pH of the entire core as a whole must exceed 7. It only states that if an acid is in the core, it must not be in contact with the omeprazole. The '505 patent also allows that the pH of the entire core may be less than 7, yet still contain an ARC. For example, the '505 patent recognizes that cores containing ARCs may have a pH below 7 when suspended in water. At column 5, the patent states:

FN22. In addition to the Defendants currently on trial before the court, this argument was raised by Second Wave Defendants Lek, Impax, and Eon Labs.

The alkaline reacting core material and/or alkaline salt of the active ingredient, omeprazole, enhances the stability of omeprazole. The cores [alkaline reacting core] suspended in water forms a solution or a suspension which has a pH, which is higher than that of a solution in which the polymer used for enteric coating is just soluble.

(P1, col. 5:23-29.) According to this statement, the pH of the core is only limited to being a value higher than the pH at which the enteric coating dissolves. Extrinsic evidence confirms that enteric coats begin to become soluble at pH values higher than those ordinarily present in the stomach, about pH 5. (Langer Tr. 299:6-8.) According to the patent itself, some enteric coatings dissolve at pH values below 7. For instance, as indicated in Table 5, formulation Example 3 dissolved at pH 6.0. (P1, col. 14:19-33.) Thus, the '505 patent teaches that the pH of the entire core can be less than 7 and as low as 6. This is possible, for example, where a formulator ensures that the environment around the omeprazole particles contains ARC even though other regions of the core contain acidic components that lower the pH.

In support of their attempt to restrict the pH of the entire core to values in excess of pH 7, Defendants rely on the inclusion of the terms "alkaline core" and "alkaline reacting core" in the patents. However, the use of those terms, which do not appear in claims 1, does not support importation of such a claim limitation, even with respect to claims containing the terms. A reading of both specifications makes clear that the terms "alkaline core" and "alkaline reacting core" are being used as shorthand for cores containing either an alkaline reacting compound or an alkaline salt of the active ingredient. The '505 patent uses the phrase "alkaline core" as a synonym for a core that contains an ARC, as may be seen from the following passages in the '505 patent:

In order to enhance the storage stability the *cores which contain* omeprazole *must also contain alkaline reacting constituents*. When such an *alkaline core* is enteric coated ....

(P1, col. 1:57-60 (emphasis added).)

Cores containing omeprazole *mixed with alkaline compounds* or an alkaline salt of omeprazole optionally mixed with an alkaline compound are coated with two or more layers, whereby the first layer/layers is/are soluble in water o[r] rapidly disintegrating in water and consist(s) of non-acidic, otherwise inert pharmaceutically acceptable substances. This/these first layer/layers separates/separate *the alkaline core* material from the outer layer, which is an enteric coating.

(P1, col. 3:21-29 (emphasis added).)

Thus, the special preparation according to the invention consists of *cores containing* omeprazole *mixed with an alkaline reacting compound* or cores containing an alkaline salt of omeprazole optionally mixed with an alkaline reacting compound..... The cores are coated with an inert reacting water soluble or in water rapidly disintegrating coating, optionally containing a pH-buffering substance, which separates *the alkaline cores* from the enteric coating.

(P1, col. 5:19-33 (emphasis added).) Because one of ordinary skill would understand "alkaline core" to refer to any core containing an ARC or an alkaline salt of omeprazole, such a person would not understand that the entirety of the core necessarily must have a pH above 7. Similar to the definition of "alkaline core" in the '505 patent, the term "alkaline reacting core" in the '230 patent means a core that contains either an ARC or an alkaline salt of an acid labile compound. The patent specification confirms this construction.FN23 (*See* P2A, col. 3:66-col. 4:43 ("In order to enhance the storage stability, *the cores which contain the acid labile substance* must also contain alkaline reacting constituents. When *such an alkaline core* ....") (emphasis added); P2A, col. 10:14-25 ("Thus the special preparation according to the invention consists of *cores containing* the acid labile compound mixed with *an alkaline reacting compound* or .... The cores are coated with a water soluble or in water rapidly disintegrating coating, optionally containing a pH-buffering substance, which separates *the alkaline cores* from the enteric coating.") (emphasis added).)

FN23. Of course, Second Wave Defendants' Lek, Impax and Eon Labs are correct that the term "alkaline reacting core" in the '230 patent cannot always mean simply a core that contains an ARC, because that construction is only one third of the term's definition. That is, the "alkaline reacting core" of the '230 patent must contain one of the following: (1) an acid labile compound plus an ARC, (2) an alkaline salt of an acid labile compound, (3) an alkaline salt of an acid labile compound plus an ARC. In all three cases, the "alkaline reacting core" of the '230 patent is alkaline reacting because it contains a substance, whether an ARC, an alkaline salt of the active substance, or a combination of the two, that stabilizes the active substance and ensures that the micro-pH around the active substance is greater than pH 7. Thus, the term "alkaline reacting core" does not require that the pH of the entire core be greater than 7, it simply requires that the core contain the appropriate mixture of substances, as defined by claim 1, to stabilize the acid labile active ingredient in the formulation and to create a micro-pH of at least 7 around the particles of the active ingredient.

[22] In a similar vein, the patent claims do not require that a substance be proven to create a micro-pH of not less than 7 around every single, individual omeprazole particle present in the core of a formulation. The law is plain, infringement need not be perfect to be infringement. Shamrock Techs., Inc. v. Medical Sterilization, Inc., 903 F.2d 789, 792 (Fed.Cir.1990) (inefficient infringement is still infringement). Unless it is expressly excluded by the claim language, the term "substantially" is understood as being incorporated into every patent claim. *See* AFG Indus., Inc. v. Cardinal IG Co., 239 F.3d 1239, 1250 (Fed.Cir.2001) (stating that, with respect to a patent for which the parties generally agreed that a "layer" requires a "uniform" chemical composition, absent any specific statement in the patent of chemical uniformity as a characteristic of a layer, the layer must be understood as only "substantially" uniform.). KUDCo attemptsto inappropriately add to "alkaline reacting compound" a requirement that it provide a microenvironment pH of not less than 7 around *each* omeprazole particle. However, claim terms must be construed practically, and a patent is infringed even if the infringement is less than perfect. *See* Shamrock Techs. Inc., 903 F.2d at 792. The examples in the patents demonstrate that the inventors did not contemplate that each and every particle of omeprazole must be enclosed perfectly in a microenvironment pH of at least 7 by the ARC. Table 3 of the patent shows that even when using the invention, some degradation of omeprazole occurs. (P1, col. 7:12-28.) Thus, complete inclusion of every particle of omeprazole was not deemed essential to the invention, and the court will not import such perfectionism into the definition of the term "alkaline reacting compound" where it is not called for by the claims.

d. Other Limitations

Cheminor seeks a construction of the term "alkaline reacting compound" that would limit claims 1(a) to the narrowed classes of alkaline reacting compounds identified in the specification. Cheminor's proposal unduly limits the claim to specific embodiments in the specification. Karlin Tech., Inc. v. Surgical Dynamics, Inc., 177 F.3d 968, 973 (Fed.Cir.1999). Moreover, limiting the alkaline reacting compounds solely to those listed is directly contradictory to the patent specification, which expressly states that the list was not meant to be exhaustive. (P1, col. 3:54-56.) The language of claims 1 does not require that every specific alkaline reacting substance alleged to be infringing be identified or listed in the specification. *See* Specialty Composites v. Cabot Corp., 845 F.2d 981, 989 (Fed.Cir.1988) (finding unlisted plasticizers within the scope of the claims). Although the definition of the term "alkaline reacting compound" must be found in the specification in light of the other intrinsic evidence, that definition is one based on the function of the ARC, not its identity. Therefore, the appropriate inquiry is whether a particular compound has the required

properties to perform the functions required of an ARC, not whether the compound is included in a non-exhaustive list of examples in the specification. *See* Specialty Composites, 845 F.2d at 987 ("The emphasis is on the suitability of any plasticizer that will achieve the specified properties, not on the particular class of plasticizer.").

Cheminor also argues that the ARC must be water soluble and "otherwise inert." Once again, Cheminor's attempt to define the ARC as a water soluble compound is an attempt to read a preferred embodiment into claims 1. Nothing in the claim language requires water solubility of the ARC, and the specification does not contain such a limitation. Even the portions of the specification relied on by Cheminor to define alkaline reacting compounds refer to practically insoluble ARCs. (P1, col. 3:48-50 (referring to $Mg_6Al_2(OH)_{16}$ CO_3->$4H_2O$ (hydrotalcite)); Astra's Cl. Constr. Mem. of 11/5/01, Ex. 10, Martindale 13th ed. at 886 (1993).) Similarly, the court rejects Cheminor's argument as to "otherwise inert" because the requirement is not contained in the claims. While the phrase is used in the specification of the patents relative to alkaline reacting substances, (P1, col. 3:41-42), "inert" is not in the claim as a modifier of "alkaline reacting compound," and it should not be imported into the claim. Also, other portions of the specifications do not include that language. (*See, e.g.,* P1, col. 1:57-59; P2A, col. 3:66-68.)

Accordingly, based on the claim language, the numerous disclosures in the specifications of the '505 and the '230 patents, the statements Astra made about the prior art and the claimed invention during prosecution, and the admissions of Astra's own experts, the court finds that the term "alkaline reacting compound" means:

(1) a pharmaceutically acceptable basic substance having a pH greater than 7.0

(2) that stabilizes the omeprazole or acid labile active compound

(3) by reacting to create a micro-pH of not less than 7.0 around the particles of omeprazole or active acid labile compound.

3. The Term "Effective Amount"

[23] Subpart (a) of claim 1 of the '505 patent requires an "effective amount of a material selected from the group consisting of omeprazole plus an alkaline reacting compound," (P1, col. 16:43-45), and the parties dispute the meaning of the phrase "effective amount." FN24 The dispute between Astra and the four Defendants before the court boils down to a disagreement over whether the phrase "effective amount" applies to the omeprazole alone or to both the omeprazole and the alkaline reacting compound in the core. Astra argues for the former, while Defendants prefer the latter construction. The Second Wave Defendants also weigh in to argue that the claimed oral structure cannot be construed to encompass a capsule containing multiple "core regions," each one of which does not have an "effective amount" of omeprazole because claim 1 of the '505 patent requires a single core region that contains the entire "effective amount." The court agrees with the Second Wave Defendants in so far as the court finds that each core or core region must contain an "effective amount." FN25 The plain language of subpart (a) of claim 1 dictates that finding. The question remains-an effective amount of what? FN26

FN24. The phrase "effective amount" also appears in claim 14 of the '505 patent, but it does not appear in the claims of the '230 patent. Even though the claim limitation of an "effective amount" is not present in '230 patent, the court notes that its construction of the term "alkaline reacting compound" requires the

stabilization of the acid labile compound. Even though no explicit ratio or quantity relationship is present in the claims of the '230 patent, that requirement is implicit in the characteristics of the ARC as defined by the patentees. According to the disclosures in the specification of the '230 patent, unless there is sufficient ARC in the core to create a micro-pH around the particles of the active ingredient of not less than pH 7, the formulation simply will not work. The '230 patent, however, must be enabling, and therefore, "effective amount" is found implicitly in the ARC claim limitation.

FN25. As will become apparent in the portion of this court's opinion devoted to infringement analysis, there is no prejudice to Astra in this court's decision to consider the claim construction arguments proffered by the Second Wave Defendants with respect to the phrase "effective amount." Under the construction adopted by the court, the ANDA products of Defendants Genpharm, Cheminor, and Andrx contain an "effective amount" of omeprazole and an alkaline reacting compound in *each* individual core.

FN26. Adopting Astra's construction for "effective amount," which requires a therapeutically effective amount of omeprazole, the Second Wave Defendants argue that an "effective amount" cannot be construed to cover an oral pharmaceutical preparation with multiple pellets in which no single pellet has a core region with sufficient omeprazole to equal an entire therapeutically effective amount of omeprazole. This theory would restrict findings of literal infringement such that claim 1 of the '505 patent would cover only a tablet with a single coated core with a therapeutic amount of omeprazole or a capsule containing pellets where each pellet has a coated core with a therapeutic amount of omeprazole. Of course, the First Wave Defendants are precluded from relying on that argument in support of noninfringement. It has never been raised by a First Wave Defendant and no notice was provided to Astra of that position prior to this trial. Astra has had no opportunity for discovery of evidence that would support claims of infringement under the doctrine of equivalents. It seems likely that any Defendant whose formulation infringed literally when made in the form of one large core would also infringe under the doctrine of equivalents by using numerous small cores or beads filled into a capsule.

Astra's proposed construction of the claim term "effective amount" is a therapeutically effective amount of omeprazole sufficient to reduce gastric acid secretion. Under Astra's proposed construction, such an effective amount is a daily dose that can range from 1 to 400 mg of omeprazole, depending on the individual. This range is the only therapeutically effective amount of omeprazole disclosed in the '505 patent specification. (*See* P1, col. 6:12-20, and '505 Certificate of Correction.) The court declines to adopt Astra's proposed construction. The term "effective amount" in claims 1 and 14 of the '505 patent does *not* have the word "therapeutically" associated with it, and therefore, contrary to Astra's proposed construction, a person of ordinary skill in the art understands the term "effective amount" in claims 1 and 14 to have a different meaning than the phrase "therapeutically effective amount," which appears in claim 10. (P1, col. 16:43, 17:25, 18:15; Auslander Tr. 2538:7-2540:15; Langer Tr. 735:8-740:5.) On its face, claim 1 cannot be construed so that the "effective amount" requirement only refers to the amount of the omeprazole. First, the term "effective amount" modifies the phrase "a material selected from the group consisting of." Simple grammar rules indicate that the "effective amount" requirement applies to whatever, alone or in combination, constitutes the "material." Claim 1 also makes clear that the "material" is the group consisting of (1) omeprazole plus an ARC; (2) an alkaline omeprazole salt plus an ARC; and (3) an alkaline omeprazole salt alone. (P1, col. 16:43-47.) If the court were to define "effective amount" solely by the active ingredient, then in any given formulation the effective amount of "an alkaline omeprazole salt plus an

alkaline reacting compound" would always be the same as the effective amount of "an alkaline omeprazole salt alone," because in those formulations the alkaline omeprazole salt is the active ingredient. Such a construction would thus effectively write out part of claim 1-option 2-as redundant, and is inconsistent with the specification's teaching that the alkaline salt can be mixed beneficially with an ARC, as stated in option 2. (*See* P1, Exs. 7 & 8, Col. 10:66-Col. 11:41, Comparative Ex. V, Col. 13:41-65.) The claim requires "an effective amount of *material,*" not just an effective amount of active ingredient.

Having determined that the term "effective amount" applies to all substances required as part of the "material" required in claim 1(a), the court now concerns itself with the combination of omeprazole plus an ARC, which is the only option in claim 1(a) asserted by Plaintiffs against Defendants. The court finds that the term "effective amount" applies to both omeprazole and the ARC and requires an amount of each substance such that the combination of omeprazole plus the ARC meets the stated goal of the invention of stabilizing the omeprazole. (*Accord* Auslander Tr. 2539:8-2540:15.) That is, the term "effective amount" is a relative term. It requires that the ARC and omeprazole be present in the "material" in an appropriate ratio such that the ARC stabilizes the omeprazole. The ARC is used in the claimed formulation to improve storage stability. (Langer Tr. 740:6-741:2, *see also* Langer Tr. 735:8-740:5.) Therefore, an "effective amount" of an ARC in relation to a chosen amount of omeprazole in a given formulation is an amount sufficient to stabilize the omeprazole in the formulation's core. (Langer Tr. 740:23-741:15; *see generally* Langer Tr. 735:8-741:15.) As the specification discloses, that stabilization is achieved by using an ARC in the core to create a micro-pH around the omeprazole particles of not less than pH 7.

D. Part "(b)" of Claims 1

1. Ordinary Meaning of the Term Subcoating

[24] Part (b) of claim 1 of the '505 patent requires "an inert subcoating which is soluble or rapidly disintegrating in water disposed on said core region, said subcoating comprising one or more layers of materials selected from among tablet excipients and polymeric film-forming compounds." (P1, col. 16:48-52; *see also* P2A, col. 13:10-15.) Part (b) of claim 1 of the '230 patent does not contain any material differences. (*See* P2A, col. 13:10-15.) The meaning of the term "subcoating" is apparent simply from a reading of the claims and the ordinary meaning of the terms contained therein. The subcoating is a layer of material that "coats" and is "disposed on" the core region; therefore, it must be physically on or in contact with that core region. The plain meaning of the noun "coating" requires a "material that will form a continuous film over a surface." McGraw-Hill Dictionary of Scientific and Technical Terms, 5th ed. at 394 (1994). *See* Interactive Gift Express Inc. v. Compuserve, Inc., 256 F.3d 1323, 1331 n. 1 (Fed.Cir.2001) ("Dictionaries, which are a form of extrinsic evidence, hold a special place and may sometimes be considered along with the intrinsic evidence" when determining the ordinary meaning of claim terms.); *Vitronics,* 90 F.3d at 1584 n. 6. A "coating," like a film, must conform to the contours of the thing it "coats." The subcoating is also "sub," under or beneath, the enteric coating layer. In the context of the claims of the '505 and '230 patents, the court finds that the "subcoating" claim limitation requires a coating or covering that is physically on, or in contact with, and conforms to the contours of the core region.FN27 The patent specifications support the court's finding that the patentees employed the ordinary meaning of the term "subcoating. " The '505 patent describes "subcoated pellets" where the subcoating "was sprayed on the uncoated pellets." (P1, col. 8:6-15.) An additional four examples of subcoated pellets use this same technique. (P1, col. 8:55-62, col. 9:25-32, col. 10:8-10, col. 11:17-27.) Another subcoated core using a drying coating technique is described as well. (P1, col. 11:68-col. 12:22; *see also* P2A, col. 12:1-22.) In each of these coatings, the subcoating is physically on, in contact with, and conforms to the contours of the core region. In conclusion, a subcoating is a layer that is physically on and conforms to the contours of a

core and is underneath another layer-the enteric coating.

FN27. Even Defendant Genpharm agrees that the term "disposed on" requires "the subcoating to be physically on the core." (Genpharm's Mem. On Cl. Constr. of the '230 and '505 Patents at 17.)

Defendants misconstrue the term subcoating by (1) attempting to broaden the claims by ignoring the prosecution history in which the applicant and the examiner acknowledged that the claimed subcoatings do not include a capsule separating layer, (2) ignoring basic grammar rules to require more than one material in the subcoating, (3) attempting to narrow the claims by reading process limitations and the preferred embodiment from the specification into the claims, and (4) requiring a super-coat with no imperfections-a standard that no formulation meets in the real world.

2. Gelatine Capsules Are Not Subcoatings

Defining the term "subcoating" to encompass gelatine capsules, Genpharm focuseson the word "subcoating" and finds it synonymous with the term "separating layer" while ignoring the requirement of the claims that the subcoating be "disposed on the core region." Genpharm adopts this construction largely to create a definition for the claim term so broad that it encompasses certain aspects in the prior art that Genpharm then argues invalidate the patents. Turning first to the intrinsic evidence relative to Genpharm's argument, the claims in question all use the language "subcoat;" they do not mention the term "separating layer," which appears only in the specification. Genpharm is correct, however, that both subcoatings and gelatine capsules are *types* of separating layers; the patent specification itself makes that clear. When read in context, the specifications disclose that a subcoating is a type of separating layer. For that reason, when describing subcoating techniques in column 4 of the '505 patent, the specification acknowledges "the subcoating layer, in the following defined as the separating layer." The specification then goes on to describe other separating layers such as gelatine capsules, (P1, col. 4:57-58); however, the specification nowhere suggests that every separating layer is a subcoat. Thus, the specifications of the '505 and '230 patents describe two types of separating layers-subcoatings and capsules. (P1, col. 4:3-58; P2A, col. 8:66-col. 9:52.) Genpharm's assertion that the '505 and '230 patents expressly teach that hard gelatine capsules are subcoatings is simply erroneous. The portions of the patents to which Genpharm refers do not use the word "subcoating." (*See* P1, col. 3:66-68, 4:57-58; P2A, col. 8:62-65, col. 9:51-52.) The first part in each patent states only that the powder mixture can be formulated into hard gelatine or soft gelatine capsules. The second reference in both patents says the gelatine capsule can serve as a "separating layer." Thus, according to the specification, both subcoatings and gelatine capsules are different species of the generic term "separating layer."

The fact that the specification expressly states that a gelatine capsule also can serve as a "separating layer," (P1, col. 4:57-58), does not mean a gelatine capsule is a subcoating. In fact, gelatine capsules are not subcoatings. This is understood from the plain meaning of the term "capsule," which is defined as "a soluble shell in which drugs are enclosed for oral administration," McGraw-Hill Dictionary of Scientific and Technical Terms, 5th ed. at 308 (1994), "a small gelatineous case containing medicine," New Webster's Dictionary and Thesaurus at 66 (1992), and "a shell usu. of gelatine for packaging something (as a drug or vitamins); also: usu. medicinal or nutritional preparation for oral use consisting of the shell and its contents," Merriam Webster's Collegiate Dictionary, 10th ed. at 170 (1993). As is apparent, the appropriate definitions for gelatine capsules are clearly incompatible with the requirements of a subcoating when that term is understood based upon its ordinary meaning as it appears in the claims of the '505 and '230 patents.

The prosecution history makes it unequivocally clear that gelatine capsules are not subcoatings. After the patent examiner had already granted the claims, Astra petitioned USPTO to consider a reference by authors Pilbrant and Cederberg. That reference mentions enteric-coated capsules containing omeprazole: "The dosage form-a tablet, a *capsule,* or granules-is coated with a polymer, which is insoluble in acid media but soluble in neutral to alkaline media [*i.e.,* an enteric coating]." (P84, Pilbrant & Cederberg at 115, left column (emphasis added).) In distinguishing the '505 patent application over Pilbrant & Cederberg, Astra argued that the reference "does not, however, disclose preparations having a subcoating layer, such as in the claimed invention." (P7A at 2-3, '505 File History, Petition for Consideration of Prior Art After Payment of Issue Fee of 9/16/88 (App. 1, '505 Pros. History at 279-80); P8A at 5-6, '230 File History, Amendment of 12/19/88.) The USPTO granted Astra's petition and the '505 patent was issued over the Pilbrant and Cederberg reference. ('505 Pros. History at 282.) Astra's statement in the prosecution history that the enteric-coated gelatine capsule in the Pilbrant and Cederberg reference was not the subcoat of the claimed invention and the USPTO's subsequent allowance of the application excludes the possibility that gelatine capsules are "subcoatings" as required by the '505 patent claims. Goldtouch Techns. Inc. v. Microsoft Corp., No. A99CA336ss, 2000 WL 85555, at (W.D.Tex. Jan. 14, 2000) (excluding possibility during claim construction that claims covered matters disclaimed during prosecution history). Simply put, a gelatine capsule is not a "subcoating" within the meaning of the claimed invention of either the '505 or the '230 patent.

[25] In support of its argument that gelatine capsules are subcoatings as that term is understood in the claims of the '505 and '230 patents, Genpharm relies heavily on statements made by Astra when it filed patent applications corresponding to the '505 and '230 patents in various foreign jurisdictions. Genpharm improperly seeks to rely on these foreign proceedings, since Genpharm has not even tried to lay a foundation for its argument that foreign prosecutions should be considered on an issue of United States law-namely, claim construction. *See* Heidelberger Druckmaschinen AG v. Hantscho Commercial Prods. Inc., 21 F.3d 1068, 1072 n. 2 (Fed.Cir.1994); Medtronic, Inc. v. Daig Corp., 789 F.2d 903, 907-08 (Fed.Cir.1986). The cases cited by Genpharm for the proposition that certain statements made by a patentee in connection with counterpart foreign applications may be relevant to claim construction of a United States patent, Tanabe Seiyaku Co. v. Inter. Trade Comm'n, 109 F.3d 726, 733 (Fed.Cir.1997); Caterpillar Tractor Co. v. Berco, SpA, 714 F.2d 1110, 1116 (Fed.Cir.1983), both relate to analysis under the doctrine of equivalents, a question of fact. *See* Insta-Foam Prods., Inc. v. Universal Foam Sys., Inc., 906 F.2d 698, 702 (Fed.Cir.1990). Even assuming the alleged foreign "admissions" are admissible, however, they fail to support Genpharm's position.

During the prosecution of Astra's European omeprazole formulation patent application that corresponds to the '505 and '230 patents on July 27, 1990, the European Patent Office ("EPO") rejected Astra's application for lack of novelty, citing EP-A-124 495 (the " '495 patent"). (11/5/01 Hovden Decl., Ex. 7.) The '495 patent discloses a formulation that contains an alkaline omeprazole salt in a hard gelatine capsule that is enteric coated. (11/5/01 Hovden Decl., Ex. 8.) The examiner stated that the '495 patent referred to omeprazole salts in cores that were filled in hard or soft gelatin capsules allegedly functioning as a subcoat or separating layer. The following appeared at page 7 of the European application, lines 11-12: "In case of gelatin capsules the gelatin capsule itself serves as separating layer." (11/5/01 Hovden Decl., Ex. 9.) To overcome the examiner's lack of novelty rejection based on the gelatine capsule formulation disclosed in the '495 patent, Astra made the following amendments to its application on November 23, 1990:

D1 [the '495 salts patent] is the Applicant's own patent. According to D1 it is either enteric coated granules or a powder that are filled into the hard gelatine capsules or a solution that is filled into the soft capsules. The wording on page 7, lines 11 and 12 in our specification, which the Examiner has pointed out and also

the lines 31-34 on page 5 of our specification has been amended on the attached copies of said pages in order to define the invention without difficulty and clearly restrict us from D1.

(11/5/01 Hovden Decl., Ex. 10, at 2.) In a follow-up communication from Astra to the European Patent Office three days later, Astra directly addressed the issue of whether a separating layer-capsule falls within the meaning of the term subcoating in the patent claims:

We refer to our letter of November 23, 1990 and would like to further define the difference between citation D1 [the '495 salts patent] and this application. Please be informed that the enteric coated granules in D1 have no subcoating. As this was obvoius [sic] to us we forgot to stress this important difference. As a consequence we are enclosing a further amended page 4, where this is clarified and we kindly ask the Examiner to perform this amendment in the file copies.

(Astra's Resp. to Defs.' Cl. Constr. Briefs, Ex. 64, Margareta Linderoth's 11/26/90 Letter to EPO.) The amendment provided the following changes to the European Specification, handwritten in at the bottom of page 4 of Exhibit 64: "E-P-A-124 495 describes enteric coated granules without subcoating or powder that are filled into hard gelatine capsules or a solution that is filled into soft capsules." (Astra's Resp. to Defs.' Cl. Constr. Briefs, Ex. 64, Margareta Linderoth's 11/26/90 Letter to EPO, at 3; Ex. 66, EP 247 983 B1, at 4:19-20.) About a year later on October 11, 1991, Astra again communicated with the EPO in correspondence that states, "[f]urther there is no subcoating according to D1 [the '495 patent]. Thus the claimed invention is novel over D1. The examiner also recognized inventiveness of the invention at the interview, but wanted to have a written explanation of the citations." (Astra's Resp. to Defs.' Cl. Constr. Briefs, Ex. 65.) Again, Astra informed the EPO that the '495 patent did not disclose a subcoat, and this communication pointed out that the examiner agreed, as shown by the fact that the examiner recognized inventiveness at the interview. (Astra's Resp. to Defs.' Cl. Constr. Briefs, Ex. 67.) These facts, which Genpharm admitted in its claim construction briefing, show that all separating layers are not subcoatings and that the hard and soft gelatine capsules in the reference at issue were not subcoatings. Thus, Astra's European prosecution is consistent with the ordinary meaning of the claim term "subcoating" and the plain language of the '505 and '230 patents.

Genpharm also refers to foreign patent proceedings in the Republic of South Africa during Astra's prosecution of an omeprazole formulation patent that corresponds to the '505 and '230 formulation patents. Genpharm relies upon the following language from an amendment discussing the '495 patent:

EP-A-0 173 664 (A B Hassle) and EP-A-0 124 495 (A B Hassle) are citable as prior art. The Applicant believes that these patent specifications do not destroy the novelty of claim 1 of the patent because gelatine capsules where the capsule serves as a subcoating, fall outside the scope of claim 1 when properly construed. In order to avoid a possible adverse finding based on these prior art documents, the Applicant seeks to delete reference to gelatine capsules at the passages cited, thereby ensuring that the patent specification is clear in this regard and is not vulnerable to an attack based on this prior art.

(11/5/01 Hovden Decl., Ex. 11, at 3.) Even the portion quoted by Genpharm acknowledges that gelatine capsules fall outside the scope of claims 1 of the '505 and '230 patents when properly construed. (*See* 11/5/01 Hovden Decl. Ex. 11, at 3.) Once again, a document from the South African file expressly refutes Genpharm's assertion that the claimed subcoating covered gelatine capsules. (Astra's Resp. to Defs.' Cl. Constr. Briefs Ex. 36, Application to Amend South Africa Specification, filed 9/17/97, at 7.)

Additional extrinsic evidence also supports Astra's construction. Dr. Langer testified that a subcoating was a substantially continuous film, distinguishing between subcoatings on one hand and separating layers or gelatine capsules on the other. (Langer Tr. 419:1-4, 421:8-16, 442:16-18, 5026:4-5027:9, 5029:3-16.) While a subcoating and gelatine capsules both separate, the subcoating conforms to and is in contact with the core. (Langer Tr. 5026:1-5027:3.) The inventors also distinguished between subcoatings and separating layers or gelatine capsules. (Pilbrant Tr. 1631:20-24, 1718:5-23, 1719:1-11; Lovgren Tr. 4520:14-24.) Prior to trial, others of at least ordinary skill, including Genpharm's expert Dr. Story and Cheminor's expert Dr. Porter, construed the term "subcoating" so that it did not include gelatine capsules and acknowledged that the subcoatings of claims 1 were missing from the prior art describing such gelatine capsule separating layers. (*See* Story Tr. 4798:9-4799:11, 4799:21-4801:8.) Dr. Porter stated categorically that the '974 patent, FN28 which refers to enteric-coated gelatine capsules, is missing the subcoating. (Astra's Cl. Constr. Resp. of 11/12/01, Ex. 34, Porter Dep. Tr. 86:7-87:10.) In other words, Dr. Porter recognized that the gelatine capsules are not subcoatings as they are claimed in the '505 and '230 patents. Dr. Goldberg, Andrx's expert, expressly noted the difference between coatings and capsules in a sworn affidavit:

FN28. The '974 patent, G345, is the U.S. patent corresponding to the '495 patent, EP 124,495.

The process of making capsules is substantially different than the process of microencapsulation. The process of microencapsulation involves coating the individual particles of the material, while the manufacture of capsules involves placing multiple particles into a pre-existing shell capsule. Capsules can also contain drugs that have been microencapsulated.
(Astra's Resp. to Defs.' Cl. Constr. Briefs, Ex. 61, Decl. of Dr. Arthur H. Goldberg dated 2/26/98, at 6.)
To sum up, based upon the ordinary meaning of the terms "subcoating" and "capsule," the patent specifications and file histories, the foreign proceedings raised by Genpharm, and other extrinsic evidence, the court finds that the phrase "subcoating ... disposed on said core region" that appears in claims 1 of the '505 and '230 patents does not include gelatine capsules.

3. One Subcoating May Contain One "Material"

Cheminor asserts that under claim 1 of both the '505 and the '230 patents, the subcoating must be made up of two or more materials and that any subcoating consisting of only one material does not come within the scope of the claims. The court notes that this construction, like others adopted by Cheminor, is newly proposed. Cheminor conceded in a letter written two months after trial began that this was a new claim construction. (*See* Letter from Cheminor to court of 2/6/02; Trial Tr. 4037:16-4038:5.) Cheminor did not come forward with it until a month after Astra's last witness with respect to infringement, Dr. Lovgren, left the stand on January 4, 2002. The prejudice to Astra from this decidedly late claim construction argument is plain. Astra did not have a reasonable opportunity to present documentary evidence or to have its experts testify concerning this new construction. The court, therefore, sustains Astra's objection to Cheminor's change in position and precludes Cheminor from asserting noninfringement on the basis of this argument. Nevertheless, for purposes of completeness, the court addresses this argument, which is at best superfluous and at worst specious. Before February of 2002, Cheminor apparently never noticed this new construction, and it can hardly be deemed the way one of ordinary skill in the art would construe the claims.

Turning to the claim language itself, the pertinent language is not merely "materials," but rather claim 1 of the '505 patent, which requires "one or more layers of materials," (P1, col. 16:50-51), and claim 1 of the '230 patent, which requires "one or more layers comprising materials." (P2A, col. 13:12-13). When

construing this claim language, the court must remain cognizant of the rules of grammar and syntax. In re Hyatt, 708 F.2d 712, 714 (Fed.Cir.1983). The court finds that even though the term "materials" in claims 1 of the '505 and '230 patents was clearly intended to include the singular, the plural form was used to comply with grammatical correctness. *See* Huntington Dry-Pulverizer Co. v. Whittaker Cement Co., 89 F. 323, 326 (D.N.J.1898) (construing the claim, which included the terms "rollers" and "shafts," to include a roller and a shaft; explaining that "the use of the plural included the singular, if the singular could do the work marked out by the plural"). The phrases "one or more layers of materials" and "one or more layers comprising materials" require at least one material when there is one layer, and at least two materials when there is more than one layer. This is the only construction that makes sense for either the '505 or the '230 patent when one considers the substance of the inventions. There is no support in either patent for the exclusion of subcoatings made of only one material. Several examples listed in the patent use only one material in their subcoats: Examples 3 and 4 use only polyvinylpyrrolidone ("PVP") in the subcoating (P1, col. 8:58, 9:27); and Examples 2, 5, 7, and 8 use only HPMC (P1, col. 8:10, 10:10, 11:23-24). Any construction of the claims that excludes 6 of the first 8 examples included in the patent cannot be the proper construction, absent some express intent or reason to exclude them, and Cheminor relies solely on attorney argument in support of this contention and has presented no testimony on the issue. Therefore, the court rejects Cheminor's attempt to limit the claims of the '505 and '230 patent to cover only those formulations containing more than one "material" in the subcoating.

4. The Term "Disposed on" Does Not Require a Separate Processing Step

[26] [27] [28] Andrx argues that the phrase "disposed on" requires that the subcoating be "physically applied to" the core, as opposed to forming spontaneously. Andrx's definition attempts to import process limitations into a product claim. It is improper to limit product claims to a particular process. Vanguard Prods. Corp. v. Parker Hannifin Corp., 234 F.3d 1370, 1372-73 (Fed.Cir.2000) (holding scope of claim for electromagnetic shielding gasket not limited to method of manufacture set forth in specification). A novel product that meets the criteria for patentability is not limited by the process by which it is made, Vanguard Prods., 234 F.3d at 1372-73, and the specification need not describe every possible way of making the product, SRI Int'l v. Matsushita Elec. Corp. of Am., 775 F.2d 1107, 1121-22 (Fed.Cir.1985). Andrx's claim construction position ignores this basic principle and attempts to narrow the product claims of the '505 and '230 patents to cover only those formulations made by applying the subcoating in a particular way. However, the product claims are not limited in the manner in which the product is made and so would include products in which the subcoating was formed *in situ*. *See* Atlas Powder Co. v. E.I. du Pont De Nemours & Co., 750 F.2d 1569, 1581 (Fed.Cir.1984) (upholding the district court's rejection of defendant's argument that because its product is formed *in situ* it is different from the claimed product) ("It is the claimed product, ... not the process of forming it, that is involved.").

The intrinsic evidence is crystal clear. The '505 patent contains 8 asserted product claims and 1 asserted process claim. It is not surprising, therefore, that the specification contains disclosure about the process. Even if the patent contained only product claims, the law would require the patent to enable the making of the invention. *See* 35 U.S.C. s. 112. For this reason, Defendants are wrong when they refer to the different methods disclosed in the specification as evidence that the product claims are limited. FN29 The phrase "disposed on" only appears in the product claims, which provide a composition and structure for the claimed formulation. As such, the phrase "disposed on" as used is used in its conventional patent law sense-that is, to refer to the position or location of an element in a structure. *See generally* Moeller v. Ionetics, Inc., 794 F.2d 653, 655 (Fed.Cir.1986); Lawler Mfg. Co. v. Bradley Corp., No. IP98-1660, 2000 WL 33281119, at (S.D.Ind. Nov. 30, 2000). Contrary to Andrx's arguments, the court finds that the patentees did not act as

their own lexicographers to define this commonly understood phrase with any special meaning. The ordinary meaning of the phrase "disposed on" in the context of these product claims refers to the position of the subcoating relative to the core and, as mentioned above, means that the subcoating is in contact with the core region. The court finds that the term "disposed on" does not require that the subcoating be applied using any particular process and that the subcoating need not necessarily be "physically applied to" the core in a separate processing step.FN30

FN29. None of the portions of the '230 file history that Andrx relies on in support of this argument actually addresses a process step.

FN30. Astra's construction is further supported by the '281 patent prosecution history. In particular, the examiner of the '281 patent interpreted the product claims of the '230 patent to cover products where the subcoating forms *in situ,* without a separating subcoating step, and rejected the then-pending product claims over the '230 patent. (P9A at 2, '281 File History Office Action of 11/5/98.) The patent examiner recognized that the product claims in the '230 patent covered the formulation regardless of the process used to manufacture the product. (Id.) In response, Astra canceled the product claims and the '281 patent eventually issued with process claims, but not product claims. (P9A, '281 File History, Amendment under 37 C.F.R. s. 1.115, at 7.)

5. The Claims Do Not Require Perfection

While the parties seem to agree that the subcoating, as a type of separating layer, has to separate the core and the enteric coating, (*see* P1, col. 5:29-33), Andrx's claim construction arguments would also impose numerous additional requirements on the subcoating. Andrx would include in the definition of the term subcoating several components designed to ensure that the required separation is perfect and absolute. Andrx's position, developed at trial through its expert Dr. Banakar, is that in 1985 a person of ordinary skill in the art of pharmaceutical formulation would have understood that a subcoating "has to separate something" such that "[w]hat is being separated cannot be in the separating layer," "has to be 100% continuous," "has to have defined boundaries," and "has to have a defined thickness." (Banakar Tr. 3217:1-5.) In other words, adoption of Andrx's position would require that the subcoating have no imperfections. The court finds that Andrx's position is inconsistent with the intrinsic evidence and the real world.

Looking at the intrinsic evidence, the claims omit any words like continuous, separating, definite boundaries or specific thicknesses. If there were any doubt, Table 3 of the patent, (P1, col. 7:12-28), shows that even some subcoated formulations of the invention exhibited discoloration, and so were not perfect. What is important is that even though some of those formulations showed some discoloration, they were improved over those with no subcoat. (*See* P1, col. 7:12-28.) In other words, the formulation with a subcoating discolored less than the formulation with no subcoat. Thus, the patent contemplates, and the court construes the claims to cover, subcoatings that are less than perfect, including subcoatings that contain inconsequential amounts of omeprazole or permit inconsequential contact between portions of the core and the enteric coat. The claims do not require a perfectly continuous, exactly uniform subcoating. *See* Atmel Corp. v. Info. Storage Devices, Inc., 997 F.Supp. 1210, 1221 (N.D.Cal.1998) (rejecting defendant's argument that a layer cannot have a varying thickness because there is "nothing in the meaning of the word 'layer' that so restricts the patent"); AFG Indus., Inc. v. Cardinal IG Co., 239 F.3d 1239, 1250 (Fed.Cir.2001) (stating that, with respect to a patent for which the parties generally agreed that a "layer" requires a "uniform" chemical

composition, absent any specific statement in the patent of chemical uniformity as a characteristic of the layer, the layer must be understood as only "substantially" uniform). As the court has already noted, infringement need not be perfect to be infringement, Shamrock Techns., Inc. v. Medical Sterilization, Inc., 903 F.2d 789, 792 (Fed.Cir.1990) (inefficient infringement is still infringement), and the term "substantially," unless expressly excluded, is understood as being incorporated into a patent claim. Contrary to Andrx's assertions with respect to the meaning of "subcoating," a subcoating can still be sufficiently continuous, despite the presence of an imperfection, to be considered a film. Whether perfect or not, a subcoating is still a subcoating.

Although the court need not look to extrinsic evidence to construe the claim term "subcoating," the court notes that the extrinsic evidence supports rejection of Andrx's perfectionistic claim construction. In the real world of pharmaceutical formulation, it is understood that coatings may have imperfections. For this reason, when asked whether the subcoating had to be continuous, Dr. Langer stated that the subcoating should be "substantially continuous." (Langer Tr. 419:1-4; *see* Langer Tr. 424:2-8 ("The only thing I don't want to imply is that something can be absolutely perfect because nothing in science is perfect. Anyone of ordinary skill would know that.").) Thus, Andrx's strained requirements of perfection are inconsistent with the understanding of those skilled in the art.FN31 The court must construe the patent terms practically.

FN31. The court does not credit the opinions expressed by Dr. Banakar addressing the level of perfection Andrx would require for a subcoating, a position that is clearly litigation-driven. (*See* Banakar Tr. 3218:10-16.) Although Dr. Banakar's opinion purported to explain what a skilled formulator would require of a subcoat in an omeprazole formulation, the opinion was contrary to common sense and cannot be relied upon by the court.

6. The Term "Inert"

[29] Subparagraphs (b) of claims 1 of the '505 and '230 patents require that the subcoating be "inert." (P1, col. 16:48; P2A, col. 13:10.) The inventors nowhere defined the term "inert" to have any specialized meaning; "inert" is not expressly defined in the '505 and '230 patents, or in their file histories. That means that the ordinary meaning of the term controls, and the ordinary meaning of "inert" is very clear. At the time of the patents, a person of ordinary skill in the art of pharmaceutical formulation would have understood the term "inert" to mean pharmaceutically, chemically, and pharmacologically inactive. (Banakar Tr. 3220:24-3221:1.) This is consistent with the common understanding of the term set forth in dictionaries and technical treatises. *See, e.g.,* Oxford University Press (1974) (defining "inert" as "without active chemical properties"); Oxford University Press (1973) (defining "inert" as "without active chemical, physiological or other properties; neutral"; Random House (defining "inert" as "having little or no ability to react"; "Pharm. having no pharmacological action, as the excipient of a pill"); A55 at 635 (Hawley's Condensed Chemical Dictionary (12th ed.) ("Inert: A term used to indicate chemical inactivity in an element or compound.")).) In *Remington's Pharmaceutical Sciences,* for example, the term "inert" is used as follows: "[i]n addition to the active or therapeutic ingredient, tablets contain a number of *inert* materials. The latter are known as *additives or excipients*." *Remington's Pharmaceutical Sciences,* 17th ed. at 1605 (1985) (emphasis added) (Andrx Reply Mem. Regarding Cl. Constr. of 11/12/01, Ex. Q). These terms, which are widely used in pharmaceutical science, are terms of art meaning an inactive material in a pharmaceutical dosage form. *Handbook of Pharmaceutical Excipients,* Arthur H. Kibbe, Ph.D., Ed., Preface at xv, 3d ed. (2000) (Andrx Reply Mem. Regarding Cl. Constr. of 11/12/01, Ex. R). The *Handbook of Pharmaceutical Excipients* does not list any pharmaceutically active substance as an additive or excipient. Thus, the court adopts the

construction proffered by Defendants, which is grounded entirely in the ordinary meaning of the term. *See* Johnson Worldwide Assocs., Inc. v. Zebco Corp., 175 F.3d 985, 989 (Fed.Cir.1999) (holding that the ordinary meaning of claim language is heavily presumed and that party seeking to use statements in the written description to affect a patent's scope must at the very least identify a claim term that is susceptible to clarification); *see also* Renishaw PLC v. Marposs Societa' per Azioni, 158 F.3d 1243, 1248-49 (Fed.Cir.1998).

Reliance on the ordinary meaning of the term, however, does not require blindfolding oneself to reality, as Defendants have done. Just as Defendant Andrx argued that the subcoating had to be 100% continuous, among other things, Defendants argue that the term "inert" requires the absolute absence of *any* pharmaceutically active or chemically reactive substances in any infringing subcoating. Under Defendants' proposed construction, this absence of reactivity is to be determined in a vacuum, based solely upon the known characteristics of a particular substance found to be in a subcoating and without reference to the invention or consideration of the materials with which that particular substance interacts. Defendants' construction would bar even a single molecule of omeprazole from appearing in the subcoating of an infringing formulation. Once again Defendants' claim construction theory attempts to read an unattainable "perfection" limitation into the claims. Indeed, since almost no substance is totally inert under all conditions, Defendants' construction would vitiate any possibility of proving infringement and thereby render the claims meaningless. The law is plain, infringement need not be perfect to be infringement. Shamrock Techns., Inc. v. Medical Sterilization, Inc., 903 F.2d 789, 792 (Fed.Cir.1990). Moreover, the term "substantially," unless expressly excluded, is understood as being incorporated into a patent claim. *See* AFG Indus., Inc. v. Cardinal IG Co., Inc., 239 F.3d 1239, 1250 (Fed.Cir.2001) (stating that, with respect to a patent for which the parties generally agreed that a 'layer' requires a "uniform" chemical composition, absent any specific statement in the patent of chemical uniformity as a characteristic of a layer, the layer must be understood as only "substantially" uniform.). A subcoat that is "substantially" inert will also meet the claim limitation of "inert subcoat." Genpharm's Andrx's and Cheminor's contention that "inert" must mean totally and absolutely inert is simply wrong as a matter of law.

The claim language and other disclosures in the patent support the position that the use of the word "inert" to modify the term "subcoating" was not intended to cut off all possibility of reactivity. In fact, the claim language "said subcoating comprising ... materials selected from ..." permits the presence of additional components in the subcoating. *See* Crystal Semiconductor Corp. v. TriTech Microelectronics Int'l, Inc., 246 F.3d 1336, 1348 (Fed.Cir.2001). In addition, the patent claims and specifications themselves make it clear that the subcoating can contain chemically reactive substances, like alkaline reacting compounds. Defendant's definition is inconsistent with claim 11 of the '505 patent, which expressly requires that the subcoating of claim 1 include an ARC, (P1, col. 18:1-3), and the '505 patent specification, which expressly permits ARCs in the subcoating, (P1, col. 4:14-27). Any doubt that the "inert subcoating" of claim 1 can include reactive compounds and pharmaceutically active compounds is directly addressed by reviewing claim 1 in the context of claim 11. Claim 11 expressly calls for "[a] preparation according to claim 1, wherein the subcoating further comprises an alkaline buffering compound." (P1, Col. 18:1-3.) In other words, subcoats may include "alkaline buffering compounds," like disodium hydrogen phosphate, which is not only an ARC but also a pharmaceutically active compound. (Astra's Cl. Constr. Mem. Ex. 11, 1996 Merck Index 12th ed. at 1481 (DHP listed with therapeutic activity in humans).)

The patent prosecution histories also teach that the subcoating can contain pharmaceutically active substances, like omeprazole. During the prosecution of the '230 patent, the examiner rejected Astra's claims as indefinite, asserting that acid labile compounds and ARCs could be the same thing. ('230 Prosecution

History, at 216 ("[T]he language 'acid labile compound' and 'alkaline reacting compound' read on the same compound whereas applicants specification specifically identifies precise and exact compounds that are not related.").) In its response, Astra pointed out that the examiner was correct, that ARCs can also be acid-labile compounds. ('230 Prosecution History at 256 ("this is precisely what applicants intended").) That part of the prosecution history shows that ARCs may be pharmaceutically active, acid labile compounds, and the specification expressly states that a subcoating may contain such compounds. (P2A, col. 9:23-25 ("The separating layer consists of one or more water soluble inert layers, optionally containing pH-buffering substances.").)

Credible extrinsic evidence supports the court's construction as well. For example, Defendants' experts Dr. Auslander and Dr. Porter opined that formulators understand the term "inert" to mean not having an adverse affect on the formulation and to encompass situations where there is a small amount of interaction. (*See* Astra's 11/12/01 Cl. Constr. Resp., Exs. 34, 70.) FN32 Even the prior art relied on by Defendants shows that the term "inert" means substantially non-reactive. (*See* G31, GB 760 403 at 2, col. 2:67-70 ("By 'inert mineral solid' is meant a mineral solid which is substantially non-reactive with either the coating substance [enteric coating] or the medicament and is inert to acid medium.").) For these additional reasons, the aspects of Defendants' claim construction requiring that every molecule of every substance in the subcoating be utterly devoid of all reactivity are inconsistent with the patents' claim language, specifications, and prosecution histories.

FN32. The text of the depositions referenced by Astra in support of its claim construction arguments reads as follows:
Q: Would you utilize formulation studies to determine which materials were inert in the context of that particular formulation that you were developing?
A: Yes.
Q: And would you conclude that materials that were inert were the materials that didn't have an adverse effect on the formulation that you were developing?
A: That's correct.

(Astra's 11/12/01 Cl. Constr. Resp., Ex. 70, Auslander Dep. Tr. 75:15-24.)
Q: What is your understanding of the definition of inert?
A: That is a very broad question because I think my understanding would be in a given circumstance does the material have any likely interaction with ingredients in the formulation that would be compromising to performance or stability of that formulation.
Q: Would you in real life practice understand that while there might be some small amount of interaction, that as long as that interaction isn't so great as to compromise the performance or stability of that formulation that it would be inert?
....
A. I would think yes.

(Astra's 11/12/01 Cl. Constr. Resp., Ex. 34, Porter Dep. Tr. 42:14-43:6.)
Defendants worry about the slippery slope; they ask, if the materials in the subcoating do not have to be *completely* inert, just how "inert" is enough to qualify as "inert?" Defendants' fear is unwarranted. A person of ordinary skill reviewing the '505 and '230 patent specifications would understand that the invention is a stable formulation. That requires a subcoating that protects the omeprazole and maintains the integrity of the

enteric coating. (*See, e.g.,* P1, col. 15:34-38; *see also* P1, col. 15:7-16.) The meaning of "inert" flows directly from the invention described in the specification-the subcoating layer cannot adversely affect the properties of the omeprazole or the enteric coating. The patent specification provides that "not adversely affecting ... the enteric coating" means that the formulation retains gastric acid resistance. (*See, e.g.,* P1, col. 5:33-53 ("Without this separating layer the resistance towards gastric juice would be too short and/or the storage stability of the dosage form would be unacceptably short.").) This construction of the term "inert" is also supported by the file histories of the two patents. For example, United States Patent 4,685,918 ("Amidon"), a document referenced in the prosecution history for the '505 patent, discusses " *inert* inorganic and organic solvents" that "do not adversely harm the core, wall, and the materials forming the final wall." (Astra's Cl. Constr. Mem., Ex. 19, '505 Pros. History at 295, Amidon, col. 10:4-8 (emphasis added).)

The patent specifications describe the properties the subcoating should have in terms of stability. The subcoating must provide increased gastric acid resistance and storage stability. (*See, e.g.,* P1, col. 5:33-53.) Thus, the patent teaches that the subcoating must be inert under those conditions, which allows for the possibility that some inconsequential amounts of different components may react under some conditions or to such a limited extent that gastric acid resistance and storage stability remain uncompromised for practical purposes. Therefore, the court construes the term "inert" in claims 1 of the '505 and '230 patents, when modifying "subcoating," to require that the subcoating be chemically, pharmaceutically, and pharmacologically inactive such that the subcoating does not adversely affect the properties of the active ingredient or the enteric coating material in the formulation.

7. The "Soluble or Rapidly Disintegrating in Water" Requirement

[30] The phrase "which is soluble or rapidly disintegrating in water" is straightforward; it requires that the subcoating dissolves or breaks up quickly in water. The specification provides examples of water soluble compounds and polymers: "The material for the separating layer is chosen among the pharmaceutically acceptable, water soluble, inert compounds or polymers used for film-coating applications such as, for instance sugar, polyethylene glycol, polyvinylpyrrolidone, polyvinyl alcohol, hydroxypropyl cellulose, methylcellulose, hydroxymethyl cellulose, hydroxypropyl methylcellulose, polyvinyl acetal diethylaminoacetate or the like." (P1, col. 4:35-42 and '505 Certificate of Correction; *see also* P2A, col. 8:43-55.) The "soluble or rapidly disintegrating in water" requirement affords omeprazole release in the very upper portion of the small intestine, also referred to as the "duodenum" or "proximal part" of the small intestine, the desired site for absorption. (P1, col. 1:45-47, col. 2:29-30, 53-55.)

E. Part "(c)" of Claims 1

[31] Part "(c)" of claims 1 of both patents requires an enteric-coating layer and defines the required characteristics of that layer. This portion of the claims is largely self-explanatory. On the subcoating layer is an enteric-coating material, a material that protects the medicinal preparation so that it will pass through the stomach unaltered. An enteric-coating material is a polymer that is insoluble in acid media but soluble in neutral to alkaline media; therefore, it resists breakdown in the stomach. Examples of enteric coatings may be found in the '505 patent and include hydoxypropyl methylcellulose phthalate and Eudragit L-100 brand enteric coating, which is a methacrylic copolymer. (P1, col. 4:59-col. 5:18.)

Unlike claim 1(c) of the '505 patent, claim 1(c) of the '230 patent contains additional language further characterizing the subcoating. (P2A, col. 13:16-20.) The claim language "wherein the subcoating layer isolates the alkaline reacting core from the enteric coating layer such that the stability of the preparation is enhanced" is self-explanatory in that it means that the subcoating layer isolates or separates the core from

the enteric coating sufficiently to enhance the formulation's stability. According to the specification of the '230 patent, the subcoating of claim 1 isolates the core from the enteric coating through the creation of a "pH-buffering zone" between them. (*See* P2A, col. 9:4-8 ("The subcoating layer, (the separating layer), also serves as a pH-buffering zone in which hydrogen ions diffusing from the outside in towards the alkaline core can react with hydroxyl ions diffusing from the alkaline core towards the surface of the coated articles.").) As claim 1 of the '230 patent expressly states, the existence of this subcoating zone, in combination with the rest of the claimed formulation, enhances stability. As explained in the '230 patent specification, (P2A, col. 8:67-col. 9:4), the subcoating, in combination with the other claimed elements, enhances stability by protecting against the "degradation/discoloration of the acid labile compound during the coating process o[r] during storage." (P2A, col. 9:2-4.) FN33

FN33. Once again, Defendants improperly attempt to read structural limitations into the claim through their definition for "isolates" by requiring that the subcoating "completely" separates the core and the enteric coating such that there can be no imperfections in the subcoating. As the court has previously held, the court will not import such perfection into the claims, where it is neither required by the claims nor suggested by the specification.

F. Claim 3 of the '505 Patent

Claim 3 of the '505 patent is dependent on claim 1: "A preparation according to claim 1 wherein the subcoating comprises two or more sub-layers." (P1, col. 16:60-61.) This claim has been asserted only against Defendant Andrx, and no corresponding claim in the '230 patent has been asserted. The claim unambiguously requires that the subcoating be made up of at least two sublayers and does not raise any additional claim construction disputes.

G. '505 Patent **Claim 5/**'230 Patent **Claim 6**

Claim 5 of the '505 patent and claim 6 of the '230 patent also depend from claims 1:

A preparation according to claim 1 wherein the alkaline core comprises omeprazole and pH-buffering alkaline compound rendering to the micro-environment of omeprazole a pH of 7-12.

(P1, col. 16:65-68.)

A preparation according to claim 1, wherein an alkaline core comprises the acid labile compound and a pH-buffering alkaline reacting compound which renders to the micro-environment of the acid labile compound a pH of 7-12.

(P2A, col. 14:4-8.) Both of these claims contain three additional disputed terms-"alkaline core," "pH-buffering compound" or "pH-buffering alkaline reacting compound," and "microenvironment."

1. The Term "Alkaline Core"

Claim 5 of the '505 patent depends from claim 1 and includes a reference to " *the* alkaline core." Unless claim 5 is invalid for lack of an antecedent basis for this claim element, the alkaline core must be the same as the core region in claim 1. *Cf.* 35 U.S.C. s. 112; Manual of Patent Examining Procedure 7th ed., s. 2173(e). As the court previously held, one of ordinary skill would understand the term "alkaline core" in

claim 5 of the '505 patent to refer to any core containing an ARC or an alkaline salt of omeprazole. Such person would not understand that the entirety of the core must have a pH above 7. Similarly, one of ordinary skill would understand the term "alkaline core" in the '230 patent to refer to any core that contains either an ARC or an alkaline salt of an acid labile archive compound.

2. The Terms "pH-Buffering Compound" and "pH-Buffering Alkaline Reacting Compound"

As apparent from the court's discussion of the "alkaline reacting compound" claim limitation, one of the central disputes in this case has been the meaning of the phrase "alkaline reacting compound" as that phrase is used in the claims of the '505 and '230 patents. That dispute also extends to other variations of that term, such as "pH-buffering compound" and "pH-buffering alkaline reacting compound." The term "alkaline reacting compound" appears in claims 1 and 14 of the '505 patent and claims 1 and 12 of the '230 patent. The terms "pH-buffering alkaline compound" and "alkaline buffering compound" appear in claims 5 and 11 of the '505 patent, respectively. The terms "pH-buffering alkaline reacting compound" and "alkaline buffering compound" appear in claims 6 and 15 of the '230 patent, respectively. Originally, the parties agreed that those variations of the term all have the same meaning as "alkaline reacting compound." (*See, e.g.,* Joint Mem. of Defs. KUDCo & Genpharm on Claim Construction of the Term "Alkaline Reacting Compound" at 1 n.2, 4-5; Mem. in Supp. of Cheminor Defs.' Construction of Certain Terms of the Claims of 11/5/01, at 13 n.11.) Now the definitions of all those terms are disputed, and different definitions are proposed.

Until about a month after Astra's last witness on infringement with respect to the '505 and '230 patents, Dr. Lovgren, left the stand on January 4, 2002, no Defendant disputed Astra's construction of the term "buffering," which is used in the phrase "pH-buffering" in claim 5 of the '505 patent and claim 6 of the '230 patent, and in "alkaline buffering compound" in claim 11 of the '505 patent and claim 15 of the '230 patent. (*See, e.g.,* Genpharm's Cl. Constr. Br. of 11/5/01, at 20 ("Astra and Genpharm agree that, properly construed, alkaline reacting compounds are the same in the patents as alkaline buffering compounds.").) Astra has consistently argued that those phrases have the same meaning as the phrase "alkaline reacting compound" in claims 1. In the middle of trial, three defendants-Genpharm, Cheminor, and KUDCo-changed their positions and began to urge that the narrower, "classical" definition of "buffer," FN34 which generally is not required of an ARC, should be used in construing the patents. (*See* Tr. 3754:6-3755:24 (Astra's objection to the testimony of Dr. Story on this new theory of infringement); *see also* Letter from Cheminor to court of 2/6/02; Letter from KUDCo to court of 2/11/02.) At the time, the court expressed concern about new claim construction theories. (Tr. 3989:19-3991:1.) As Astra predicted, those new theories of claim construction ultimately led to additional noninfringement positions urged by Defendants. (*See* KUDCo FF 36, n.4; Cheminor PFF 4.6(b), n.6, 8.7.) In the interest of attempting to resolve the claim construction disputes as comprehensively as possible in this case, the court reserved ruling on Astra's objection at the time. (Tr. 4045:19-22.)

FN34. Generally a buffer, in the classical or traditional sense, is defined to mean a solution containing an acid-base pair-both a weak acid and its conjugate weak base-whose pH changes only slightly on the addition of an acidic or alkaline substance because the buffer has the ability to maintain a constant pH despite assault from basic or acidic groups. (Pilbrant Tr. 1426:7-1427:10.)

[32] Despite the utter tardiness with which they were raised, the court will address Defendants' new claim construction arguments in the interest of ensuring that the court's claim construction is as accurate as

possible; the court has no interest in precluding any party from pursuing the *correct* claim construction. It is not the claim construction arguments, but rather the previously undisclosed, undiscovered noninfringement positions that result from them that present potential prejudice to Plaintiffs. At this time, the court finds that Defendants' attempts to utilize these new claim construction arguments to assert novel noninfringement defenses after the close of Astra's direct case severely prejudiced Plaintiffs. Astra had no reasonable opportunity to have its expert witnesses address these "buffer" theories or to question Defendants' experts effectively on these new theories. Given the chance to develop the information during discovery, Astra surely would have introduced evidence specifically directed to those constructions and their implications for Astra's infringement claims. Therefore, the court precludes Defendants from arguing noninfringement of any of the patent claims at issue in this suit on the basis of their new construction that the phrases "pH-buffering compound" and "pH-buffering alkaline reacting compound" mean something different from the term "alkaline reacting compound."

Now Defendants argue that the terms "pH-buffering alkaline compound" recited in claim 5 of the '505 patent and "pH-buffering alkaline reacting compound" recited in claim 6 of the '230 patent require a compound that can maintain a constant pH in an aqueous solution when an acid or base is added to it within the buffering capacity of the compound. The reasons Defendants did not think to dispute Astra's initial construction until this time are evident in the patents. In both patents, the examples of alkaline reacting compounds largely overlap the substances described as "pH-buffering compounds." (*Compare* P1, col. 3:47-59, *with* P1, col. 4:14-27; *compare also* P2A, col. 8:43-55, *with* P2A, col. 9:9-23.) During the initial rounds of claim construction briefing, Cheminor even conceded that with respect to the categories of ARCs listed in the patent, "the patent makes clear that the specified 'alkaline reacting compounds' *are all* 'conventional buffering substances.' " (Mem. in Supp. of Cheminor Defs.' Constr. of Certain Terms of the Claims of 11/5/01, at 13 (emphasis added).) The patents also repeatedly describe substances that are not buffers in the traditional sense as compounds that have buffering characteristics or create buffering zones. For example, the patents provide a lengthy list of substances can be added to the subcoating to " *strengthen*" its "pH-buffering properties," and those substances are referred to as "pH-buffering compounds." (P1, col. 4:14-27 (emphasis added).) This disclosure indicates to a person of ordinary skill in the art that even a subcoating that does not contain the optional pH-buffering compound has "pH-buffering properties," albeit properties capable of improvement. Additionally, magnesium hydroxide, which is not an acid-base pair but which is listed as an ARC, (P1, col. 3:53), is called a "buffering substance" in the '505 patent, (P1, col. 15:28). The use in the patents of a broad definition of the term "buffer" as something that provides a barrier between the active ingredient and other potentially harmful substances or that helps to stabilize the active ingredient, like an ARC, is exemplified further by the use of the phrase "pH-buffering zone" in the patents to describe the subcoating as possessing "pH-buffering properties." (P1, col. 4:10, 14; P2A, col. 9:5, 9.) KUDCo's expert Dr. Auslander testified that the "pH-buffering zone" was "providing a barrier" and that the term "buffer" in that phrase was not used in the "classical sense of chemistry." (Auslander Tr. 2703:19-2704:13.)

[33] As discussed earlier in this opinion, the patentees acted as their own lexicographers and defined the term "alkaline reacting compound," which would not be have been readily understood by someone of skill in the art at the time of the patents, in the specifications. Based on a detailed review of the intrinsic evidence, particularly the claims and the specifications, the court finds that a person of ordinary skill in the art of pharmaceutical formulation, who read the patents and understood the term "alkaline reacting compound" in light of the specifications, would realize that the terms "pH-buffering compound" and "pH-buffering alkaline reacting compound" are used interchangeably with the term "alkaline reacting compound" throughout the patent. (*See* Lovgren Tr. 4477:21-4478:5 ("I think an average skilled formulator reading this

patent will see these terms used interchangeably so many times in the specifications.").) The person of ordinary skill in the art would, therefore, understand that the term "pH-buffering" generally was not used in the patent to convey the traditional characteristics of a buffer in chemistry. Instead of relying on the ordinary meaning of the term "pH-buffering," the patentees made it clear that they had something special in mind-an ARC. Thus, the patenteesassigned their own definition to the terms "pH-buffering compound" and "pH-buffering alkaline reacting compound" by equating them with an ARC, a concept the patentees clearly and specifically defined in the specifications. The court rejects Defendants' late-raised claim construction as unsupported by the intrinsic evidence; therefore, the court construes the terms "pH-buffering alkaline compound" and "pH-buffering alkaline reacting compound" to mean the same thing as the term "alkaline reacting compound" in the patents.

3. The Term "Micro-environment"

[34] The term "micro-environment" introduces a limitation relative to claims 1 concerning the core region. (*See, e.g.,* P1, col. 16:67; P2A, col. 14:7.) Claim 5 requires that the core "comprises omeprazole" and a "pH-buffering alkaline compound" that renders to the "microenvironment" of omeprazole a pH of 7 to 12. The term "microenvironment" is construed to refer to the regions immediately around or in close proximity to the omeprazole particles. (*See* Langer Tr. 318:16-23, 588:16-589:11; Auslander Tr. 2691:3-7; Seth Tr. 2057:12-15.) This definition is supported by the patent specifications, which state that the alkaline reacting compound should create a "micro-pH" around the omeprazole when water is adsorbed to the particles ... or when water is added in small amounts to the mixture." (P1, col. 3:43-46.) The exact size of the microenvironment depends on the way the core is formulated, including the substances in it. (*See* Davies Tr. 1173:4-1177:2.) Defendant Genpharm argues that the term "microenvironment" is unclear and renders the claim invalid under 35 U.S.C. s. 112. The court will address that argument in the section of this opinion devoted to invalidity defenses.

H. '505 Patent **Claim 6/**'230 Patent **Claim 7**

Claim 6 of the '505 patent in turn is dependent on claim 5:

A preparation according to claim 5 wherein the alkaline compound comprises one or more of magnesium oxide, hydroxide or carbonate, aluminium hydroxide, aluminium, calcium, sodium or potassium carbonate, phosphate or citrate, the composite aluminium/magnesium compounds Al_2O_3->6MgO->CO_2->12H_2O or MgO-> Al_2O_3->2SiO_2->nH_2O where n is not an integer and less than 2.

(P1, col. 17:1-8.) Similarly, claim 7 of the '230 patent in turn is dependent on claim 6:

A preparation according to claim 6 wherein the alkaline reacting compound comprises one or more of magnesium oxide, hydroxide or carbonate, aluminium hydroxide, aluminium, calcium, sodium or potassium carbonate, phosphate or citrate, the composite aluminium/magnesium compounds Al_2O_3->6MgO->CO_2->12H_2O or MgO->Al_2O_3->2SiO_2->nH_2O where n is not an integer and less than 2.

(P2A, col. 14:9-16.) Again, "alkaline compound" in claim 6 of the '505 patent has the same meaning as "alkaline reacting compound," as used in the other claims of the '505 and '230 patents, including claim 7 of the '230 patent. In order to fall within these claim limitations, the alkaline compound or ARC must be selected from one of the compound types listed in the claims.

I. '505 Patent **Claim 8/**'230 Patent **Claim 10**

Claim 8 of the '505 patent and claim 10 of the '230 patent are dependent upon claims 1:

A preparation according to claim 1 wherein the enteric coating comprises hydroxypropyl methylcellulose phthalate,cellulose acetate phthalate, co-polymerized methacrylic acid/methacrylic acid methyl ester or polyvinyl acetate phthalate, optionally containing a plasticizer.

(P1, col. 17:13-18.)

A preparation according to claim 1 wherein the enteric coating comprises hydroxypropyl methylcellulose phthalate, cellulose acetate phthalate, co-polymerized methacrylic acid/methacrylic acid methyl ester or polyvinyl acetate phthalate, optionally containing a plasticizer.

(P2A, col. 14:24-29.) The composition of the enteric coating materials in these claims is self-explanatory. "Plasticizer" means an additive that imparts flexibility, workability, or stretchability to an enteric-coating polymer. Examples of plasticizers are provided in the '505 patent specification and include diethyl phthalate and cetyl alcohol. (P1, col. 9:53-55.)

J. '505 Patent **Claim 9/**'230 Patent **Claim 11**

Claim 9 of the '505 patent is also dependent upon claim 1: "A preparation according to claim 1 wherein the water content of the final dosage form containing omeprazole does not exceed 1.5% by weight." (P1, col. 17:19-21.) Claim 11 of the '230 patent imposes the same water content requirement upon the "final dosage form" of the '230 patent containing the "acid labile compound." (P2A, col. 14:30-32.) Defendant Cheminor alone challenges Astra's proposed constructions with respect to these claims.

[35] The court agrees with Cheminor that the term "water content" is not an ambiguous term. It simply means the amount of water in a given thing. Contrary to this plain and readily discernible meaning, Astra proposed that the term "water content" should incorporate concepts of molecular crystallinity and boiling temperatures. Astra proposes that the phrase "water content" refers to water that can be released from the formulation at elevated temperatures up to about the boiling point of water; it does not include bound water, or water of crystallization.FN35 (*See* Astra Cl. Constr. Mem. of 11/5/01, at 33.) There is no reference in either patent to "bound water" or a test of water content that includes elevating temperatures to "about the boiling temperature." These new concepts Astra seeks to inject into the patent claims are extrinsic to the claims and the specification and, of course, can only be proven by extrinsic evidence. Because this claim term can be construed solely from the intrinsic evidence, there is no need for the court to even consider such extrinsic evidence. Indeed, "if the meaning of the claim limitation is apparent from the intrinsic evidence alone, it is improper to rely on evidence other than that used to ascertain the ordinary meaning of the claim limitation." Bell Atl. Network Servs., Inc. v. Covad Communications Group, Inc., 262 F.3d 1258, 1268 (Fed.Cir.2001); *Vitronics,* 90 F.3d at 1582. Accordingly, the court rejects Astra's proposed definition and holds that the term "water content" simply refers to any water in the final dosage form. FN36

FN35. Bound water is defined by the Hawley's Condensed Chemical Dictionary, 146, 10th Ed.1981, as "water molecules that are tightly held by various chemical groups in a larger molecule."

FN36. Plaintiffs incorrectly argue that they have been prejudiced by Cheminor's proposed construction,

which Plaintiffs claim is new. Defendant Cheminor clearly included this construction in the claim construction briefing requested by the court prior to trial in response to the definition proposed by Astra. (*See* Mem. in Supp. of Cheminor Defs.' Constr. of Certain Terms of 11/5/01, at 23.)

The specification defines the "final dosage form" as, for example, the enteric-coated pellets that are found inside the capsules. (P1, col. 5:60-63; P2A, col. 10:37-40.) Every example of the "final dosage form" listed in the specification refers to a formulation that has been *enteric coated,* which does not include the capsule into which enteric-coated formulations are filled. Under the section titled "Final dosage form," the '230 patent specification states that "[i]t is essential for the long term stability during storage that the water content of the final dosage form containing acid labile compound (*enteric coated tablets, capsules or pellets*) is kept low, preferably not exceeding 1.5% by weight." (P2A, col. 10:40-44 (emphasis added); *see also* P1 col. 5:67-col. 6:5 ("[a]s a consequence the final package containing hard gelatine capsules filled with enteric coated pellets preferably also contain a desiccant, which reduces the water content of the gelatine shell to a level where the *water content of the enteric coated pellets* filled in the capsules does not exceed 1.5% by weight.") (emphasis added).) Only Cheminor challenges this definition, relying on extrinsic evidence and mischaracterization of quotes from the specifications to argue that the water content measurement must be construed to include both the capsule and the enteric coated pellets. This interpretation cannot stand, because the specification expressly states that the "final dosage form" is the formulation that has been enteric coated, before being filled into any capsule. (*See* P1, col. 5:60-63; P2A, col. 10:37-44.) In addition, the test results relating to water content in the patent specification refer to testing "pellets," not the final package. (*See* P1, col. 14:46-61.) Since the "final dosage form" referenced in the claims is the enteric-coated pellets, and not pellets filled into a capsule, the term "1.5% by weight" refers to the water content of the enteric-coated pellets, calculated as a weight percentage.

K. '505 Patent **Claim 10/**'230 Patent **Claim 13**

Claim 10 of the '505 patent and claim 13 of the '230 patent cover a method of treatment utilizing the formulation claimed in claims 1:

A method of treatment of gastrointestinal disease comprising administering to a host in need of such treatment a therapeutically effective amount of a preparation according to claim 1.

(P1, col. 17:22-25.)

A method for the treatment of gastrointestinal disease characterized in that a preparation according to claim 1 is administered to a host in the need of such treatment in a therapeutically effective amount.

(P2A, col. 14:42-45.) "Gastrointestinal disease" refers to diseases related to gastric acid secretion. (P1, col. 6:12-15.) "Administering" refers to "give as a remedy to cure or relieve a disease or bodily disorder," in this case via the oral route required by claim 1. In the '230 patent, this claim language confirms that the acid labile pharmaceutically active substance of claim 1 must be useable to treat gastrointestinal disease. (P2A, col. 14:42-45.) This claim language unambiguously requires that the acid labile pharmaceutically active substance of all claims, including claims 1 and 13 of the '230 patent, have an effect on gastrointestinal disease.

[36] "Therapeutically effective amount" means an amount that is effective in therapy, or an amount

sufficient to provide a therapeutic effect. An amount that is effective in therapy is an amount which produces a biological activity and will depend, among other things, on the individual. "The typical daily dose of the active substance varies and will depend on variousfactors such as the individual requirements of the patients, the mode of administration and disease. In general the daily dose will be in the range of 1-400 mg of omeprazole." (P1, col. 6:15-20 and '505 Certificate of Correction; *see* P2A, col. 10:59-61.) The preparations of the invention encompass a vast number of acid labile pharmaceutically active compounds. Each will have its own dosage particulars; as evidenced by the patents themselves, Astra's proposed limitation of 1 to 400 mg is only applicable to omeprazole or to benzimidazoles, a subset of the substances claimed in claim 2 of the '230 patent, a claim that is dependent from claim 1. Since omeprazole is the compound at issue, however, that portion of the specification is helpful in providing guidance on the appropriate range for this case.

L. '505 Patent **Claim 11/**'230 Patent **Claim 15**

Claim 11 of the '505 and claim 15 of the '230 patent are nearly identical claims that are dependent on their respective claims 1:

A preparation according to claim 1, wherein the subcoating further comprises an alkaline buffering compound.

(P1, col. 18:1-3; *see also* P2A, col. 14:50-52.) These claims narrow claims 1 to instances in which the subcoating contains an "alkaline buffering compound." As discussed above, the phrase "alkaline buffering compound" has the same meaning as "alkaline reacting compound." These two claims simply require that the subcoat contain an alkaline buffering compound or ARC. In contrast to suggestions by Defendants, the presence of an ARC in the "inert" subcoating does not necessarily create conflict with the term "inert." It is possible to include ARCs in an inert subcoating, so long as the ARC does not compromise the enteric coat or cause degradation of the omeprazole. (P1, col. 4:14-27 (demonstrating use of ARCs in subcoats); P1, Table 2, col. 6:54-65 (subcoating includes ARC magnesium hydroxide).)

M. '505 Patent **Claim 12**

Claim 12 of the '505 patent is also dependent on claim 1 of the '505 patent: "A preparation according to claim 1, wherein the core comprises omeprazole and disodium hydrogen phosphate, and the subcoating comprises hydroxy propyl methyl cellulose." (P1, col. 18:4-7.) Claim 12 is self-explanatory and does not appear to raise any additional claim construction disputes.

N. '505 Patent **Claim 14/**'230 Patent **Claim 12**

Claim 14 of the '505 patent covers a process for formulating an omeprazole dosage form:

A process for the preparation of an oral pharmaceutical preparation containing omeprazole, comprising:

(a) preparing a core comprising an effective amount of a material selected from the group consisting of omeprazole plus an alkaline reacting compound, an alkaline omeprazole salt plus an alkaline reacting compound and an alkaline omeprazole salt alone;

(b) coating the core with one or more layers of an inert subcoating material selected from among tablet excipients and polymeric film-forming compounds to form a subcoated core; and

(c) coating the subcoated core with an enteric coating.

(P1, col. 18:13-25.) Similarly, claim 12 of the '230 patent covers a process for preparing a formulation containing an acid labile compound:

Process for the preparation of an oral pharmaceutical preparation containing an acid labile compound, in which cores containing the acid labile compound mixed with an alkaline reacting compound or compounds or an alkaline salt of the acid labile compound optionally mixed with an alkaline reacting compound or compounds are coated with one or more inert reacting subcoating layers whereafter the subcoated cores are further coated with an enteric coating layer.

(P2A, col. 14:33-41.) Terms common to these two claims and claims 1 of the '505 and '230 patents have the same meaning in both instances. "Coating" in claim 14 parts (b) and (c) and "coated" in claim 12 are both used as verbs and mean a process step wherein either the inert subcoating or enteric coating material is applied onto either the core or subcoated core, respectively, so that the inert subcoating or the enteric coating takes the form of the thing being coated.

While not expressly discussed in Genpharm's proposed findings of fact and conclusions of law, Genpharm apparently is construing the terms "coating" and "coated" in these two claims as covering encapsulation and filling capsules in connection with its invalidity arguments. Neither patent specification uses the term "coating" or "coated" as a verb in relation to gelatine capsules. Rather, the term "coating," when used as a verb, is used in relation to fluidized bed or pan coating and dry coating techniques. (P1, col. 8:6-16, col. 12:1-4, 18-20; P2A, col. 11:29-31, col. 12:13-15.) As previously discussed, filling a capsule is not a coating step. There is no support for any construction of "coating" or "coated" that would bring capsules and encapsulation into the process claims 14 and 12, respectively, in the '505 and '230 patents.

O. Claim Construction Issues Limited to the '230 patent

[37] Two disputed claim limitations-"acid-labile pharmaceutically active substance" or "acid labile compound" and "the stability of the preparation is enhanced"-are peculiar to the '230 patent in that the terms do not appear in the claims of the '505 patent. As an initial matter, the court must address whether the '230 patent covers any omeprazole-containing formulation, specifically whether the claim language "acid labile pharmaceutically active substance" includes omeprazole. After over three years of litigation, Defendants for the first time on October 29, 2001, suggested that the '230 patent claims excluded omeprazole. However, the court finds that Defendants' claim construction theory is inconsistent with the evidence intrinsic to the '230 patent. The court determines that the terms "acid-labile pharmaceutically active substance" and "acid labile compound" in the '230 patent include omeprazole. This definition is supported by both the intrinsic and extrinsic evidence.

Claims 1 and 12 of the '230 patent concern pharmaceutical formulations comprising "an acid-labile, pharmaceutically active substance" and "an acid labile compound," respectively. (P2A, col. 13:2-3, col. 14:34-35.) The parties do not distinguish between these two terms, and the court likewise sees no evidence in the intrinsic or extrinsic record that they are distinct. On its face, the language of the claims of the '230 patent asserted against Defendants, claims 1, 6, 7, 10-13, and 15, unambiguously covers omeprazole. Claim 1, subpart (a) requires the presence of an "acid-labile pharmaceutically active substance" or an alkaline salt of such substance. (P2A, col. 13:2-9.) "Acid-labile pharmaceutically active substances" are those that are

transformed into biologically active compounds by a rapid degradation or transformation in acid media. (P2A, col. 2:30-33 ("A common feature of these compounds are that they are transformed into the biologically active compounds via rapid degradation/transformation in acid media.").) These compounds include compounds that are defined by the general formula I, depicted in column 1 of the patent, (P2A, col. 1:30-40), and certain other compounds, such as 2-[(2-dimethylamino benzyl)sulfinyl]-benzimidazole. (P2A, col. 1:30-col. 2:5.) It is undisputed that the general formula I includes omeprazole. There are other claims in the '230 patent that expressly exclude omeprazole. (*See, e.g.,* P2A, col. 13:42-45.) For instance, claim 2, depends from claim 1 and expressly limits the acid labile substance to those of formula I substituted benzimidazoles "except the compound omeprazole." (P2, col. 13:21-46.) The claims that exclude omeprazole have not been asserted against any Defendant.

Where the claim language is clear and unambiguous on its face, the court need not consider any other intrinsic evidence. Johnson Worldwide Assocs. Inc. v. Zebco Corp., 175 F.3d 985, 989-90 (Fed.Cir.1999) (holding that the ordinary meaning of claim language is heavily presumed and that party seeking to use statements in the written description to affect a patent's scope must at the very least identify a claim term that is susceptible to clarification); Renishaw PLC v. Marposs Societa' per Azioni, 158 F.3d 1243, 1248-49 (Fed.Cir.1998) (holding that a party seeking to use the written description to affect a patent's scope must at the very least identify a term requiring clarification). Indeed, "a court must presume that the terms in the claim mean what they say ...." Johnson Worldwide Assocs., 175 F.3d at 989. Thus, on the basis of the language of the asserted claims alone, the court finds that the asserted claims of the '230 patent cover the use of omeprazole as the acid labile active ingredient.

Even if the court were to resort to the intrinsic evidence beyond the language of the claims themselves, the court would reach the same conclusion. Claim 1 of the '230 patent covers a very broad group of active ingredients referred to as "acid-labile pharmaceutically active substance[s]." (P2A, col. 13:2-3.) The '230 patent specification states that acid labile compounds are those "substances that are labile in acid media." (P2, col. 1:14-27.) Claim 2, on the other hand, claims a narrower group of active ingredients that have the "general formula I," which is described in the claim. (P2A, col. 13:21-46.) The specification also describes this subset of acid-labile compounds, benzimidazoles according to "formula I," which "are virtually biologically inactive as such, but degrade/transform to active inhibitors of certain enzyme systems in acid media." (P2A, col. 2:6-9.) In support of their construction that the '230 patent claims do not include the compound omeprazole, Defendants point to a single passage in the specification. (P2A, col. 7:51-55.). The specification states that "[t]he object of the present invention is thus an enteric coated dosage form of acid labile compounds with the general formula I defined above except the compound omeprazole." (P2A, col. 7:51-54.) This statement, which is discussing compounds of the general formula I, clearly relates to claim 2 and does not limit the scope of claim 1. The formula I compounds in the '230 patent specification, claimed in claim 2, are a subset of the general acid labile compounds found in claim 1; there is no limitation in claim 1 that requires the acid labile substances to be benzimidazoles according to formula I. Moreover, even if the phrase cited by Defendants were applicable to claim 1, a single passage in the specification in apparent conflict with the language of the claims and the written specification as a whole must be ignored when interpreting a claim. *See* Digital Biometrics, Inc. v. Identix, Inc., 149 F.3d 1335, 1345 (Fed.Cir.1998).

Defendants' proposed construction also ignores key portions of the prosecution history that clearly refute Defendants' arguments on this point. *See* Burke, Inc. v. Bruno Indep. Living Aids, Inc., 183 F.3d 1334, 1341 (Fed.Cir.1999) (looking not only to the specification, but also to the prosecution history). The '230 patent prosecution history resolves any question about whether claim 1 of the '230 patent includes omeprazole. During prosecution of the application that matured into the '230 patent, Astra realized that it might be

necessary for Astra to file a terminal disclaimer in view of the issuance of the '505 patent. (*See* Astra Resp. to the First Office Action of 12/19/88, Ex. 28 to Astra's Cl. Constr. Mem.) Thereafter, the patent examiner rejected the claims, including what is now claim 1, over the '505 patent. The examiner stated that "[a]lthough the conflicting claims are not identical, they are not patentably distinct from each other *because the pharmaceutically active substance of the instant application could be omeprazole as in U.S. 4,786,505*." (P8A, Office Action 9/2/88, at pg. 2 (emphasis added).) In other words, the patent examiner rejected what is now claim 1 of the '230 patent, as well as the other asserted claims of the '230 patent, because those claims include omeprazole. In response to this rejection, Astra did not amend the claims but instead overcame the rejection by filing a terminal disclaimer, in which Astra agreed that any resulting patent would expire on the same date that the '505 patent expired. (P8A, '230 Prosecution History at 311, Terminal Disclaimer of 1/19/89.) Astra thus acknowledged that its '230 patent claims covered omeprazole and forfeited part of the life of the '230 patent rather than amend its claims to exclude omeprazole. As a result, the patent examiner allowed the claims. (P8A, Notice of Allowability of 3/28/89.) The patent examiner's interpretation of the claim at issue, and Astra's decision not to amend the claims, confirm that claim 1 of the '230 patent covers omeprazole.

Defendants rely on two recent cases from the Federal Circuit for the proposition that a feature of an invention that has been disclaimed cannot be included in the scope of the claims. *See* SciMed Life Sys., Inc. v. Advanced Cardiovascular Sys., Inc., 242 F.3d 1337, 1341 (Fed.Cir.2001) ("Where the specification makes clear that the invention does not include a particular feature, that feature is deemed to be outside the reach of the claims of the patent, even though the language of the claims, read without reference to the specification, might be considered broad enough to encompass the feature in question."); Cultor Corp. v. A.E. Staley Mfg. Co., 224 F.3d 1328, 1331 (Fed.Cir.2000). Defendants' reliance on these cases is misplaced, however, for they failed to take into account the relevant portions of the prosecution history. For example, in *Cultor,* the court expressly stated that "[w]hether a claim must, in any particular case, be limited to the specific embodiment presented in the specification depends on each case on the specificity of the description of the invention *and on the prosecution history*." Cultor, 224 F.3d at 1331 (emphasis added). In *Cultor,* the prosecution history repeatedly distinguished the prior art based on a narrow disclosure of the invention. In contrast, here, the patent examiner said the claims covered omeprazole, and Astra agreed. Similarly, in *SciMed,* the court found "nothing pertinent" in the prosecution history to consider. 242 F.3d at 1340. Clearly that is not the case here. The analysis in these two cases is inapplicable because Defendants' failed to consider the prosecution history.

III. Defendants' *Daubert* Motions

All Defendants move to exclude various portions of the testimony of both Dr. Davies and Dr. Langer, two of Plaintiffs' expert witnesses who testified at the trial. Defendants initially made timely motions *in limine,* pursuant to Federal Rules of Evidence 104, 402, 702, and 703 to exclude the challenged testimony under *Daubert*. Because Defendants' *Daubert* challenges were raised just prior to trial and this trial was conducted as a bench trial, the court elected to hear the *Daubert* proof during the trial itself. (*See* Mem. of Law in Supp. of Andrx's Mot. to Exclude Expert Testimony of Martyn C. Davies under *Daubert* at 1 ("Andrx believes that it would be most efficient for the Court to determine the overlapping and related issues of admissibility and weight in the context of overall post-trial determinations.").) Although courts often hold pretrial evidentiary hearings in the context of Rule 104(a) rulings on the admissibility of expert testimony, "[n]othing in *Daubert,* or any other Supreme Court or Second Circuit case, mandates that the district court hold a *Daubert* hearing before ruling on the admissibility of expert testimony." Colon v. Bic USA, Inc., 199 F.Supp.2d 53, 71 (S.D.N.Y.2001); *see also* Stone v. 866 3rd Next Generation Hotel, LLC, No. 99 Civ. 4780,

2002 WL 1046706, at (S.D.N.Y. May 22, 2002).

At the conclusion of the trial, Defendants renewed their motions. The court has now considered thoroughly all submissions and arguments relating to the motions of all Defendants. The court has considered all of the testimony of the experts, as well as the other evidence offered at trial. For the following reasons, Defendants' motions to exclude or strike portions of the testimony of Dr. Davies and Dr. Langer and exhibits offered through those two witnesses are denied in their entirety.

A. Choice of Law

[38] [39] When deciding issues in a patent case, a district court applies the law of the circuit in which it sits to nonpatent issues and the law of the Federal Circuit to issues of substantive patent law. In re Cambridge Biotech Corp., 186 F.3d 1356, 1368 (Fed.Cir.1999). An issue "that is not itself a substantive patent law issue is nonetheless governed by Federal Circuit law if the issue pertains to patent law, if it bears an essential relationship to matters committed to [the] exclusive control [of the Federal Circuit] by statute, or if it clearly implicates the jurisprudential responsibilities of [the Federal Circuit] in a field within its exclusive jurisdiction." Midwest Indus., Inc. v. Karavan Trailers, Inc., 175 F.3d 1356, 1359 (Fed.Cir.1999) (*en banc* in relevant part) (internal citations and quotations omitted). Under these rules, evidentiary rulings concerning the admissibility of expert testimony are generally governed by regional circuit law. Odetics, Inc. v. Storage Tech. Corp., 185 F.3d 1259, 1276 (Fed.Cir.1999) ("Because these evidentiary rulings raise procedural issues not unique to patent law, this court applies the law of the regional circuit where appeals from the district court would normally lie."); WMS Gaming Inc. v. Int'l Game Tech., 184 F.3d 1339, 1361 (Fed.Cir.1999). However, the determination of whether material is relevant in a patent case is governed by Federal Circuit law when the material relates to an issue of substantive patent law. *See* Midwest Indus., Inc., 175 F.3d at 1359 (citing Truswal Sys. Corp. v. Hydro-Air Eng'g, Inc., 813 F.2d 1207, 1212 (Fed.Cir.1987)). Thus, this court is governed by the law of the Federal Circuit as to relevance and the law of the Second Circuit as to the other issues raised by Defendants' challenges to the testimony of Dr. Davies and Dr. Langer.

B. Legal Requirements Under *Daubert* and Rule 702

If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise, if (1) the testimony is based upon sufficient facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case.

The admissibility of all expert testimony under Rule 702 is a preliminary question of law for the district court to determine pursuant to Federal Rule of Evidence 104(a), *see* Daubert, 509 U.S. at 592, 113 S.Ct. 2786, and district courts have broad discretion when determining whether or not to admit expert testimony, Fiataruolo v. United States, 8 F.3d 930, 941 (2d Cir.1993). The proponent of the evidence, in this case Astra, must establish admissibility under Rule 104(a) by a preponderance of the evidence. *See* Bourjaily v. United States, 483 U.S. 171, 175-76, 107 S.Ct. 2775, 97 L.Ed.2d 144 (1987); *see also* Colon v. Bic USA, Inc., 199 F.Supp.2d 53, 69 (S.D.N.Y.2001). However, when interpreting the requirements under *Daubert* and its progeny, the Second Circuit has noted that "[a]lthough expert testimony should be excluded if it is speculative or conjectural, or if it is based on assumptions that are so unrealistic and contradictory as to suggest bad faith or to be in essence an apples and oranges comparison, other contentions that the

assumptions are unfounded go to the weight, not the admissibility, of the testimony." Boucher v. United States Suzuki Motor Corp., 73 F.3d 18, 21 (2d Cir.1996) (internal quotations and citations omitted).

[41] In determining admissibility under *Daubert,* trial judges are charged with a gate-keeping function pursuant to Rule 702 whereby they must determine (1) whether the theory or methodology underlying the testimony is reliable and (2) whether the expert's theory or methodology is relevant in that it "fits" the facts of the case. *See* Daubert, 509 U.S. at 590-91, 113 S.Ct. 2786; Kumho Tire Co. v. Carmichael, 526 U.S. 137, 149-50, 119 S.Ct. 1167, 143 L.Ed.2d 238 (1999); Campbell v. Metro. Prop. & Cas. Ins. Co., 239 F.3d 179, 184-85 (2d Cir.2001). For consideration by district courts in determining the reliability of expert testimony, the Supreme Court set forth the following non-dispositive, non-exclusive factors as "flexible" guidelines in *Daubert:* (1) whether the theory or technique can be or has been tested; (2) whether the theory or technique has been subjected to peer review and publication; (3) the known or potential rate of error associated with the technique along with the existence and maintenance of standards controlling the technique's operation; and (4) whether the technique or theory has been generally accepted in the scientific community. Daubert, 509 U.S. at 592-95, 113 S.Ct. 2786. In addition to the five factors explicitly discussed in *Daubert,* a variety of other factors have been considered by district courts in the Second Circuit when determining the admissibility of expert testimony. Some of the more commonly used factors include consideration of the foundation for the opinion, its subjectivity, any failure to test, the expert's consideration of alternative causes, and a comparison of the methodology to the expert's regular professional work. *See, e.g.,* Franklin v. Consolidated Edison Co., 37 Fed.Appx. 12, 15, No. 01-7559, 2002 U.S.App. LEXIS 6518, at (2d Cir. Apr. 9, 2002); Brooks v. Outboard Marine Corp., 234 F.3d 89, 92 (2d Cir.2000); United States v. Mazzeo, 205 F.3d 1326, 2000 WL 232032, at *2, No. 99-1223, 2000 U.S.App. LEXIS 818, at (2d Cir. Jan. 21, 2000); Washburn v. Merck & Co., 213 F.3d 627, 2000 WL 528649, at *2, No. 99-9121, 2000 U.S.App. LEXIS 8601, at (2d Cir. May 1, 2000); B.F. Goodrich v. Betkoski, 99 F.3d 505, 524-27 (2d Cir.1996).

[42] [43] [44] The "fit" or relevance requirement enunciated in *Daubert* has been interpreted to encompass several concepts. In order for scientific evidence to be admissible it must be relevant, which means the evidence must have the "tendency to make the existence of any fact that is of consequence to the determination of the action more probable or less probable than it would be without the evidence." Fed.R.Evid. 401; Daubert, 509 U.S. at 587, 113 S.Ct. 2786. Thus, even if the methodology used by the expert is considered to be reliable, the expert's testimony will nevertheless fail to meet the "fit" requirement and should be excluded if the data relied upon by the expert is materially different from the data relevant to the facts of the case. *See* Raskin v. Wyatt Co., 125 F.3d 55, 67-68 (2d Cir.1997). If the expert has failed to consider the necessary factors or if the analysis is premised upon a faulty assumption, his testimony may be excluded for lack of probative value. *See* Lightfoot v. Union Carbide Corp., 175 F.3d 1008, 1999 WL 110424, at *2, No. 98-7166, 1999 U.S.App. LEXIS 3329, at (2d Cir. Mar. 1, 1999). Likewise, where the proffered testimony is based on a methodology transposed from one area to a completely different context, and there is no independent research supporting the transposition, the "fit" requirement may not be satisfied. To the extent that Dr. Davies and Dr. Langer have based their opinions on studies, models, or experiments, therefore, it is Astra's burden to connect those analyses to the facts of this case. *See* General Electric Co. v. Joiner, 522 U.S. 136, 144, 118 S.Ct. 512, 139 L.Ed.2d 508 (1997).

[45] [46] Even if an expert's methodologies satisfy the *Daubert* standard for admissibility, the court must still determine whether that evidence actually supports the expert's conclusions. Joiner, 522 U.S. at 146, 118 S.Ct. 512. The court must reject expert testimony where "there is simply too great an analytical gap between the data and the opinion proffered." Joiner, 522 U.S. at 146, 118 S.Ct. 512; Graham v. Playtex Prods., 993 F.Supp. 127, 132 (N.D.N.Y.1998) (noting that *Joiner* applies *Daubert* gate-keeping to conclusions as well as

methodology). Failure to test for alternative causes or the use of control experiments may provide a basis for exclusion. *See* In re Executive Telecard Ltd., Sec. Litig., 979 F.Supp. 1021, 1026 (S.D.N.Y.1997); Valentine v. Pioneer Chlor Alkali Co., 921 F.Supp. 666, 677 (D.Nev.1996). It is not required, however, that an expert categorically exclude each and every possible alternative cause in order to render the proffered testimony admissible. *See, e.g.,* Zuchowicz v. United States, 140 F.3d 381, 385-87 (2d Cir.1998).

C. Expert Qualifications

Before determining whether the testimony and evidence offered by Dr. Davies and Dr. Langer meets the *Daubert* standards, the court must first determine whether each expert is qualified to testify.FN37 *See* In re Paoli R.R. Yard PCB Litig., 35 F.3d 717, 741 (3d Cir.1994); Mancuso v. Consol. Edison, 56 F.Supp.2d 391 (S.D.N.Y.1999), *aff'd in relevant part, vacated in part,* 216 F.3d 1072 (2d Cir.2000). The ultimate issue for the court to determine is whether the witness has "specialized knowledge" through "experience, training or education" as to the contents of his proposed expert testimony. Fed.R.Evid. 702. The court considered each expert's background and experience in order to determine whether each witness was qualified to render the opinion testimony he offered at trial. *See* McCullock v. H.B. Fuller Co., 61 F.3d 1038, 1043 (2d Cir.1995) (*cited in* Johnson Elec. N. Am., Inc. v. Mabuchi Motor Am. Corp., 103 F.Supp.2d 268, 279 (S.D.N.Y.2000)). Pursuant to those standards, Dr. Davies was accepted by the court as an expert in the testing and characterization of pharmaceutical dosage forms. (Tr. 798:10-11.) Dr. Langer was accepted by the court as an expert in drug delivery systems and pharmaceutical dosage forms. (Tr. 291:10-12.)

FN37. Of course, the issue of qualification as an expert in particular fields is also relevant to the court's decision on Defendants' *Daubert* challenges. If a witness is not qualified as an expert in the scientific field that governs the topics covered in his testimony, that testimony cannot possibly meet the requirements mandated by *Daubert*.

D. Genpharm's Motions

Defendant Genpharm filed a motion to strike the testimony of Dr. Davies concerning certain pH tests he conducted on Genpharm's ANDA products. Genpharm also moved to strike the testimony of Dr. Langer as unreliable and irrelevant to the extent that Dr. Langer's opinions were based on Dr. Davies' tests. First, Genpharm argues that Dr. Davies' tests regarding the pH of the HPMC used in Genpharm's subcoating are irrelevant because they do not test for buffering capacity. However, as this court's claim construction makes clear, the pH of the HPMC used in the subcoating is undeniably relevant to the issue of whether the HPMC is alkaline, which is a requirement for all ARCs and "alkaline buffering" compounds. Second, Genpharm argues that Dr. Davies' acetone-washing procedure is unreliable because it has not been subjected to peer review or gained general acceptance within the scientific community. Finally, Genpharm argues that the court should exclude Dr. Davies' tests on the microenvironment of the active layer of Genpharm's ANDA products as unreliable and irrelevant. Specifically, Genpharm argues that Dr. Davies failed to account for the effects of degradation products of omeprazole and dissolved HPMC in the acetone bath he used to remove the enteric coating and the subcoating from the pellets before testing their pH. (*See* Davies Tr. 1145:21-25, 1146:1-3, 1182:14-1186:19.) Genpharm also objects to the type of electrode Dr. Davies employed to conduct the test.

[47] The court finds that Dr. Davies' acetone-washing technique is reliable and his testimony concerning the technique and results obtained thereby are admissible. Genpharm emphasizes the lack of peer review or publication of Dr. Davies' acetone-washing procedure. Although peer review and publication of an expert's

technique enhance its reliability, *see generally,* Campbell v. Metro. Prop. and Cas. Ins. Co., 239 F.3d 179, 186 (2d Cir.2001), the mere fact that an expert's findings have not been peer-reviewed or published is not a sufficient reason to exclude it, *see, e.g.,* Jarvis v. Ford Motor Co., 92 Civ. 2900, 1999 WL 461813, at *6, 1999 U.S. Dist. LEXIS 10041, at (S.D.N.Y. Jul. 6, 1999), *aff'd in part, vacated in part,* 283 F.3d 33 (2d Cir.2002). Particularly in areas raising issues that may never have interested any scientist, the absence of peer review may not be surprising. Kumho Tire Co. v. Carmichael, 526 U.S. 137, 151, 119 S.Ct. 1167, 143 L.Ed.2d 238 (1999). Dr. Davies employed the acetone-washing procedure to accommodate the different types of product samples provided to Astra by Defendants during discovery. Dr. Davies' acetone-washing techniques were necessary and carefully developed to isolate the particular layers of each Defendant's products for further testing. Dr. Davies developed the procedure to handle a new problem unique to this litigation; therefore, the court does not find a lack of prior publication to be either noteworthy or indicative of a lack of reliability.

Dr. Davies described his acetone-washing procedure as follows:

What we did was, again, we took a capsule and we emptied the contents of the capsule into some acetone. We then-acetone is a very good solvent for the enteric coating. Also, these particles are in this liquid and they are rolling over each other, so they are washing each other, they are rubbing each other. So that helps rub away the enteric coating. Using this process, it also helped rub away the subcoating and the drug layer was remaining.

(Davies Tr. 804:10-17.) Dr. Davies used a well known and widely accepted technique, attenuated total reflectance fourier transform infrared spectroscopy ("ATR-FTIR"), to monitor the progress of the acetone washing. (*See, e.g.,* Davies Tr. 804:8-805:18, 1158:23-1159:10, 1159:23-1160:4, 1181:19-1182:1, 1183:4-7.) Dr. Davies ran numerous ATR-FTIR spectra to confirm that his acetone-washing procedures were accurate and that the active layer was at the surface of the Genpharm products for further testing. (Davies Tr. 804:8-805:18, 1158:23-1159:10, 1159:23-1160:4, 1181:19-1182:1, 1183:4-7.)

Once the acetone washing was completed, Dr. Davies tested the pH of the active layer of the Genpharm products. Genpharm challenges the techniques used by Dr. Davies for his pH tests. Obtaining pH measurements using an electrode and a pH meter, as Dr. Davies did, however, is a standard, reliable method for determining whether a material has alkaline characteristics. (Langer Tr. 321:3-5.) Every witness who testified on this subject, and the manufacturers of the substances like HPMC that were tested, acknowledged that pH-electrode testing is a standard analytical tool. (*See, e.g.,* Carr Tr. 2402:8-11; Schmitt Tr. 3602:15-20; Davies Tr. 1194:3-4.) FN38 Dr. Davies conducted his pH tests with a Beetrode micro-pH electrode and a pH meter and used standard buffer solutions for calibration. (Davies Tr. 809:18-811:19.) Several Defendants, including Genpharm, criticize Dr. Davies for his choice of electrode. The Beetrode electrode is, however, not some previously unheard-of device. It is a commercial piece of equipment, in use since at least the mid 1980s. (Davies Tr. 4343:12-13.) Dr. Davies cited references that showed the use of microelectrodes and Beetrode-type electrodes for over 20 years. (P1271; P1275; Davies Tr. 4218:18-4220:6, 4220:23-4221:2.) Dr. Davies also pointed out references that measured the microenvironment pH using microelectrodes. (P768A; Davies Tr. 793:1-10.) Astra presented numerous references during trial that evidenced the general scientific acceptance of microenvironment and micro-pH, (P1303; P1304; P1305; P1309; P1310); moreover, Dr. Davies checked the accuracy of his specific instrument by measuring standard buffer solutions with established pHs of 4, 7, and 10 and got precisely accurate readings of each. (P1270; Davies Tr. 4215:15-4216:7.)

FN38. Dr. Carr was accepted by the court as an expert in the fields of analytical chemistry, electrochemistry, acid-base chemistry, characterization of chemical compounds, and analytical chemical techniques and instrumentations, including pH measurements. (Tr. 2267-2269.) Dr. Carr is a member of the faculty in the department of chemistry at the University of Minnesota, where he has been a full tenured professor for the last twenty-four years. (Carr Tr. 2261:6-9.) Dr. Carr is the President and Chief Science Officer of ZirChron, a company that licenses technologies based on the results of his research. (Carr Tr. 2265:20-2266:12.)

As described above, Dr. Davies' analysis of the Genpharm products involved a processby which he washed the enteric coat and HPMC subcoat from the Genpharm products by subjecting the pellets to an acetone-washing procedure. (*See* Davies Tr. 1181-83.) Genpharm argues that Dr. Davies' pH test results are unreliable because he allegedly failed to account for what happens to the HPMC during the acetone-washing process, (Davies Tr. 1181-83), and he allegedly failed to account for any degradation of the active omeprazole layer during his protocol, (Davies Tr. 1182-87). The court finds, however, that there is no evidence that degradation occurs during acetone washing. Dr. Davies expressly refuted the hypothesis that degradation would occur during his acetone-washing procedure because the pellets were exposed for a very short period of time. (Davies Tr. 1185:9-24.) In fact, Dr. Davies' ATR-FTIR analyses demonstrated that no degraded omeprazole was present at the surface of Genpharm's active pellets when they were tested after the acetone-washing procedure. (Davies Tr. 1185:19-24, 1186:22-1187:1.)

[48] For the foregoing reasons, the court denies Genpharm's motion to strike the testimony of Dr. Davies. In light of the court's rulings concerning the admissibility of the pH tests performed on Genpharm's ANDA products by Dr. Davies, the court also denies Genpharm's motion to strike portions of Dr. Langer's testimony and reports. Pursuant to Rule 703, an expert may rely on any facts or data "of a type reasonably relied upon by experts in the particular field," including facts, data, and opinions that are otherwise inadmissible. There is no requirement that an expert must run his own tests. Gussack Realty Co. v. Xerox Corp., 224 F.3d 85, 94-95 (2d Cir.2000) ("[A]n expert may rely on data that she did not personally collect."). The court has admitted the testimony and test results by Dr. Davies upon which Dr. Langer relied, and the court finds that Dr. Langer's reliance on that information was reasonable.

E. Cheminor's Motions

Defendants Cheminor filed a motion pursuant to Federal Rules of Evidence 104, 402, 702, and 703 to strike portions of the trial testimony of Dr. Davies relating to the water content and pH of Cheminor's ANDA products. Cheminor also filed a motion to strike selected portions of the trial testimony of Dr. Langer concerning the water content of Cheminor's "final dosage form" and the pH of the microenvironment of Cheminor's core. Cheminor attacks those opinions of Dr. Langer because Cheminor believes they rely solely upon inadmissible portions of Dr. Davies' opinions and testing.

As an initial matter, Cheminor objects to the identity of the individuals who performed the testing and the manner in which Defendants' samples were handled at Dr. Davies' laboratory. The court finds these criticisms to be without merit. Dr. Davies received bottles marked with labels containing samples of Cheminor's products. (Davies Tr. 1056:10-16, 1061:7-19.) When performing the tests, Dr. Davies and his colleagues identified the samples they tested by looking at the label on the bottle from which the sample came. (Davies Tr. 1055:8-14, 1060:6-14.) Dr. Davies appropriately stored the *sealed* bottles of Cheminor's samples in a climate-controlled environment. (Davies Tr. 1063:25-1065:1, 1057:21-1058:2.) Dr. Davies testified that the storage of the product samples was important and that the products remained stable in the

lab. (Davies Tr. 1058:24-1059:3.) There is no real question with record keeping or procedure with respect to Dr. Davies' pH testing. All of the tests were performed under Dr. Davies' direction and by appropriate personnel. The scientists under Dr. Davies' direction who performed the tests on Cheminor's product include an analytical chemist and a pharmacist. (Davies Tr. 1047:23-1048:15-16.) Dr. Davies relies on his laboratory and competent scientist for academic and other professional endeavors, (Davies Tr. 1046:19-1047:2), and he is entitled to rely upon the work of his colleagues on experiments that he designed. *See* Ecolab Inc. v. Amerikem Lab., Inc., 98 F.Supp.2d 569, 574 (D.N.J.2000)(rejecting the notion that expert must personally conduct each experiment, finding no legal authority for the proposition), *aff'd in part, vacated in part,* 264 F.3d 1358 (Fed.Cir.2001). This notion is consistent with Federal Rule of Evidence 703, which specifically provides that an expert may rely on facts or data "perceived by or made known to the expert at or before the hearing." Fed.R.Evid. 703.

The court has already addressed the admissibility of Dr. Davies' pH testing with respect to the Genpharm products. The court incorporates that discussion to the extent it is relevant to the testing conducted on the Cheminor products. In addition, the court notes a detailed data sheet was used to record the pH measurements. (*See* P591 I.) The operating procedure, sample size, sample description, sample temperature, calibration details for the Beetrode probe, and actual sample measurements were recorded for each experiment. (*See* P591 I.) A simple review of the data sheets refutes Cheminor's argument that there were no standards in Dr. Davies' pH testing. Dr. Davies' detailed calibration procedures ensured that the data was accurate and reproducible. (Davies Tr. 809:18-810:25.) Although Cheminor claims that Dr. Davies failed to test the micro-pH when he tested the bulk core of Cheminor's product, the court finds that Dr. Davies' pH test was conducted on the appropriate substance. Just as the pH of the core is a result of the pH from the combination of all excipients present in the core region, (Ravinder Dep. Tr. 47:25-48:7), the pH of the microenvironment around the omeprazole results from the combination of all the excipients present in the core, (Ravinder Dep. Tr. 227:12-228:3). Testing the pH of the core in its entirety reveals the pH of the microenvironment of the omeprazole in the core of Cheminor's products, which is exposed to all of the other excipients present in the core.

Dr. Davies' pH testing is completely unchallenged by any expert on behalf of Cheminor. While it is true that Cheminor need not offer expert testimony to challenge the reliability of Dr. Davies' testing, *see* Brooks v. Outboard Marine Corp., 234 F.3d 89, 92 (2d Cir.2000), Cheminor must, at a minimum, present a cogent, reasonable argument in support of its motion. Instead, Cheminor selectively quotes from the testimony of Dr. Carr, an expert who testified on behalf of KUDCo, and implies that there are numerous potential sources of error in Dr. Davies' pH testing. The bulk of Cheminor's complaints, in fact, are drawn directly from Dr. Carr's testimony concerning the potential for errors when testing the pH of HPMC at very high concentrations. These include errors associated with liquid junction potential and colloidal and non-aqueous solutions. There is no question that the pH tests Dr. Davies conducted on Cheminor's products differ dramatically from those Dr. Davies performed on the HPMC used in KUDCo's products. Those differences in testing technique stem from actual differences in the two Defendants' ANDA products. Aside from implausible attorney argument, Cheminor has presented no evidence linking Dr. Carr's criticisms of Dr. Davies' high-concentration HPMC pH tests to the pH tests conducted on the core of Cheminor's products. As such, Cheminor's unsupported argument that the pH-testing technique used by Dr. Davies to test Cheminor's core did not result in reliable results is wholly without merit. The court finds that Plaintiffs have established the admissibility of Dr. Davies' pH testing of Cheminor's products and denies Cheminor's motion to strike the portions of Dr. Davies' testimony discussing those tests.

[49] The court also finds that Dr. Davies' Coulometric Karl Fischer titration tests will assist the court by

providing relevant information necessary on infringement issues. Claim 9 of the '505 patent and claim 11 of the '230 patent require that the water content of the "final dosage form" does not exceed 1.5% by weight. This court construes the term "final dosage form" to refer to enteric-coated pellets. Therefore, Dr. Davies' water content tests on Cheminor's enteric-coated pellets are directly relevant to the issue of Cheminor's infringement of claim 9 of the '505 patent and claim 11 of the '230 patent. Dr. Davies used a reliable method for testing Cheminor's water content that is approved in the United States Pharmacopoeia ("USP"). (P1134 at 2705; Davies Tr. 900:4-901:2, 1042:23-1043:11; Langer Tr. 639:3-6, 639:14-640:4; P590A; P1038 (Dem.Ex.) at 6.) The methods Dr. Davies used for water content testing are standard and well known in the field of testing and characterizing pharmaceutical dosage forms. (Davies Tr. 900:17-901:2, 1042:23-1043:11; Langer Tr. 639:14-640:6.) Even Cheminor admits that "there are many articles and published tests on the Karl Fischer Titration method." (Cheminor's Davies *Daubert* Motion at 21; Thiex Aff. para. 1.3 ("The oven technique of Karl Fischer analysis ... can provide valid and reliable information about the water content of many different kinds of materials.").) Any criticism about the technique exclusively being put to judicial use is nonsense. Cheminor admits that "the technique of determining water content by Karl Fischer Titration is accepted by science, and thus put to nonjudicial use." (Cheminor's Davies *Daubert* Motion at 24.) When implementing his Karl Fischer titration method, Dr. Davies followed the guidance of the USP, (Davies Tr. 899:17-900:2), and he selected the appropriate parameters and conditions for the test to ensure accurate results, (Davies Tr. 1078:1-8; Davies Supp. Dep. Tr. 185:4-186:9, 186:17-25, 189:20-190:9, 206:4-13, 207:7-20). Dr. Davies also ensured that those working in his laboratory used appropriate operating procedures for the titrator. (Davies Supp. Dep. 207:7-20, 208:15-209:13.)

The court agrees with Cheminor that Dr. Davies' water content tests are by no means flawless. For instance, Dr. Davies' test results had a very high standard deviation.FN39 The court will address those potentialproblems carefully when determining the appropriate weight to be given Dr. Davies' water content tests on the issue of Cheminor's alleged infringement of the '505 and '230 patents. *See* McCullock, 61 F.3d at 1043 ("Disputes as to the strength of his credentials, faults in his use of differential etiology as a methodology, or lack of textual authority for his opinion, go to the weight, not the admissibility, of his testimony.") Nevertheless, the court finds that Plaintiffs demonstrated sufficient relevance and reliability to surpass the *Daubert* requirements as implemented by Rule 104 in conjunction with Rules 702 and 703. The court denies Cheminor's motion to strike the portions of Dr. Davies' testimony addressing his water content testing.

FN39. Standard deviation is used to measure the spread of the data. For a particular data set, the actual mean plus or minus a standard deviation is a range in which a scientist can expect the true results to reside with a particular level of probability. Basic statistical analysis includes calculation of the average, the standard deviation, and the coefficient of variation ("CV"). (Thiex Daubert Aff., para. 2.1.) CV is an indicator of how tightly grouped the data are around the average. This value demonstrates the precision of the method used. (Thiex Daubert Aff., para. 2.2.) The calculation of Dr. Davies' water content data is as follows: average 1.42%, standard deviation 0.39%, and CV 28%. (Thiex Daubert Aff., para. 2.3.) The standard deviation of Dr. Davies' data shows that there is a 95% probability that the results of a Karl Fischer water analysis of Cheminor's ANDA products would be in the range from 1.03% to 1.81%. This means that there is an equal probability that a water content determination would be above or below the average value of 1.42. (Thiex Daubert Aff., para. 2.4.) The CV of 28% is extremely high, indicating that Astra's Karl Fischer analysis was imprecise. (Thiex Daubert Aff., para. 2.5.) The generally accepted CV for Karl Fischer analysis, as applied to samples like Cheminor's omeprazole product, should be in the range of about 2%-3% with an extreme of up to about 7%. (Thiex Daubert Aff., para. 2.6.) *Cf.* United States v. White Horse, 177 F.Supp.2d 973, 975 (D.S.D.2001) (excluding evidence with error rate of 24%); Koch v. Shell Oil Co., 49

F.Supp.2d 1262, 1268 (D.Kan.1999) (excluding testimony with error rate estimated at 20% and no evidence it was a typical error rate).

In light of the court's rulings concerning the pH and water content tests performed on Cheminor's ANDA products by Dr. Davies, the court denies Cheminor's motion to strike portions of Dr. Langer's testimony and reports. *See* Fed.R.Evid. 703; Gussack Realty Co. v. Xerox Corp., 224 F.3d 85, 94-95 (2d Cir.2000) ("[A]n expert may rely on data he or she did not personally collect."). The court has admitted the testimony and test results by Dr. Davies upon which Dr. Langer relied, and the court finds that Dr. Langer's reliance on that information was reasonable.

F. Andrx's Motions

[50] Defendant Andrx filed a motion to exclude portions of the expert testimony of Dr. Davies under *Daubert*. Andrx objects to nearly every technique employed by Dr. Davies to analyze its ANDA products. Specifically, Andrx attacks Dr. Davies' ultraviolet ("UV") fluorescence microscopy, sample preparation techniques, film and water solubility experiments, and ATR-FTIR analyses. Each of these objections to Dr. Davies' testing fails for the same reason-every single one represents conjecture based upon theoretically possible sources of error, fails to account for the totality of Dr. Davies' testing, and is divorced from the facts of this case. The court finds that Dr. Davies conclusively established the reproducibility and reliability of his results not only by obtaining the same results using multiple trials for each type of experiment, but also by utilizing numerous testing techniques to verify the results using different types of equipment, testing methods, and sampling techniques. The court concludes that Plaintiffs have established the relevance and reliability of the testing performed on the Andrx products by Dr. Davies. FN40

FN40. Many of Andrx's criticisms relate to the details of how the testing was carried out and evaluated and are more pointed criticisms than those appropriate for this court's *Daubert* determinations. Those criticisms will be considered in the portions of this court's opinion dealing with the infringement proof because they go to the weight to be given the test results, rather than their admissibility.

As an initial matter, Andrx objects to Dr. Davies' microtoming technique, which he used to slice off the top portion of the Andrx pellets so that he could examine a cross-section of the pellets using UV fluorescence microscopy. Confirmation of the validity of Dr. Davies' sectioning technique was undertaken using confocal laser scanning microscopy ("CLSM") of sectioned active beads to reveal the cross-section of the area of the microtomed surfaces. (Davies Tr. 4162:21-24.) Using the microtome technique, Dr. Davies was attempting to remove the top 10 microns of the Andrx pellets. CLSM performed on microtomed pellets indicated that the average diameter of the section was 172 microns, which confirms an average sampling depth of 10.1 microns assuming spherical shape of the beads. (Davies Tr. 4163:5-11.) The methodology used to microtome the top of Andrx's active pellet to expose the interior of the active layer 10 microns down was done three separate times prior to November 2000, revealing consistent and reproducible ATR-FTIR data on the chemical composition of the interior of the pellets. (Davies Tr. 4162:12-13; P227; P1265 at 1.) The ATR-FTIR microprobe crystal was precisely positioned in the center of the sectioned area using the cross-hairs of the CCD camera on the microscope, allowing the collection of the ATR-FTIR data from only the middle 50 (mu)m of the microtomed region. (Davies Tr. 4163:12-25.) This careful placement of the probe avoids collection of data from the edge of the section region. Evidence obtained from the microtoming procedure is clearly relevant to the issues in this case, since it permitted Dr. Davies to test the interior of

Andrx's active pellets for the existence of a subcoating. The court also finds this evidence to be reliable since Dr. Davies' use of CLSM and ATR-FTIR verified the reproducibility and accuracy of the microtome procedure. Therefore, the court rejects Andrx's *Daubert* challenge to Dr. Davies' microtome technique.

Andrx also challenges the UV fluorescence microscopy techniques used by Dr. Davies to test the microtomed pellets. The court finds that Dr. Davies' UV fluorescence microscopy tests are relevant to the issue of Andrx's infringement-they address the questions of whether Andrx's product has a subcoating and whether that subcoating meets the limitations of the claims. UV fluorescence microscopy is a microscopic technique for obtaining spatial analytical information about a sample. (A626 (Dem.Ex.); Davies Tr. 937:24-938:2.) Fluorescence is a physical phenomenon in which a material absorbs light, called the "excitation" light, and then emits light at a higher (longer) wavelength, called the "emitted" light. (Salzberg Tr. 3459:4-22.) The excitation light is in the ultraviolet range with a wavelength shorter than about 390 nanometers, and a material that does not absorb the excitation light will not fluoresce. (Salzberg Tr. 3459:22-24, 3460:5-18.) In fluorescence microscopy, the sample to be examined is illuminated with a given excitation wavelength, and the microscope collects the light emitted by the sample, which will include any light emitted due to fluorescence, as well as light due to other optical phenomena. (Salzberg Tr. 3459:12-3460:4, 3484:9-14; Davies Tr. 800:4-15.) With this type of microscopy, differences in color in an image indicate a different chemical environment that may be due to a different chemical composition. (Davies Tr. 800:16-24; *see also* P1286 (Dem.Ex.) at 3; P1036 (Dem.Ex.) at 2.)

The UV fluorescence testing Dr. Davies conducted shows the presence of a brightly fluorescing, continuous layer that appears with a different intensity and color than the surrounding regions. (Davies Tr. 821:19-824:2, 824:8-15.) The different intensity and color of the fluorescence indicate a physical and chemical environment different from the enteric coat and the active layer. (Davies Tr. 799:18-800:15, 827:23-828:19, 4088:14-22.) That evidence is unquestionably relevant to the issue of whether a subcoating, later determined to be an HPMCP-salt subcoating, exists at all. Dr. Davies also analyzed the intense, fluorescing layer for continuity and thickness. (Davies Tr. 799:18-800:15, 821:10-15, 827:23-828:19, 926:13-16, 941:2-7.) Dr. Davies' use of UV fluorescence microscopy on Andrx's product is directly relevant to the issues in this case and assists the court in determining whether or not the Andrx product meets the subcoating claim limitation of the '505 and '230 patents.

The court also finds that Dr. Davies' UV fluorescence microscopy testing is reliable. There is no question that UV fluorescence microscopy is an accepted, reliable methodology. (*See, e.g.,* Davies Tr. 4088:19-22; Banakar Tr. 3318:18-3319:4.) UV fluorescence microscopy is an appropriate technique for studying the structure of a bisected pharmaceutical formulation. (Davies Tr. 4088:14-17.) Publications put forth by Dr. Davies, (*see, e.g.,* P997A, P1003A), and by Dr. Salzberg, (*see, e.g.,* A542), demonstrate that UV fluorescence microscopy can be effectively and reliably used to detect the presence or absence of different environments. All three articles confirm that a scientist can analyze UV fluorescence microscopy tests by visually inspecting the image. Dr. Davies used the same peer reviewed methodology when testing Andrx's product. (Davies Tr. 4088:14-22.) Andrx wrongly alleges that visual inspection is inappropriate to detect color change in UV fluorescence microscopy images. Dr. Davies directly addressed that criticism: "We must always remember that visual inspection is one accepted method of evaluating changes in color. That's why they put eyepiece, binocular eyepieces on microscopes, so you can look down the microscope and see the color, see the features. You use the eye to do that." (Davies Tr. 4149:25-4150:1-6.) Dr. Davies visually inspected the UV fluorescence microscopy images and concluded that the intense fluorescing layer fluoresced a different color, (Davies Tr. 817:5-820:2, 822:24-823:17.); however, Dr. Davies did not rely purely upon his eye to detect the different chemical layer. He confirmed the color change in the intense band

by using spectroscopic confocal laser scanning microscopy ("CLSM"), a dispersive technique.FN41 An image of the areas studied and the resulting light emission spectra from 475 to 650 nanometers ("nm") are depicted in Exhibit P1263. This test shows that the fluorescing region of the HPMCP salt is both more intense and of a different color than the adjacent regions. For example, compare region "B," the active layer, with region "G," the intense, fluorescing layer, in the normalized intensity graph. The G curve has a peak intensity that is shifted to longer wavelengths, which means that it is less blue and more yellow-green than the active layer. (Davies Tr. 4146:4-4150:20; P1263; P1263A.) Thus, regardless of whether a color change is observable by visual inspection, the existence of a different chemical was verified by two independent techniques, ATR-FTIR and CLSM color dispersive testing.

FN41. A wavelength dispersive technique takes light and "spreads it out the way a prism would spread out daylight ... spreads the light into its component colors and then measures the intensity of each of these wavelengths, and that gives you a fingerprint, an optical fingerprint for the material that's fluorescing." (Salzberg Tr. 3464:13-23.)

Andrx's argument that chemical identification by UV fluorescence microscopy requires that the sample's chemistry be known is a misdirection. Dr. Davies found time and time again that a brightly fluorescing layer occurred "right all the way around" each and every Andrx pellet he examined. (Davies Tr. 817:5-818:6, 821:19-24.) Dr. Davies did not use UV fluorescence microscopy to determine the identity of the chemicals present in the bright fluorescing layer. The presence of the intense, fluorescing layer led to further relevant testing to isolate that layer by acetone washing, (Davies Tr. 822:2-824:15), and to identify its chemical composition by ATR-FTIR, (Davies Tr. 831:22-833:6). Dr. Davies performed ATR-FTIR to determine that the brightly fluorescing layer corresponded to an HPMCP salt. (Davies Tr. 831:22-833:16, 924:2-12.)

At trial, Andrx's expert Dr. Salzberg suggested that the HPMCP salt did not absorb light in the wavelengths used for Dr. Davies' UV fluorescence microscopy so it could not be the bright fluorescing layer. To determine whether Dr. Salzberg's suggestion was accurate, Dr. Davies conducted UV absorbance testing on an HPMCP-salt sample and showed that it did absorb light in the 340 to 360 nm range. (P1261.) In addition, Dr. Davies showed that the HPMCP salt fluoresced when excited with light in the 340 to 360 range. (P1262 at 1-6.) Dr. Davies also conducted a test to demonstrate that an HPMCP-salt solution absorbs and fluoresces when excited by the wavelengths used in his UV fluorescence microscopy. (Davies Tr. 4143:12-4145:20; P1262.) The tests showed that the HPMCP-salt solution does fluoresce under the conditions used in Dr. Davies' UV fluorescence microscopy tests.FN42 (Davies Tr. 4144:2-6.) A similar analysis was done using 458 nm excitation, the same wavelength used for Dr. Davies' CLSM tests, and monitoring 475-650 nm emission confirming the fluorescence. (Davies Tr. 4145:21-4146:3; P1262 at 11, 12.)

FN42. Andrx misleadingly alleges that Dr. Davies improperly increased the concentration of the HPMCP-salt solution when testing the sample for fluorescence. So that it can point to inconsistencies, where there are none, Andrx tries to link UV absorbance tests run for infringement with a different set of tests run for *Daubert* purposes. The UV absorbance tests run for infringement show that HPMCP salts dissolve in water. HPMCP salt has a phthalate group, which has "an extremely strong signal at 230 and 280 nanometer." Dr. Davies conducted a UV absorbance test to check for those absorption peaks because they confirmed that the HPMCP salt was soluble in water, which is a claim limitation. (P232.) Dr. Davies selected a concentration for testing that permitted study of the portion of the UV absorbance spectra that tested water solubility. As Dr. Davies explained, the phthalate group that he was looking for has such strong absorbance that he had to use a very low concentration of HPMCP-salt solution because larger amounts "would have saturated the

whole of that detector in that range" and obscured the absorbance spectra in the range of interest. (Davies Tr. 4312:19-23.)

The 2002 *Daubert* tests were not designed to identify absorption peaks at 230 and 280 nm. Instead, the question to be answered was whether HPMCP salt absorbs the excitation light between 330 and 390 nm. That was relevant because Dr. Salzberg had suggested that HPMCP salt does not fluoresce when exited by light in the 340 to 360 nm range. For that reason, Dr. Davies conducted a test to demonstrate that the HPMCP-salt solution fluoresced when excited by the wavelengths used in UV fluorescence microscopy. (Davies Tr. 4143:12-4145:20; P1262.) Dr. Davies therefore tested a more concentrated solution suitable for the purpose of determining if it absorbed in the 330 to 390 nm range, and it did. (P126.) That HPMCP-salt solution also fluoresced when excited by light in the 340 to 360 nm range. (P1262 at 1-6.) There is no inconsistency in Dr. Davies' testing-they were simply different tests run for different reasons, using the same piece of equipment.

Through its expert Dr. Salzberg, Andrx also argues that Dr. Davies failed to account for artifacts that could result in potential errors in his UV fluorescence microscopy testing. These criticisms ignore all of the confirmatory testing conducted by Dr. Davies; FN43 moreover, Dr. Davies demonstrated that the artifacts described by Dr. Salzberg are not distorting the presence of the fluorescing ring as it appears in the UV images. On cross-examination, Dr. Davies addressed issues of refraction, (Davies Tr. 965:18-966:3), interference, (Davies Tr. 966:13-23), and out-of-focus fluorescent flare (Davies Tr. 976:18-977:12), issues that were later raised again by Dr. Salzberg. To some extent, Dr. Salzberg's criticisms are irrelevant due to his lack of expertise in the relevant field of testing and characterizing pharmaceutical dosage forms. *See, e.g.,* In re Unisys Savs. Plan Litig., 173 F.3d 145, 156-57 (3d Cir.1999). Dr. Salzberg is experienced in the study of biological samples. (Salzberg Tr. 3446:14-17.) Dr. Salzberg has no experience applying UV fluorescence microscopy to pharmaceutical dosage formulations, and he never tested an Andrx sample or any other pharmaceutical. (Salzberg Tr. 3495:9-14, 3496:13-16.) Moreover, Dr. Salzberg admitted that he was not aware of the nature of the Andrx sample. (*Id.*) Instead of focusing his criticisms on the nature of the problem at issue, Dr. Salzberg listed every remotely possible error he could imagine and then admitted on cross-examination that he had no way of knowing whether any of the errors he identified were actually present in Dr. Davies' images. (Salzberg Tr. 3521:14-3522:16, 3523:2-19.) A comparison of Exhibit P1206, Dr. Salzberg's copy of a UV image, with P220, the copy of the same image from Dr. Davies' original report, shows that the images that Dr. Salzberg examined are inadequate to make judgments concerning focus or resolution. (Davies Tr. 4122:7-4124:6.) Dr. Salzberg never visually inspected a good copy of the original UV fluorescent images to assess color change, or any other issue related to blurriness or resolution. Based on the poor quality pictures Dr. Salzberg was provided by Andrx, he could not distinguish the differences, or color, between the active layer and the sugar seed. (Salzberg Tr. 3515:9-3516:19; *see also* Salzberg Tr. 3517:6-3518:3.) While the delineation between the active layer and the sugar seed is fully obscured in P1206, it is sharp in P220. (Davies Tr. 4124:4-20.) Moreover, the effects that Dr. Salzberg speculated about are more pronounced in the biological samples and translucent samples with which he is familiar based on his biology background. (Davies Tr. 4099:14-4101:23.) Under these circumstances, Dr. Davies is not obligated to conduct every experiment Dr. Salzberg might imagine, and ultimately, Dr. Salzberg acknowledged that the intense, fluorescing ring in the Andrx product may be due to the existence of a layer. (Salzberg Tr. 3536:9-12.)

FN43. On cross-examination Dr. Salzberg admitted that he thought Dr. Davies based his identification of a different chemical environment solely on UV fluorescence microscopy and did not consider Dr. Davies' ATR-FTIR. (Salzberg Tr. 3497:19-3498:2.)

Nevertheless, to confirm the reproducibility and reliability of his UV fluorescence microscopy results, and to show that the theoretical possibility of out of focus, edge effects, and other potential problems described by Dr. Salzberg are not the cause of the brightly fluorescing band present in the UV fluorescence testing, Dr. Davies conducted a battery of confirmatory testing using CLSM. (Davies Tr. 4088:23-4089:21.) Those additional tests confirmed that the UV fluorescence microscopy results that Dr. Davies relied on initially were accurate, reliable, representative of the Andrx product, and showed true structural features, not artifacts. (Davies Tr. 4139:22-4140:13.) The CLSM and the UV fluorescence microscopy images all show the same intense, fluorescing region. To confirm the correlation between CLSM and UV fluorescence microscopy when viewing Andrx's enteric-coated pellets, Dr. Davies examined the same pellets using both techniques. Exhibit P1250 is a side by side comparison of the same pellet studied by both UV fluorescence microscopy and CLSM. An additional two pellets were studied in a similar manner. (P1251; P1252.) The brightly fluorescing region appears in both the UV fluorescence microscopy and the CLSM, confirming that the features observed in the UV fluorescence microscopy images are true representations of the sample and are not due to out of focus, scattering, edge or interface effects. (Davies Tr. 4090:8-4091:5.) For example, the two portions of Exhibit P1253 circled on the side-by-side comparison contain two parallel high intensity bands. Based on the CLSM image, the left-hand side, the thinner left-hand band is about 3.2 microns thick, and the right-hand band is about 7.3 microns. For the UV fluorescence microscopy image, the right-hand side, the thinner left-hand band is about 2.2 microns and the right-hand band is about 6.8 microns. FN44 (P1286 (Dem.Ex.) at 1; Davies Tr. 4096:19-4098:16.) These results confirm the validity and reliability of Dr. Davies' earlier UV fluorescence microscopy work represented by Exhibit P220. (*See also* P1254; P1255; P1256; Davies Tr. 4115:11-4120:17.) Additional CLSM images confirm that the presence of an intense, fluorescing region shown in the UV images is representative of Andrx's product. (*See* P1254; P1255; P1256; Davies Tr. 4115:11-4120:17.)

FN44. Relying on percentages to distort the differences in testing results obtained using the CLSM and UV techniques, Andrx suggests that the CLSM data does not confirm the UV data because the CLSM shows features to be "as much as 50% wider" than the UV data. Andrx's criticism fails to acknowledge the extremely diminutive nature of the 1.0 micron difference.

In response to Dr. Salzberg's criticisms, Dr. Davies also recorded the excitation light reflected back from CLSM samples. (P1254 at 6; P1255 at 5.) The images show the texture of the bisected pellets. The reflectance images do not exhibit evidence of light scattering, which means that the features in the fluorescence microscopy images are not due to scattering of light. (Davies Tr. 4117:21-4118:13, 4131:19-4132:8.) The intense ring also is not an edge effect or "mirage." The intense ring does not appear in any of the other Defendants' products, which were examined using the same procedure; it only appears in Andrx's enteric-coated omeprazole products. (*Compare* P82, P387, and P554, *with* P220.) CLSM data also show that the intense, fluorescing ring is not due to an interface effect. CLSM confirms the ATR-FTIR results and shows that the intense region is located above the active layer. A reflectance image of the acetone-washed pellet with fluorescence overlayed, P1260, shows that the morphology or texture of the intense region is different from the active layer and confirms that the intense, fluorescing region is a distinct layer that forms where the enteric coat was applied. (Davies Tr. 4134:14-4137:15.)

Andrx would prefer that Dr. Davies performed all his testing using CLSM; nevertheless, the court finds that the use of CLSM is not necessarily the preferred method in this case. In fact, while CLSM may provide an improved image for certain samples, like improved focus in translucent or biological samples, those benefits

are diminished when a sample is flat and does not permit deep penetration of significant amounts of light. (Davies Tr. 4099:21-4101:23; *see, e.g.,* P1286 (Dem.Ex.) at 2; A542 at 358-59.) When the sample is flat and nontranslucent and there is nothing in front of the plane of interest, differences in contrast and focus between UV fluorescence microscopy and CLSM are reduced. (Davies Tr. 4100:18-4105:14, 4113:15-4114:16; A543 at 121.) Now faced with the validation of Dr. Davies' UV data by his CLSM data, Andrx next asserts that the CLSM images obtained by Dr. Davies are somehow misleading or erroneous due to "stacking." FN45

FN45. By Order dated February 8, 2002, this court granted Astra leave to conduct new tests and introduce new evidence during its rebuttal case to rebut the *Daubert* proof introduced at trial by Defendants that had been previously undisclosed prior to the start of trial. The court specifically directed that the new evidence to be presented by Astra would "be taken only as to the *Daubert* admissibility issue." (Order of 2/8/02, at 3.) Even before issuing that Order, the court advised Defendants that they would not be permitted to rebut Dr. Davies' testimony, but would be permitted as much time as they needed to cross-examine him. (Tr. 3993.) The court issued that ruling because it had become apparent to the court throughout the course of the trial that Defendants had failed to provide Astra with notice during discovery of their *Daubert* challenges and had introduced numerous exhibits and new expert testimony in an effort to combat Dr. Davies' opinions that had not previously been disclosed during discovery.

During Dr. Davies' rebuttal testimony concerning the stacking of his CLSM images, the court permitted Andrx to cross-examine Dr. Davies using evidence of single Z-slices that were not stacked. Over Astra's objection, the court admitted the individual Z-slices offered by Andrx into evidence, (Order of 3/6/02). Astra objected to Defendants' submission of less than all Z-slices relating to a CLSM image as incomplete. In response to Astra's completeness objection, the court permitted Astra to complete the record and required Astra to submit a supporting affidavit attesting to the authenticity and relevancy of the remaining Z-slices. (*Id*.) On March 11, 2002, Astra submitted a Declaration of Dr. Davies. Andrx immediately voiced an objection that the submission exceeded the boundaries set by the court's prior orders. The court granted Andrx leave to respond to Astra's submission in connection with the rebuttal findings on Phase I, but expressly ordered that the response should not "contain or refer to new evidence not raised previously in connection with Phase I of the trial." (Order of 3/21/02, at 1.) Andrx's rebuttal submission complied with that Order; however, Andrx also submitted a new offer of proof including a declaration by a previously undisclosed expert witness in response.

The court finds that Dr. Davies' Declaration did not exceed the authorization granted by the court. Paragraphs 1 through 12 and 17 of Dr. Davies' Declaration explain the relevance of the evidence submitted. Those paragraphs do not rely on new evidence but simply paraphrase Dr. Davies' earlier testimony. Dr. Davies addresses the authenticity of the complete set of Z-slices in paragraphs 13 and 15. The court will not rely on the declaration for any purpose beyond demonstrating admissibility through authentication and relevance. In view of the foregoing circumstances, the court denies Andrx's request that the court consider the Declaration of Dr. David W. Piston submitted with Andrx's unauthorized, April 2, 2002, Offer of Proof. The court will not allow Andrx to submit new expert opinions after the record has been closed. *See, e.g.,* Loral Fairchild Corp. v. Victor Co. of Japan Ltd., 911 F.Supp. 76, 79 (E.D.N.Y.1996).
As Dr. Davies explained at trial, maximum intensity projection is a standard approach used to present an accurate image of CLSM data of the surface of a sample by combining Z-slices that may only contain CLSM data for a portion of the surface. (Davies Tr. 4111:2-16.) CLSM collects data for one optical image slice (Z-slice) at a time. (Davies Tr. 4104:18-19.) The data for each Z-slice is collected by three detectors.

(Davies Tr. 4104:6-9; P1286-3 (Dem. Ex.).) The first Z-slice is collected beginning above the sample. Then the microscope moves down one step, the distance between the middle of consecutive Z-slices, and takes a second Z-slice that overlaps with the first. This progression of obtaining Z-slices continues until all of the Z-slices are obtained. (Davies Tr. 4108:11-17, 4109:25-4110:3, 4111:23-4112:4; P1286 (Dem.Ex.) at 4, 5.) The Z-slices were only 1.28 microns apart, and Dr. Davies gave a detailed explanation of how the 1.28 micron measurement was determined. (Davies Tr. 4296:6-16.) The only portion of the pellets that could fluoresce and therefore be detected is the top 5 microns because the Argon laser used for CLSM penetrates the sample about 5 microns. (Davies 4109:8-13, 4109:25-4110:3, 4111:23-4112:4; P1286 (Dem.Ex.) at 5.) Since each Z-slice only collects fluorescence in a limited depth of field and the relatively flat surface of the bisected pellet may be on a tilt, all of the Z-slices are considered when evaluating the surface of the bisected pellet. (Davies Tr. 4292:19-4293:5.) Considering only one or two Z-slices does not give an accurate representation of the complete surface of the tilted sample. (Davies Tr. 4292:19-4293:5.) The court finds that Dr. Davies properly used maximum intensity projection to present his CLSM images.

As mentioned previously, Dr. Davies employed two techniques to confirm that the presence of the bright fluorescing ring in the UV images represented a layer with a distinct chemical composition as compared to those neighboring it and to identify the substances in that layer-acetone washing and ATR-FTIR. Andrx objects to both of those procedures as well. The court has already addressed the admissibility of Dr. Davies' acetone-washing procedure with respect to the Genpharm products. The court incorporates that discussion to the extent it is relevant to the testing conducted on the Andrx products. Contrary to Andrx's assertions, Dr. Davies' acetone-washing technique did not result in a wide range of results. The original 5 acetone-washed results and the newly-conducted ATR-FTIR analyses show that the HPMCP salt forms and is detected clearly in every sample where the enteric coating has been removed. (Davies Tr. 4165:16-4166:2.) If a washing was incomplete, the ATR-FTIR spectrum matched the spectrum for the enteric coating. (Davies Tr. 986:10-14, 994:3-7.) However, the presence of talc peaks in the ATR-FTIR spectrum does not indicate that the enteric coat was removed incompletely because talc is co-deposited on the Andrx pellets with HPMCP during the enteric-coating process. (Davies Tr. 4298:7-10.) Andrx's suggestion that there is no possibility of obtaining a negative result is incorrect. If a salt layer was not present, Dr. Davies would never detect the salt. In that case, Dr. Davies would have first detected the enteric coating and then, upon removing the enteric coating, the active layer. That is not what happened. Upon washing, Dr. Davies detected an HPMCP-salt layer. (Davies Tr. 822:17-823:11.) Andrx's complaint that HPMCP is only slightly soluble in acetone fails to take into account that Dr. Davies relied on the difference in the solubility of the HPMCP in the enteric coating and the HPMCP-salt subcoating for the washing process. (*See* Davies Tr. 4300:11-16.) Dr. Davies explained that in the acetone wash the HPMCP washed away in a matter of minutes. (Davies Tr. 4299:22-24.) The wash technique includes washing multiple pellets at the same time; when they rub together, the rubbing facilitates the erosion of the enteric coating. (*See, e.g.,* Davies Tr. 804:19-24, 1158:23-1159:10.) In addition, the peak shapes and positions of the ATR-FTIR spectra are consistent, showing reproducibility and reliability of the results. (*Id.*)

Attenuated total reflectance fourier transform infrared spectroscopy ("ATR-FTIR") is an analytical technique that is commonly used to analyze the chemical composition of a sample. (Davies Tr. 805:20-806:2; Gardella Tr. 3853:18-24.) FN46 ATR-FTIR analysis is based on the wavelengths of infrared light that are absorbed by a sample. (Davies Tr. 828:25-829:11.) With this technique, infrared light is projected into a sample to a depth of approximately 1 micron. (Davies Tr. 937:22-23, 938:9-10, 939:12-13; *see also* Davies (*Daubert*) Tr. 4304:24-4305:1.) Some of the light is absorbed and some is reflected. The difference between the projected light and the reflected light yields a "fingerprint" of the chemical contents of the material being tested. (Davies Tr. 828:25-830:11.) In order to identify a particular chemical compound in an

unknown sample with ATR-FTIR, a "reference" spectrum is compared against the spectrum of the unknown sample. (Davies Tr. 832:20-23; P773; P774.) The ATR-FTIR showed that the brightly fluorescing layer in the Andrx products corresponds to an HPMCP salt. (Davies Tr. 832:2-833:16, 924:2-12.) The ATR-FTIR data, in conjunction with the UV microscopy pictures, (P220; P221), show that the HPMCP-salt layer corresponds to the intense, fluorescing region. (Davies Tr. 835:19-836:7.) This was reconfirmed by partial acetone-wash tests reported as part of the reliability proofs. (*See, e.g.,* P1266.) The peak assignments that Dr. Davies focused on are similar to those discussed in a recent ATR-FTIR publication relating to phthalic acid and identifying its peaks for the acid form and salt form. (Davies Tr. 4167:19-4169:1; P769 at 1639-41, figure 1, Table 3.) The court concludes that Dr. Davies' ATR-FTIR testing produced accurate and reliable results that are admissible at trial. Those ATR-FTIR results are also clearly relevant to the issue of what chemical substances exist in the brightly fluorescing layer visually apparent in the Andrx products.

FN46. Dr. Gardella has extensive experience with the development and use of surface analytical techniques. (Gardella Tr. 3830:15-3831:6, 3834:15-22.) He has been recognized in particular for his innovations in the use of ToF-SIMS to study surface chemistry (Gardella Tr. 3836:8-3837:22), and has published approximately 40 papers on the use of SIMS for surface analyses, (Gardella Tr. 3973:13-19; A427).

Like the other Defendants, Andrx also moves to exclude the testimony of Dr. Langer. In light of the court's rulings concerning the tests performed on Andrx's ANDA products by Dr. Davies, the court denies Andrx's motion to exclude portions of Dr. Langer's testimony and reports under *Daubert*. *See* Fed.R.Evid. 703; Gussack Realty Co. v. Xerox Corp., 224 F.3d 85, 94-95 (2d Cir.2000) ("[A]n expert may rely on data that she did not personally collect."). The court has admitted the testimony and test results by Dr. Davies upon which Dr. Langer relied, and the court finds that Dr. Langer's reliance on that information was reasonable. It is also clear that an expert in a case like this one may comment upon and rely on the testimony of the scientists who developed an allegedly infringing formulation; accordingly, the court concludes that it was reasonable for Dr. Langer to rely upon the testimony of Drs. Timothy Weng and Joseph Chou.FN47 Therefore, the court denies Andrx's motion to exclude Dr. Langer's testimony under Rule 702 as interpreted by *Daubert* and its progeny.

FN47. As the court explains in more detail in the portion of this opinion dealing with infringement, the court is unable to credit the portions of the testimony of Drs. Weng and Chou relied on by Astra in support of its infringement case against Andrx. To the extent that Dr. Langer's opinions rely on those comments, then, the court does not give those opinions much weight.

G. KUDCo's Motions

Defendants KUDCo filed a motion pursuant to Federal Rule of Evidence 702 and *Daubert* to exclude evidence relating to the high-concentration pH meter testing of HPMC conducted by Dr. Davies. All of the arguments made by KUDCo in that motion were directed to the relevancy and reliability of the high-concentration tests Dr. Davies performed on the HPMC used in the KUDCo formulation. Defendants KUDCo also filed a motion to exclude the expert testimony of Dr. Langer pursuant to Rule 702, Rule 703 and *Daubert*. That motion attacked the opinions Dr. Langer testified to at trial that relied upon Dr. Davies' high-concentration HPMC pH test results. In light of the analysis contained in the portion of this opinion concerning KUDCo's noninfringement of the '505 and '230 patents, the court finds that KUDCo's motions to exclude portions of the testimony of Dr. Davies and Dr. Langer are moot.

H. *Daubert* Analysis Applies to Weight and Credibility Determinations

Of course, many of the *Daubert* factors go not only to the admissibility of the evidence, but also to the weight that evidenceis to be given and the credibility of the expert witness. *See* Libas, Ltd. v. United States, 193 F.3d 1361, 1366 (Fed.Cir.1999) ("[T]he proposition for which [*Daubert* and *Kumho*] stand, that expert testimony must be reliable, goes to the weight that [the] evidence is to be accorded as well as to its admissibility."); McCullock, 61 F.3d at 1044 ("Disputes as to ... faults in his use of ... a methodology, or lack of textual authority for his opinion, go to the weight ... of his testimony."). The court must take a "hard look" at the expert scientific testimony offered to prove infringement, even the evidence admitted under the *Daubert* standard, and the court must reject an expert's conclusions where there is "too great an analytical gap between the data and the opinion proffered." General Elec. Co. v. Joiner, 522 U.S. 136, 146, 118 S.Ct. 512, 139 L.Ed.2d 508 (1997). Therefore, the court will reconsider the issues raised by Defendants' *Daubert* motions in the context of its infringement analyses.

IV. Infringement of the '505 & '230 Patents

A. General Principles

Section 271(e)(2) provides, in relevant part, that "[i]t shall be an act of infringement to submit ... an application under [21 U.S.C. s. 355(j)] for a drug claimed in a patent or the use of which is claimed in a patent." As described above, this is an artificial act of infringement based on the filing of an ANDA and challenging existing patents through a Paragraph IV certification. Eli Lilly & Co. v. Medtronic, Inc., 496 U.S. 661, 676, 110 S.Ct. 2683 (1990); 21 U.S.C. s. 355(j)(2)(A)(VII)(iv). A claim of infringement brought under section 271(e)(2) focuses on the hypothetical product described in the ANDA. Bayer AG v. Elan Pharm. Research Corp., 212 F.3d 1241, 1248 (Fed.Cir.2000), *cert. denied,* 531 U.S. 993, 121 S.Ct. 484, 148 L.Ed.2d 457 (2000). "[I]t is proper for the court to consider the ANDA itself, materials submitted by the ANDA applicant in support of the ANDA, and any other relevant evidence submitted by the applicant or patent holder." Bayer AG, 212 F.3d at 1249, *cert. denied,* 531 U.S. 993, 121 S.Ct. 484, 148 L.Ed.2d 457 (2000). "When a patentee seeks to block FDA approval of an NDA under 35 U.S.C. s. 271(e)(2)(A), the infringement inquiry focuses on the hypothetical infringement that would occur if the defendant's NDA were approved and the defendant began to make and sell the drug." Novartis Corp. v. Ben Venue Labs., Inc., 271 F.3d 1043, 1047 (Fed.Cir.2001).

[51] [52] Comparing the accused product to the asserted claims, for analysis of either literal infringement or infringement under the doctrine of equivalents, is a question of fact. Glaxo Group, Ltd. v. Ranbaxy Pharms., Inc., 262 F.3d 1333, 1335 (Fed.Cir.2001); Hilton Davis Chem. Co. v. Warner-Jenkinson Co., 62 F.3d 1512, 1520, 1522 (Fed.Cir.1995), *rev'd on other grounds,* 520 U.S. 17, 117 S.Ct. 1040, 137 L.Ed.2d 146 (1997). Plaintiffs bear the burden to prove their claims of infringement by a preponderance of the evidence. Wilson Sporting Goods Co. v. David Geoffrey & Assocs., 904 F.2d 677, 685 (Fed.Cir.1990). This standard applies to both literal infringement and infringement under the doctrine of equivalents. Lemelson v. United States, 752 F.2d 1538, 1547 (Fed.Cir.1985). The fact that section 271(e)(2) creates an artificial act of infringement does not lessen that burden. Glaxo, Inc. v. Novopharm, Ltd., 110 F.3d 1562, 1567 (Fed.Cir.1997). The burden rests at all times on Astra to prove through an accurate, scientific method that the claimed invention is actually present in the allegedly infringing ANDA product. *See* Novartis Corp., 271 F.3d at 1050.

1. Literal Infringement

[53] Proof of infringement is a two-step process. The court has already construed each claim to determine its proper scope and meaning. *See* Markman v. Westview Instruments, Inc., 517 U.S. 370, 384, 116 S.Ct. 1384, 134 L.Ed.2d 577 (1996). Now, the court must determine whether Astra has proven by a preponderance of the evidence that Defendants' products meet each and every element or limitation recited in the properly construed claims. *See* Southwall Techs., Inc. v. Cardinal IG Co., 54 F.3d 1570, 1575 (Fed.Cir.1995); Morton Int'l v. Cardinal Chem. Co., 5 F.3d 1464, 1468 (Fed.Cir.1993). There can be no infringement as a matter of law-even under the doctrine of equivalents-if a claim limitation is not found in the accused device. Phonometrics Inc. v. Northern Telecom Inc., 133 F.3d 1459, 1467 (Fed.Cir.1998); Gen. Am. Transp. Corp. v. Cryo-Trans, Inc., 93 F.3d 766, 771 (Fed.Cir.1996).

2. Infringement Under the Doctrine of Equivalents

[54] The doctrine of equivalents prevents an accused infringer from avoiding liability for infringement by changing only minor or insubstantial details of a claimed invention while retaining the invention's essential identity. Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., 234 F.3d 558, 564 (Fed.Cir.2000). "If an asserted claim does not literally read on an accused product, infringement may still occur under the doctrine of equivalents if there is not a substantial difference between the limitations of the claim and the accused product." Bayer AG, 212 F.3d at 1250-51; *see also* Warner-Jenkinson, Inc. v. Hilton Davis Chem. Co., 520 U.S. 17, 21, 117 S.Ct. 1040, 137 L.Ed.2d 146 (1997). The doctrine of equivalents is used to "temper unsparing logic and prevent an infringer from stealing the benefit of the invention." Festo Corp., 234 F.3d at 564. In pursuing these goals, the doctrine attempts to strike a balance between ensuring that the patentee enjoys the full benefit of his patent and ensuring that the claims give "fair notice" of the patent's scope. *Id.* However, as the Federal Circuit recognized, "it is impermissible to erase under the doctrine of equivalents 'meaningful limitations of the claim on which the public is entitled to rely in avoiding infringement.' " Genentech Inc. v. Wellcome Found., 29 F.3d 1555, 1568 n. 41 (Fed.Cir.1994) (citation omitted). In other words, because each element of a claim is material and essential, equivalency requires the accused product to have an equivalent of every element of the claim. Warner-Jenkinson, 520 U.S. 17, 30-31, 117 S.Ct. 1040, 137 L.Ed.2d 146 (1997).

[55] Equivalence is a question of fact. Graver Tank & Mfg. Co. v. Linde Air Prods. Co., 339 U.S. 605, 609, 70 S.Ct. 854, 94 L.Ed. 1097 (1950). To determine whether the accused device includes equivalents for a claimed limitation, the court applies an "insubstantial difference" test. Toro Co. v. White Consol. Indus., Inc., 266 F.3d 1367, 1370 (Fed.Cir.2001). Quoting the Supreme Court in Graver Tank, 339 U.S. at 607, 70 S.Ct. 854, the Federal Circuit stated:

courts have ... recognized that to permit imitation of a patented invention which does not copy every literal detail would be to convert the protection of the patent grant into a hollow and useless thing. Such a limitation would leave room for-indeed encourage-the unscrupulous copyist to make unimportant and insubstantial changes and substitutions in the patent which, though adding nothing, would be enough to take the copied matter outside the claim, and hence outside the reach of law.

Toro, 266 F.3d at 1370. The test for whether an element in the infringer's product or process is equivalent to a claimed element is whether the differences between the two are insubstantial to one of ordinary skill in the art. KCJ Corp. v. Kinetic Concepts, Inc., 223 F.3d 1351, 1359 (Fed.Cir.2000).

[56] [57] The use of a substitute with "known interchangeability" with a literally claimed element is an objective factor to be considered in determining whether the substitute meets the claim limitation under the

doctrine of equivalents. Warner-Jenkinson Co. v. Hilton Davis Chem. Co., 520 U.S. 17, 36, 117 S.Ct. 1040, 137 L.Ed.2d 146 (1997). The "known interchangeability" test looks to the knowledge of the skilled artisan to see whether the artisan would "contemplate the interchange as a design choice." Interactive Pictures Corp. v. Infinite Pictures, Inc., 274 F.3d 1371, 1383 (Fed.Cir.2001). Where skilled artisans would contemplate an interchange as a design choice, this is "substantial evidence" of equivalence. *Id*. Proof can be made in any form, "through testimony of experts or others versed in the technology; by documents, including texts and treatises; and, of course, by the disclosures of the prior art." Graver Tank, 339 U.S. at 609, 70 S.Ct. 854. Courts have sometimes employed a tripartite function-way-result test in determining whether a change is "insubstantial." The function-way-result test inquires into whether the accused structure performs substantially the same function in substantially the same way to achieve substantially the same result. Warner-Jenkinson, 520 U.S. at 39-40, 117 S.Ct. 1040. The doctrine is not applied to the invention as a whole, but to individual elements of the claimed invention. Id. at 29, 117 S.Ct. 1040.

B. Genpharm

[58] Plaintiffs assert that Genpharm's omeprazole formulations will infringe claims 1, 5, 6, 8-12, and 14 of the '505 patent and claims 1, 6, 7, 10-13, and 15 of the '230 patent either literally or under the doctrine of equivalents. Genpharm's ANDA describes two proposed omeprazole products. The first is a 10 mg delayed-release capsule, and the second is a 20 mg delayed-release capsule (hereinafter sometimes referred to as "Genpharm's ANDA products" or "Genpharm's products"). The pellets that make up the 10 mg and 20 mg capsules are the same. The only difference between the two dosage forms is the number of pellets contained in the capsules. (Langer Tr. 308:6-8; Genpharm by Judy 30(b)(6) Dep. Tr. 235:21-237:14.) Genpharm's omeprazole formulation and the detailed manufacturing process for Genpharm's pellets is set forth in Exhibit P85. Genpharm's products are to be administered orally as delayed-release capsules. (Langer Tr. 310:6-21; P87 at G46-47; Genpharm by Judy 30(b)(6) Dep. Tr. 246:24-247:16.) Therefore, Genpharm's omeprazole capsules, both 10 mg and 20 mg, are "oral pharmaceutical preparations" as that phrase is used in claims 1 of both the '505 and '230 patents.

Genpharm raises two principal non-infringement arguments: (1) that its ANDA products do not include the claimed "core region" and (2) that its ANDA products do not include the claimed "subcoating." Genpharm argues that its ANDA products do not infringe claims 1 of the patents because Genpharm's core is an inert neutral pellet; therefore, the first layer in Genpharm's products is the active drug layer, not the inert subcoating. Genpharm's contentions as to the core region and subcoating limitations are based solely on its proposed claim construction, which would graft onto claims 1(a) a requirement of homogeneity in order to exclude a core built on a sugar seed. Despite Genpharm's arguments, the court has not adopted Genpharm's proposed claim construction for the terms "core" and "core region;" therefore, the court finds that Genpharm's omeprazole products meet every limitation of claims 1 of the '505 and '230 patents.

In March of 1997, Mr. Craig Judy, Genpharm's Manager of Formulation Development, began working on the development of an ANDA omeprazole product for Genpharm. (Judy Dep Tr. 5:16-19, 124:21-24, 125:3-11.) Ultimately Genpharm decided to use a formulation developed by Ilsan Iltas. (Judy Dep. Tr. 146:23-147:2, 147:5, 149:4-22.) Now Genpharm's ANDA product is manufactured by Ilsan Iltas, a generic pharmaceutical company located in Istanbul, Turkey. (Pike Tr. 3630:17-21; Ugurlu Tr. 3649:14-16.) Genpharm begins its pellet manufacturing process with a sugar seed. (Langer Tr. 309:10-15.) Genpharm then sprays an active coating solution containing micronized omeprazole, lactose, sodium lauryl sulphate, disodium hydrogen phosphate ("DHP"), HPMC, and low substituted hydroxypropyl cellulose onto the sugar seed. (Langer Tr. at 308:21-309:21; P85 at G4133; Pike Tr. at 3638:20-3639:8; G17B.) A protective coating

layer of HPMC is then sprayed onto the active drug layer. (Langer Tr. 309:21-24; P85 at G4143-44; Pike Tr. 3638:20-3639:8; G17B.) Finally, an enteric coating containing HPMCP and diethyl phthalate is sprayed onto the protective coating layer. (Langer Tr. 309:25-310:5; P85 at G4152-53; Pike Tr. 3638:20-3639:8; G17B.)

Claim 1(a) of the '505 describes "a core region comprising an effective amount of material selected from the group consisting of omeprazole plus an alkaline reacting compound." (P1, col. 16:43-45.) Claim 1(a) of the '230 further describes "an alkaline reacting core comprising an acid-labile pharmaceutically active substance and an alkaline reacting compound different from said active substance." (P2A, col. 13:2-5.) In preparing Genpharm's draft Development Report, Mr. Judy himself defined the sugar seed together with the active drug layer of omeprazole and disodium hydrogen phosphate as the "core" of Genpharm's product. (Judy Dep. Tr. 340:3-25; P19 at G13038.) Even in the final Development Report prepared in connection with Genpharm's ANDA, Mr. Judy again defined a sugar seed together with the omeprazole active drug layer in Genpharm's generic product as a "core." (Judy Dep. Tr. 362:9-12; P20 at G13549.) This court has construed the terms "core" and "core region" to mean the portion of the patented preparation that lies beneath the subcoating and contains the active ingredient and, in the case of omeprazole as the active ingredient, an ARC. Spraying layers onto a sugar seed is a conventional way of making cores or pellets in the pharmaceutical industry. (Langer Tr. 312:7-313:10; P1, col. 3:1-2; Judy Dep. Tr. 307:20-22, 308:4-17, 309:4; P921 at 12; P20 at G13549; P85 at G4133.) The court finds, therefore, that Genpharm's ANDA products have a core that includes a sugar sphere, micronized omeprazole, lactose, DHP, and sodium lauryl sulphate. (Langer Tr. 308:6-309:24, 312:3-313:10; Davies Tr. 802:21-803:4; Genpharm by Judy 30(b)(6) Dep. Tr. 236:3-237:7, 237:10-19, 248:3-24, 254:22-25, 255:4-18, 255:23-256:2; P51, at G24635; P82; P85; P87; P1039.) There is no dispute that omeprazole is an acid labile pharmaceutically active substance. (Langer Tr. 313:20-314:2; Genpharm by Judy 30(b)(6) Dep. Tr. at 352:4-5,8.) The active drug layer, which is part of the core in Genpharm's product, includes DHP, (Langer Tr. 308:15-309:2; Ugurlu Tr. 3680:17-24), and DHP is undeniably an ARC, (Langer Tr. 311:5-15; Genpharm by Judy 30(b)(6) at 279:15-18, 21; P20 at G13546). In fact, DHP is expressly listed in the '505 and '230 patents as an ARC. (P1, col. 7:64; P2, col. 11:10.)

The DHP in Genpharm's ANDA products is used as a pH-adjuster to stabilize the omeprazole while it is in the active-coating suspension, and it accomplishes that objective by maintaining the solution of the active-coating suspension at an appropriate pH. (Genpharm by Judy 30(b)(6) Dep. Tr. 285:10-15, 353:11-24.) DHP itself is an alkaline material, (Ugurlu 3680:25-3681:6), and the purpose of including it in Genpharm's product is to adjust the pH of the active drug layer so that the omeprazole does not degrade and to create a more stable product. (Langer Tr. 311:16-22; Genpharm by Judy 30(b)(6) Dep. Tr. 258:9-25, 353:11-22, 353:24; P51 at G24635.) Genpharm carefully calculated the amount of DHP to include in order to provide the proper pH range for stabilizing omeprazole in its formulation, (Judy Dep. Tr. 305:3-306:10), and the DHP does, in fact, prevent the degradation of omeprazole from occurring, (Genpharm by Judy 30(b)(6) Dep. Tr. 285:16-25, 288:19-289:6).

The evidence introduced at trial clearly shows that the pH of the microenvironment of the omeprazole in Genpharm's core is at least 7. In fact, Dr. Davies testified and submitted data that show that the pH of the microenvironment of the omeprazole in Genpharm's formulation is between 7 and 12, as required by claim 5 of the '505 patent and claim 6 of the '230 patent. The active drug layer in Genpharm's products is homogenous. (Ugurlu Tr. 3679:11-3680:16; G17C at G50205.) Because of that homogeneity, Dr. Davies could measure the pH of the microenvironment of the omeprazole in the core by washing off the enteric coating with an acetone wash, cracking off a piece of the exposed active drug layer, adding a small amount

of water, and measuring the pH. (Davies Tr. 804:9-808:13.) Dr. Davies conducted pH testing to determine the pH of the omeprazole microenvironment in Genpharm's product. (Davies Tr. 803:22-808:2; P83.) As measured by Dr. Davies, Genpharm's active drug layer has a microenvironment pH of about 7.39 and 7.29, within the 7 to 12 range. (Davies Tr. 808:6-13, 814:7-15; P591A; P83; Langer Tr. 322:8-12; Genpharm by Judy 30(b)(6) Dep. Tr. 392:5-17.) Even if the court did not rely on Dr. Davies' pH tests on the microenvironment of Genpharm's product, Genpharm itself has admitted on several occasions that its product meets this limitation. Genpharm's own documents and witnesses establish beyond any doubt that the active drug layer in its product not only is homogenous but also has a pH between 7 and 12. Genpharm's Development Reports state that the pH of the active coating solution in its product is 8.4. (Judy Dep. Tr. 342:7-343:8; P19 at G13038; Genpharm by Judy 30(b)(6) Dep. Tr. 291:12-292:5; P20 at G13550.) Mr. Judy testified that even taking into account normal variation, the pH of the active coating solution does not fall below 7.5. (Judy Dep Tr. 343:16-344:6, 344:21-24.) Moreover, Genpharm realized that the use of DHP in its product would meet the '505 patent claim limitation for an ARC. (Genpharm by Judy 30(b)(6) Dep. Tr. 339:19-23, 340:5-22, 341:4-5.) Since Genpharm's ANDA products are composed of enteric-coated pellets that have cores that contain either 10 mg or 20 mg of omeprazole, which is an acid labile pharmaceutically active substance, in the presence of disodium hydrogen phosphate, an ARC, Genpharm's ANDA products meet all limitations of claims 1(a).

Claim 1 of the '505 patent also requires "(b) an inert subcoating which is soluble or rapidly disintegrating in water disposed on said core region, said subcoating comprising one or more layers of materials selected from among tablet excipients and polymeric film-forming compounds." Similarly, claim 1 of the '230 patent requires "(b) an inert subcoating which rapidly dissolves or disintegrates in water disposed on said core region, said subcoating comprising one or more layers comprising materials selected from the group of tablet excipients, film forming compounds and alkaline compounds." The structure of Genpharm's ANDA products is such that the core, comprised of the active drug layer and the sugar seed, is underneath a protective layer of hydroxypropyl methylcellulose ("HPMC"). (Langer Tr. 308:15-309:24, 311:23-312:6; Davies Tr. at 799:7-803:21; P82; Ugurlu Tr. 3655:18-3656:24, 3680:17-24, 3681:16-20.) The HPMC protective coating is on top of and in intimate contact with the active coating layer. (Genpharm by Judy 30(b)(6) Dep. Tr. 312:20-313:24, 314:2-9.) The HPMC used in Genpharm's product is a tablet excipient and a polymeric film forming compound, and the HPMC protective layer in Genpharm's product is inert and soluble in water. (Langer Tr. 314:3-315:5; Genpharm by Judy 30(b)(6) Dep. Tr. 310:19-25, 311:2-312:5; P77 at G3672.) Not only does the HPMC used in Genpharm's ANDA products possess the qualities required by the patent for subcoating materials, HPMC is expressly identified as one choice for the subcoating in the '505 patent. (P1, col. 4:35-42.) The court finds that Genpharm's ANDA products contain a subcoating of HPMC disposed on the core and between the core and the enteric coating. (*See* Story Tr. 3784:9-16 (testifying that the subcoat in the Genpharm product provides the same function as the subcoat in the '505 patent).)

Genpharm argues that the "subcoating" must be the "first layer" in the formulation. Genpharm then reasons that the HPMC protective layer in its products is not the "first layer" in the formulation because the active layer is applied to the sugar seed first. In this regard, Genpharm relies on the disclosure in the patent specifications. (*See* P1, col. 3:26-28.) Genpharm's argument fails for several reasons. Initially, the term "first" appears nowhere in any of the asserted claims. There is no requirement that the subcoating be the "first" layer in the formulation. (P1, col. 16:42-54.) Even if it were appropriate to read into the asserted claims the disclosure cited by Genpharm, (*see* P1, col. 3:20-28), at best that disclosure indicates that the subcoating is the first layer *on the core,* not the first layer in the whole formulation. When the term "core region" is construed properly to include both the sugar sphere and the active drug coating, the HPMC

protective layer in Genpharm's products *is* the "first" layer on top of the core. Because there is no dispute that Genpharm's products have an inert, water-soluble subcoating, (*see* Genpharm PFF 477 (citing Ugurlu Tr. 3656:18-24); Langer Tr. 314:3-315:9; P85 at G4143), the court finds that Genpharm's ANDA products meet the requirements of claims 1(b) of the '505 and '230 patents. The subcoating in Genpharm's products also meets claim 1(c) of the '230 patent because it enhances the stability of Genpharm's products. (Langer Tr. 316:1-9; Judy Dep. Tr. 79:12-23.)

Finally, claim 1 of the '505 patent requires "(c) an outer layer disposed on said subcoating comprising an enteric coating." Claim 1 of the '230 patent also requires "(c) an enteric coating layer surrounding said subcoating layer, wherein the subcoating layer isolates the alkaline reacting core from the enteric coating layer such that the stability of the preparation is enhanced." There is no dispute that Genpharm's ANDA products have an enteric coating layer containing hydroxypropyl methylcellulose phthalate ("HPMCP") and diethyl phthalate disposed on the HPMC subcoating and that claims 1(c) of the '505 and '230 patents are met by the Genpharm product. (Langer Tr. 315:10-316:9; Genpharm by Judy 30(b)(6) Tr. 314:10-15; Judy Dep. Tr. 79:12-23; P1, col. 4:65-67.) Since Genpharm's ANDA products meet every limitation of claims 1 of the '505 and '230 patents, the court concludes that Genpharm literally infringes claims 1 of both the '505 and '230 patents.

Claim 5 of the '505 patent calls for "[a] preparation according to claim 1 wherein the alkaline core comprises omeprazole and pH-buffering alkaline compound rendering to the micro-environment of omeprazole a pH of 7-12." (P1, col. 16:65-68.) Claim 6 imposes a similar requirement with respect to a core comprising an acid labile compound and a pH-buffering alkaline reacting compound. The only new requirement beyond claims 1 is that the micro-pH fall between 7 and 12. As discussed in relation to claims 1, Dr. Davies' tests clearly show that this claim limitation is met by Genpharm's ANDA products. Genpharm repeats the noninfringement arguments made with respect to claims 1, but Genpharm also raises an additional argument concerning the requirement for a "pH-buffering alkaline compound." Essentially, Genpharm argues that Astra failed to demonstrate that the DHP in Genpharm's core demonstrates pH-buffering capacity; this argument depends entirely on an assumption of Genpharm's claim construction. The court has already precluded Defendants from asserting noninfringement positions on the basis of their belated claim construction arguments for the term "pH-buffering alkaline compound;" moreover, the court declined to adopt the claim construction upon which Genpharm relies. Therefore, Genpharm's noninfringement positions with respect to these claims fail, and the court concludes that Genpharm literally infringes claim 5 of the '505 patent and claim 6 of the '230 patent.FN48

FN48. Even if the court were to accept Genpharm's claim construction, require the ARC to have the properties of a classical buffer for the purposes of these two claims, *and* permit Genpharm to argue a noninfringement position based upon that belated construction, Genpharm would not prevail. The DHP in Genpharm's ANDA products is a buffering agent. (Genpharm by Judy 30(b)(6) Dep. Tr. 275:15-21, 331:21-23, 332:5, 339:12-14, 339:17-18.) Contrary to Genpharm's opinion, it was unnecessary for Dr. Davies to test Genpharm's product for buffering activity, (*see* Davies Tr. 1194:18-20), because the buffering capacity of Genpharm's DHP was proven through other evidence.

Claim 6 of the '505 and claim 7 of the '230 patent call for "[a] preparation ... wherein the alkaline compound comprises one or more of ... sodium ... phosphate." (P1, col. 17:1-8; P2A, col. 14:9-16.) Genpharm uses disodium hydrogen phosphate, which is a kind of sodium phosphate, in the core of its ANDA products. (Langer Tr. 322:17-323:6; P85 at G4133; Pike Tr. 3638:20-3639:8; G17B.) Claim 6 of the '505 patent

depends from claim 5, and Genpharm raises no additional arguments as to noninfringement. The same holds true for claim 7 of the '230 patent, which depends from claim 6. Therefore, the court concludes that Genpharm literally infringes claim 6 of the '505 patent and claim 7 of the '230 patent.

Claim 8 of the '505 patent and claim 10 of the '230 patent require "[a] preparation according to claim 1, wherein the enteric coating comprises [HPMCP] ..., optionally containing a plasticizer." (P1, col. 9:50-54.) Genpharm's ANDA products contain HPMCP in the enteric coating layer. (Genpharm by Judy 30(b)(6) Dep. Tr. 314:10-15; P56.) Genpharm also adds diethyl phthalate to the enteric coating as a plasticizer. (P93 at Response Nos. 35, 36; Langer Tr. 309:3-7, 323:7-324:7.) Claim 8 of the '505 patent and claim 10 of the '230 patent depend from claims 1 of the patents, and Genpharm raises no additional arguments of noninfringement as to these claims. For the reasons given above, and in light of this court's findings concerning the enteric coating layer in Genpharm's ANDA products, the court concludes that Genpharm literally infringes claim 8 of the '505 patent and claim 10 of the '230 patent.

Claim 9 of the '505 patent calls for "[a] preparation according to claim 1 wherein the water content of the final dosage form containing omeprazole does not exceed 1.5% by weight." (P1, col. 17:20-22.) Claim 11 of the '230 patent imposes the same requirements for the formulation containing the acid labile compound. (P2A, col. 14:30-32.) Both claim 9 of the '505 patent and claim 11 of the '230 patent depend from claims 1, and Genpharm raises no additional arguments of noninfringement as to these claims. In fact, Genpharm has admitted that "[t]he water content of the enteric coated pellets in Genpharm's ANDA products does not exceed 1.5% by weight." (P93 at Response No. 37; Genpharm by Judy 30(b)(6) Dep. Tr. 332:24-333:10, 334:11-335:4, 336:9-25; P68.) On the basis of these facts, the court concludes that Genpharm literally infringes claim 9 of the '505 patent and claim 11 of the '230 patent.

Claim 10 of the '505 patent is directed to "[a] method for the treatment of gastrointestinal disease comprising administering to a host in need of such treatment a therapeutically effective amount of a preparation according to claim 1." (P1, col. 17:23-26.) Similarly, claim 13 of the '230 patent is directed to "[a] method for the treatment of gastrointestinal disease characterized in that a preparation according to claim 1 is administered to a host in need of such treatment in a therapeutically effective amount." (P2A, col. 14:42-45.) The court finds that Genpharm's 10 mg and 20 mg capsules contain a therapeutically effective amount of omeprazole, and Genpharm's products are designed for use in treating gastrointestinal disease. (Langer Tr. 325:5-14; P737 at G24437-38.) Because these two claims depend from claims 1 of both patents, Genpharm raises the same non-infringement arguments, which fail for the same reasons. Genpharm also argues that Astra failed to prove inducement because Astra failed to offer evidence of actual infringement by third parties or of affirmative acts of inducement by Genpharm, but the court has already found such proof unnecessary. First, Genpharm submitted its ANDA seeking approval to market its product for use in the method patented in these claims. (P737 at G24438.) That submission constitutes an act of direct infringement under 35 U.S.C. s. 271(e)(2). Thus, the court finds that Genpharm literally infringes claim 10 of the '505 patent and claim 13 of the '230 patent.

[59] Claim 11 of the '505 patent and claim 15 of the '230 patent call for "[a] preparation according to claim 1, wherein the subcoating further comprises an alkaline buffering compound." Genpharm's subcoating is made of HPMC. (Ugurlu Tr. 3656:18-24; G17B; Davies Tr. 814:13-14; Langer Tr. 326:22; Genpharm by Judy 30(b)(6) Dep. Tr. 308:22-309:3.) The HPMC Genpharm uses is from Colorcon. (Genpharm by Judy 30(b)(6) 309:4-8, 310:8-18; P55 at G3698; P77 at G3672; G17D at G3699.) The court finds by a preponderance of the evidence that Genpharm uses concentrations of HPMC in its subcoating that are alkaline. According to Genpharm's own specifications, HPMC with a pH up to 8 is acceptable for use in

Genpharm's products. (Ugurlu Tr. 3682:24-3683:3, 20-22; G17D at G3698.) Genpharm points out that Ilsan tested and found the pH of Colorcon's HPMC to be 6.8; however, that testing was performed on a 1% solution. (Ugurlu Tr. 3684:19-21; G17D at G3698.) The concentration of HPMC in the protective-coating solution used in Ilsan's manufacturing process for preparing Genpharm's products is greater than 1%. (Ugurlu Tr. 3684:22-3687:8.) As determined by Dr. Davies, the HPMC used in Genpharm's subcoat has a pH of 7.93 to 8, with a mean value of 7.97, in a 10% solution. (Davies Tr. 811:19-22, 812:24-25; P591B; P84.) The mean pH value of Genpharm's HPMC increases from 7.97 to 8.51 to 8.75 to 9.12 with increasing concentrations from 10% to 20% to 40% to 60%; the more HPMC added, the higher the pH. (Davies Tr. 812:24-813:6; P591B; P84.) Thus, Astra has shown that the HPMC used in Genpharm's subcoat is alkaline.

However, proving that a substance is alkaline is not sufficient to demonstrate that it is an ARC. The '505 and '230 patents list HPMC as an example of a material that can be used as an *inert* subcoating. (P1, col. 4:35-41; P2A, col. 9:30-36.) HPMC is inert and has not been shown by a preponderance of the evidence to be an ARC. (Story Tr. 3760:7-8.) *See supra* Part IV. E. The Genpharm formulation does not have an alkaline buffering compound or ARC in the subcoat. (Story Tr. 3756:10-13, 3757:23-25.) The sole basis for Dr. Langer's conclusion that HPMC contains alkaline buffering compound are the tests Dr. Davies conducted that demonstrated that when HPMC is added to water the pH increases. (Langer Tr. 697:25-698:14.) All additional documents and testimony Astra cites, including P591B, Dr. Davies' lab notebook, and P84, summary of pH measurements from Dr. Davies' report, show at most alkaline pH values for components of Genpharm's proposed product. Astra has presented no additional evidence or argument on this issue. Plaintiffs have failed to prove by a preponderance of the evidence that Genpharm's HPMC either is itself or contains an alkaline buffering, or alkaline reacting compound. Therefore, the court concludes Plaintiffs have failed to prove that Genpharm infringes claim 11 of the '505 patent or claim 15 of the '230 patent either literally or under the doctrine of equivalents.FN49

FN49. Astra expressly limited its equivalents arguments solely to whether Genpharm's proposed products have an equivalent to the "core" or "core region" claimed in the '505 and '230 patents. (Taylor Tr. 3426:10-22.) Therefore, Astra did not present any evidence or argument with respect to an equivalent to an ARC or pH-buffering alkaline compound in the Genpharm ANDA products. Since the court finds that Defendant Genpharm literally infringes all other claims asserted by Plaintiffs against Genpharm, the court need not address the parties' arguments concerning infringement under the doctrine of equivalents.

Claim 12 of the '505 patent depends from claim 1 and requires that "the core comprises omeprazole and disodium hydrogen phosphate, and the subcoating comprises hydroxy propyl methyl cellulose." (P1, col. 18:4-7.) Genpharm raises no additional arguments for claim 12, and indeed, claim 12 of the '505 patent claims precisely the ingredients used in the core and subcoating of Genpharm's ANDA products. That is, Genpharm's ANDA products use omeprazole and disodium hydrogen phosphate in the core and HPMC in the subcoating. (Langer 327:20-329:1; P85 at G4133, G4143-44.) Thus, Genpharm literally infringes claim 12 of the '505 patent.

Claim 14 of the '505 patent and claim 12 of the '230 patent are directed to "[a] process for the preparation of an oral pharmaceutical preparation," (P1, col. 18:13-14), or "formulation," (P2A, col. 14:33-34.) Genpharm's ANDA describes its method for preparing its omeprazole capsules. Genpharm will practice a method for preparing an "oral pharmaceutical preparation" or formulation as that phrase is used in the patents. (Langer Tr. 328:22-329:2; P87 at G46-47.) Claim 14 further involves "preparing a core comprising an effective amount of material selected from the group consisting of omeprazoleplus an alkaline reacting

compound." (P1, col. 18:15-17.) Similarly, claim 12 of the '230 patent involves a process for preparing a formulation that has "cores containing the acid labile compound mixed with an alkaline reacting compound." (P2, col. 14:35-36.) Under the process described in its ANDA, Genpharm first prepares cores, containing, amongst other things, omeprazole, which is an acid labile compound, and DHP, which is an ARC. Genpharm's process includes steps for preparing a core with an effective amount of omeprazole and an alkaline reacting compound. (Langer Tr. 329:3-15; P85 at G4133.) Claim 14 also requires "coating the core with one or more layers of an inert subcoating material selected from among tablet excipients and polymeric film-forming compounds to form a subcoated core." (P1, col:18:20-23.) Similarly, claim 12 of the '230 patent requires that the foregoing cores "are coated with one or more inert reacting subcoating layers." (P2A, col. 14:39-40.) Genpharm's manufacturing process includes a step for coating the core with an inert subcoating comprising HPMC. (Langer Tr. 329:16-330:2; P85 at G4143, G4144.) HPMC is water soluble and is a polymer used for film-coating applications. Finally, claim 14 of the '505 patent requires "coating the subcoated core with an enteric coating." (P1, col. 18:24-25.) Likewise, claim 12 of the '230 patent requires that "the subcoated cores are further coated with an enteric coating layer." (P2A, col. 14:40-41.) Genpharm's manufacturing process includes this step, which involves spraying its subcoated pellets with a coating that includes HPMCP. (Langer Tr. 330:3-16; P85 at G4152.)

Genpharm raises two arguments in support of its noninfringement defenses to the process claims, which focus on the first two steps of claim 14. Specifically, and in a manner similar to its approach to claim 1, Genpharm argues (1) that it does not prepare a "core" as required by the claim and (2) that the HPMC protective layer in its product is not the "first" coating. Both arguments fail for much the same reason as explained above with respect to claim 1-they are predicated entirely on an erroneous claim construction. First, the term "core" does not exclude nonpareil technology, which was conventional at the time the '505 patent was filed. In fact, Genpharm's own expert, Dr. Story, testified that a person who was working in this field prior to 1986 knew that pellets could be made by various conventional methods, including extrusion and spheronization, coating an inert sugar seed in a fluidized bed and pan coating an inert sugar seed. (Story Tr. 3792:11-3793:6.) The fact that claim 14 is a process claim and requires "preparing a core" does not change the analysis. Nowhere in the claim is there any requirement that the "preparing" be accomplished in any particular way, such as by extrusion and spheronization. On its face, claim 14 covers any method used to "prepare" a core. Moreover, the fact that Genpharm "purchases" its sugar sphere from a third party, (Ugurlu Tr. 3668:23-3669:3, 3671:20-3672:7), is irrelevant. The claim does not foreclose the purchase of raw materials from a third party to be used in "preparing a core." The claim also does not require that the step of "coating the core with ... a subcoating material" be the "first" coating or layer in the formulation. As with claim 1, the word "first" appears nowhere in claim 14, and the specification merely describes the subcoating as the first layer added after the core is complete. For the foregoing reasons, the court concludes that Genpharm literally infringes claim 14 of the '505 patent. Claim 12 of the '230 patent does not differ materially from claim 14 of the '505 patent, and Genpharm repeats the same noninfringement arguments. For the same reasons as given for claim 14 of the '505 patent, the court finds that Genpharm literally infringes claim 12 of the '230 patent.

[60] Any argument that Genpharm manufactures its ANDA products outside the United States does not avoid infringement of these process claims. Infringement under s. 271(g) includes the importation, offer to sell, sale, or use of a product made by a process patented in the United States. Bio-Tech. Gen. Corp. v. Genentech, Inc., 80 F.3d 1553, 1560 (Fed.Cir.1996); *see* 35 U.S.C. s. 271(g) ("Whoever without authority *imports into the United States* or offers to sell, sells, or uses within the United States *a product which is made by a process patented in the United States* shall be liable as an infringer, if the importation, offer to sell, sale, or use of the product occurs during the term of such process patent.") (emphasis added). A

patentee may seek a declaration that a person will infringe a patent under 35 U.S.C. s. 271(g) in the future, but there must be an actual controversy for a district court to have jurisdiction. "To demonstrate that an actual controversy exists, a patentee must show that '(1) the defendant must be engaged in an activity directed toward ... an infringement charge ... or be making meaningful preparation for such activity; and (2) acts of the defendant must indicate a refusal to change the course of its actions in the face of acts by the patentee sufficient to create a reasonable apprehension that a suit will be forthcoming.' " Glaxo, Inc. v. TorPharm, Inc., No. 95 C 4686, 1997 WL 282742, at (N.D.Ill. May 18, 1997) (citations omitted). Here there is no question that all Defendants seek or have obtained FDA approval to sell the proposed ANDA product within the near future; therefore, the actual controversy requirement is met and the declaratory judgment action will be entertained. *Id*. Astra is entitled to declaratory judgment concerning claim 14 of the '505 patent and claim 12 of the '230 patent.

C. Cheminor

Plaintiffs assert that Cheminor's omeprazole formulations will infringe claims 1, 5, 9, 10, and 14 of the '505 patent and claims 1, 6, and 11-13 of the '230 patent either literally or under the doctrine of equivalents. Cheminor's ANDA describes three proposed omeprazole products-10 mg, 20 mg, and 40 mg omeprazole capsule shells containing enteric-coated pellets (hereinafter sometimes referred to as "Cheminor's ANDA products" or "Cheminor's products"). All the pellets that fill the 10 mg, 20 mg, and 40 mg capsules are the same-they have the same composition. (Prasad Tr. 2986:1-5, 2953:8-25.) The only difference is the number of pellets contained in each type of capsule. Cheminor's omeprazole formulations and the detailed manufacturing process for making Cheminor's products is described in Cheminor's ANDA. (Langer Tr. 378:17-379:15; P446 at OME3321-26, OME3331; P445 at OME60711; *see also* P446 at OME3338.) Cheminor's products are "oral pharmaceutical preparations" or formulations as those terms are used in claim 1 of both the '505 and '230 patents.

[61] When this litigation began, Cheminor did not have a good faith basis for asserting that its product did not infringe claims 1, 4, 5, 8, 10, and 14 of the '505 patent and at least claim 1 of the '230 patent. (Cheminor by Koprowski 30(b)(6) Dep. Tr. 51:4-6, 12-16, 19-23, 52:4-12, 58:4-7, 13.) Even though the facts necessary to assess infringement, including knowledge of its own product and the patent claims, specification, and file history, were available to Cheminor long ago, Cheminor has only now raised two infringement issues: (1) whether the meglumine in its products is an ARC or an alkaline buffering compound as required by the claims, and (2) whether its product includes the subcoat of claim 1(b) of the '505 patent and claim 1(b) and (c) of the '230 patent. Cheminor also asserts that the '230 patent does not cover omeprazole.FN50 The court finds that Cheminor literally infringes claims 1, 5, 10, and 14 of the '505 patent and claims 1, 6, 12, and 13 of the '230 patent.FN51

FN50. In addition to these substantive arguments, Cheminor also claims that Plaintiffs have failed to establish standing to sue for enforcement of the '505 and '230 patents. Proof of ownership, by one or more the named plaintiffs of the patent-in-suit is sufficient to show standing to bring suit to enforce a patent. "The issuance of [a] patent by the Patent Office to the plaintiff establishe[s], prima facie, ownership." Electric Auto-Lite Co. v. P. & D. Mfg. Co., 78 F.2d 700, 704 (2d Cir.1935) (citing Beckwith Box Toe Co. v. Gowdy, 244 F. 805 (D.C.Mass.1916)). The court finds that Astra has met its burden of demonstrating standing to enforce the '505 and '230 patents. Drs. Lovgren and Pilbrant are named inventors on the '505 and '230 patents, and they assigned their rights in the '505 and '230 patents to named plaintiff Aktiebolaget Hassle. (P1, P2A.) U.S. Patents 4,786,505 and 4,853,230 were issued in the name of assignee Aktiebolaget Hassle and were admitted into evidence. (P1, P2A.) Aktiebolaget Hassle is noted on the patents as the owner

through assignment of the '505 and '230 patents. Cheminor incorrectly asserts that Astra has failed to meet its burden of proving ownership of the patents and raises no credible evidence to rebut Astra's prima facie showing of ownership. As rebuttal "evidence," Cheminor offers mere speculation that "it is unknown if Aktiebolaget Hassle survived the merge" between Astra and Zeneca. Even if such rank speculation were sufficient to overcome the patents as prima facie proof of ownership, the evidence at trial indicates that Aktiebolaget Hassle continues to exist as a legal corporate entity under the laws of Sweden and remains the owner of the '505 and '230 patents by virtue of assignment from the inventors. (*See* P1399.)

FN51. Since the court finds that Cheminor literally infringes all claims asserted by Astra against Cheminor except claim 9 of the '505 patent and claim 11 of the '230 patent and Astra did not assert a theory under the doctrine of equivalents with respect to the water content requirement of those two claims, the court need not address the arguments raised by the parties concerning infringement under the doctrine of equivalents.

Cheminor tried several formulation approaches during its omeprazole development efforts. (Cheminor by Ravinder 30(b)(6) Dep. Tr. 40:4-8; Ravinder Dep. Tr. 53:24-54:7.) These efforts included a surfactant approach and a buffer approach. (Ravinder Dep. Tr. 54:11-22, 64:15-17.) The surfactant approach involved the use of a surfactant without using any stabilizers, (Ravinder Dep. Tr. 64:18-20), but the results indicated that a stabilizer was needed in the formulation, and the surfactant approach was discontinued, (Ravinder Dep. Tr. 65:1-24). Cheminor also evaluated the use of a number of buffers as stabilizers in another approach, including phosphate, citrophosphate, and carbonate buffers. (Cheminor by Ravinder 30(b)(6) Dep. Tr. 40:9-41:3; Seetaraju Dep. Tr. 91:5-92:7, 104:3-8; Ravinder Dep. Tr. 56:11-21.) These ingredients were not selected because of the potential for salt formation, which would run afoul of U.S. Patent No. 4,738,974, an Astra patent covering omeprazole salts. (Prasad Tr. 2926:23-2927:8, 2940:15-22, 2941:16-21, 2942:17-24.) Cheminor wanted to have a formulation with an alkaline core for the omeprazole. (Ravinder Dep. Tr. 225:4-7, 15-25.) Ultimately, Cheminor selected meglumine, which has an alkaline pH. (Langer Tr. 381:19-382:9, 383:25-384:8; P767 at 870-71; P763 at 378.)

Cheminor makes its core pellets by extrusion and spheronization. Cheminor's core pellet contains omeprazole, mannitol (an excipient), crospovidone (a disintegrant), meglumine (an alkaline compound), poloxamer and HPMC (binders). (Prasad Tr. 2889:8-10; Langer Tr. 378:17-25; P446 at OME3321-26; *see* C174 (Cheminor Development Report); C217 (Batch Production Record).) The 3.0 mg of meglumine used by Cheminor constitutes 1% of the core of Cheminor's ANDA products. (Prasad Tr. 2889:8-10, 2890:5-21; *see* C174; C217.) That meglumine stabilizes the omeprazole by providing an alkaline environment around the omeprazole in the core region of Cheminor's products. (Cheminor by Ravinder 30(b)(6) Dep. Tr. 48:15-19; Ravinder Dep. Tr. 48:17-49:7; Seetaraju Dep. Tr. 56:15-57:4, 58:16-18, 64:23-65:2, 65:12-19; Prasad Tr. 2963:2-2964:9; P489 at OME11562A; Langer Tr. 381:7-18; P489 at OME11562A; P767 at 870-71; P998 at 332-33.)

Cheminor spray coats its core pellets with a coating solution of polyvinylpyrrolidone ("PVP"). (Langer Tr. 379:1-9; P446 at 3331-34; Cheminor by Ravinder 30(b)(6) Dep. Tr. 77:11-16.) Cheminor chose to use Povidone K-30 PVP as the layer or barrier coat between the enteric coat and the core pellet. (Seetaraju Dep. Tr. 118:5-8; P489 at OME11553A.) Cheminor's barrier layer contains 26.8 mg of PVP, which is the only material in the intermediate layer between the core and the enteric coating. (Prasad Tr. 2889:24-2890:1, 2917:22-24, 2890:15-21.) PVP is soluble in water. (Prasad Tr. 2915:22-2916:1.) The PVP coating provides an inert barrier between the enteric coat and the core region. (Langer Tr. 390:4-9; P446 at OME3331; P489

at OME11553A; Seetaraju Dep. Tr. 70:18-23; P543 at CD-V-00073.) The purpose of the PVP coat in Cheminor's products is to protect the core materials from the enteric coat, (Prasad 2978:23-25; Langer Tr. 389:16-390:11; P489 at OME11553A), and the PVP coating helps to enhance the stability of Cheminor's product, (Langer Tr. 391:13-21; Cheminor by Ravinder 30(b)(6) Dep. Tr. 79:2-4). Cheminor's final step in making its Enteric-coated Pellets will involve pan-coating its PVP-Coated Pellets with a solution of Eudragit L 100-55, triethyl citrate and magnesium stearate in isopropyl alcohol to form an outer enteric coating layer containing Eudragit L 100-55, triethyl citrate and magnesium stearate disposed on the PVP-Coated Pellets. (C217, at OME03338-41.) Eudragit L 100-55 is an enteric-coating material; thus, the outer layer on Cheminor's pellets is an enteric coating. (Prasad Tr. 2979:1-3.)

Claim 1(a) of the '505 patent describes "a core region comprising an effective amount of material selected from the group consisting of omeprazole plus an alkaline reacting compound." (P1, col. 16:43-45.) Claim 1(a) of the '230 patent further describes "an alkaline reacting core comprising an acid-labile pharmaceutically active substance and an alkaline reacting compound different from said active substance." (P2A, col. 13:2-5.) There is no dispute that the core region of Cheminor's products contains omeprazole and meglumine, (Langer Tr. 378:17-22; P446 at OME3321-26; P489 at OME11553A; Prasad Tr. 2962:24-2964:12, 2976:17-24; Seetaraju Dep. 45:20-22), and the court finds by a preponderance of the evidence that meglumine is an ARC. (*See* Langer Tr. 389:13-15; *see also* Langer Tr. 381:3-384:8; P998 at 332-33; P767 at 870-71.) FN52 The Merck Index specifies that meglumine has an alkaline pH-the pH of meglumine is 10.5 in a 1% solution, (Langer Tr. 382:6-9; *see* P767 at 870-71); moreover, Cheminor's witnesses admit that meglumine is an alkaline compound with a pH of about 10.5, (Prasad Tr. 2962:18-23; Ravinder Dep. Tr. 233:9-11; Seetaraju Dep. Tr. 65:12-14).

FN52. Cheminor improperly takes issue with some of the bases for Dr. Langer's opinions concerning meglumine and its properties. During discovery, Cheminor failed to respond to Astra's requests for admissions concerning claims 1(a) in a timely manner, which resulted in those requests being deemed admitted as a matter of law and completely vitiated Cheminor's noninfringement position. Cheminor later moved the court to permit Cheminor to rely on belated responses. The court granted Cheminor's motion, thereby allowing Cheminor to proceed with its "meglumine defense;" however, to avoid prejudice to Astra, the court permitted Dr. Langer to rely on evidence at trial, including the Merck Index and a 1978 article about meglumine, that was not disclosed during discovery in order to combat Cheminor's newly revived meglumine defense. Dr. Langer's opinion that meglumine is an ARC is based on those publications and Cheminor's internal documents, and not solely on Dr. Davies' testing.

The ARC claimed in the '505 and '230 patents must stabilize the omeprazole by providing a micro-pH of not less than 7 around the omeprazole particles in the core, and the meglumine in Cheminor's products has that very same function. (Prasad Tr. 2966:14-2968:2; P489 at OME11562A.) Dr. Davies tested the pH of the microenvironment around the omeprazole particles in the Cheminor product.FN53 (Davies Tr. 895:12-896:16; *see* P1038 at 4-6; P5911.) The microenvironment around the omeprazole particles in Cheminor's product has a pH of about 9.17, which is within the 7 to 12 range. (Langer Tr. 391:22-392:15; Davies Tr. 896:2-897:19; P5911.) Cheminor argues that Dr. Davies' measurement of the pH of the core of Cheminor's ANDA products is irrelevant to the pH in the microenvironment. Cheminor bases this argument on testimony by Dr. Pilbrant. (*See* Pilbrant Tr. 1498:21-23 ("The entire core doesn't say anything about the micro-pH, and the pH of the immediate surrounding is what controls the stability of omeprazole.").) The portion of Dr. Pilbrant's testimony upon which Cheminor attempts to rely was elicited by counsel for Astra and demonstrates that it is possible to maintain a micro-pH above 7 even though the pH of the entire core is

less than 7. The testimony says nothing about the validity of using particular testing methods on particular cores.

FN53. Cheminor objects to Dr. Davies' pH tests on several bases. The court has addressed some of Cheminor's objections previously during its discussion of Cheminor's motion to strike Dr. Davies' pH testing of Cheminor's products. One additional objection needs to be addressed at this time. Cheminor posits that the HPMC in the core of its products caused Dr. Davies' test results to be unreliable for two reasons. First, Cheminor claims that the HPMC did not dissolve properly, and, therefore, Dr. Davies' tests do not accurately reflect the pH of Cheminor's core. Second, Cheminor argues that Dr. Davies failed to prove that it was, in fact, the meglumine that was acting as the ARC in the Cheminor product because the HPMC in Cheminor's core may have caused the alkaline pH readings.

Cheminor's positions are entirely inconsistent. The first assumes that the HPMC did not dissolve; the second assumes that the HPMC dissolved and thereby affected the pH values. The court is not persuaded as to Cheminor's first argument. Dr. Davies' pH tests of Cheminor's core were accurate, notwithstanding the presence of HPMC, because the HPMC in Cheminor's core readily dissolved in water when Dr. Davies tested the core pellets. (Davies Tr. 1115:11-1116:2.) Moreover, contrary to Cheminor's implication, there is no evidence in the record that supports Cheminor's hypothetical that some component other than meglumine, including the HPMC, provides the alkaline microenvironment. Cheminor's argument is just that-a lawyer's hypothesis. Even if the court were to conclude that the HPMC in the core of Cheminor's products also contributes to the pH as another ARC, then Cheminor simply infringes for two reasons. Two ARCs may be better than one, and, in either case, the product infringes. Nor is there a requirement that Astra identify the actual ingredient in the accused product where a patent claim describes an ingredient, like the ARC in the '505 and '230 patents, by particular properties. *See* Flow-Rite, Inc. v. Sears Roebuck & Co., Inc., No. 89 C 4305, 1991 WL 144158, at (N.D.Ill. Jul. 19, 1991). Accordingly, there is no requirement that Astra identify the particular alkaline compound that creates the microenvironment pH. Finally, the court notes that unless Cheminor's own internal testing results are unreliable, Dr. Davies' test results, which fall in the middle of the range of values obtained by Cheminor's own internal tests of the core of its products, are accurate. Cheminor's argument ignores the significant structural differences that can exist among different omeprazole formulations, which imply that different testing procedures are appropriate to determine the micro-pH of the omeprazole present in different types of cores. The '505 and '230 patents specifically discuss the measurement of micro-pH in the context of the "mixture" of omeprazole, an ARC, and the "conventional pharmaceutical constituents" found in the core. (P1, col. 3:36-46; P2A, col. 8:32-42.) The patents themselves provide explicit directions for completion of an appropriate micro-pH test. Specifically, the experimenter is to test a small amount of the omeprazole-containing region with a small amount of water-like milligrams of material with microliters of water. (P1, col. 3:45-47 ("when water is adsorbed to the particles of the mixture or when water is added in small amounts to the mixture"); P2A, col. 8:40-42; Davies Tr. 806:15-807:11, 896:2-16.) This is precisely what Dr. Davies did to test the micro-pH of the omeprazole in the core of Cheminor's products. Dr. Davies conducted tests on three samples of Cheminor's ANDA products by taking a 2 mg sample of the core region and placing it in 2 to 4 microliters of water.FN54 (Davies Tr. 1094:20-1095:2.) For Cheminor's products, Dr. Davies found that it was sufficient to conduct the pH test on the bulk contents of the omeprazole-containing core. (Davies Tr. 895:12-896:16.) This is because Cheminor makes its cores by mixing all of its core excipients together, (P446; Langer Tr. 395:7-22), which means that the omeprazole resides throughout the core, the omeprazole comes into contact with all of the other excipients in the core, and the core itself is the omeprazole-containing region of the pellets, (Davies Tr. 895:12-896:1).FN55 The court finds that Dr. Davies designed the pH test most suitable for the type of core used by Cheminor. Because the ingredients in Cheminor's core are mixed together, the

micro environment of the omeprazole contains all the excipients present in the core itself. Just as the pH of the core is a result of the pH from the combination of all excipients present in the core region, (Ravinder Dep. Tr. 47:25-48:7), the pH of the microenvironment around the omeprazole results from the combination of all the excipients present in the core, (Ravinder Dep. Tr. 227:12-228:3). Therefore, the court finds that a pH value for the core as a whole, when tested in keeping with the method required by the patents, represents the pH value for the microenvironment of the omeprazole in the Cheminor formulation.

FN54. One of the samples was tested in triplicate.

FN55. For Andrx's and Genpharm's products, on the other hand, Dr. Davies isolated the omeprazole-containing region from the sugar seed used in each product. (P85; Langer Tr. 308:15-22; P116; Langer Tr. 333:4-11.) This is because Andrx and Genpharm spray their omeprazole-containing solutions onto the sugar seeds. Accordingly, the omeprazole-containing region for the Genpharm and Andrx products is separate from the sugar seed.

Dr. Davies' test results are confirmed by Cheminor's own witnesses and documents. Cheminor's internal tests demonstrate that meglumine provides an alkaline environment when mixed with omeprazole; therefore, Cheminor's internal data provides an independent basis for concluding that meglumine renders to the microenvironment of omeprazole a pH of 7-12.FN56 (C222A at CDL 595.) FN57 In fact, they demonstrate that the core region of Cheminor's product has a pH of around 9.FN58 (C226 at CDL 841; Ravinder Dep. Tr. 267:22-269:20, 270:11-18.) Cheminor tested the pH of its core pellets by crushing and dissolving them in water. (C226 at CDL 841 ("3.1 omeprazole pellets ... were crushed and powdered... 3.2 each sample ... transferred to 100 ml beaker having 100 ml purified water and stirred").) Cheminor's scientists also verified that the purpose of the meglumine in Cheminor's products is to provide an alkaline environment around the omeprazole in the core and thereby stabilize the omeprazole. (Prasad Tr. 2963:2-2964:9; Seetaraju Dep. Tr. 56:15-57:4; 58:16-18, 64:23-65:2, 65:12-19; *see also* P489 at OME11562A.) Finally, Cheminor's Development Report, which was made available to the FDA for review, states, "[m]eglumine provides alkaline environment around omeprazole particles and thus improves stability of omeprazole." (P489 at OME11562A; Prasad 2964:10-2965:13; C174 at OME11562A.) On the basis of these facts, the court finds that Cheminor's ANDA products meet all the limitations of claims 1(a).

FN56. The internal test results reported by Cheminor were as follows:
4.1 ... pH of [omeprazole] suspension after addition of .5 ml of 2% w/v solution of meglumine- *9.03*.

4.2 ... pH of [omeprazole] suspension after addition of .5 ml of 5% w/v solution of meglumine- *9.35*.

FN57. The court overrules Cheminor's relevance objections to Exhibits C222A, C224, and C226. Exhibits C222A, C224, and C226 are admitted for all purposes.

FN58. The test results reported were as follows:

S.N.	material	qty. taken (g/100 ml)	pH observed
1.	omeprazole core pellets	1	8.81
2.	omeprazole core pellets	5	9.39

Cheminor's primary argument for noninfringement rests on the position that meglumine is not an ARC as required by subpart (a) of claims 1 of the '505 and '230 patents. All of the credible evidence submitted at the trial, however, demonstrates that meglumine is alkaline, it provides an alkaline environment for the omeprazole in Cheminor's formulation, and it improves the stability of the omeprazole in Cheminor's product. Cheminor's Development Report for its product leaves little doubt: "Meglumine is used as a stabilizer for Omeprazole. It is included in FDA Inactive Ingredients guide. Meglumine provides alkaline environment around Omeprazole particles and thus improves stability of Omeprazole." (P489 at OME11562A.) In addition, Cheminor's internal pH tests of meglumine in solution demonstrate that meglumine is an alkaline substance.FN59 (C224 at CDL 794.) Cheminor cites no evidence to contradict its witnesses, internal tests, development report, learned treatises, or tests by Dr. Davies. Cheminor did not cite to any admissible evidence indicating that meglumine is not an ARC, but instead relies on hearsay and attorney argument for its defense.

FN59. The testing results reported were as follows:

S. No.	Ingredient	qty. (mg) per 100ml	pH
1.	Purified Water	--	5 .89
3.	Meglumine	15	10 .50

One position taken by Cheminor addresses an alleged lack of similarity between meglumine and Tris-Buffer, a compound listed in the patents as an ARC. In order to exclude meglumine from the definition of an ARC, Cheminor propounds a new definition of ARC that seeks to read additional limitations into the claims and contains a logical disconnect. Cheminor's argument is that the patent refers to a specific organic compound, "TRIS Buffer," as an example of an ARC, and meglumine is not such a buffer, so meglumine is not an ARC. Cheminor's argument is analogous to saying that New York City includes the Bronx; Brooklyn is not the Bronx; and, therefore, New York City does not include Brooklyn. Whether meglumine is or is not like Tris-Buffer is irrelevant to the determination of whether meglumine is an ARC. The term "alkaline reacting compound" is broader than the subset of organic pH buffering substances that is listed in the patents, and the patent expressly states that the list of ARCs provided was not meant to be limiting. (*See* P1, col. 3:47-48.)

Cheminor also argues that meglumine cannot be an ARC because it contains no acid-base pair and is not a "buffer" as that term is used in classical chemistry. The court has already held that the patents use the term "buffer" more broadly than the limited technical meaning Cheminor proposes. Even Cheminor itself used that broader definition when it described its use of meglumine as a "buffer" during the development of its product. The Cheminor/Schein development meeting minutes concerning the development of omeprazole products expressly refer to meglumine as a buffer. (P760 at OME59614 ("[T]he initial data for the formula based on Meglumine as a buffer and Poloxamer as a surfactant looks encouraging."); FN60 Prasad Tr. 2969:22-24, 2971:11-23; Cheminor by Ravinder 30(b)(6) Dep. Tr. 106:3-14, 106:25-107:3; *see also* Prasad Tr. 2968:21-2970:6; Cheminor by Ravinder 30(b)(6) Dep. Tr. 103:16-104:5, 104:9-105:2.)

FN60. Cheminor points out that Exhibit P760 was not admitted into evidence for its truth during the trial;

Astra argues for its admission at this time as a business record. (*See* Tr. 2973:23-25 ("MR. CARLIN: Your honor, I would like to offer into evidence Plaintiff Trial Exhibit 760. THE COURT: No, you have just used it to impeach him.").) The court reconsiders its earlier ruling because the court finds that Exhibit P760 is properly admissible as a business record. Cheminor had phone conferences with Schein and Reddy-Cheminor as part of its ordinary course of business. (Cheminor by Ravinder 30(b)(6) Dep. Tr. 103:16-23.) Cheminor relies on the accuracy of the minutes of those meetings, which are recorded shortly after each conference, while conducting its business. (Cheminor by Ravinder 30(b)(6) Dep. Tr. 103:16-105:2.) Thus, the court admits Exhibit P760, the August 6, 1997, minutes of a telephone conference occurring that same day in evidence as a business record. (*See also* Prasad Tr. 2968:19-2969:24.)

A second Cheminor position is that meglumine was not known in the art as an excipient for pharmaceuticals in 1986, and therefore could not come within the claims of the '505 or '230 patents. Specifically, Cheminor argues that meglumine was not known to be a buffer in 1986, so it could not have been considered or claimed as an "organic pH-buffering substance[ ] such as Tris-Buffer." As an initial matter, the court notes that this assessment of the state of the art is irrelevant because it is infected by Cheminor's mistaken claim construction argument that in order to be an ARC meglumine must be an organic buffer like Tris-Buffer. Meglumine need not have been known as a buffer to be an ARC; it simply needs to function as an ARC in the omeprazole formulation. *See* Specialty Composites v. Cabot Corp., 845 F.2d 981, 989 (Fed.Cir.1988) (holding plasticizers not listed in the specification still within scope of claims) ("The emphasis is on the suitability of any plasticizer that will achieve the specified properties, not on the particular class of plasticizer."). Thus, under a proper construction of the claim terms, Cheminor's ANDA products meet all the limitations of claims 1(a) of the patents.FN61

FN61. To the extent that Cheminor's position could be construed as an attempt to raise a defense under 35 U.S.C. s. 112 relating to the term "alkaline reacting compound" in the patents, Cheminor has been precluded from raising any defense pursuant to s. 112. (*See* Order of 2/15/02, at 1-2.) Nevertheless, the court notes that two well-respected references submitted by Cheminor itself indicate that at the time of the patents meglumine was an alkaline substance with known uses in pharmaceuticals. (*See* Merck Index, 10th ed., 1983, Entry 5949, N-Methylglucamine pp. 870-71; Hawley's Condensed Chemical Dictionary, 10th ed., 1981, N-methylglucamine, p. 680.) The only testimony Cheminor cites is from one individual who said that *he* never used it in an *oral* pharmaceutical formulation. (*See* Prasad Tr. 2945:2-4.)

To date, Cheminor also has not raised a noninfringement defense under the reverse doctrine of equivalents before this court, and Cheminor would be precluded from doing so at this time. Moreover, it is clear that the reverse doctrine of equivalents is inapplicable to the facts of this case. *See* Caterpillar Tractor Co. v. Berco, S.p.A., 714 F.2d 1110, 1115 (Fed.Cir.1983) ("It is possible, of course, for a claim to be literally but not actually infringed, where, for example, a claim may 'read on' a structure having no relation to the invention. Instances are rare."); *cf.* SRI Int'l v. Matsushita Electric Corp. of America, 775 F.2d 1107, 1132 n. 19 (Fed.Cir.1985) (plurality opinion) (noting that reverse doctrine of equivalents defense is "rarely offered" because "products on which patent claims are readable word for word often are in fact the same, perform the same function in the same way, and achieve the same result, as the claimed invention.").
Claim 1(b) of the '505 patent requires "an inert subcoating which is soluble or rapidly disintegrating in water disposed on said core region, said subcoating comprising one or more layers of materials selected from among tablet excipients and polymeric film-forming compounds." Similarly, claim 1(b) of the '230 patent requires "an inert subcoating which rapidly dissolves or disintegrates in water disposed on said core region, said subcoating comprising one or more layers comprising materials selected from the group of

tablet excipients, film-forming compounds and alkaline compounds." The '505 and '230 patents specifically describe PVP as an inert subcoating material. (P1, col. 3:35-39 and Certificate of Correction at 1 ("The material for the separating layer is chosen among the pharmaceutically acceptable, water soluble, inert compounds or polymers used for film-coating applications such as, for instance, ... polyvinylpyrrolidone."); P2A, col. 9:30-36.) Invention examples 3 and 4 of the '505 patent employ PVP as the only subcoating material in the formulation. (P1, col. 8:52-60, col. 9:25-30.) Cheminor's PVP subcoating serves as an inert barrier between the enteric coat and the alkaline core region and helps to enhance the stability of the product. (Langer Tr. 389:16-390:15; P489 at OME11553A; Seetaraju Dep. Tr. 70:18-25; P543 at CD-V-00073; Cheminor by Ravinder 30(b)(6) Dep. Tr. 79:2-4.) Despite its argument to the contrary, Cheminor fails to set forth any credible position through evidence, expert testimony, or opinion that would support a noninfringement position based on its subcoating not being inert. The only evidence cited by Cheminor is a pH test of Povidone (PVP) that indicated an acidic pH of 3.6. (Prasad Tr. 2916:21-2917:8.) The patent does not indicate any pH requirement for the materials in the subcoating, and this testimony fails to provide any indication of the effect of PVP in the subcoating on either the core or the enteric coating of Cheminor's ANDA products. Although counsel for Cheminor would like the court to assume that this pH value means that "it [PVP] is unlikely to be inert with respect to omeprazole," (Cheminor's Rebuttal Proposed Findings of Fact Concerning Phase I, para. 13.3), Cheminor presented no evidence in support of that logical leap. Indeed, the evidence actually presented at trial is to the contrary. Both Mr. Prasad and Mr. Seetaraju, Cheminor's formulator, testified that the PVP coating in Cheminor's product is inert, (Prasad Tr. 2977:10-11; Seetaraju Dep. Tr. 70:18-23). As to the "enhanced stability" required by claim 1(c) of the '230 patent, the court finds by a preponderance of the evidence that Cheminor's PVP coating enhances the stability of its ANDA products. (Langer Tr. 391:13-21; Cheminor by Ravinder 30(b)(6) Dep. Tr. 79:2-4.) The court concludes that Cheminor's PVP subcoating meets the limitations of claim 1(b) of the '505 patent and claim 1(b) and (c) of the '230 patent.

Cheminor belatedly has contrived a noninfringement position based on an incorrect construction of subpart 1(b) as requiring that the subcoating contain a plurality of "materials," an argument no other Defendant espouses. As the court has already noted, PVP is specifically listed in the patent specification as one example of an inert subcoating, (P1, col. 4:39 and Certificate of Correction), and the patent contains several examples of formulations in which the inert subcoat contains only one polymer film-forming material, (*see* P1, Ex. 2, col. 8:8-11, Ex. 3, col. 8:56-58, Ex. 4, col. 9:25-28, Exs. 7-8, col. 11:21-24). This is another Cheminor position without support in the record. There is no doubt that a person of ordinary skill in the art reading these patents would understand that claims 1(b) cover a subcoating containing only PVP. Under a proper construction of the claim terms, Cheminor's PVP coat meets the limitations of subpart (b) of claims 1 of the '505 and '230 patents.

Finally, claim 1(c) of the '505 patent requires "an outer layer disposed on said subcoating comprising an enteric coating." Claim 1(c) of the '230 patent also requires "an enteric coating layer surrounding said subcoating layer, wherein the subcoating layer isolates the alkaline reacting core from the enteric coating layer such that the stability of the preparation is enhanced." There is no question that Cheminor's product contains an enteric coating as required by claims 1(c) of the '505 and '230 patents. (Langer Tr. 390:20-391:12; P489 at OME11553A.) In light of the court's findings that all elements of claims 1 are satisfied by Cheminor's ANDA products, the court concludes that Cheminor literally infringes claims 1 of the '505 and '230 patents.

Claim 5 of the '505 patent calls for "[a] preparation according to claim 1 wherein the alkaline core comprises omeprazole and pH-buffering alkaline compound rendering to the microenvironment of

omeprazole a pH of 7-12." (P1, col. 16:65-68.) Claim 6 imposes a similar requirement with respect to a core comprising an acid labile compound and a pH-buffering alkaline reacting compound. The only new requirement beyond claims 1 is that the micro-pH fall between 7 and 12. In connection with its analysis as to claims 1, the court has already determined by a preponderance of the evidence that the micro-pH of the omeprazole particles in Cheminor's core falls in the range of pH 7 to pH 12. Therefore, the court concludes that Cheminor literally infringes claim 5 of the '505 patent and claim 6 of the '230 patent.

[62] Claim 9 of the '505 patent calls for "[a] preparation according to claim 1 wherein the water content of the final dosage form containing omeprazole does not exceed 1.5% by weight." (P1, col. 17:20-22.) Claim 11 of the '230 patent imposes the same requirements for the formulation containing the acid labile compound. (P2A, col. 14:30-32.) The court finds that Astra has failed to prove by a preponderance of the evidence that Cheminor's enteric-coated pellets have a water content that does not exceed 1.5% by weight. Dr. Davies tested Cheminor's products for water content. (Davies Tr. 899:8-900:11; P590A; FN62 *see* P1038 at 6.) Dr. Davies testedthe enteric-coated pellets in Cheminor's products by using the coulometric method of Karl Fischer titration, and he found that the water content results for six samples were 1.76, 0.83, 1.15, 1.89, 1.38, and 1.46% and that the water content in Cheminor's products averaged 1.42%.FN63 (Davies Tr. 900:12-903:13, 902:3-13; P590A; P1024; P556; *see* P1031 at 6-7.) Dr. Davies based his findings on that average; however, Dr. Davies' data alone does not support an infringement finding. Dr. Langer testified that the standard deviation of the data was 0.2 at a minimum, meaning that, in his view, the data is, at best, accurate within a range of 1.22% to 1.62%.FN64 (Langer Tr. 640:21-641:2; Davies Tr. 891:13-17.) Therefore, the court finds that Dr. Davies test results, even assuming their accuracy, do not demonstrate by a preponderance of the evidence that Cheminor's ANDA products have a water content of less than 1.5%.

FN62. Cheminor objects to the admission of Exhibit P590A, which contains the water content data pertinent to the Cheminor omeprazole products, on the grounds that it is inadmissible hearsay. Fed.R.Evid. 801(c). The court admitted the exhibit into evidence as a business record on December 18, 2001, (Tr. 1300:13-23), but permitted briefing on the issue. The court overrules Cheminor's objection. Exhibit P590A is admissible as a business record. Fed.R.Evid. 803(6). Rule 803(6) favors admission of evidence rather than its exclusion if it has any probative value at all, and the record has sufficient indicia of trustworthiness to be considered reliable. Phoenix Associates III v. Stone, 60 F.3d 95, 101 (2d Cir.1995). The proffered record must be supported by a proper foundation, namely, that the document was "kept in the course of a regularly conducted business activity" and also that it was the "regular practice" of that business activity to make that record. *Id*. This foundation must be established by the testimony of the custodian of the record or other qualified witness. *Id*. The witness testifying to the foundation of the document need not have personal knowledge of the actual creation of the document; he need only be sufficiently familiar with the business practices under which the records were created. *Id*. All that is required is proof that it was the business entity's regular practice to get information from the person who created the document. *Id.; see also* Stein Hall & Co. v. S.S. Concordia Viking, 494 F.2d 287, 292 (2d Cir.1974) ("This circuit has always interpreted the business records exception 'most liberally' ... the testimony of [the] witness describing the procedure and swearing that the records resulted from that procedure is sufficient to establish admissibility.").

The original laboratory notebook from which Exhibit P590A is drawn comprises a bound volume and is of the type ordinarily used in Dr. Davies' work. In fact, P590A is the type of record Molecular Profiles normally uses in its ordinary course of business. It is part of Dr. Davies' job as Director of Molecular Profiles to direct, supervise, and review the creation of lab notebooks including P590A. (Davies Tr. 1297:23-1299:1.) It was part of the business practice at Molecular Profiles that persons under Dr. Davies'

control had the responsibility of recording results of tests they ran in lab notebooks. According to Dr. Davies' ordinary practice, the person supervising the experiment observes the preliminary experiments and ensures the accuracy of the results but does not necessarily sign the lab notebooks. (Davies Tr. 1053:10-21.) The notebooks are dated and signed by the scientist performing the test. (Davies Tr. 1053:5-9.) The court finds that the data recorded in P590A are an accurate representation of water content tests performed on Cheminor's ANDA products at Dr. Davies' direction. The results were recorded at the time of the experiments. (Davies Tr. 1299:6-1301:6.) Each page of the laboratory notebook excerpt is dated and signed by the scientist who performed the tests, Shen Luk, whose handwriting was identified by Dr. Davies at trial. (Davies Tr. 1072:2-9; P590A.) Based on the testimony of Dr. Davies and an examination of the exhibit, the court concludes that the exhibit is trustworthy and reliable. Therefore, the court affirms its earlier ruling to admit Exhibit P590A as a business record. *See* United States v. Manshul Constr. Corp., No. 93 Civ. 0308, 1996 WL 267945, at (S.D.N.Y. May 20, 1996) (holding that the party seeking to introduce a hearsay statement as a business record must demonstrate that: "1) the statements were recorded at or near the time of the purported transaction; 2) the record was made by or from information communicated by an individual with personal knowledge; and 3) the record was made in the regular practice of business activity.").
FN63. Cheminor objects to Dr. Davies' tests on the grounds that he did not run sufficient trials. When Cheminor evaluated its omeprazole formulation, it ran *two or four* tests and averaged them to obtain a result. (Reddy Tr. 2834:11-13, 2835:10-11, 2836:10-12.) This is consistent with the approach Dr. Davies utilized.

FN64. The court notes that Dr. Langer calculated these figures extemporaneously during cross-examination with no calculator or other means of assistance. In fact, Dr. Thiex's data indicates that the standard deviation is 0.39%. (Thiex Daubert Aff., para. 2.3.) Since Dr. Thiex's affidavit was submitted by Cheminor and accepted by the court only as to *Daubert* issues, the court relies upon Dr. Langer's estimate instead. Generally, for a large population, approximately 68% of the population members lie within one standard deviation of the mean, and approximately 95% lie within two standard deviations of the mean. *See Statistics for Business & Economics,* Paul Newbold, 4th Edition, at 21-21. Even assuming that the standard deviation were as low as 0.2%, this suggests that 95% of Cheminor's enteric-coated pellets have a water content somewhere between 1.02% and 1.82%. Of course, the court does not rely on these rough calculations to demonstrate that, in fact, Cheminor's ANDA products have a water content in excess of 1.5% by weight. Rather, the court simply demonstrates more clearly the concept that Dr. Langer acknowledged on the stand- that Dr. Davies' data does not demonstrate by a preponderance of the evidence that Cheminor's ANDA products have a water content of less than 1.5%.

Astra argues that infringement exists even when some, though not all, products fall within the claims of a patent. Bell Communications Research, Inc. v. Vitalink Communications Corp., 55 F.3d 615, 622-23 (Fed.Cir.1995) ("[A]n accused product that sometimes, but not always, embodies a claimed method nonetheless infringes."); Paper Converting Mach. Co. v. Magna-Graphics Corp., 745 F.2d 11, 20 (Fed.Cir.1984) ("[I]mperfect practice of an invention does not avoid infringement."). However, based upon the evidence submitted at trial, the court is unable to find by a preponderance of the evidence that any of the enteric-coated pellets manufactured by Cheminor infringes these claims. Proof of infringement of claim 9 of the '505 patent and claim 11 of the '230 patent requires physical testing of the water content of the final dosage form. (Langer Tr. 393:4-15.) Given the nature of Cheminor's manufacturing process, which takes a mass of material and reduces the material to tiny spheres, the court does not agree with Astra that variations in water content test results from 0.83% to 1.76% are adequately explained by Astra's conclusion that there

is that much actual water content variation in the samples.

In addition to the failure of proof indicated by Dr. Davies' numerical results, problems with the testing methods used cause the court to question further the reliability of Dr. Davies' results. Dr. Davies' Karl Fischer machine was purchased only two days before the water content tests were conducted on Cheminor's product, (Davies Tr. 1037:12-15; 1073:23-25), and Dr. Davies was unfamiliar with the Karl Fischer testing method and equipment, (Davies Tr. 1071:8-12). Dr. Davies did not run the Karl Fischer tests himself, and no evidence was presented as to the qualifications or knowledge of the individual who did. (*See, e.g.,* Carr Tr. 2328:22-2329:2.) Dr. Davies used the coulometric method of Karl Fischer water content titration. (Davies Tr. 1087:1-2). The coulometric method is particularly suited for substances with low water content that are chemically inert, unlike omeprazole, but including hydrocarbons, alcohols, and ethers, (Reddy Tr. 2867:6-2868:8; P1134; C508), and the method is to be avoided where the ingredients react, (C508). When conducting the testing, Dr. Davies did not account for factors like desiccants, which minimize the water content of a material when present in the container with the material, (Davies Tr. 1063:8-24), and neither Dr. Davies nor his laboratory assistants heated any sample above 100 degrees Celsius to determine if all of the critical water was removed from the sample, (Davies Tr. 1074:18-25). Finally, the lab notebook in which the water content data pertaining to Cheminor's omeprazole product was recorded omits one of the experiments that is nonetheless reflected in Dr. Davies' expert report and in his testimony. (Davies Tr. 901:3-15.) In light of these circumstances, which indicate a lack of reliability of testing methods, and the significant potential for error illustrated by the test results themselves, the court finds that Plaintiffs failed to prove by a preponderance of the evidence that Cheminor infringes claim 9 of the '505 patent and claim 11 of the '230 patent. Therefore, the court concludes that Cheminor does not literally infringe either claim 9 of the '505 patent or claim 11 of the '230 patent.

Claim 10 of the '505 patent is directed to "[a] method for the treatment of gastrointestinal disease comprising administering to a host in need of such treatment a therapeutically effective amount of a preparation according to claim 1." (P1, col. 17:23-26.) Similarly, claim 13 of the '230 patent is directed to "[a] method for the treatment of gastrointestinal disease characterized in that a preparation according to claim 1 is administered to a host in need of such treatment in a therapeutically effective amount." (P2A, col. 14:42-45.) Cheminor's proposed package insert for its omeprazole capsules instructs the user to swallow the capsules whole and states under the Indication and Usage section that its products can be used for duodenal ulcer, gastric ulcer, gastroesophageal reflux disease (GERD), erosive esophagitis and pathological hypersecretory conditions. (Langer Tr. 394:3-17; P525 at OME60096; *see also* C207 at OME79.) Thus, Cheminor's package insert instructions for using its omeprazole products direct the treatment of gastrointestinal disease by having patients in need of such treatment swallow a 10 mg, 20 mg, or 40 mg capsule, all of which are therapeutically effective amounts. Cheminor's only argument in support of noninfringement of claim 10 and claim 13 is that Cheminor has not yet sold, offered to sell or administered to patients its products. That argument is irrelevant because no actual sale or use is required to show infringement under 35 U.S.C. s. 271(e)(2). Thus, the court finds that Cheminor literally infringes claim 10 of the '505 patent and claim 13 of the '230 patent.

Claim 14 of the '505 patent and claim 12 of the '230 patent are directed to "[a] process for the preparation of an oral pharmaceutical preparation," (P1, col. 18:13-14), or "formulation," (P2A, col. 14:33-34.) Cheminor's manufacturing process for its ANDA products is a process for preparation of an oral pharmaceutical preparation. (Langer Tr. 380:1-12, 395:1-5; P569 at OME60011; *see also* C207 at OME79.) The process includes steps for preparing a core containing an effective amount of omeprazole and an ARC. (Langer Tr. 395:7-22; P446 at OME3322; *see also* Langer Tr. 380:13-25; P752 at OME2.) The process also includes a

step for coating the core with a layer of an inert subcoating comprising PVP. (Langer Tr. 395:23-396:5; P446 at OME3333.) Finally, Cheminor's manufacturing process includes a step for coating the subcoated core with an enteric coat. (Langer Tr. 396:6-12; P445 at OME60713; *see also* P446 at OME3338.)

Cheminor only asserts noninfringement of this claim because Cheminor uses the infringing process outside the United States. Cheminor, however, infringes claim 14 of the '505 patent and claim 12 of the '230 patent pursuant to 35 U.S.C. s. 271(g), which includes the importation, offer to sell, sale, or use of a product made by a process patented in the United States. Bio-Tech. Gen. Corp. v. Genentech, Inc., 80 F.3d 1553, 1560 (Fed.Cir.1996); *see* 35 U.S.C. s. 271(g) ("Whoever without authority *imports into the United States* or offers to sell, sells, or uses within the United States *a product which is made by a process patented in the United States* shall be liable as an infringer, if the importation, offer to sell, sale, or use of the product occurs during the term of such process patent.") (emphasis added). A patentee may seek a declaration that a person will infringe a patent under s. 271(g) in the future, but there must be an actual controversy for a district court to have jurisdiction. "To demonstrate that an actual controversy exists, a patentee must show that '(1) the defendant must be engaged in an activity directed toward ... an infringement charge ... or be making meaningful preparation for such activity; and (2) acts of the defendant must indicate a refusal to change the course of its actions in the face of acts by the patentee sufficient to create a reasonable apprehension that a suit will be forthcoming.' " Glaxo, Inc. v. TorPharm, Inc., No. 95 C 4686, 1997 WL 282742, at (N.D.Ill. May 18, 1997) (citations omitted). Where there is no question that the defendant seeks imminent FDA approval to sell the proposed ANDA product within the near future, the actual controversy requirement is met and the declaratory judgment action will be entertained. Glaxo, Inc., 1997 WL 282742, at *3. Here there is no question that all Defendants seek or have obtained FDA approval to sell the proposed ANDA product within the near future; therefore, the actual controversy requirement is met and the declaratory judgment action will be entertained. *Id*. The court finds that Astra is entitled to a declaratory judgment that the importation, use, and sale of Cheminor's ANDA product will literally infringe claim 14 of the '505 patent and claim 12 of the '230 patent under 35 U.S.C. s. 271(g).

D. Andrx

Plaintiffs assert that Andrx's omeprazole formulations will infringe claims 1, 3, 5, 6, 8, 10, and 11 of the '505 patent and claims 1, 6, 7, 10, 13, and 15 of the '230 patent either literally or under the doctrine of equivalents. Andrx's ANDA describes its omeprazole formulations and the process for making that formulation. (Langer Tr. 333:10; P116 at 2888-93, 2919-24.) Andrx's ANDA describes three proposed omeprazole products-10 mg, 20 mg, and 40 mg capsules (hereinafter sometimes referred to as "Andrx's ANDA products" or "Andrx's products"). The pellets that make up the 10 mg, 20 mg, and 40 mg capsules are the same, and the three dosage forms are proportional in their active and inactive ingredients. (Langer Tr. 332:10-17; P253; P254; Andrx Stipulated Statements of Fact No. 9.) The process for making Andrx's omeprazole products is described in detail in Exhibits P116 and P153. Each strength of capsule will be for an oral route of administration. Therefore, Andrx's ANDA products, 10 mg, 20 mg, and 40 mg, are "oral pharmaceutical preparations" as those terms are used in the '505 and '230 patents.

The first step of the manufacturing process required in Andrx's ANDA is the creation of an active, omeprazole-containing pellet. (Jan Tr. 3077:18-3078:8.) Andrx's ANDA requires that a homogenized suspension of micronized omeprazole; sodium lauryl sulphate, which helps disperse the omeprazole in the suspension; disodium hydrogen phosphate, which helps stabilize the omeprazole; lactose anhydrous, a filler; Povidone, a binder; and water, the solvent, be sprayed onto sugar seeds that carry the active coat for 12 hours in a conventional coating and drying device, known as a fluidized-bed coater. (Jan Tr. 3077:18-

3078:8, 3081:11-3082:10; *see* Langer Tr. 333:4-11, 405:4-8.) A key element of the manufacturing process required in Andrx's ANDA is homogenization. (A390 at 2477-78 (Add ingredients while "homogenizing;" "dissolve completely;" "[c]ontinuously stir the drug suspension throughout the coating process.").) The homogenization process ensures that the lactose is fully dissolved, and stirring during the coating process "make[s] sure omeprazole is uniformly dispersed." (A554, Weng 5/15/00 Dep. Tr. 128:9-22.) In the fluidized-bed coater, the pellets pass through an extremely fine mist of the omeprazole suspension and then continue circulating through the air, which is heated to 104 degrees Fahrenheit. (Jan Tr. 3085:3-16, 3087:19-3088:17.) These active pellets are then further dried in an oven for hours. (Jan Tr. 3089:11-19.)

The second step of the manufacturing process required in Andrx's ANDA is the creation of the enteric-coated pellet. (Jan Tr. 3078:15-3079:6.) Andrx's ANDA requires that a homogenized solution of hydroxypropyl methylcellulose phthalate ("HPMCP"), cetyl alcohol, talc, acetone, and isopropyl alcohol be sprayed onto the active pellets for 12 hours in the fluidized-bed coater. (Jan Tr. 3078:15-3079:6; Langer Tr. 334:21-23; P153 at 2919-2924.) The enteric coating ingredients are extensively homogenized. (A390 at 002492-93 (Add ingredients "while homogenizing;" "[a]llow all materials to dissolve completely;" "[k]eep mixing throughout the entire coating process.").) Andrx refers to the formulation at this stage as enteric-coated pellets. (P153 at 2919.) Ultimately, the enteric-coated pellets are encapsulated in gelatin capsules of various sizes. (Jan Tr. 3079:8-11; Banakar Tr. 3280:12-19.)

Claim 1(a) of the '505 patent describes "a core region comprising an effective amount of material selected from the group consisting of omeprazole plus an alkaline reacting compound." (P1, col. 16:43-45.) Claim 1(a) of the '230 patent further describes "an alkaline reacting core comprising an acid-labile pharmaceutically active substance and an alkaline reacting compound different from said active substance." (P2A, col. 13:2-5.) Andrx admits that its formulation meets claim 1(a) of the '505 patent. (P273, Request to Admit No. 15; Langer Tr. 333:12-17; *see also* Weng Dep. Tr. 61:18-62:10; Davies Tr. 856:13-85711, 929:23-930:3; Langer Tr. 350:20-351:6.) The alkaline reacting compound in Andrx's product is disodium hydrogen phosphate. (Id.; Andrx Stipulated Statements of Fact No. 15 ("Disodium phosphate is an alkaline reacting compound.").) Before trial, Andrx also admitted that its ANDA products met the limitations of claim 1(a) of the '230 patent. (*See* Langer Tr. 334:1-5; P273 at 5 (Response to Request for Admission No. 16) ("Each of Andrx's ANDA omeprazole products include the elements of part (a) of claim 1 of the '230 patent.").) Nevertheless, in the Joint Pre-trial Order, Andrx asserted that the '230 patent does not cover omeprazole. Since the court has construed claim 1 of the '230 patent to include omeprazole, the court rejects Andrx's argument.

Andrx's ANDA products contain omeprazole as the active ingredient and have a microenvironment pH of between 7 and 12. (Langer Tr. 349:12-350:17.) Fashioning the proper test for the microenvironment around the omeprazole depends on the product being tested. (Langer Tr. 619:1-19.) Because of the way Andrx makes its active layer, the pH of the microenvironment of the omeprazole is the pH of the active layer itself. (Davies Tr. 856:13-857:11.) Dr. Davies measured the pH of the microenvironment by washing off the enteric coat of Andrx's pellets with an acetone wash, cracking off a piece of the exposed active drug layer, adding a small amount of water and measuring the pH. (Davies Tr. 804:9-808:16; 854:23-855:17; P591C.) The pH testing conducted on the omeprazole-containing region of Andrx's ANDA products, the active layer, shows that the region has a pH of about 8.15 to 8.3, based on eight separate readings. (Davies Tr. 856:13-23; P591C; P233; *see also* P1036 (Dem.Ex.) at 20.) Andrx uses DHP in its active layer. (P116 at 2888.) Disodium hydrogen phosphate is an ARC and a pH buffering alkaline compound. (*See, e.g.,* P1, col. 4:14-27; P2A, col. 9:9-22 ("The pH buffering properties ... can be further strengthened by introducing ... the sodium ... salt[ ] of phosphoric" acid.); *see also* Langer Tr. 353:2-5.) As demonstrated above, the

omeprazole-containing region of Andrx's ANDA products contains DHP, an alkaline reacting compound that stabilizes the omeprazole by creating a micro-pH between pH 7 and pH 12 around the particles. Therefore, the court finds that Andrx's ANDA products meet all the limitations of claims 1(a) of both the '505 and '230 patents.

[63] Andrx's noninfringement defense centers around the argument that Andrx practices the prior art. Andrx makes three uses of the prior art and the comparative examples in the '505 patent in its post-trial briefing. First, Andrx claims that it practices the prior art that was disclaimed in the patent and, therefore, cannot be infringing. A claim is literally infringed if the elements of the asserted claim are present in the allegedly infringing product, process or method of use. Enercon v. Int'l Trade Comm'n, 151 F.3d 1376, 1384 (Fed.Cir.1998). The Federal Circuit has "made unequivocally clear ... that there is no 'practicing the prior art' defense to literal infringement." Tate Access Floors, Inc. v. Interface Architectural Resources, Inc., 279 F.3d 1357, 1365 (Fed.Cir.2002). The Federal Circuit rejected the "practicing the prior art" defense to literal infringement, in part, because such a defense impermissibly skews the burdens of proof by letting an infringer avoid the "clear and convincing evidence" standard required to prove invalidity. Tate, 279 F.3d at 1367. Literal infringement analysis is determined by comparing claims to the accused device, "not by comparing the accused device to the prior art." Tate, 279 F.3d at 1365 (citing Baxter Healthcare Corp. v. Spectramed, Inc., 49 F.3d 1575, 1583 (Fed.Cir.1995)); Atlantic Thermoplastics Co. v. Faytex Corp., 970 F.2d 834, 846 (Fed.Cir.1992). Thus, Andrx's comparison of its ANDA products to the Pilbrant and Cederberg reference and other alleged prior art as part of an infringement analysis impermissibly flips the burdens of proof. The court has already addressed some of these arguments in connection with claim construction, and the court will reconsider them later only in so far as they relate to Andrx's invalidity defenses.

[64] Second, Andrx asserts the related argument that its ANDA products represent formulations that were disclaimed as part of the comparative examples in the '505 patent. Andrx is correct that the formulations described in the comparative examples are not claimed by the patents. (*See* P1, col. 12:40-42, col. 15:11-12; Pilbrant Tr. 1390:1-13, 1390:23-25; Lovgren Tr. 1834:22-24.) Therefore, the information contained in those Comparative Examples is in the public domain and not covered by the patents. The law is clear that claims of infringement cannot encompass that which has been affirmatively disclaimed and dedicated to the public. *See* Rheox, Inc. v. Entact, Inc., 276 F.3d 1319, 1325 (Fed.Cir.2002); *see* Johnson & Johnston Assocs. v. R.E. Serv. Co., 285 F.3d 1046, 1054 (Fed.Cir.2002)(holding matters disclosed but not claimed are not within the claims of the patent and may not be recaptured under the doctrine of equivalents). However, the court finds that Andrx's formulations do not represent any of the comparative examples. Andrx's comparison of its products to Comparative Example III ("CE III") is flawed. Andrx's product composition and process parameters differ significantly from CE III. Andrx's Dr. Chen admits that Andrx's products have significantly more ARC than the comparative examples. (Chen Tr. 3057:3-6.) The amount of DHP on a weight/weight basis in the omeprazole-containing region in CE III is 1.19%, whereas for Andrx's product the amount is 5.51%. (*Compare* P1, col. 12:52-59, *with* P116 at 2888.) Dr. Chen also admits that Andrx uses significantly more lactose than the comparative examples. (Chen Tr. 3058:3-6.) Mannitol is the major component in CE III, while lactose is the major excipient component in Andrx's products. (*Compare* P1, col. 12:52, *with* A207 at G5133.) CE III does not disclose detailed process information concerning the preparation of the core region or the enteric coating, but sufficiently detailed process information is available for Andrx's process to demonstrate that it is not the same as CE III. (*Compare* P1, col. 12:40-60, *with* P116, P198.) Dr. Chen admits that in the Andrx process the lactose is completely dissolved, while in the '505 patent comparative examples the lactose is not dissolved. (Chen Tr. 3058:7-25.) The formulation of CE III has gastric acid resistance of 58%, a poor result, but good storage stability, while the formulation used by

Andrx has both good gastric acid resistance and good stability. (P1, col. 14:31.)

Andrx also erroneously asserts that it is practicing one of the non-subcoat formulations of Example 1 in the '505 patent. Example 1 discloses a tablet formulation. (P1, col. 6:28-29.) Andrx's products are not tablets. The process for making a tablet can involve different processing steps and different processing parameters from formulating a pellet. (Langer Tr. 502:7-503:12, 528:11-16; Davies Tr. 934:21-935:18.) The '505 patent does not provide details on the process conditions of Example 1, including tabletting techniques employed for the core and the order of addition of ingredients. As previously explained, Andrx includes a process step to completely dissolve lactose and Dr. Chen admits that the lactose in the example is not completely dissolved. (Chen Tr. 3058:18-22.) The final product characteristics are also different. For example, a review of the stability data in Table 3 shows that the unsubcoated tablet from Example 1 (Roman I, core material 2) degrades over time-starting white and turning brownish white to deep brown under accelerated testing conditions. (P1, col. 7:17-19.) Those data show that discoloration was present on bisected pellets. (P1, col. 7:33-37.) Andrx's product does not exhibit the same type of degradation over time. Therefore, the court finds that Andrx does not practice the non-subcoated Example 1 formulations.

Third, Andrx relies on the prior art as a defense to Astra's claims under the doctrine of equivalents. While there is no question Andrx may do so, *see* We Care Inc. v. Ultra-Mark Int'l Corp., 930 F.2d 1567, 1571 (Fed.Cir.1991) (holding that the range of equivalents may not extend to what the prior art anticipates under 35 U.S.C. s. 102 or to what the prior art makes obvious under 35 U.S.C. s. 103), the court need not address these arguments because the court finds that Andrx literally infringes all of the asserted claims with the exception of claims 3 and 11 of the '505 patent and claim 15 of the '230 patent. Moreover, as to those three remaining claims, the court finds that Astra has failed to carry its burden of demonstrating infringement under the doctrine of equivalents, without reaching the argument of whether Andrx's products are covered by the prior art.

The infringement issue, then, depends upon whether Andrx's ANDA products include the subcoat required by claims 1(b) of the '505 and '230 patents. Claim 1(b) of the '505 patent requires "an inert subcoating which is soluble or rapidly disintegrating in water disposed on said core region, said subcoating comprising one or more layers of materials selected from among tablet excipients and polymeric film-formingcompounds." Similarly, claim 1(b) of the '230 patent requires "an inert subcoating which rapidly dissolves or disintegrates in water disposed on said core region, said subcoating comprising one or more layers comprising materials selected from the group of tablet excipients, film-forming compounds and alkaline compounds." Andrx asserts that it does not infringe any of the asserted claims because its ANDA products have no subcoating. Astra argues that Andrx's enteric-coated pellets have an inert subcoating containing two sublayers that form a barrier between the omeprazole-rich region and the enteric coating as described by claims 1(b) of the '505 and '230 patents. According to Astra, one sublayer is made of HPMCP salt, a film-forming compound, and the other is made of lactose, a tablet excipient. The court finds that Andrx's ANDA products have an inert subcoating that is disposed on the core region; that subcoating is composed of an HPMCP salt that is rapidly soluble in water and is a polymeric film-forming compound. (*See* Langer Tr. 346:14-347:5; Davies Tr. 846:20-847:11.) The HPMCP-salt subcoating forms a barrier between the omeprazole and the enteric coating and enhances the stability of Andrx's preparations. However, the court finds that Plaintiffs have not proven the existence of a lactose-enriched layer that meets the limitations of claims 1 by a preponderance of the evidence.

Numerous scientific tests were conducted on Andrx's ANDA products; however, Dr. Davies was the only expert in this case who analyzed Andrx's *enteric-coated* products. Among other testing, Dr. Davies

examined the structure and chemical make-up of Andrx's enteric-coated pellets using ultraviolet fluorescence ("UV") microscopy, attenuated total reflectance-fourier transform infrared spectrometry ("ATR-FTIR"), time of flight ion mass spectrometry ("ToF-SIMS"), scanning electron microscopy ("SEM"), x-ray photo-electron microscopy ("XPS"), confocal laser scanning microscopy ("CLSM"), solubility testing, pH testing, and visual inspection.FN65 (Davies Tr. 790:12-791:6, 816:11-14, 828:20-22, 854:17-22, 939:23-940:16, 968:23-969:9.) The court previously has discussed many of these techniques in connection with its *Daubert* analysis. One of the first tests Dr. Davies performed on the Andrx ANDA products was to view the Andrx samples FN66 using ultraviolet ("UV") fluorescence microscopy. During the summer of 2000, Dr. Davies bisected over 20 Andrx enteric-coated pellets and observed the cross-section using UV fluorescence microscopy. (Davies Tr. 817:16-21.) A representative UV fluorescence microscopy picture of Andrx's ANDA products, Exhibit P220, shows a continuous, very bright, intense ring all the way around the bead. (Davies Tr. 816:21-817:22, 821:19-24; *see also* Davies Tr. 817:23-818:6; P1040 (Dem.Ex.) (pointing out the intense, fluorescing region in P220).) Without exception, every Andrx pellet has this bright ring, (Davies Tr. 817:23-818:6), which is below the enteric coating, but on top of the region of the lactose-containing core region, (Davies Tr. 815:13-23; Langer Tr. 335:18-336:5, 342:16-344:8). The dark blue region all the way to the left of P220 is the sugar seed; the lighter region next to the sugar seed is the active drug layer, and the dark blue region on the outer surface is the enteric coating. (Davies Tr. 818:22-819:7, P220.) The intense, fluorescing layer underneath the enteric coating ranges in thickness between 3 and 7 microns, (Davies Tr. 827:23-828:10; P220), and is composed of an HPMCP salt that results from the reaction of HPMCP and DHP. (Davies Tr. 815:18-816:3, 837:4-20, 839:9-840:14, 840:22-841:5; Langer Tr. 344:8-345:4). The more intense, more yellow-green layer was shown to have chemical characteristics different from the enteric coating layer; it fluoresces a different color, (Davies Tr. 817:24-818:7), and it is not as soluble in acetone as the enteric coating layer, (Davies Tr. 822:7-823:11, 824:8-23).

FN65. UV fluorescence microscopy, CLSM, and SEM are spatial analytical techniques that provide information about the spatial relationship among the components of the sample and, in some cases, certain physical characteristics of those components. (Davies Tr. 937:17-938:2; Gardella Tr. 3853:12-3854:4.) ToF-SIMS, XPS, and ATR-FTIR are non-spatial techniques that provide information about the chemical composition of a substance. (Davies Tr. 937:17-938:2; Gardella Tr. 3853:12-3854:4.) ToF-SIMS analyzes only the topmost one nanometer, or one millionth of a millimeter, (Gardella Tr. 3852:5-11), of a sample. (Davies Tr. 938:3-5; Gardella Tr. 3853:22-23.) As a result, ToF-SIMS is well-suited to determining the composition of the topmost molecular layer of a sample. (Davies Tr. 938:18-25, 939:19-22; Gardella Tr. 3857:19-24.) XPS is also quite sensitive, measuring to a depth of only 2 to 10 nanometers. (Davies Tr. 938:6-8; Gardella Tr. 3853:23-24.) By contrast, ATR-FTIR provides information on the composition of the top one micron of a sample, or 1,000 times as deep as ToF-SIMS. (Davies Tr. 937:22-23, 938:9-10, 939:12-13.)

FN66. The samples Dr. Davies analyzed were supplied by Andrx and are representative of Andrx's ANDA products. The samples remained within the specifications for assay, meaning they remained stable, well after the date Dr. Davies performed his tests (P1058 at ANDRX23506; P1059 at 18845, 18852; P1060 at 18937, 18941, 18945.) In fact, Andrx submitted to the FDA testing conducted on samples in June and July 2001, well after Dr. Davies conducted his testing on samples from the same lots. *Id*.

Dr. Davies isolated the bright ring visible in the UV images of the Andrx ANDA products by washing the enteric-coated pellets in acetone. (Davies Tr. 822:7-823:11; 824:8-23.) The court does not agree with

Andrx's criticisms of the acetone-washing method Dr. Davies developed to isolate the intense, fluorescing layer. Dr. Davies' acetone washing was designed to remove the enteric coating of the Andrx products. (Davies Tr. 985:24-986:3.) Dr. Davies used ATR-FTIR to test the pellets at intervals as he washed them to confirm where he was in the washing process. (Davies Tr. 804:17-805:18.) If he detected the HPMCP enteric coating using the ATR-FTIR testing, Dr. Davies knew he had not yet reached the active or any other layer. (Davies Tr. 986:4-14.) Andrx claims that by defining the washing procedure in terms of finding particular substances, Dr. Davies was able to discard every result in which he was unable to detect any HPMCP salt by claiming he just had not washed those samples enough. Andrx's suggestion is ludicrous. Dr. Davies was able to tell he had not washed the sample enough because the ATR-FTIR detected the ingredients of the enteric coating, including unreacted HPMCP. Dr. Davies only discovered and identified the HPMCP salt upon ATR-FTIR testing. (Davies Tr. 991:14-21.)

Andrx also argues that the presence of talc in Dr. Davies' ATR-FTIR analysis indicates that the enteric coating was not fully removed by the acetone-washing procedure. This argument distorts the facts. Dr. Davies explained that the salt layer is the result of a reaction between the HPMCP in the enteric-coating material and the DHP in the active layer. The talc from the enteric-coating spray remains in the HPMCP-salt layer when the HPMCP converts to the salt. (Davies Tr. 992:16-993:4 ("Talc is placed on the product in the enteric coating layer. It is still present during the formation of the HPMCP salt layer .... [The] salt layer [and] the enteric coating layer both contain talc.").) As can be seen by a comparison of Exhibits P220 and P221, the intense, fluorescing layer remains after washing Andrx's enteric-coated pellets in acetone to remove the enteric coating. (Davies Tr. 821:19-824:7; *compare* P220 (enteric-coated pellet before acetone wash); *with* P221 (enteric-coated pellet after acetone wash).) Dr. Davies then viewed the acetone-washed pellet using UV fluorescence microscopy. (Davies Tr. 822:17-823:3.) By comparing an active pellet (no bright fluorescing layer) with an enteric-coated pellet (bright fluorescing layer under enteric coating) and an acetone washed pellet (bright layer on the surface), Dr. Davies determined that the bright layer resulted from the enteric-coating process. (Davies Tr. 823:7-824:2.) The absence of the intense, fluorescing layer in the active-coated pellet, which has not been enteric coated, shows that the active-coating process is not the cause of the fluorescence. Its appearance in the enteric-coated pellet shows that the intense, fluorescing layer is created during or after the enteric-coating process. (Davies Tr. 823:24-824:2.) Dr. Davies recognized that the intense, fluorescing layer may be different chemically from the enteric coating because the acetone washing did not remove the fluorescing layer, which means that the two layers have different solubility characteristics. (Davies Tr. 824:16-23.)

Without any support, Andrx suggests that an Astra-developed acetone-wash methodology, designed to examine a single tablet, is superior to the test used by Dr. Davies. Astra's methodology and Dr. Davies' washing techniques were designed for different types of products. The court finds that Dr. Davies' procedure was appropriate for Andrx's samples. (*See* Davies Tr. 1032:10-1033:12.) The Astra procedure related to washing a large tablet with a thicker coating for a much longer time than appropriate for Andrx's enteric-coated smaller pellets with a much thinner enteric coating. (Davies Tr. 1032:20-1033:12.) Both Dr. Davies' and Astra's methodologies included monitoring the wash. Dr. Davies monitored the wash using ATR-FTIR. (*Id.; see also* Davies Tr. 991:18-21; Davies Tr. 993:20-25 ("[W]hen you undertake a series of washings, you watch for the presence of the HPMCP, distinctive peaks, and you would see those change into the salt peaks. That's how you know you got to the salt layer.").) Dr. Davies explained that if the washing is not complete, the ATR-FTIR spectrum matches the spectrum for the enteric coating. (Davies Tr. 994:3-7 ("When you're acetone washing and you don't go far enough, you just see the same spectrum as you see from the outside of the enteric coating. You haven't gone far enough. When you continue to wash, you see those peaks change. You see the ester peaks stay, the acid peaks change into the salt.").)

Intrigued by the appearance of the unexpected bright layer in the UV images, Dr. Davies decided to identify the chemical composition of the layer using ATR-FTIR. (*See* Davies Tr. 827:23-828:22.) ATR-FTIR spectra were obtained from (1) the surface of Andrx's enteric-coated pellet, (P222); (2) the intense, fluorescing layer that remains after removing the enteric coat, (P228); (3) an HPMCP reference film, (P223); and (4) an *in situ* HPMCP-salt reference film made by placing a drop of disodium hydrogen phosphate on an HPMCP film, (P229). The enteric coating has a unique ATR-FTIR spectrum, like a fingerprint. (Davies Tr. 829:22-833:16.) A comparison of the ATR-FTIR spectra for the enteric coating and the intense, fluorescing layer shows that the bright layer has a different ATR-FTIR spectrum than the enteric-coating material and, therefore, is different chemically. (Davies Tr. 831:15-833:16, 836:3-16; *compare* P228; *with* P222.)

After analyzing the ATR-FTIR test results, Dr. Davies determined that the intense, fluorescing region is a layer of the carboxylic acid salt of HPMCP ("HPMCP salt"). (Davies Tr. 832:12-833:16.) Dr. Davies determined that the ATR-FTIR spectrum for the HPMCP enteric-coating material exhibits absorption peaks at about 1725 cm^{-1} and 1283 cm^{-1}. (Davies Tr. 833:21-834:22; P222.) Relying on authoritative treatises as well as his own experience, Dr. Davies determined that these peaks reflected the acid-ester in HPMCP. (Davies Tr. 831:19-832:11.) For example, the Aldrich Library of Infrared Spectra, an authoritative treatise, (P774 at 92), shows two peaks associated with an acid-ester, (C-O at about 1725 cm^{-1} and C-O at about 1283 cm^{-1}). (Davies Tr. 833:21-834:22; *see also* P774, at 1017 (showing characteristic absorption peaks for aromatic esters like those found in HPMCP).) On the other hand, the ATR-FTIR spectra for the intense, fluorescing layer exhibits absorption peaks at 1725 cm^{-1} and between 1640 cm^{-1} and 1540 cm^{-1}. (Davies Tr. 834:19-835:11.) Again, relying on authoritative treatises as well as his own experience, Dr. Davies determined that these peaks reflect the presence of an aromatic salt and indicate that the intense, fluorescing region is a layer of HPMCP salt. (Davies Tr. 833:21-836:2.) A comparison of the spectra for the enteric coating and the intense, fluorescing layer shows that salt peaks are present in the bright layer that are not present in the enteric coat. (*Compare* P228, *with* P222.) This indicates that the intense, fluorescing region is an HPMCP-salt layer that is chemically distinct from the enteric coating. (Davies Tr. 831:12-833:16; *see* P1036 (Dem.Ex.) (comparing P228 with P222).)

Dr. Davies confirmed the identity of the salt in the bright layer by comparing ATR-FTIR spectra from a separately prepared HPMCP-salt film with ATR-FTIR spectra from the intense, fluorescing layer. (Davies Tr. 841:22-844:23; *compare* P231; *with* P228; *see also* P1036 at 9 (comparing P223 with P229); P1036 at 10 (comparing P229 with P228).) The existence of the salt peaks in both Exhibits P228 and P231 and the similarity in the spectra confirm that the intense, fluorescing layer is composed of an HPMCP-salt. (Davies Tr. 844:24-845:9; P228; P231.) Dr. Davies examined the composition of Andrx's active-coated pellet, (Davies Tr. 837:4-14), and based on his ATR-FTIR test results for (1) the Andrx enteric coat compared with an HPMCP reference sample, (Davies Tr. 838:1-24; P1036 (Dem. Ex.) at 8; P223; P222); (2) the Andrx bright layer compared with an HPMCP-salt reference sample, (Davies Tr. 839:9-840:14, 841:6-842:3); and (3) the salt reference and Andrx bright layer compared with the enteric coat and HPMCP reference samples, (Davies Tr. 831:15-833:16; P1036 (Dem.Ex.) at 6; P1036 (Dem Ex.) at 10; P229; P228; P1036 (Dem.Ex.) at 10; P222; P223), Dr. Davies determined that the HPMCP-salt layer forms as a result of the interaction between the enteric coating and the DHP in the active-coated pellet. (Davies Tr. 815:24-816:3, 837:4-20; Langer Tr. 344:7-345:5.) Thus, the court finds that an HPMCP-salt layer forms in the Andrx products as a result of a reaction between the DHP in the core and the HPMCP in the enteric coating.FN67 (*See* Davies Tr. 815:24-816:3, 837:11-20, 839:9-840:14, 841:10-842:11; Langer Tr. 344:7-345:5.)

FN67. Andrx speculates that the HPMCP salt may be formed as a result of a reaction with omeprazole; however, that hypothesis is inconsistent with the testing evidence and the testimony at trial:
Q: If a carboxylic acid salt were formed between the reaction between omeprazole and HPMCP, then the reference would also show up, wouldn't it?
A: No, it would be quite different.
Q: It would be different?
A: Because the ATR-FTIR spectra, you'd not only see the peaks relating to the salt, but you'd also see the peaks relative to omeprazole. We've shown this. It contains a unique fingerprint. You'd see that within the ATR-FTIR spectra.

(Davies Tr. 1001:24-1002:7; *see also* Gardella Tr. 3978:20-25.)
Andrx relies on the testing completed by its expert Dr. Gardella to rebut Astra's infringement proofs.FN68 The only affirmative evidence Dr. Gardella relied on to disprove the existence of an HPMCP-salt layer was his own Time of Flight-Secondary Ion Mass Spectometry ("ToF-SIMS") analysis for phosphate on the surface of Andrx's active pellets.FN69 (Gardella Tr. 3900:3-6.) Secondary Ion Mass Spectometry ("SIMS") is a type of mass spectrometry that uses a beam of "primary" ions, which are charged particles, to cause other "secondary" ions to be ejected from the surface of the sample. (Gardella Tr. 3855:24-3856:6.) In the case of ToF-SIMS, the mass of the secondary ions is calculated by measuring the time it takes for them to travel a known distance. (Gardella Tr. 3856:7-14.) ToF-SIMS is a form of mass spectrometry that is commonly used to analyze the surface of a sample. (Davies Tr. 937:20-23; Gardella Tr. 3855:14-3856:20.) The technique provides very precise and specific information on the particular molecular structures present on the topmost molecular surface of a sample. (Gardella Tr. 3853:22-23, 3857:19-3858:7; Davies Tr. 1023:20-1024:3.) ToF-SIMS is a recognized technique that has been developed over the past fifty years and the use of which is described in published and peer-reviewed scientific literature. (Gardella Tr. 3855:24-3857:16; P771.)

FN68. Andrx also attempts to call the conclusions Dr. Davies' draws from his UV fluorescence and ATR-FTIR results into question by relying on scanning electron microscopy testing ordered by Andrx on its own products. Scanning Electron Microscopy ("SEM") is a microscopic technique to analyze the detailed physical topography of a sample. (Chen Tr. 3038:20-22, 3031:23-25, 3062:3-5.) The SEM images relied on by Andrx, Exhibits A138 and A139, were admitted during the testimony of Dr. Chen. (Tr. 3046:17-20; *see also* Chen Tr. 3032:21-3033:8, 3064:11-14). At trial however, Dr. Chen was unable to provide any detail concerning the testing. (*See* Chen Tr. 3059:13-25, 3060:1-3062:2.) The court, therefore, cannot credit this attempt to disprove the existence of the salt layer in the slightest. Not only was Dr. Chen's testimony insufficient to establish the reliability of the SEM images, but other testimony at trial clearly proved that SEM is simply the wrong test. As Dr. Langer explained, SEM is not a very sensitive way of detecting differences in the sample. (Langer Tr. 474:23-475:23.) Unlike UV fluorescence microscopy, which detects changes in chemical environment, (Davies Tr. 800:16-24), SEM only detects the topography of a sample. (Chen Tr. 3062:3-5.)

FN69. Dr. Gardella tested only the active pellet. Dr. Gardella never did any testing on any enteric-coated pellet and never looked at an enteric-coated pellet to see if there was an HPMCP-salt layer present. (Gardella Tr. 3899:19-3900:1.)

Dr. Gardella conducted two negative ToF-SIMS analyses to detect phosphate and commented on only one of those tests. (Gardella Tr. 3948:4-10.) The only source of phosphate in Andrx's products is the DHP in the core. (Gardella Tr. 3957:2-11.) Dr. Gardella's theory was that the ToF-SIMS analysis showed no detectable amount of phosphate on the surface of the active pellet, which meant that there was insufficient DHP present to permit the HPMCP-salt layer to form. (Gardella Tr. 3869:18-3870:1.) Ultimately, Dr. Gardella opined that phosphate was not present above the detection limit of the ToF-SIMS instrument because he did not detect a peak at 95 m/z. (Gardella Tr. 3866:11-18; *see generally* Gardella Tr. 3865:20-3867:7.) However, Dr. Gardella ignored authoritative treatises that disclose that distinctive peaks for the presence of phosphate appear at 63 m/z and 79 m/z when a sample of DHP is tested. (Gardella Tr. 3953:2-20, 3954:22-25; Davies Tr. 4179:22-4180:4; 4180:8-4182:3.) For example, the Munster High Mass Resolution Static SIMS Library shows the expected spectrum for negative ToF-SIMS analysis of DHP. (Gardella Tr. 3953:2-20.) According to this reference, distinctive peaks appear at 63 m/z and 79 m/z, and both have about the same intensity of approximately 40%. (Gardella Tr. 3955:21-23; P1195.) The peak for phosphate at 95 m/z, on the other hand, has a listed intensity of 0.05%. (Gardella Tr. 3955:24-3956:1.) That means that the 63 m/z and 79 m/z peaks are about 1000 times more prominent than the 95 m/z peak. Looking at the mass units above 95 in the Library, there is no peak above 95 mass units that has a higher intensity than about 0.5%. (Gardella Tr. 3955:4-3956:7.) Likewise, according to the Static SIMS Library, DHP exhibits peaks at 63 m/z and 79 m/z-the same places the Munster reference shows peaks. (Gardella Tr. 3960:17-3961:17.)

Without consulting any reference, Dr. Gardella focused on 95 m/z as the place where he thought phosphate was going to be and looked for masses above that location. (Gardella Tr. 3958:21-3959:3.) Dr. Gardella amplified the region of his spectrum from 94 to 99 mass units, but did not amplify the region below 94, (Gardella Tr. 3963:1-6); this caused his spectrum to distort the scale of the various peaks that were amplified in comparison with those that were not. On cross-examination, Dr. Gardella admitted that his negative ToF-SIMS spectrum does show peaks at 63 m/z and 79 m/z and that these two peaks are a positive indication for phosphate in that spectrum. (Gardella Tr. 3963:7-20.) Dr. Gardella also acknowledged that ToF-SIMS analysis conducted by Dr. Davies showed detectable peaks at 63 m/z and 79 m/z, (Gardella Tr. 3979:23-3980:9), and that Dr. Davies' peaks at 63 m/z and 79 m/z are consistent with Dr. Gardella's negative ToF-SIMS. (Gardella Tr. 3980:10-13.) The court finds that it is unable to credit Dr. Gardella's opinions concerning the amount of phosphate on the surface of the Andrx product for the formation of an HPMCP-salt layer.FN70 Unlike Dr. Gardella's results, which appear noisier, Dr. Davies' ToF-SIMS analysis also exhibits the comparatively weak peak at 95 m/z. (Davies Tr. 4183:23-4185:12; P1276 at 7; P1286 (Dem.Ex.) at 14.) FN71 Because ToF-SIMS is not quantitative, even that small peak for phosphate may correlate with the presence of a large amount of DHP. (Gardella Tr. 3964:17-20; Davies Tr. 4184:24-4185:12.) Dr. Gardella himself testified that peaks at 63 m/z, 79 m/z, and 95 m/z would indicate phosphate concentrations greater than 1%, (Gardella Tr. 3975:19-24), and Dr. Davies found all three of those peaks.

FN70. While Dr. Gardella acknowledged that doing a control analysis is important to identify what peaks to look for, he did not run any reference standards for phosphate. (Gardella Tr. 3950:24-3951:7, 3951:23-25, 3952:1-3.) Dr. Gardella could have checked his negative ToF-SIMS by running a control with the authentic DHP that Andrx provided, but he did not. (Gardella Tr. 3957:21-3958:1.) Dr. Gardella explained that he did not need to run a DHP reference because he has used ToF-SIMS to study phosphate-and DHP in particular-for "many years" and is familiar with its properties and characteristics under the static analysis conditions he used for his analysis here. (Gardella Tr. 3866:4-3867:2, 3951:12-22.) Likewise, Dr. Gardella indicated that he did not need a control because he had "analyzed phosphate in our [ToF-SIMS] instrument many times." (*Id*.) Despite Dr. Gardella's assurances to the contrary, the court finds that Dr. Gardella would have benefited

from these cautionary procedures to buttress his ToF-SIMS conclusions, which the court does not find to be as reliable as those obtained by Dr. Davies.

FN71. Defendant Andrx filed a motion to strike the cited portion of Dr. Davies' testimony, which is referenced in Astra's Proposed Finding of Fact Section 7.6. Andrx's attempt to exclude references to Dr. Davies' ToF-SIMS data is not well founded. Andrx was in full possession of Dr. Davies' ToF-SIMS data as of November of 2000. Andrx also questioned Dr. Davies about his ToF-SIMS testing at his November 2000 deposition. Dr. Davies testified at that deposition that the ToF-SIMS data indicated that DHP was present on the surface of Andrx's active pellet. (*See, e.g.,* Davies Dep. Tr. 385:11-17, 387:18-25, 388:18-24, 392:23-393:6, 406:18-407:7.) Moreover, Dr. Gardella reviewed these documents in another room during Dr. Davies' deposition and cited them in his Supplemental Expert Statement on January 30, 2002. (*See* Gardella Supp. Statement at 7.) At trial, Dr. Gardella testified about his ToF-SIMS data. (*See, e.g.,* Gardella Tr. 3854:13-25.) Dr. Gardella also testified about the two sets of data and compared their results. (*See, e.g.,* Gardella Tr. 3852:11-17.) Finally, counsel for Andrx initially raised this issue with Dr. Davies on cross-examination. Dr. Davies clearly testified on cross-examination and re-direct about his ToF-SIMS opinions. (Davies Tr. 914:14-23, 1024:4-16.) After reviewing the expert reports, deposition testimony, trial testimony and the motion papers, the court finds that Dr. Davies' testimony concerning his ToF-SIMS analysis is admissible not only for *Daubert* purposes but also substantively as appropriate rebuttal. Andrx cannot point to any prejudice arising from the admission of this evidence. Therefore, the court denies Andrx's motion to strike.

As noted earlier, none of Andrx's experts conducted testing on Andrx's *enteric-coated* product. Since Andrx has no direct evidence to present in support of its argument that there is no subcoating present in its final product, Andrx resorts to attacking the reliability of Dr. Davies' testing. The court has addressed some of those objections in conjunction with its decision to deny Andrx's motion to exclude Dr. Davies' testimony under *Daubert*. The court will address the remainder of those objections at this time. Dr. Davies consulted a series of tests to gain a basic understanding of Andrx's product, to determine appropriate testing methodology, and to assure that his testing accurately characterized Andrx's ANDA product. (*See, e.g.,* Davies Tr. 822:13-25, 940:6-16.) The court finds that the evidence demonstrates that Dr. Davies' tests are reliable and that Dr. Davies' tests provide compelling evidence that Andrx's product has an HPMCP-salt subcoating.

One test performed by Dr. Davies that Andrx attacks is the UV fluorescence microscopy. Dr. Davies used UV fluorescence microscopy to verify the structure of the products for all Defendants in this litigation. (Davies Tr. 790:12-23; *see also* P82 (Genpharm), P220 (Andrx), P387 (KUDCo), P554 (Cheminor).) Using UV fluorescence microscopy, Dr. Davies found a subcoating layer in the Andrx ANDA products; other testing later confirmed that layer was composed of an HPMCP salt. (Davies Tr. 816:11-14.) After viewing the whole pellet under the microscope, Dr. Davies zoomed in on the portions of Andrx's products that showed the presence of different coatings. (Davies Tr. 801:6-802:4, 816:6-8.) Dr. Davies noticed an intense, fluorescing ring all the way around the Andrx pellet. (Davies Tr. 817:5-818:6; P220; P221; *see also* P249-P251.) Dr. Davies viewed over twenty Andrx pellets. (Davies Tr. 817:23-818:6.) As a result of the number of pellets studied, the court is confident that P220 is representative of Andrx's product. (Davies Tr. 821:19-24.) There is no dispute that a change in the intensity of fluorescence, like that seen in Exhibit P220, indicates a different environment, (Salzberg Tr. 3504:18-21); moreover, color change may indicate a different chemical environment that can be due to a different chemical substance being present, (Salzberg Tr. 3503:10-15; Davies Tr. 800:16-24). According to Dr. Davies, the intense, fluorescing layer appeared to

be a different color from the area on either side of it, indicating the presence of a different chemical environment. (Davies Tr. 800:16-24; *see also* Davies Tr. 818:24-819:18.)

Andrx criticizes Dr. Davies because he relied on a visual inspection to determine that a color change existed in the first instance. (*See* Davies Tr. 951:2-4.) The court notes that Dr. Davies has the trained eye of a scientist who has interpreted many UV fluorescence microscopy images of drug formulations. (*See, e.g.,* Davies Tr. 784:5-14.) More importantly, the difference in the chemical nature of the intensely fluorescent layer, and, therefore, the presence of the HPMCP-salt layer, was confirmed by ATR-FTIR testing. Andrx's suggestion that Dr. Davies needed to bolster his opinion that the UV fluorescence image exhibited a color change ignores the confirmatory ATR-FTIR testing that proves that the intense, fluorescing region corresponds to the chemically distinct HPMCP salt. On behalf of Andrx, Dr. Salzberg asserted that independent color-change tests of the intense, fluorescing region were a necessity. This assertion demonstrates that Dr. Salzberg does not understand the objective of the testing. Dr. Davies' study was not designed to find a "color change." The study was designed to learn more about the bright region. (Davies Tr. 821:25-822:6.) Dr. Davies accomplished this task using a different, but scientifically appropriate, method that provided more information than a test for color change-the ATR-FTIR identified the chemical substance. (Davies Tr. 828:20-830:16.) Dr. Salzberg wrongly believed that Dr. Davies was basing his determination that the fluorescing layer was chemically distinct solely on visual inspection of the UV fluorescence microscopy image and not on ATR-FTIR testing. (Salzberg Tr. 3498:25-3499:15.) Dr. Salzberg is not an expert in ATR-FTIR, has never used ATR-FTIR, and did not pay attention to Dr. Davies' use of ATR-FTIR. (Salzberg Tr. 3497:6-18, 3498:21-24.) Dr. Davies' ATR-FTIR testing confirmed that the HPMCP-salt layer corresponded to the intense, fluorescing layer observed with the UV fluorescence microscopy.

Andrx suggests that the presence of omeprazole in the core might have affected Dr. Davies' results in two ways. First, Andrx implies that the ring-like fluorescence is the result of the effect of acetone on omeprazole during the washing procedure. If the salt did not exist, however, Dr. Davies would not have detected any salt peaks using the ATR-FTIR testing. Moreover, Dr. L ovgren testified that he personally examined a number of *in situ* formed subcoats made using a placebo-no omeprazole-that exhibited fluorescence. (Lovgren Tr. 1810:24-1811:7.) If the fluorescence were caused by an interaction with omeprazole, placebo pellets would not fluoresce. In addition, Dr. Davies' ATR-FTIR testing of the salt layer did not detect omeprazole or degraded omeprazole. (Davies Tr. 968:23-970:9, 971:7-22; Gardella Tr. 3978:20-25.)

Similarly, Andrx argues that omeprazole may react with HPMCP to form a salt, so Astra has failed to demonstrate that the ATR-FTIR test proves that the compound reacting with the HPMCP to form the salt layer is, in fact, DHP. It is true that both Dr. Davies and Dr. Gardella testified that a salt of HPMCP and omeprazole would produce carboxylate peaks like those seen by Dr. Davies when using the ATR-FTIR to test the fluorescing layer. (Gardella Tr. 3976:2-18; Davies Tr. 1001:24-1002:19.) However, Dr. Davies testified unequivocally that there were no other peaks present to indicate the presence of an HPMCP/ omeprazole salt in the Andrx products. (Davies Tr. 1002:12-19.) In particular, the ATR-FTIR spectra did not depict any peaks for omeprazole or degraded omeprazole (Davies Tr. 969:8-970:9, 1002:2-7.) While Andrx challenges Dr. Davies' conclusion, it is notable that none of Andrx's experts, who were providedwith Dr. Davies' ATR-FTIR spectra, pointed out the appearance of any peaks in the spectra for either omeprazole or degraded omeprazole.

Contrary to Andrx's theories, the ATR-FTIR data, in conjunction with the UV fluorescence microscopy pictures, P220 and P221, show that the HPMCP-salt layer corresponds to the intense, fluorescing region,

(Davies Tr. 836:3-16), and that the fluorescing layer forms where the initial enteric coating is placed onto the active layer, (Davies Tr. 986:17-22). The difference in fluorescence and the difference in solubility were indicators that the layer was chemically different from the materials on either side of it. (Davies Tr. 824:8-23.) Dr. Davies determined that the location of the bright region was the same on both the enteric-coated, P220, and acetone-washed, P221, images by comparison. (Davies Tr. 823:12-17.) Then Dr. Davies used the ATR-FTIR tests to confirm that the bright, fluorescing region corresponds with an HPMCP-salt layer. For example, the distinctive HPMCP-salt spectrum appeared only after the enteric coating was removed by acetone washing and the bright, fluorescing layer was exposed. (Davies Tr. 831:1-833:16.) Thus, Dr. Davies' initial set of ATR-FTIR testing determined that the intense, fluorescing layer is in fact an HPMCP salt that is different from the enteric coating.

Dr. Davies then set out to determine what was forming the salt layer. (Davies Tr. 836:25-837:6.) Dr. Davies reviewed Andrx's ANDA and arrived at the initial opinion that based on the components in Andrx's product, DHP, a base, reacted with the HPMCP in the enteric coat to form the salt. Dr. Davies then conducted additional tests, (Davies Tr. 837:15-25), which confirmed that opinion. Dr. Davies prepared an HPMCP film, and after checking to be sure that the film matched Andrx's enteric coating, exposed the film for only 5 seconds to DHP; ATR-FTIR testing on the film confirmed that the HPMCP salt readily forms when HPMCP comes into contact with DHP. (Davies Tr. 838:1-840:6.) Dr. Davies also cast an HPMCP-salt reference film and compared the reference film to the salt sublayer in Andrx's product using ATR-FTIR. (Davies Tr. 842:24-844:9.) This comparison further confirmed that the enteric coating in Andrx's product was reacting with the DHP to form the HPMCP-salt layer. (Davies Tr. 844:19-845:9.)

Andrx's suggestion that Dr. Davies misidentified the HPMCP-salt peaks is contrary to the evidence.FN72 In support of his opinion that an HPMCP-salt layer exists in the Andrx ANDA products, Dr. Davies relied on changes in two pairs of peaks in the ATR-FTIR spectra: the so-called "salt peaks" in the 1580 and 1380 ranges and the "acid/ester" peaks in the 1720 and 1280 ranges. (Davies Tr. 832:12-833:16; P1036-6 (Dem.Ex.).) Dr. Davies observed that the "acid/ester" peaks in the spectra of the acetone-washed pellets are less intensethan in the spectra of the enteric-coated pellets and that the "salt peaks" emerge or become more intense in the spectra of the acetone-washed pellets. (Davies Tr. 832:19-833:17; P1036-6 (Dem.Ex.).) Andrx now argues that Dr. Davies has no evidence that it is not unreacted HPMCP in the region he is detecting because the "acid/ester" peaks are still present even in the spectra of the acetone-washed pellets. (*See* Davies Tr. 979:21-980:3, 980:18-981:12.) However, during cross-examination, Dr. Davies explained why certain ester peaks present in the spectra for both HPMCP and HPMCP salt indicate the presence of the salt, and not unconverted HPMCP, when considered with the presence of the salt-related peaks and changes in peak intensities. (Davies Tr. 980:12-981:12.) When counsel for Andrx suggested the presence of both the salt and also some HPMCP, Dr. Davies explained that was "incorrect" and pointed out that the ATR-FTIR data "indicates that you have got quite a strong conversion" into HPMCP salt. (Davies Tr. 981:3-12.)

FN72. Andrx is also incorrect in suggesting that one of the peaks Dr. Davies assigned to the HPMCP salt should have been assigned to lactose. Andrx improperly focuses on one peak at about 1381 rather than the package of peaks relating to lactose, namely peaks at 1422, 1359, and 1341. (*See* P225.) If the peak at about 1380 were due to lactose in the HPMCP-salt layer, other lactose peaks would be easily identifiable in the HPMCP-salt layer spectra. (P228.) Yet none of those peaks are present in the HPMCP-salt layer spectra, (P228), or in the HPMCP-salt reference spectra that Dr. Davies made, (P231). No lactose was present in the HPMCP-salt layer, (Davies Tr. 993:8-14), and Dr. Davies' testing that shows signs of lactose was conducted at a portion of the salt layer that had been thinned by the acetone-washing process, (Davies Tr. 993:8-14, 997:10-998:6). That lactose, then, was present in the *core*.

Andrx further attempts to question the existence of the HPMCP-salt layer by suggesting that the fluorescing layer contains other materials, including HPMCP that was not converted to the salt. The evidence, however, demonstrates that nearly complete conversion of HPMCP to the salt takes place in the intense, fluorescing layer. Dr. Davies' ATR-FTIR spectra exhibit the presence of HPMCP salt and the absence of HPMCP. (Davies Tr. 993:20-25, 994:3-7; *see* Davies 980:12-983:2.) Andrx also suggests that the layer contains lactose. Dr. Davies explained, however, that no lactose was present in the HPMCP-salt layer. (Davies Tr. 993:8-14.) The ATR-FTIR testing to which Andrx refers that shows signs of lactose was conducted at a particularly thin portion of the salt layer on an acetone-washed pellet. The process of acetone washing causes some of the HPMCP-salt layer to be eroded. Accordingly, when lactose peaks are seen, it is because the detector is "seeing" what is on the other side of the salt layer, which has been thinned by the acetone-washing process. (Davies Tr. 993:8-14, 997:10-998:6.)

After reviewing all the evidence and considering the testing criticisms raised by Andrx, the court finds it is absolutely clear that there is an HPMCP-salt layer present between the core and the enteric coating in the Andrx ANDA products. Now the court must consider whether that layer is a "subcoating" as that term is used in claims 1 of the '505 and '230 patents. In order to satisfy the characteristics of a subcoating acting as a separating layer, the HPMCP-salt layer must be inert, it must be water soluble, and it must separate the core from the enteric coating by providing an isolating barrier between the two layers.

The court finds that the HPMCP-salt layer is inert. The court has construed the term "inert" in the context of the '505 and '230 patents to mean pharmaceutically, chemically, and pharmacologically inactive. The court finds that the HPMCP-salt layer is not harmful to omeprazole. (*See* Langer Tr. 345:11-346:4, 347:3-7.) There is no evidence of omeprazole degradation when Andrx's enteric-coated pellet is bisected. Dr. Davies did not observe degradation upon visual inspection-the pellets Dr. Davies observed were white and degraded omeprazole is brown. (Davies Tr. 967:22-968:8.) In addition, the ATR-FTIR data did not exhibit signs of omeprazole degradation. (Davies Tr. 968:23-970:9, 971:10-22.) Despite Andrx's contention that the alleged presence of HPMCP in the salt layer means it is not inert, the court finds there is no evidence that HPMCP itself, as opposed to the salt, is present in the subcoating. Dr. Davies testified that the ATR-FTIR testing of this subcoating layershowed the presence of HPMCP salt and talc but not other components, (Davies Tr. 924:2-12, 992:16-993:4; *see also* Langer Tr. 517:10-18), and the presence of talc in the subcoating does not affect the court's finding that the salt layer is inert. Andrx's own Dr. Chen expressly identified talc as an "inert processing aid," (Chen Tr. 3043:3-7), and the '505 and '230 patent specifications expressly permit talc in the subcoating and the enteric coating. (P1, col. 4:54-56, col. 5:16-18; P2A, col. 9:48-50.) Finally, Astra made subcoatings that include neutralized enteric coatings and talc. (Lovgren Tr. 1859:8-13.) Thus, the evidence shows that Andrx's HPMCP-salt layer, which contains talc because it is included in the enteric coating solution, is inert as the phrase is used in the '505 and '230 patents.

Second, the court finds that the HPMCP-salt layer is film-forming and "soluble or rapidly disintegrating in water" as that phrase is used in the '505 and '230 patent claims. (*See* Langer Tr. 346:24-347:2; Davies Tr. 842:24-843:21, P230; Davies Tr. 845:10-847:11; P232.) Dr. Davies tested the properties of an HPMCP-salt film in water. His tests showed that the HPMCP salt was film-forming and dissolved in water in less than 15 seconds. (Davies Tr. 845:16-846:1.) Even Dr. Banakar, Andrx's expert witness, agreed that HPMCP salt should be water soluble. (Banakar Tr. 3338:10-13.) Andrx's unsupported suggestion that the HPMCP salt in Andrx's product and in Dr. Davies' reference sample have different solubility characteristics is directly contradicted by the record evidence. Dr. Langer explained that the ATR-FTIR data proves that the reference

and the Andrx salt layer are the same; therefore, they have the same properties, regardless of how they were made. (Langer Tr. 523:2-18.) Moreover, the presence of talc does not affect this court's finding that the HPMCP-salt subcoating is soluble in water-it is expressly listed as an appropriate ingredient in the patents. (P1, col. 4:54-56, col. 5:16-18; P2A, col. 9:48-50; *see also* G31, at 3, ll. 1-11 (suggesting minimum 30% talc in enteric coating) & at 4, ll. 66-70 (when enteric coating exposed to alkaline material, coating completely disintegrates).) Andrx also suggests that the HPMCP-salt layer may have other components present. That assertion, however, is not supported by the evidence. Dr. Davies testified that the ATR-FTIR testing of this subcoating layer showed the HPMCP salt and talc, but did not identify the presence of other components.FN73 (*See, e.g.,* Davies Tr. 924:2-12, 992:16-993:4; *see also* Langer Tr. 517:10-18.) Thus, the court finds by a preponderance of the evidence that the HPMCP-salt layer is water soluble or rapidly disintegrates in water.

FN73. To the extent that Dr. Davies testified on cross-examination during his rebuttal testimony limited solely to *Daubert* issues that it is possible that other components of the enteric coating, in addition to talc, may be present in the HPMCP-salt layer, the court agrees with Dr. Davies that such a conclusion stems naturally from the fact that the HPMCP-salt subcoating forms when the components of the enteric coating react with the active layer. (*See* 4239:2-14.) However, there is absolutely no evidence in the record from which it would be appropriate for the court to conclude that the theoretical presence of such other components in the salt layer destroys its solubility, particularly in light of the testing conducted on the salt layer itself, which indicates rapid dissolution in water. Once that HPMCP-salt-which is the film-forming compound that forms the subcoating-dissolves, the subcoating disintegrates.

Third, the court finds that the HPMCP-salt layer serves as a separating layer-it is sufficiently continuous to separate and isolate the core from the enteric coating such that the stability of the preparation is enhanced. The UV fluorescence microscopyand ATR-FTIR data each independently provides strong proof of the continuous nature of the salt layer. (Davies Tr. 817:5-12, 817:23-818:6, 821:19-24; P220; Davies Tr. 823:7-833:16, 835:12-836:16; *compare* P228, *with* P222; P1036 (Dem.Ex.) at 6.) In combination, the data provide overwhelming evidence that the salt layer is not only present but also continuous. Dr. Davies' testing shows the location of the HPMCP-salt layer to be under the enteric coat and above the active layer. (*Compare* P220 *with* P221; Davies Tr. 821:25-824:15; *see also* P1036 (Dem.Ex.) at 3.) The UV fluorescence microscopy data clearly shows a continuous layer all the way around the pellet in that location. (Davies Tr. 817:5-12, 817:23-818:6, 821:19-24; P220.) The UV fluorescence microscopy results also indicate that the intense, fluorescing region corresponds to the salt layer and that the layer measures 3-7 microns, (*See, e.g.,* Davies Tr. 828:6-10). Moreover, as discussed previously, the ATR-FTIR testing conducted on the HPMCP-salt layer did not detect omeprazole or degraded omeprazole, which would be present if the ATR-FTIR test, sampling down a full micron, were reaching the core. (*See* Davies Tr. 968:23-970:9, 971:7-22, 993:8-14, 997:10-998:6.) Andrx's experts had the opportunity to review the ATR-FTIR data and point out the presence of omeprazole in the HPMCP-salt layer, but they did not.

Finally, the court finds by a preponderance of the evidence that Andrx's HPMCP-salt layer enhances the stability of the preparation. An inert sublayer, whether sprayed on as a neutral enteric coat or whether formed by the process itself has the same function. (*See* Pilbrant Tr. 1664:19-1665:1; A168 at AAC2722 ("This extra layer, positioned in between the outer enteric coat and the inner alkaline core, seem to serve the same function as the separating layer in the Losec (omeprazole) formulations.").) Examining the totality of Dr. Davies' tests, the court finds that they conclusively show the presence of an HPMCP-salt layer in the Andrx ANDA products that separates the active pellet from the enteric coating. With respect to that

HPMCP-salt subcoating, pictures really are worth a thousand words. The HPMCP subcoating in Andrx's products surrounds the core and separates it from the enteric coating entirely. (*See, e.g.,* P220.) The Court finds that the isolation prevents reaction between the two layers, and thereby enhances the stability of the Andrx formulations. Thus, the court concludes that the HPMCP-salt layer present in Andrx's ANDA products literally meets all the requirements of claims 1(b) of the '505 and '230 patents; moreover, the HPMCP-salt layer also meets the requirements for the subcoating found in claim 1(c) of the '230 patent.

[65] Andrx attempts to make much of the argument that the omeprazole on the surface of the active pellet is available to react with the enteric coating as it is being applied and, therefore, since that coating is sprayed "right on top of" the active pellets, (Davies Tr. 928:18-23), the Andrx process allows for contact between the omeprazole and the acid groups in the enteric coating, which is exactly what the subcoating claimed in the patent is supposed to prevent. (Lovgren Dep. Tr. 154, 161-62; Langer Tr. 301:4-19.) This noninfringement position fails as a matter of law. Where, as here, the specification as a whole, and the claims in particular, contain no temporal limitation to the claimed product, product claims as properly interpreted are entitled to a broad scope that is not time-limited. Exxon Chem. Patents v. Lubrizol Corp., 64 F.3d 1553, 1558 (Fed.Cir.1995). Accordingly, if at any time from the date of their manufacture Defendants' ANDA products meet the claim limitations as recited in the product claims of the '505 and '230 patents, then Defendants infringe. Should the HPMCP-salt layer in Andrx's ANDA products form during the enteric coating process or after manufacture, those products still infringe the '505 and '230 patents. There is no evidence in the record to support Andrx's argument that such a subcoating cannot function as required by the claims.

Defendant Andrx also argues that the processing conditions required by its ANDA are insufficient to create the HPMCP-salt layer. Specifically, Andrx argues that the elements necessary for the acid-base reaction to form the HPMCP salt-including HPMCP, DHP, and water-are not present in the necessary amounts or molecular state to form the salt layer. As an initial matter, the court finds that the evidence offered by Andrx to prove that the HPMCP-salt layer does not exist because it cannot form during the Andrx process does not controvert the convincing evidence put on by Astra and Dr. Davies that the HPMCP-salt layer in fact exists. Moreover, to prove infringement, Astra need not show how, or why, or even precisely when the HPMCP-salt layer forms in the Andrx ANDA products.FN74 The simple fact is that the layer is present, and by proving its existence Astra has proven that Andrx infringes claims 1 of the '505 and '230 patents by a preponderance of the evidence. Infringement exists if any one of a patent's claims covers the alleged infringer's product or process. Markman v. Westview Instruments, Inc., 517 U.S. 370, 374, 116 S.Ct. 1384, 134 L.Ed.2d 577 (1996). In determining whether a product claim has been infringed, the court will look to the alleged infringing product, not the process by which the product was made. Exxon Chem. Patents, 64 F.3d at 1557. "If indeed the same product is ultimately obtained, it matters not that in order to do so the competitor tweaked the process in some manner. Of course, if the rule were any different, then product claims would easily be thwarted by even the most minuscule methodological modifications. Such a doctrine would render patent protection meaningless." Amgen, Inc. v. Hoechst Marion Roussel, Inc., 126 F.Supp.2d 69, 80-81 (D.Mass.2001). Therefore, as to all but claim 14 of the '505 patent and claim 12 of the '230 patent, the court need only determine the composition and structure of Defendants' proposed ANDA products. The processes by which Defendants' products are made are irrelevant. Id.

FN74. Even Dr. Weng, the Andrx employee responsible for the bulk of the work on the Andrx formulations, testified that he could only guesstimate as to the time of formation of the HPMCP-salt layer, yet he never disputed that it formed in the Andrx product:
Q. During that [enteric coating] spraying process there is a portion of the coating which comes in contact

with the alkaline containing core materials; correct?
A. Right.
Q. In that process is there neutralization of the HPMCP coating?
....
A. Not right away.
....
Q. Does it happen?
A. Yes.
Q. How long does it take for it to happen.
A. It depends on formulation operation condition.
Q. In the conditions used to prepare the Andrx ANDA formulation, how long does it take for that to happen?
A. I can't recall.
Q. Is that something you evaluated?
A. Yes. When bead is open I saw pink color between HPMCP and drug layer.
....
A. Well, the pink color it forms, time to form the pink color, it depends on what kind of condition you are talking about. In accelerated condition it forms faster. Under drug-in bank condition it takes longer time to form that layer.
Q. Do you understand that this pink layer contained neutralized HPMCP salt?
A. In theory, yes.

(Weng Dep. Tr. 62:14-64-4.)
Finally, claim 1(c) of the '505 patent requires "an outer layer disposed on said subcoating comprising an enteric coating." Claim 1(c) of the '230 patent also requires "an enteric coating layer surrounding said subcoating layer, wherein the subcoating layer isolates the alkaline reacting core from the enteric coating layer such that the stability of the preparation is enhanced." There is no dispute that Andrx's ANDA products have the enteric coating required by claims 1(c) of the '505 patent. (*See* Langer Tr. 334:16-335:4; P153 at 2919.) Thus, the court concludes that Andrx literally infringes claims 1 of the '505 and '230 patents.

[66] Claim 3 of the '505 patent calls for "[a] preparation according to claim 1 wherein the subcoating comprises two or more sub-layers." Astra argues that Andrx's enteric-coated pellets meet the requirements of this claim because the Andrx products have not one, but two subcoatings: the HPMCP-salt subcoating, and a lactose-enriched layer. Astra argues that the lactose layer in Andrx's formulations has a similar function and works in the same way as the other inert subcoatings of the '505 patent in that it serves to separate the omeprazole from the enteric coating material, to produce the same result of increasing the stability of the formulation. The evidence does not establish that what Astra alleges to be the lactose-enriched layer exists, much less meets the requirements of a subcoating claimed by the patents. Therefore, the court finds that Astra has failed to prove by a preponderance of the evidence that Andrx infringes claim 3 of the '505 patent, either literally or under the doctrine of equivalents.

The active layer of the Andrx ANDA products contains about 45% by weight lactose and 45% by weight omeprazole. (P116 at 2888.) Dr. Davies examined the structure and chemical composition of Andrx's active-coated pellets using ATR-FTIR. (Davies Tr. 847:12-853:10.) Astra argues that Dr. Davies' tests show that Andrx's products have a lactose-enriched layer at the surface of the active-coated pellet. (*See* Davies Tr. 847:5-14, 850:14-21, 852:17-853:10.) Dr. Davies tested the surface of the active pellet, which is the surface

of Andrx's active layer, and also tested the interior of the active layer approximately 10 microns below the surface. (Davies Tr. 850:25-851:20.) ATR-FTIR spectra for the surface of the active pellets exhibit lactose peaks that are prominent. (Davies Tr. 850:22-851:7; P224; P225.) In comparison, the omeprazole peaks for the active pellet surface spectra are less pronounced. (Davies Tr. 848:18-852:21; P224; P226.) ATR-FTIR spectra of the interior of the active layer, after cutting 10 microns into the surface, show peaks relatively equivalent in magnitude for both lactose and omeprazole. (Davies Tr. 851:21-853:10; *compare* P224 *with* P227.) The peak size in the ATR-FTIR spectra for the surface and the interior of Andrx's active layer relate to the concentration of the compounds present. (Davies Tr. 853:11-23.) Accordingly, the ATR-FTIR spectra show that the location Dr. Davies tested on the surface of the active layer has a higher concentration of lactose in comparison with omeprazole than that present at the location Dr. Davies tested approximately 10 microns into the layer. (Davies Tr. 816:4-10, 847:15-22; 851:25-853:10; *see also* Langer Tr. 337:16-338:13.) FN75 Based on those test results, Astra posits the existence of a layer of lactose surrounding and protecting the remainder of the omeprazole in the core. Even assuming the existence of that lactose-enriched layer, the court finds that Astra has not proven that it meets the claim limitations applicable to a subcoating in the '505 and '230 patents. Therefore, the court finds that Astra has failed to prove by a preponderance of the evidence that Andrx infringes claim 3 of the '505 patent, either literally or under the doctrine of equivalents.

FN75. Under Astra's theory, there are equal amounts of lactose and omeprazole in the interior portions of the drug layer, but a four to one ratio of lactose to omeprazole in the outer "lactose-enriched" layer. (Davies Tr. 996:11-12, 1008:11-14.) In view of these different concentrations of the two compounds, the density and chemical nature of the interior and exterior regions should also be different. Yet, Dr. Davies' UV fluorescence micrographs of the Andrx product show no distinct layers or regions within the active drug layer. Indeed, Dr. Langer specifically stated with respect to the UV fluorescence micrographs that "what we don't see in this [Exhibit P220]" is "the lactose-enriched layer." (Langer Tr. 342:23-25; Langer Tr. 343:1.)

In its effort to prove that the alleged "lactose-enriched" layer is a subcoating, Astra relied on two sources of proof-Dr. Davies' ATR-FTIR testing and the deposition testimony of Drs. Weng and Chou, who developed the Andrx formulations. Astra's experts offered no affirmative opinions concerning the mechanism by which a "lactose-enriched" layer could form in the Andrx product. In fact, the Andrx manufacturing process requires continuous homogenization throughout the production of the active pellets.FN76 The active drug solution is continuously sprayed onto the sugar seed and the spraying is only interrupted on order to clean the filter in the machine. What is never interrupted is the constant stirring of the suspension. (A391 at 2708-09; Banakar Tr. 3362:16-17.) The manufacturing process described in the Andrx ANDA does not provide for any change in the ratio of lactose to omeprazole during the spraying process. (A391 at 2706-12.) FN77 As a result of this continuous homogenization during the manufacture of the active pellets, "all ingredients in ... the homogenized suspension will show up on the core." (Banakar Tr. 3229:10-23.) At the outermost surface of Andrx's active pellets, omeprazole, DHP, lactose, and sodium lauryl sulphate, which are the components of the suspension sprayed onto the sugar seed, are all present. (Banakar Tr. 3230:1-4; Chen Tr. 3039:5-7.) The lactose in the Andrx products does not completely cover all of the omeprazole in the drug layer. (A554, Weng 5/17/00 Dep. Tr. 335:15-23.) Even Dr. Langer admitted that the region he characterized as a lactose-enriched layer contains all of the ingredients of the active pellet. (Langer Tr. 471:1-11.) Dr. Davies' ATR-FTIR data confirms that the "lactose enriched" layer contains lactose and omeprazole, and his XPS data also confirms the presence of disodium hydrogen phosphate and sodium lauryl sulphate. (P244 (listing data for "Na_2HPO_4" and "SLS").) At best, then, what Dr. Davies describes is not a layer separating the active pellet from the HPMCP-salt layer and the enteric coating, but rather a concentration gradient

within a section of the active pellet, and Dr. Langer did not offer any useful opinion on whether such a concentration gradient forms a subcoating as that term is used in the patents. (*See* Langer Tr. 471:18-472:15 (concentration gradient can be a separating layer "if you get the benefits of the invention").)

FN76. Elsewhere in his analysis of the Andrx product, Dr. Davies himself relies on the assumption that the drug layer was substantially homogenous. When he conducted his pH testing on the Andrx active pellets, samples were taken from throughout the drug layer in the active pellets, including the alleged lactose-enriched layer. (Davies Tr. 929:5-22.) Dr. Davies testified that this random sampling method produced "extraordinarily reproducible" and "very accurate reproducible" results. (Davies Tr. 929:5-7, 930:9-10.) If the outer portions of the active drug layer contained significantly more lactose than the inner portions, as Dr. Davies' claims, one would expect to see different pH readings in the supposed lactose-enriched layer. (A748A, Pilbrant 7/11/00 Dep. Tr. 138:12-13.) Yet Dr. Davies' pH analyses of different samples of Andrx's active layer did not evidence any such variation. Rather, his tests consistently showed pH values between 8.13 and 8.28 throughout the active drug layer. (P1036 (Dem.Ex.) at 20; P1013 (Dem.Ex.) at 26.)

FN77. Despite his repeated reliance on Dr. Weng's testimony to support his "lactose enrichment" theory, Dr. Langer ignored Dr. Weng's express testimony that the processing parameters of Andrx's active coating process include stirring to "make sure [the] omeprazole is uniformly dispersed." (A554, Weng 5/15/00 Dep. Tr. 128:19-22.) Dr. Langer's selective reliance on only those portions of Dr. Weng's testimony that supported Dr. Langer's opinion significantly undercuts the value of those opinions.

Dr. Davies' own x-ray photoelectron spectrometry ("XPS") results show that there is a substantial amount of omeprazole-15% to 19%-exposed on the surface of the active pellet. (P244.) X-Ray Photoelectron Spectometry ("XPS") is another analytical technique that is commonly used to analyze the surface of a sample. (Davies Tr. 1020:6-8.) XPS identifies chemical elements, rather than molecular species, and provides composite information concerning the distribution of elements within the top few molecular layers of a sample. (Davies Tr. 1020:6-16; Gardella Tr. 3853:22-24.) Dr. Davies' XPS data showed that the top 2 to 10 nanometers of the Andrx active pellets was 15% to 19% omeprazole. (P244 at DAVIES21563; Davies Tr. 916:6-16.) Dr. Davies confirmed that this omeprazole is not "embedded" but is, instead, "available for reaction" on the very surface of the active pellet (Davies Tr. 996:4-19.) Thus, Dr. Davies' own XPS testing demonstrates that the alleged "lactose enriched" layer does not function as a barrier between the core and the materials on the other side of the layer. (Davies Tr. 995:9-23.) Even on redirect, Dr. Davies rejected the suggestion by Astra's counsel that his XPS data overstated the amount of omeprazole on the surface of the active pellet. (Davies Tr. 1021:24-1022:12.) This data and Dr. Davies' testimony directly refutes Dr. Langer's statements that there are only "tiny amounts" of omeprazole on the surface. (Langer Tr. 469:19-21; *see also* Langer Tr. 506:4-15.) The XPS data leaves no doubt that there is a significant amount of omeprazole on the surface of Andrx's active pellet and that it is not covered or embedded in lactose. (Davies Tr. 996:4-19.) There was also no competent evidence of the thickness or continuous nature of the lactose-enriched layer. Dr. Davies merely opined that the relative concentration of lactose as compared to omeprazole was higher on the surface of the active pellet than it was when he cut 10 microns into the pellet, (Davies Tr. 1008:4-18), and that his ATR-FTIR detected enrichment somewhere within the one micron sampling depth of his ATR-FTIR probe, (Davies Tr. 927:3-9). Indeed, Dr. Banakar's testimony that lactose "cannot coat and cannot form a film" supports Dr. Davies' conclusion that the omeprazole is not completely embedded in lactose. (Banakar Tr. 3261:10-11; *see also* Langer Tr. 469:4-5 ("lactose isn't a film").) Thus, the foremost failure in Astra's proof is that Astra failed to demonstrate that the lactose layer actually

separates or isolates the omeprazole from the materials that come into contact with the core.

Astra also failed to prove that lactose-enriched layer is either inert or water soluble. To prove these required claim limitations, Astra relies entirely upon the deposition testimony of Andrx employees Drs. Weng and Chou. Dr. Davies performed no tests and offered no opinion whatsoever on this issue. Astra erroneously claims that Andrx's developers admit that the lactose in Andrx's product serves as an inert separating layer. In fact, Dr. Weng did testify that Andrx used lactose "instead of" an inert subcoating. (Weng Dep. Tr. 130:23-131:4.) Moreover, the court is unable to credit the bulk of the testimony offered by Drs. Weng and Chou concerning the characteristics of the lactose layer in the Andrx ANDA products as they relate to the claim terms. The court watched the designated portions of the depositions of Drs. Weng and Chou, which were admitted into evidence during the trial, on videotape. After assessing the two witnesses' demeanor and carefully considering their testimony and the method of questioning used during the depositions, the court concludes that the testimony does not provide a reliable indication of whether the lactose-enriched layer in the Andrx products actually serves as a subcoating as that term is used in the patents.FN78 The conclusory testimony of Drs. Weng and Chou in response to leading questions from counsel for Astra using legal catch-phrases that neither scientist, whose native language was not English, was familiar with is not a reliable indicator of the true characteristics of the lactose-enriched layer. Directly contrary to the inferences Astra would like the court to draw from the deposition testimony, Dr. Weng specifically testified that Andrx took the approach of using lactose in the active pellet because it was precluded by Astra's patents from putting "a barrier between [the] drug layer and enteric coating." (Weng Dep. Tr. 206:5-11.)

FN78. Indeed, Dr. Chou explicitly disclaimed any understanding of the meaning of the terms used in the patent as they would be construed under patent law:
So I always separated between these two [scientific formulation and patent law], because from my point of view, a lot of patents from when I read, I cannot see any[thing] novel in a particular patent, okay? And sometimes I don't see why we infringe .... So I usually leave the patent infringe or not, that issue, to [others]-and we just focus on the formulation.

(Chou Dep. Tr. 24:3-11; *see also* Chou Dep. Tr. 23:20-24:24.)
[67] Because the court cannot find by a preponderance of the evidence that the lactose-enriched layer meets the claim limitations of the patents, the court finds that Astra has failed to meet its burden of proof as to either literal infringement or infringement under the doctrine of equivalents as to claim 3 of the '505 patent. The only evidence Astra presented in support of its position that Andrx infringes under the doctrine of equivalents is the testimony of Drs. Chou and Weng. Astra has not presented any evidence to overcome the fact that any lactose-enriched layer that forms in the Andrx product still allows substantial amounts of omeprazole-at least 15% to 19% of the surface of the active pellet, to come into direct contact with the materials above it. In the face of the lack of affirmative proof to support Astra's position, the presence of so much omeprazole at the interface between the active pellet and the remainder of the Andrx formulation precludes any finding that the lactose-enriched layer in the Andrx products is equivalent to the "subcoating" required by the claims. *See* Lear Siegler, Inc. v. Sealy Mattress Co., 873 F.2d 1422, 1425 (Fed.Cir.1989) (holding that evidence and argument relating to infringement under the doctrine of equivalents cannot be subsumed in a plaintiff's case of literal infringement); *see also* Altech Controls Corp. v. E.I.L. Instruments, Inc., 71 F.Supp.2d 677, 684-85 (S.D.Tex.1999). There can be no infringement as a matter of law-even under the doctrine of equivalents-if a claim limitation is not found in the accused device. Phonometrics Inc. v. Northern Telecom, Inc., 133 F.3d 1459, 1467 (Fed.Cir.1998); General Am. Transp. Corp. v. Cryo-Trans, Inc., 93 F.3d 766, 771 (Fed.Cir.1996). In conclusion, the court finds that Andrx's ANDA products do not

infringe claim 3 of the '505 patent, either literally or under the doctrine of equivalents.

Claim 5 of the '505 patent calls for "[a] preparation according to claim 1 wherein the alkaline core comprises omeprazole and pH-buffering alkaline compound rendering to the micro-environment of omeprazole a pH of 7-12." (P1, col. 16:65-68.) Claim 6 imposes a similar requirement with respect to a core comprising an acid labile compound and a pH-buffering alkaline reacting compound. The only new requirement beyond claims 1 is that the micro-pH fall between 7 and 12. In connection with its analysis as to claims 1, the court has already determined by a preponderance of the evidence that the micro-pH of the omeprazole particles in Andrx's core falls in the range of pH 7 to pH 12. Therefore, the court concludes that Andrx literally infringes claim 5 of the '505 patent and claim 6 of the '230 patent.

Claim 6 of the '505 patent and claim 7 of the '230 patent call for preparations according to claim 5 and claim 6, respectively, wherein the ARC includes a sodium phosphate. (P1, col. 17:1-8; P2A, col. 14:9-16.) Andrx's products contain disodium hydrogen phosphate, (Andrx Stipulated Statement of Facts No. 15; P116 at 2890), which is a sodium phosphate, (Langer Tr. 350:21-351:5; P116 at 2890). The court finds that Andrx literally infringes claim 6 of the '505 patent and claim 7 of the '230 patent.

Claim 8 of the '505 patent and claim 10 of the '230 patent require "[a] preparation according to claim 1, wherein the enteric coating comprises hydroxypropyl methylcellulose phthalate, ... optionally containing a plasticizer." (P1, col. 17:13-18; P2A, col. 14:42-45.) Andrx's ANDA products, 10 mg, 20 mg, and 40 mg, contain hydroxypropyl methylcellulose phthalate, HPMCP, in the enteric coating. (Langer Tr. 351:10-25; P153 at 2919.) Andrx also adds the plasticizer cetyl alcohol to its enteric coating. (Id.) On the basis of these facts, the court concludes that Andrx literally infringes claim 8 of the '505 patent and claim 10 of the '230 patent.

Claim 10 of the '505 patent is directed to "[a] method for the treatment of gastrointestinal disease comprising administering to a host in need of such treatment a therapeutically effective amount of a preparation according to claim 1." (P1, col. 17:23-26.) Similarly, claim 13 of the '230 patent is directed to "[a] method for the treatment of gastrointestinal disease characterized in that a preparation according to claim 1 is administered to a host in need of such treatment in a therapeutically effective amount." (P2A, col. 14:42-45.) As required by claim 10 of the '505 patent and claim 13 of the '230 patent, Andrx's package insert instructions for using its omeprazole products direct the treatment of gastrointestinal disease by having patients in need of such treatment swallow a 10 mg, 20 mg, or 40 mg omeprazole capsule, which is a therapeutically effective amount. (Langer Tr. 352:1-18; P260 at 67504.) Specifically, Andrx's proposed package insert for its Omeprazole Capsules, 10 mg, 20 mg, and 40 mg products, instructs the user to swallow capsules whole and states under the Indications and Usage section that its products can be used for Duodenal Ulcer, Gastric Ulcer, GERD, Erosive Esophagitis, and Pathological Hypersecretory Conditions. (P260 at 67502-04.) The court concludes that Andrx literally infringes claim 10 of the '505 patent and claim 13 of the '230 patent.

Claim 11 of the '505 patent and claim 15 of the '230 patent call for "[a] preparation according to claim 1, wherein the subcoating further comprises an alkaline buffering compound." Astra argues that the lactose-enriched layer present in the Andrx product also contains DHP, which is an alkaline buffering compound. (P1, col. 18:1-3; P2a, col. 14:50-52; Langer Tr. 352:23-353:1.) However, Astra failed to prove at trial that the "lactose-enriched" area in the Andrx formulation is, in fact, a sublayer. Instead, the court finds that the entire area underneath the HPMCP-salt subcoating constitutes the core of the Andrx ANDA products. Therefore, the DHP present in Andrx's ANDA products is present in the core, not the subcoating, and the

court finds that Astra has failed to prove by a preponderance of the evidence that Andrx infringes claim 11 of the '505 patent or claim 15 of the '230 patent.

E. KUDCo

Astra alleges that KUDCo has and will continue to infringe claims 1, 5, 10, 11, and 14 of the '505 patent and claims 1, 6, 12, 13, and 15 of the '230 patent, either literally or under the doctrine or equivalents. KUDCo's Omeprazole Capsules, 10 mg and 20 mg (hereinafter sometimes referred to as "KUDCo's ANDA products") are "oral pharmaceutical preparations" as those terms are used in claims 1 of the '505 and '230 patents. (*See* Langer Tr. 359:1-5; P720 at KU36.) KUDCo is seeking FDA approval to sell 10 mg and 20 mg dosage forms of omeprazole. KUDCo's capsules each contain "microtablets." (Langer Tr. 354:20-355:5; P306 at KU1657.) Each of KUDCo's microtablets has three component parts: (1) a core; (2) a subcoat; and (3) an enteric coat. The core contains micronized omeprazole, HPMC, crospovidone, glycerol behenate, and unmicronized omeprazole. (Seth Tr. 1951:2-1958:9.) The subcoat contains HPMC, talc, silicon dioxide, and titanium dioxide. (Seth Tr. 1958:10-1960:7.) The enteric coat contains methacrylic acid copolymer (*e.g.,* Eudragit), talc, and triethyl citrate. (Seth Tr. 1960:8-1961:6; Siefert Tr. 2134:9-25, 2144:22-2147:10; K2 at 003; K284 at 030-31.) The central question in the KUDCo infringement case is whether KUDCo's formulations contain an ARC.

KUDCo licensed the manufacturing and product technology for its ANDA omeprazole products from the Pharma Pass company. (Seth Tr. 1939:3-17.) Dr. Pawan Seth, a drug formulation scientist and president of a pharmaceutical technology development company called Pharma Pass, developed the omeprazole formulation and the process for making it that was ultimately transferred and assigned to KUDCo. (Seth Tr. 1937:6-1939:11.) For the past fifteen years, Dr. Seth has had substantial hands-on experience in developing various drug formulations and has worked on approximately eighty different products throughout his career. (Seth Tr. 1940:3-1942:16.) Dr. Seth decided to develop KUDCo's omeprazole products in the form of microtablets, which have a very uniform and defined size and shape, properties that allow for improved protection of the omeprazole from the environment and, therefore, improved stability. (Seth Tr. 1945:15-1946:2.) Dr. Seth experimented with various formulations and considered different manufacturing processes. Ultimately, he chose to use fluid-bed granulation and Wurster coating as the process for manufacturing the omeprazole microtablets; that process is well-suited for omeprazole because it is a very dry process and produces soft, light granules without great differences in particle size, which is better for subsequent processing like the dry-mixing and tablet compression steps. (Seth Tr. 1948:9-24.) KUDCo's Mr. Siefert, who was responsible for transferring the Pharma Pass product and process to KUDCo in the United States, visited Pharma Pass in France to learn their process. (Siefert Dep. Tr. 12:13-16, 13:16-14:10.) The omeprazole development report prepared by scientists at Pharma Pass was given to KUDCo to provide an overview of the product and process development at Pharma Pass. (Siefert Dep. Tr. 181:6-12; P345; Seth Tr. 1980:16-1981:6; K168.)

The specific steps and parameters of KUDCo's manufacturing process are set forth in KUDCo's ANDA, which disclosed the production of the biobatch lot, and in KUDCo's December 7, 2001 Minor Amendment, which sets forth the commercial scale-up of that process. (K2 at 151-186; K284.) KUDCo begins its manufacturing process by preparing an aqueous mixture of approximately 82% water, 10.5% micronized omeprazole, and 7.5% HPMC. (Seth Tr. 1961:25-1962:9.) Specifically, KUDCo mixes the HPMC and a portion of the purified water in one container, and in another, separate container, it prepares a suspension of micronized omeprazole and purified water. (Siefert Tr. 2134:26-2135:21.) After the two containers-HPMC/water and omeprazole/water-have been prepared, they are combined and stirred gently for ten

minutes. During these various mixing and stirring steps, nothing is done to control the temperature of the water, which is at room temperature. (Seth Tr. 1961:7-1963:10; Siefert Tr. 2135:22-2136:4, 2147:11-22; K2 at 152-56; K284 at 038-39.) The mixture of purified water, micronized omeprazole, and HPMC is then sprayed from nozzles at the top of the fluid-bed granulator, which has been filled with lactose particles. (Seth Tr. 1962:16-1963:10.) Hot air is blown from the bottom of the granulator, causing the lactose particles to float and get blown around inside of the granulator. As the water, micronized omeprazole and HPMC mixture is sprayed, there are literally millions of particles floating in the air and banging into each other in a completely random manner. (Seth Tr. 1963:11-1964:6.) The process achieves a balance or equilibrium in which there is just enough air flow to float the lactose particles, at just the right temperature, with just the right amount of mixture spraying from the nozzles. (Seth Tr. 1964:7-1965:9; Siefert Tr. 2136:5-16, 2147:19-2148:1; K2 at 156; K284 at 039-40; K305 at Seth 2-4.) Granules or agglomerates of lactose, micronized omeprazole and HPMC are formed in the fluid-bed granulator as droplets of the water-omeprazole-HPMC mixture hit and stick to the lactose particles and begin to dry. HPMC is a tacky substance, and thus, during the fluid-bed granulation process, HPMC functions as a binder or glue to agglomerate the millions of lactose and micronized omeprazole particles. (Seth Tr. 1965:10-1966:25, 1970:1-11.) The particles stick to one another in a completely random manner, and form granules of all different shapes, resembling miniaturized rocks stuck together like asteroids. (Seth Tr. 1967:1-1968:12; Auslander Tr. 2542:24-2547:5.) The lactose particles in KUDCo's process have an average size of about 250 microns, while the micronized omeprazole particles have an average size of 10 microns. (Seth Tr. 1965:10-19.) The granules resulting from the agglomeration process vary in size, but generally range from 1,000 to 3,000 microns. (Seth Tr. 1968:13-15.)

After the lactose, micronized omeprazole, and HPMC granules have been prepared in the fluid bed granulator, KUDCo then processes the granulation through a particle-size reduction step. Because the granules are to be dry-mixed with glyceryl behenate, crospovidone, and unmicronized omeprazole, the particle size of the granules must be reduced first so that all of the various excipients will mix properly and evenly, thereby controlling against any variation in the contents of the compressed microtablet cores. (Seth Tr. 1972:16-1973:12.) When processing its biobatch and pilot study lots, KUDCo employed a manual step whereby the granulation was pushed through a screen to reduce the size of the granules. The entire granulation is forced through the screen by hand, so that the granules larger than the openings of the screen are "broken up, chopped up, [and] reduced in size," and when this step is complete, nothing other than some dust is left on the top of the screen. (Siefert Tr. 2136:17-20, 2214:21-2216:1, 2246:10-2248:13; K2 at 156; P341, at 3/16.) KUDCo has also incorporated a particle size-reduction step in its commercial scale-up process. Rather than pushing the granules through a screen by hand, as it did with the biobatch and pilot study lots, KUDCo uses an automated apparatus called a co-mill to reduce the size of the granules. The co-mill machine is a conical shaped apparatus that has a stainless steel screen with holes having sharp, knife-like edges, and a stainless steel impeller that, in KUDCo's scale-up process, spins at 1,250 rpm and pushes the granulation through the sharp-edged screen. (Seth Tr. 1971:19-1973:12.) The co-mill machine functions like a cheese grater or coffee grinder in that the granules are broken up, and their particle size reduced. (Seth Tr. 1968:16-22, 1971:19-1973:12, 2069:1-20; Siefert Tr. 2246:23-2249:11; Auslander Tr. 2714:4-2715:8.)

Contrary to Astra's arguments during the trial, KUDCo's manual sieving step and automated co-mill sieving step are not materially different processes. (Siefert Tr. 2151:14-2152:1, 2246:10-2249:11.) As the court has already held, "both milling and sieving, as they are used in the KUDCo process, are 'size-reduction' steps, which work to reduce the size of the granulation used in KUDCo's product." (Order of 2/11/02, at 2.) KUDCo's sieving and milling are both size-reduction steps; the primary difference is that the latter is automated while the former is a manual process.FN79 (Auslander Tr. 2550:1-24, 2708:2-7, 2714:2-2715:8.)

It is clear from the facts in the record that KUDCo's manufacturing process includes a particle-size reduction step that breaks apart and reduces the size of the lactose, micronized omeprazole, and HPMC granules.

FN79. Plaintiffs argue that KUDCo's manual size-reduction step is in fact a sieving step, not a milling step. To make this argument, Astra once again cites an inapposite portion of the Pharma Pass development report, (*see* K168 at KU 16782-83). Astra's argument relies on the proposition that KUDCo's agglomerates are only 300 (mu)m in size and so will pass through the screen or co-mill without being cut. Astra is correct that the development report indicates that the average size of the lactose particles is 250 (mu)m and the total average particle size is 300 (mu)m. (P358 at KU16782-83.) However, the development report also states that "[w]hen changing process parameters (higher pump flow rate), agglomeration could be increased." (P358 at KU16784.) It is clear that the process parameters used by KUDCo have changed over time. (*Compare* P341 at KU24965, *with* P358 at KU16782, *and* K2 at KU1815.) In light of the changes in processing parameters the KUDCo process has undergone since the development report was written, the court is not persuaded by Astra's arguments concerning particle size. The court credits the testimony of Dr. Seth and Mr. Siefert, which indicates that the size of KUDCo's agglomerates is much larger than those described in the development report, (*see* Seth Tr. 2066:2-2067:11), and, therefore, the court finds that both the sieving and milling steps are particle size-reduction steps.

Astra also cites to notes made by Mr. Siefert when visiting Pharma Pass to learn about the process. Once again, those notes are irrelevant to the determination of the actual process used by KUDCo in its ANDA formulation. If the size-reduction step were in fact a sifting operation, KUDCo's ANDA would necessarily include a subsequent process step directed to the disposition of the large agglomerates left on top of the screen. (*See, e.g.,* G17C at G50230, 235, 249 (describing sifting operation including disposition that occurs three times during Genpharm's process).)
Once the granules have been processed in the size reduction step, they are mixed together in a blender at slow speed with glyceryl behenate, crospovidone, and unmicronized omeprazole to produce the final blend. (Seth Tr. 1973:13-1974:3; Siefert Tr. 2152:2-13.) This final blend is fed into an automated, high-speed tabletting machine,where an upper and lower punch crush and compact the mixture to form hard, uncoated microtablet cores that do not crumble. (Seth Tr. 1952:7-17, 1974:4-1975:21; Siefert Tr. 2137:9-2138:9, 2152:2-2153:7; K2 at 158-62; K284 at 042-046.) Because omeprazole degrades if it comes into contact with highly acidic compounds and the enteric coat in KUDCo's formulations is highly acidic, KUDCo applies a subcoat to physically separate the omeprazole core from the enteric coat. (Siefert Tr. 2138:8-2139:6, 2153:8-2154:6; K2 at 172-182; K284 at 061-068.) Once the uncoated microtablet cores have been made, a subcoat of HPMC, talc, silicon dioxide, and titanium dioxide is applied. (Seth Tr. 1958:10-1960:7.) KUDCo uses a Wurster column, installed in the fluid bed apparatus, to apply the subcoat. (Siefert Tr. 2138:8-2139:6, 2153:8-2154:6.) Hot air is blown from the bottom of the apparatus and causes the uncoated microtablet cores to float and move through the Wurster column in a controlled, recirculating path. (Seth Tr. 1975:22-1977:13.) This is unlike the fluid bed granulation process, where the lactose particles are randomly flying around the chamber, and sticking to, and agglomerating with other lactose particles, micronized omeprazole and HPMC. In fact, in the Wurster column subcoating process, the microtablet cores should not be sticking to each other. If that were to happen, then the microtablet cores would agglomerate, and the subcoat would not be applied. (Seth Tr. 1977:14-1978:15.) That is why KUDCo uses silicon dioxide and talc as anti-tacking agents with the HPMC in its subcoating-so that the HPMC in the subcoating functions as a film forming material, and not as binder or glue. (Seth Tr. 1958:23-1959:25; K2 at 172-82; K284 at 061-068.) In the subcoating process, the subcoat mixture is sprayed from nozzles at the bottom of the apparatus and sticks to the walls of the uncoated microtablet cores. By the time the microtablet cores reach the top of the

Wurster column, the subcoat mixture has dried, and the cores fall to the bottom of the column where they are blown upwards and coated again with more of the sprayed mixture. (Seth Tr. 1975:22-1978:15.)

KUDCo applies an enteric coat on top of its subcoat in the same manner as the subcoat discussed above. Unlike many other omeprazole formulations, including those used by Plaintiffs and the other Defendants, KUDCo's microtablet cores are uniformly shaped, and uniform in size. Because of this, KUDCo is able to coat its microtablet cores with extremely uniform subcoat and enteric coat layers. (Seth Tr. 1987:1-1989:8.) Neither the subcoating nor the enteric coating of the KUDCo ANDA products differs from the '505 patent. (Seth Tr. 1995:18-20, 1996:1-7, 11-15.) The result of the subcoat and enteric coating processes is a fully and uniformly coated omeprazole microtablet. (Seth Tr. 1960:8-24, 1978:16-1979:11; Siefert Tr. 2139:7-2140:10, 2154:11-2155:7; K2 at 182-86; K284 at 069-080; K303.) As a result of the highly uniform subcoat and enteric coat, and also because KUDCo's formulation does not contain any excipients that are aggressive to omeprazole, KUDCo's omeprazole microtablets are stable. (Seth Tr. 2058:25-2061:1, 2071:6-2073:2; Siefert Tr. 2138:23-2139:3.) After applying the enteric coating, KUDCo dries the microtablets and places them in gelatine capsules. (Siefert 2139:20-24; K2 at KU1858.) The individual microtablets in KUDCo's 10 mg and 20 mg products are the same in composition and differ only in number. (Langer Tr. 354:25-255:4; P723.) KUDCo's 20 mg capsule contains 18 identical microtablets, (Siefert Dep. Tr. 62:1-13; P306 at KU1658), while KUDCo's 10 mg capsule contains only 9 identical microtablets. (P723.)

[68] As detailed above, KUDCo's formulations contain HPMC in the core. Astra argues that the HPMC found in KUDCo's ANDA products either is itself an ARC or contains an ARC, possibly in the form of an impurity. FN80 The court finds that Astra has not proven by a preponderance of the evidence that KUDCo's ANDA products contain an ARC as required by subpart "(a)" of claims 1 of the '505 and '230 patents, either literally or under the doctrine of equivalents. Because all of the independent claims of the '505 and '230 patents asserted against KUDCo require an ARC, the court holds that KUDCo's ANDA products do not infringe any of the independent claims of those patents. Furthermore, it is axiomatic that any claims that depend from those independent claims also will not be infringed. Accordingly, the court holds that KUDCo also does not infringe any of the dependent claims of the '505 and '230 patents asserted against KUDCo. Wilson Sporting Goods Co. v. David Geoffrey & Assocs., 904 F.2d 677, 685 (Fed.Cir.1990). The court finds that Astra has failed to prove by a preponderance of the evidence that KUDCo infringes, either literally or under the doctrine of equivalents, any of the claims of the '505 and '230 patents.

FN80. Astra argued, for the first time at trial, that "some types" of HPMC are "often" manufactured using alkaline materials, and therefore, it somehow follows that KUDCo's HPMC "may" contain impurities that are the claimed alkaline reacting compound. Regardless of whether the posited alkaline reacting compound is the HPMC itself or an impurity contained within HPMC, the infringement analysis remains the same.

KUDCo argues that its HPMC cannot possibly be an ARC because KUDCo has amended its ANDA so that it will use only HPMC with a certificate of analysis indicating a pH of 6.9 or less. KUDCo's ANDA specifies that KUDCo can use either Methocel HPMC from Dow Chemical Company or Pharmacoat HPMC from Shin-Etsu in its omeprazole products. (Siefert Tr. 2160:3-6.) KUDCo's ANDA includes raw material specifications for, among other things, the specific HPMC to be used in KUDCo's products. Raw material specifications are internal KUDCo documents that identify a specific raw material with a specific number, certain properties of the material, and list the tests that KUDCo will run concerning those properties when it receives that material from the supplier. (Siefert Tr. 2157:13-2160:2; K2 at 36-40.) After KUDCo originally submitted the ANDA for its omeprazole product, KUDCo amended its raw material specifications for

HPMC through an ANDA amendment filed on September 9, 2000. The raw material specifications included in that amendment tightened the specifications for the HPMC in KUDCo's omeprazole formulations, such that the HPMC will have a pH value in the range of 5.5 to 6.9, (Siefert Tr. 2161:21-2163:13), based on the particular pH tests that each supplier reports on its certificate of analysis and retests done by KUDCo. For example, Dow, one of KUDCo's potential HPMC suppliers, tests the pH of its HPMC using the American Society for Testing and Materials ("ASTM") method. (Siefert Tr. 2163:25-2165:19; K11 at 002.) The ASTM method for testing the pH of HPMC specifies that the test sample should be a 2% concentration of HPMC in hot water, which is subsequently cooled. (Siefert Tr. 2176:15-2178:17.) Shin-Etsu, the other potential supplier for KUDCo's HPMC, tests the pH of its HPMC using the European Pharmacopeia ("EP") method. (Siefert Tr. 2165:20-2166:18, 2170:10-19; K11 at 004; P1018.) The EP method for testing the pH of HPMC specifies that the test sample should be a 1% concentration of HPMC in carbon-dioxide free water that is heated, then cooled to ambient temperature. (K287A at Hypromellose monograph.) In performing its confirmatory pH tests, KUDCo prepares an aqueous solution of HPMC using room temperature USP water-a 2% solution for the Dow Methocel HPMC, and a 1% solution for the Shin-Etsu Pharmacoat HPMC. (Siefert Tr. 2179:18-2186:19; K11 at 002, 004; K3 at 222.) If any of those values exceeds pH 6.9, KUDCo must reject that HPMC, which is not in compliance with its ANDA specifications. KUDCo reasons that because its ANDA requires a pH value for HPMC (in a 1% or 2% solution) less than 6.9, KUDCo's HPMC cannot meet the requirement that the ARC itself be alkaline. KUDCo's argument is not persuasive, however, since it fails to test HPMC at the levels it is actually used in KUDCo's ANDA products.

KUDCo is correct that a Defendant's ANDA can, in certain circumstances, mandate a finding of no literal infringement. *See* Bayer AG v. Elan Pharms. Research Corp., 212 F.3d 1241, 1248 (Fed.Cir.2000), *cert. denied,* 531 U.S. 993, 121 S.Ct. 484 (2000) (patent infringement inquiry under 35 U.S.C. s. 271(e)(2)(A) is a "hypothetical inquiry [ ] properly grounded in the ANDA application and the extensive materials typically submitted in its support"). However, in this case, KUDCo's ANDA raw material specification is not directly relevant to the question of infringement. The HPMC in KUDCo's formulations is used in solutions with concentrations of about 10% or higher.FN81 KUDCo first prepares about a 20% HPMC solution, which is then diluted to about 10%. The 10% solution is mixed with omeprazole and sprayed on the lactose. The tests conducted by Dr. Davies at concentrations of 10% and higher, which KUDCo criticizes extensively, reflect the HPMC environment to which KUDCo's micronized omeprazole is actually exposed. The tests on 1% or 2% solutions for quality control analysis run by KUDCo's suppliers and KUDCo itself are not designed to, and do not, take into account the concentrations found in KUDCo's product. Therefore, KUDCo's tightened ANDA specifications for the HPMC used in its products do not establish non-infringement, and the court cannot rest its infringement inquiry on the ANDA specifications set by KUDCo for its HPMC raw materials.

FN81. Dr. Auslander confirmed that the lowest concentration of HPMC that the micronized omeprazole in the KUDCo product is exposed to is around 8%. As the spray process goes on, the water in the HPMC solution evaporates. The concentration of HPMC goes up very rapidly, exposing the omeprazole to a higher concentration of HPMC in solution. (Auslander Tr. 2661:6-2662:10.)

Since the court cannot rest its infringement inquiry on KUDCo's ANDA raw material specification for HPMC alone, the court must examine the evidence adduced at trial to determine whether the HPMC in KUDCo's core is an ARC. In order for the HPMC to meet the alkaline reacting compound claim limitation, the court must find that the HPMC stabilizes the omeprazole in the core by creating a microenvironmental pH of not less than 7 around the omeprazole particles in the core. For the reasons discussed below, the court

finds that Astra has failed to prove by a preponderance of the evidence either that the HPMC in KUDCo's product creates a micro-pH of not less than seven around the omeprazole particles FN82 or that it is actually the HPMC in the KUDCo product that stabilizes the omeprazole in the core.FN83

FN82. Astra objects to the claim construction contention by KUDCo that leads to its infringement position that Astra has failed to prove that HPMC is an alkaline reacting compound because Astra failed to demonstrate a micro-environment pH of not less than 7. Astra argues that KUDCo did not present the claim construction arguments concerning the ARC that it currently presses until after the close of discovery. Astra also argues that the position appears in no supplemental report or interrogatory response and that the September 15, 2000 report of KUDCo expert Dr. Auslander contained no reference to this contention. In fact, Dr. Auslander's report stated that [b]ased on the evidence I have reviewed and my skill in the art, I conclude that the term "alkaline reacting compound" in claim 1 means a compound that is not inert and has a pH greater than about 7 in the presence of water." (K251 at 13) (admitted only for statements made therein, not for its truth; Auslander Tr. 2706:14-20.) Astra is correct that the definition includes no reference to micro-pH and no reference to whether "each" omeprazole particle is surrounded by omeprazole. However, the court overrules Astra's objection because the court finds no prejudice to Astra in permitting these claim construction arguments and KUDCo's related noninfringement positions. Unlike some of Defendants' new claim construction positions that were raised for the first time during or after trial, this claim construction argument was raised in pre-trial briefing on claim construction that was submitted approximately one month before trial began. Moreover, it is undisputed by all parties that the claim limitation that KUDCo raises-a microenvironment of not less than 7-is part and parcel of claim 5 of the '505 patent and claim 6 of the '230 patent, which both require an even narrower measurement of micro-pH between 7 and 12. Astra has asserted claim 5 of the '505 patent and claim 6 of the '230 patent against all four Defendants in this case and has presented extensive evidence, including voluminous scientific test data and expert testimony, attempting to prove that the microenvironment of the omeprazole in all four Defendants' products lies between pH 7 and pH 12. Even assuming that claim construction briefing was really Plaintiff's first notice of these arguments, Plaintiffs had at least a month to reorganize their proof to assert the micro-pH data as to all claims of both patents. In light of these facts, the court finds that Plaintiffs are not prejudiced by the court's decision to permit Defendants to proceed with their claim construction argument that all claims of the '505 and '230 patent require an alkaline reacting compound that creates a microenvironment around the omeprazole particles of pH not less than 7.

FN83. Since the court finds that Astra has failed to prove these requirements by a preponderance of the evidence, the court need not determine whether Astra successfully proved that KUDCo's HPMC, as used in KUDCo's ANDA products, is alkaline.

Astra bases its contention that an ARC is present in the core of KUDCo's product solely on the results of pH testing run by Dr. Davies on sample mixtures of high concentrations of HPMC or HPMC and omeprazole in water. These mixtures of a single excipient with water are so different from the core of KUDCo's product that Dr. Davies' tests cannot demonstrate infringement. Astra's infringement theory against KUDCo, which incorporates Dr. Davies' tests, is based on multiple layers of assumptions and theories, each of which must be true for Astra to link Dr. Davies' high-concentration pH meter tests of HPMC to the infringement determination. Specifically, for Astra's infringement theory and Dr. Davies' tests to have any merit at all, Astra must show that, at the very least, (1) the micronized omeprazole in the core of KUDCo's fully-formulated products is totally included in HPMC; and (2) HPMC, as a commodity products including any

impurities, is an ARC that, in fact, stabilizes the omeprazole in the core of KUDCo's fully-formulated products. Astra has failed to demonstrate either of these requirements by a preponderance of the evidence.

HPMC is specifically disclosed in the '505 and '230 patents, not as an ARC, but rather as an inert, nonreactive substance that may be used as a subcoat or separating layer, which has nothing to do with the ARC in the core. (*See* P1, col. 4:31-42; P2A, col. 9:26-36.) More specifically, the specifications state: "The material for the separating layer [subcoat] is chosen among the pharmaceutically acceptable, water soluble, inert compounds or polymers used for film-coating applications such as, ... [HPMC] ...." (P1, col. 4:35-42; P2A, col. 9:30-36.) The specifications further distinguish HPMC when they state that the separating layer may also contain an ARC. (P1, col. 4:14-30; P2A, col. 9:9-25.) Hence, it would not make sense for HPMC to be both a separating layer and an ARC. Similarly, claim 1 of the '230 patent distinguishes "film-forming compounds" such as HPMC from "alkaline compounds," which Astra asserts and the court finds is yet another synonym for alkaline reacting compounds. (P2A, col. 13:13-15 ("materials selected from the group consisting of tablet excipients, film-forming compounds and alkaline compounds").) Another distinguishing fact about HPMC, as opposed to the ARC, is that the Astra applicants specifically described HPMC as inert-nonreactive. (*See, e.g.,* P1, col. 4:35-42; P2A, col. 9:30-36.) The specifications provide a list of "alkaline reacting" substances that can be mixed with omeprazole to enhance its stability. (P1, col. 3:41-59; P2A col. 8:36-55.) In contrast, the specifications refer to various other compounds, including HPMC, as "ordinary" or "conventional" excipients and "inert compounds." Astra has made a clear distinction in these patents between substances that are "alkaline reacting" and substances that are "inert." The same compound cannot be both. Thus, those compounds that the applicant explicitly defined as "inert," including HPMC, cannot be "alkaline reacting" within the meaning of the patents. The scientific evidence presented at trial supports the court's reading of the patents. Astra failed to put forward sufficient evidence at trial to prove by a preponderance of the evidence that KUDCo's product, including the HPMC contained therein, contains an ARC.

First, the court finds that the evidence put forward by Plaintiffs fails to demonstrate by a preponderance of the evidence that the micronized omeprazole in KUDCo's core is totally included in the HPMC. This renders the pH testing Dr. Davies conducted on the KUDCo products irrelevant to the determination of whether the microenvironment of KUDCo's omeprazole particles has a pH of not less than 7. First, Dr. Davies did not report or rely on tests of the microenvironment or micro-pH of KUDCo's omeprazole products. As discussed above, both the '505 and '230 patents define an ARC as a substance that creates "a micro-pH around each omeprazole particle of not less than pH=7 ... when water is adsorbed to the particles of the mixture or when water is added in small amounts to the mixture." Both Dr. Davies and Dr. Langer agreed with that proposition, and Dr. Davies admitted that the microenvironment, as set forth in the '505 patent, is the area immediately around the omeprazole particles, (Davies Tr. 1099:4-17). Moreover, the '505 and '230 patents specifically discuss the measurement of micro-pH in the context of the "mixture" of omeprazole, alkaline reacting compound, and the "conventional pharmaceutical constituents" found in the core. (P1, col. 3:36-46; P2A, col. 8:32-42.) Nothing in the patent suggests measuring the micro-pH of a single excipient alone in water or in combination with just omeprazole and water. (P1, P2A.) Despite Astra's experts' candid admissions concerning the teachings of the patents with regard to micro-pH, the tests that Dr. Davies reported and relied on with respect to KUDCo's products are tests of high concentrations of HPMC (10%, 20%, 40%, and 60%) alone, and in combination with omeprazole, *excluding all of the other excipients in KUDCo's cores*. Indeed, as to the Andrx, Cheminor, and Genpharm products, Dr. Davies testified that based on his reading of the '505 patent, he was required to test a small amount of the omeprazole-containing region with a small amount of water-milligrams of material with microliters of water. (Davies Tr. 806:24-807:11, 896:5-16.) He did not, however, follow that procedure for his pH tests of the KUDCo products.

(Davies Tr. 4332:17-4333:23.) Though Dr. Davies described KUDCo's product as also having an omeprazole-containing region, he did not report or rely on any tests of the omeprazole-containing region of KUDCo's product, even though he did perform those kinds of tests.FN84 (Davies Tr. 858:19-22.) As opposed to what Dr. Davies did to measure the micro-pH of the other Defendants' products, Dr. Davies used high volumes of water and a large sample size of isolated substances-HPMC alone and HPMC with omeprazole-in his tests for KUDCo. (Davies Tr. 1233:1-13.) For KUDCo's products, Dr. Davies "felt the most suitable way of analyzing the pH of those systems was measuring the pH of the HPMC solutions" that Dr. Davies believes "wrap around the omeprazole particles" in the KUDCo products. (Davies Tr. 4333:1-14.) For the purposes of his reported high-concentration HPMC pH tests, Dr. Davies assumed that the microenvironment around KUDCo's omeprazole contained solely HPMC based on his belief that the micronized omeprazole, excluding unmicronized omeprazole, is totally included within HPMC. (Davies Tr. 1212:20-1213:3.) Dr. Davies' high concentration HPMC tests, while potentially revealing that the HPMC used by KUDCo at the concentrations present in the KUDCo ANDA products is, in fact, an alkaline substance, are largely irrelevant and misleading as to the question of whether the HPMC functions to maintain a micro-pH of greater than 7 around the omeprazole in KUDCo's products. (*See* Davies Tr. 867:24-868:8, 1218:1-1219:9; Auslander Tr. 2524:16-2526-1.) Because Dr. Davies' high concentration pH tests do not account for the micro-pH around the omeprazole particles in the core mixture of KUDCo's products, Dr. Davies' KUDCo-specific tests deviate from, and are completely inconsistent with the relevant inquiry under the '505 and '230 patents. Therefore, Dr. Davies tests do not demonstrate by a preponderance of the evidence that KUDCo's omeprazole formulations infringe Astra's '505 and '230 patents. Astra admits that the relevance of Dr. Davies' high-concentration pH meter test depends on the accuracy of its Total Inclusion Theory, stating that "Dr. Davies tested HPMC rather than the entire core *because* ... HPMC surrounds or totally includes the micronized omeprazole particles." (AFF 5.4.1.4 (emphasis added).) Astra's theory is wrong in the first instance because it totally ignores the unmicronized omeprazole in KUDCo's core; moreover, the evidence put forward by Astra fails to establish that KUDCo's micronized omeprazole is totally included within the HPMC.

FN84. Interestingly, Dr. Davies initially performed, but did not report or rely on, pH tests on KUDCo's core omeprazole-containing region as he did for the other Defendants, including Cheminor, who similar to KUDCo does not have a sugar sphere in its product. (Davies Tr. 1275:3-17; G385.) Those initial tests on the KUDCo product clearly showed a pH well below 7-the average value was pH = 6.03-for KUDCo's core material. (Davies Tr. 1276:20-1278:14; *see generally* Davies Tr. 1275:3-1278:14.) In Dr. Davies' unreported core tests, he removed the enteric coat and the HPMC subcoat from the fully-coated microtablets, thereby exposing KUDCo's cores, which contain both micronized and unmicronized omeprazole. (Davies Tr. 1278:15-1279:14.) Based on thirty-seven measurements of eight different KUDCo biobatch cores, Dr. Davies obtained pH values ranging from pH 5.5 to 6.5. (Davies Tr. 1277:5-1278:9; G385 at 21738, 42, 53, 54.) Those unreported core tests take into account, like no other tests Dr. Davies performed, the unmicronized omeprazole in KUDCo's product, which accounts for 30% of the omeprazole in the core of KUDCo's formulation. (Davies Tr. 1278:15-24, 1279:3-16.) It was only after Dr. Davies found those results that he changed his protocol to perform the new high-concentration HPMC pH tests he ultimately reported. (*Compare* G385 at 21754; *with* G379 at 21671-82, 21695-706.)

Astra has presented no direct evidence that its total inclusion theory is accurate. As circumstantial evidence, Astra cites to statements and micrographs from a Pharma Pass development report and a related deposition statement of Jeffery Siefert. Specifically, Astra refers to page two of thirty-one in the Pharma Pass report, where it states that "[i]t was therefore concluded that stability of omeprazole could only be achieved by a

total inclusion of particles into a polymeric film. Fluidized bed granulation was then tried. To achieve a good inclusion of omeprazole particles into the polymeric film, a suspension of omeprazole in a polymer solution was used." Additionally, Astra points to another statement in the report where it states that "[w]hen examined by scanning electron micrography, the surface of the granules appeared totally covered with a layer of Pharmacoat + omeprazole (see pictures in appendix)." FN85 (K168 at 2/31, 4/31.)

FN85. With respect to the sections of the development report cited by Astra that refer to the SEMs, (*see* P346 at KU15935, 959), the court notes that the text of the report is not helpful to Plaintiffs. It simply says that omeprazole *and* HPMC were covering the lactose particles, *not* that HPMC was covering the omeprazole particles.

The Pharma Pass development report *recommends* a formulation, and associated manufacturing equipment and manufacturing parameters for KUDCo's use, but it also discusses various formulations, equipment, and manufacturing parameters that were tried at intermediate stages of product development and that were not ultimately used for the formulation transferred to KUDCo. That is, the development report is just that-it is a report that discusses generally the developmental and experimental steps in designing KUDCo's omeprazole microtablet formulations, and the process for making those formulations. It does *not* reflect KUDCo's manufacturing process or, for that matter, the exact process specifications that were transferred from Pharma Pass to KUDCo. Instead, the statements on which Astra relies in the report relate to experiments on different omeprazole formulations, and experiments to study the parameters of the overall fluidized bed granulation process. (Seth Tr. 1979:12-1984:8, 1985:4-12, 1997:15-2005:16, 2050:2-2053:10, 2061:25-2068:25; Siefert Tr. 2140:6-2141:9, 2155:12-2156:7; K220; *see also* K168.) To the extent that Astra suggests that the report only discusses the final formulation as transferred to KUDCo, that suggestion mischaracterizes the report. FN86 (*See* Siefert 6/11/00 Dep. Tr. 185:15-24.) Similarly, the statement in the report that the "stability of omeprazole could only be achieved by a total inclusion of particles into a polymeric film," represented only a *theorized* solution to the stability issue. (Seth Tr. 1979:12-1985:12.) As Dr. Seth explained, when his team tried to achieve this goal, it was not successful in obtaining inclusion of the particles, and this approach was abandoned. (*See* Seth Tr. 1982:16-1983:7.) Accordingly, the court finds that the language in the development report is insufficient to support Astra's total inclusion theory, particularly in light of KUDCo's actual agglomeration process. (*See* Seth Tr. 1985:9-12.) In fact, when Dr. Seth was provided with an opportunity on re-direct examination to explain the context of the statements in the Pharma Pass report, he testified that the experiments identified in the report resulted in *little agglomeration* with an average particle size that was *only slightly higher* than that of the lactose particle starting material. As mentioned above, the lactose particles in KUDCo's process have an average particle size of 250 microns, while the granules of lactose, micronized omeprazole, and HPMC are larger, and range in size from 1000 to 3000 microns. (Seth Tr. 1997:15-2005:16, 2050:2-2053:10, 2061:25-2067:11; K220; P358; *see also* K168.) Because a significant level of agglomeration *is* achieved in KUDCo's process, the experiments identified in the report clearly relate to a different process than that KUDCo will use to manufacture its ANDA products.

FN86. On cross-examination by Astra's counsel concerning page 2 of 31 in the development report, Mr. Siefert testified as follows:
Q. That page is a discussion surrounding the *other* approaches which were tried towards the development of a stable product; is that correct?
A. That is correct.
Q. Were you involved at all in these *initial failed attempts* by Pharma Pass?

A. No.

(Siefert June 21, 2000 Dep. Tr. at 185:15-24.)
Astra's reliance on Mr. Siefert's deposition is also misplaced. Mr. Siefert candidly admitted at trial that he had no basis for providing an opinion during his deposition that the micronized omeprazole in KUDCo's formulation is totally included within an HPMC film. (Siefert Tr. 2191:7-2194:16.) Mr. Siefert is not aware of any tests showing that was true. Before his deposition, Mr. Siefert had never even considered the "total inclusion" concept. Therefore, the court finds that that isolated portion of Mr. Siefert's deposition testimony is not reliable evidence as to the actual physical structure of KUDCo's ANDA products. (*See* Siefert Tr. 2194:17-2196:22.) Indeed, Mr. Siefert testified that he is not aware of any evidence suggesting that KUDCo's omeprazole formulation is stable because the omeprazole and lactose particles allegedly are coated with HPMC. Instead, KUDCo's stability tests show that its formulation is stable because of the uniform subcoat and enteric coats that are applied to the uniformly shaped and smooth-surfaced microtablet cores. (Siefert Tr. 2196:23-2201:24, 2250:9-2251:6; K284, at 279.)

Additionally, two aspects of KUDCo's process are utterly inconsistent with Astra's total inclusion theory. First, as discussed above, KUDCo uses a particle-size reduction step that results in the separation and breaking apart of its agglomerates. The use of this step is inconsistent with the alleged attempts by KUDCo to ensure that its omeprazole is totally included within the HPMC, since the size-reduction step results in granules that have been chopped up with various surface areas of the lactose, micronized omeprazole and HPMC exposed. (Seth Tr. 1971:19-1973:12, 2069:1-20; Siefert Tr. 2246:23-2249:11; Auslander Tr. 2546:9-2551:14.) Second, the process used by KUDCo to form the agglomerates that become part of its cores clearly utilizes HPMC as a binder or glue, and not as a film-forming agent. HPMC is a well known and widely used pharmaceutical excipient that is primarily used in granulations as a glue, or binder, and also as a film-forming agent for coating finished tablets. (Auslander Tr. 2523:23-2524:13; *see also* Seth Tr. 1952:7-17.) Indeed, in the discussion regarding the separating layer in the '505 and '230 patents, the patents clearly teach that inert film-forming compounds such as HPMC should be used in forming the subcoat. (P1, col. 4:31-42; P2A, col. 9:26-39; Auslander Tr. 2523:3-11.) Although Astra asserts that HPMC is a film forming material, it is well-known that HPMC can be used, depending on the application, as either a film-former or a binder. (Seth Tr. 1952:7-20, 1958:10-1959:20, 1967:1-20; Auslander Tr. 2523:12-2524:13; *see also* Davies Tr. 4325:9-4326:25.) Even Dr. Davies agreed that in order to determine whether the HPMC was being used as a binder or a film-former, one would have to consider the manufacturing process parameters,including the concentration of HPMC and the nature of the manufacturing equipment and materials being used, something that Dr. Davies never did. (Davies Tr. 4325:12-25.) The whole purpose behind KUDCo's fluid bed granulation process is to bind the particles to form granules, not to coat them. (Seth Tr. 2061:25-2067:11.) The dynamics of the fluid bed granulation process simply do not allow for coating millions of irregularly-shaped particles floating randomly in the granulator. (Seth Tr. 1962:16-1968:15, 1975:22-1978:22, 1985:4-12; *see also* K168.) Indeed, when HPMC is used as a binder in the granulation step of KUDCo's process, it is mixed with water and the micronized omeprazole, and sprayed from the top of the granulator to agglomerate or bind with the lactose particles. (Seth Tr. 1952:7-24.) However, when HPMC is used as a film-forming material for the subcoat in KUDCo's formulations, it is mixed with talc and silicon dioxide, which are specifically added as anti-tacking agents to reduce the stickiness or ability to function as a glue of the HPMC, and it is sprayed from the bottom in the Wurster column. (Seth Tr. 1958:10-14, 1958:23-1959:25, 1999:1-2000:21; Auslander Tr. 2554:18-2556:20.) Therefore, while it is perhaps true that some of the micronized omeprazole and lactose particles are included within HPMC, it is, at best, a small fraction. As explained above, in KUDCo's process, HPMC is used as a

binder to form agglomerates or granules of lactose, micronized omeprazole, and HPMC, which granules are then processed further in the milling, dry-mixing, and tablet compression steps. (Seth Tr. 1991:1-2000:21, 2065:18-2070:3.) That is very different from the total inclusion Astra must demonstrate in order to prove its infringement case through Dr. Davies' testing.

During the development of its omeprazole formulation, Pharma Pass conducted experiments in which the amount of HPMC varied from 5 milligrams per dose to 10 milligrams. (P346 at 4/31; Seth Tr. 2002:7-2004:13.) As would be expected based on the binding function of HPMC, it was found that when less HPMC, the 5 milligrams, was used, more omeprazole was lost in the air filters at the top of the fluid bed granulator as opposed to being bound up with the HPMC to form agglomerates or granules. When more HPMC was used, 10 milligrams, more of the omeprazole was bound and agglomerated into granules, and less omeprazole was lost in the air filters. (Id.) Astra's attempt to suggest that Pharma Pass used the higher amount of HPMC in the formulation because of *chemical* stabilization of omeprazole is a mischaracterization of the evidence. For example, the testimony of Dr. Seth that Astra cites actually provides an explicit discussion of why, due to the binding properties of HPMC, manufacturing loss was reduced by using more HPMC. (*See* Seth Tr. 2003:9-2004:13.) This *physical* manufacturing loss evaluated by Pharma Pass has absolutely nothing to do with the chemical stability of omeprazole, the problem addressed in the '505 and '230 patents.

Even if Astra's total inclusion theory had been proven as to the micronized omeprazole in the core of KUDCo's product, it utterly fails to account for the unmicronized omeprazole present in KUDCo's products, which makes up 30% of the total omeprazole in KUDCo's cores. Astra addresses its failure of proof with regard to the unmicronized omeprazole by asserting, with no proper support, that the unmicronized omeprazole in KUDCo's formulations may simply be disregarded-that it is present in the core, but is intentionally allowed to degrade and therefore "sacrificial." The court finds that the unmicronized omeprazole in KUDCo's products is an important part of the formulations and is *not* sacrificial; therefore, contrary to Astra's suggestion, KUDCo's unmicronized omeprazole cannot simply be ignored for purposes of the infringement analysis.

KUDCo's first formulation used all micronized omeprazole. Preliminary bioequivalency studies for this formulation showed that while the total amount of omeprazole released was equivalent to Astra's Prilosec(R) product, the rate of release was too fast, and therefore, the formulation was not bioequivalent. (Siefert Tr. 2092:3-2094:7.) In other words, the formulation was bioequivalent to Prilosec(R) with respect to the *extent* of drug absorption in the body, but was not bioequivalent in terms of the *rate* of absorption, which was too high. (Id.) Specifically, clinical tests on KUDCo's first formulation resulted in reported values for LN(C_{max}), the absorption *rate*-related parameter, (Seth Tr. 2025:7-16), in the range of 115.7% to 143.9% of Prilosec(R). (P358 at KU16815.) Because the requirement for bioequivalence is within 80% to 125% of the reference drug, this formulation failed to meet this specific rate-related requirement for bioequivalence. (Id. at KU16816.) KUDCo's first formulation did meet the requirement for bioequivalence as to both of the two *absorption-extent* related parameters. Specifically, the reported results for those parameters were 102.0% to 117.4% and 100.6% to 115.6% of the reference drug, both within the range of 80% to 125%. (Id.; *see also* Seth Tr. 2025:17-23.) Because the first formulation was not bioequivalent in terms of *rate* of drug absorption, it was modified by substituting 30% of the micronized omeprazole with unmicronized omeprazole ("second formulation"), such that the final KUDCo product comprises 70% micronized omeprazole and 30% unmicronized omeprazole. The effect of this reformulation was to slow the rate of release of omeprazole since the larger, unmicronized omeprazole particles took longer to dissolve than the dust-like, micronized omeprazole particles. Thus, by adding unmicronized omeprazole to the core of

KUDCo's formulations, Dr. Seth lowered the rate of absorption in the body, and as a result, achieved bioequivalence with Prilosec(R). (Seth Tr. 1955:15-1957:20.)

Contrary to Astra's assertions that this unmicronized omeprazole is sacrificial, KUDCo's bioequivalency studies show that the unmicronized omeprazole in the core of KUDCo's omeprazole microtablets is absorbed in the body, even though the rate, and, to a lesser extent, the amount of absorption was reduced when unmicronized omeprazole was added to the core of the formulation.FN87 (Seth Tr. 2015:21-2017:15, 2028:22-2030:3.) KUDCo's omeprazole formulation is bioequivalent, and KUDCo's ANDA has been tentatively approved. (Seifert Tr. 2141:19-2142:19; K16.) Further, KUDCo's dissolution stability studies show that KUDCo's microtablet formulation is protected from degradation in the stomach, while 100% of the omeprazole, both micronized and unmicronized, is released for absorption in the intestine. (Siefert Tr. 2197:8-2201:24; K284 at KU 201508-518.) Therefore, contrary to Astra's theory, the court finds that the unmicronized omeprazole, which makes up 30% of the total omeprazole in KUDCo's products, is not "sacrificial" omeprazole that is intentionally allowed to degrade. Rather, as shown by KUDCo's long-term stability data, all of the omeprazole in KUDCo's core-both micronized and unmicronized-is intended to be, and is, stable and available for absorption into a patient's bloodstream.

FN87. Astra's argument that the decreased rate and amount of absorption of omeprazole indicates that the unmicronized omeprazole is sacrificial ignores relevant evidence relating to the parameters for the testing. The limited time frame of the plasma measurements in the clinical studies (covering a span of 12 hours per patient), (*see, e.g.,* P358 at K16888) had the side effect of showing a reduction of the amount of omeprazole released during the measurement period. (*Compare* P358 at KU 16815-16 (bioequivalence test results for the first formulation), *with* P358 at KU 16884-85 (results for final formulation).) Nonetheless, the extent of drug released during the measurement period for the second formulation was bioequivalent to Prilosec(R), just as it was for the first formulation. (Id.) Indeed, long-term stability data confirms that nearly 100% of the total omeprazole-micronized and unmicronized-remains available even after three years of storage, and there was no evidence that KUDCo's omeprazole experienced any color change, as would be expected if any of the omeprazole in the core were degrading.

Even assuming Astra had been able to demonstrate total inclusion and that the unmicronized omeprazole is sacrificial, Astra failed to prove that the HPMC in the KUDCo product stabilizes omeprazole, as all ARCs must do. Astra did present some evidence that HPMC, as a compound *in a solution in water* with omeprazole, may stabilize omeprazole. Omeprazole is quickly degraded in pure water, and the patent teaches that the half-life of omeprazole at neutral pH values is about 14 hours. (P1, col. 1:24-29.) In tests to determine how long its omeprazole would remain stable in the 10% HPMC solution used in its process to coat the lactose particles, KUDCo found that it could be held overnight without degradation. KUDCo's own expert, Dr. Auslander, admitted that he could not think of any way that stability could be achieved other than by having an ARC in the composition. Thus, KUDCo's own data provide some evidence, though by no means definitive evidence, that the 10% solution of HPMC used in KUDCo's process to suspend the micronized omeprazole stabilizes the micronized omeprazole *while in that solution*. However, that data does not demonstrate that the HPMC forms a protective film around that micronized omeprazole that continues to protect the omeprazole *throughout the remainder of the formulation process and during its shelf-life;* therefore, it is irrelevant because it fails to test the *core* of KUDCo's products. The evidence concerning the omeprazole in the 10% HPMC solution also completely ignores 30% of the omeprazole in the KUDCo products, which is unmicronized and which does not come into contact with HPMC in solution.

Something is stabilizing the omeprazole in KUDCo's core, but Plaintiffs have failed to prove that it is the HPMC acting as an ARC. Dr. Seth designed around the '505 and '230 patents by developing a formulation that did not require an ARC in its core. In developing his formulation, Dr. Seth used HPMC in the ways it was intended to be used, and as it is still used today, namely, as a binder in the core and as a film-forming compound in the subcoat. Dr. Seth created a formulation that is "exempt of alkaline reacting compounds." FN88 (Seth 1989:9-1990:4; *see* K158.) As such, it does not infringe the '505 and '230 patents. In fact, when Dr. Langer, Astra's formulation expert, was asked whether he would "necessarily use an alkaline reacting compound if [he] formulated omeprazole by granulation"-which is the process that Dr. Seth used, and KUDCo uses-he said "not necessarily, no." Thereafter, in describing his other choices, Dr. Langer testified that it would be possible to use a "neutral compound" with fluid bed granulation. Significantly,this is what KUDCo does. KUDCo uses fluid bed granulation, which is a relatively dry and gentle process, with HPMC, an inert, neutral compound, as a binder to form lactose, micronized omeprazole and HPMC granules. (Langer Tr. 5039:8-14.) Additionally, Dr. Lovgren, one of the inventors on the '505 and '230 patents, conceded that it is possible to design a stable omeprazole formulation that has an enteric coat, an intermediate layer, and a core containing omeprazole without an ARC.FN89 (Lovgren Dep. Tr. at 563:15-569:25, 572:4-573:22, 719:19-720:2; G154.) Because KUDCo's omeprazole products do not read on the alkaline reacting compound in each of the asserted claims in the '505 and '230 patents, KUDCo's omeprazole products do not infringe those patents.

FN88. In fact, as a result of his work, the PTO granted Dr. Seth a patent claiming an omeprazole preparation that is "exempt of alkaline-reacting compounds." That patent covers KUDCo's omeprazole formulation. (Seth Tr. 1989:9-1990:4; K158.) Of course, the fact that Dr. Seth has received a patent on his formulation is not relevant to the issue of noninfringement, and the court has not ruled upon it.

FN89. Indeed, Dr. Lovgren also subsequently filed an international patent application on another omeprazole formulation having a subcoat and an enteric coat, in which the alkaline compound was only an *optional* ingredient in the core.

Astra argues that even if the court adopts KUDCo's interpretation of the patent claims that KUDCo's omeprazole product infringes under the doctrine of equivalents. However, the court finds that KUDCo's products do not meet the alkaline reacting compound claim limitation under the doctrine of equivalents either. In support of its assertion of infringement under the doctrine of equivalents, Astra argues that in the KUDCo formulations: (1) the micronized omeprazole is stabilized with HPMC during manufacturing; (2) the HPMC totally includes the micronized omeprazole, and (3) the unmicronized omeprazole is sacrificial. As can be seen from a quick review of these arguments, they closely mirror the arguments made by Astra as to literal infringement. At least because the court has previously found that the unmicronized omeprazole in KUDCo's products is not "sacrificial" and that Astra failed to prove that the micronized omeprazole is fully included in HPMC, any stabilization of micronized omeprazole by the HPMC/water suspension for a few moments during manufacture does not demonstrate the existence of an ARC in the core of KUDCo's products any more for purposes of the doctrine of equivalents than it did in the court's literal infringement analysis.

Astra has not provided the required particularized testimony or linking arguments to show that KUDCo's formulated product-the subject of the claims-infringes under the doctrine of equivalents. Altech Controls Corp. v. E.I.L. Instruments, Inc., 71 F.Supp.2d 677, 684-85 (S.D.Tex.1999). Nor has Astra provided

discussion of any of the various accepted analytical frameworks for infringement under the doctrine of equivalents. It has not provided an analysis of the function-way-result test, the insubstantial differences test, or the known interchangeability test. (*See* AFF 5.4.4.1.-.4.) Although Astra's equivalence argument is not clearly set forth, it simply seems to be based on the concept that any omeprazole formulation that "works" and is stable must infringe the claims. But, as the Court of Appeals for the Federal Circuit has held, evidence and argument relating to infringement under the doctrine of equivalents cannot be subsumed in a plaintiff's case of literal infringement. Lear Siegler, Inc. v. Sealy Mattress Co. of Michigan, 873 F.2d 1422, 1425 (Fed.Cir.1989).

V. Invalidity Defenses

[69] [70] Defendants have raised numerous defenses of invalidity, including failure to comply with the requirements of 35 U.S.C. s. 112, lack of novelty, and obviousness, against the asserted claims of the '505 and '230 patents. Each patent is presumed valid, and each claim of any patent is presumed valid irrespective of the validity of any other claim. 35 U.S.C. s. 282 (2002); Apple Computer, Inc. v. Articulate Sys., Inc., 234 F.3d 14, 24 (Fed.Cir.2000); Jones v. Hardy, 727 F.2d 1524, 1528 (Fed.Cir.1984). Given this statutory presumption, a patent challenger has the burden of proving invalidity by clear and convincing evidence. Robotic Vision Sys. Inc. v. View Eng'g Inc., 189 F.3d 1370, 1377 (Fed.Cir.1999); Hybritech, Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 1375 (Fed.Cir.1986). The Supreme Court has defined "clear and convincing" evidence as that which gives the finder of fact "an abiding conviction that the truth of [the proponent's] factual contentions [is] 'highly probable'." Colorado v. New Mexico, 467 U.S. 310, 316, 104 S.Ct. 2433, 81 L.Ed.2d 247 (1984) (citation omitted). The burden of showing invalidity of each claim individually and by clear and convincing evidence rests on Defendants and remains constant throughout the trial. Am. Hoist & Derrick Co. v. Sowa & Sons, 725 F.2d 1350, 1358-60 (Fed.Cir.1984).

[71] When, as here, a party asserts invalidity of a patent and bases that assertion on evidence, including prior art references, that was before the patent examiner when he allowed the patent claims, the difficulty of overcoming the presumption of validity is greater than it would be if the evidence relied on was not before the examiner. Am. Hoist & Derrick Co., 725 F.2d at 1358-60. The party attacking validity has the burden of overcoming the deference that is due to a governmental agency presumed to have done its job properly. Id., 725 F.2d at 1359. In determining whether to allow the application, the patent examiner is also presumed to have considered each reference that was before him individually and in combination with every other reference before him. In re Portola Packaging, Inc., 110 F.3d 786, 790 (Fed.Cir.1997); Applied Materials, Inc. v. Advanced Semiconductor Materials Am., Inc., No. C-92-20643, 1994 WL 270714, 1994 U.S. Dist. LEXIS 17569, (N.D.Cal. Apr. 18, 1994). Deference must be given to the findings of fact of the USPTO on the issues of validity, identity of invention, and enablement with respect to the prior art that was before the patent examiner. *See* Am. Hoist, 725 F.2d at 1359-60.

A. Defenses Raised Pursuant to 35 U.S.C. s. 112

[72] [73] [74] [75] [76] [77] Title 35 U.S.C. s. 112 in pertinent part states that "[t]he specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains ... to make and use the same ...." *Id*. The enablement requirement ensures that the public knowledge is enriched by the patent specification to a degree at least commensurate with the scope of the claims. Nat'l Recovery Techs. Inc. v. Magnetic Separation Sys., Inc., 166 F.3d 1190, 1195 (Fed.Cir.1999). A patent is invalid unless it contains the required enabling description. Atlas Powder Co. v. E.I. du Pont De Nemours & Co., 750 F.2d 1569, 1576 (Fed.Cir.1984). The scope of the claims must be less than or equal to the specification for the

enablement. Nat'l Recovery, 166 F.3d at 1196. However, a patent need not teach what is well known in the art. Ajinomoto Co. v. Archer-Daniels-Midland Co., 228 F.3d 1338, 1345 (Fed.Cir.2000); In re Myers, 56 C.C.P.A. 1129, 410 F.2d 420, 424 (C.C.P.A.1969). Invalidity for lack of enablement is a conclusion of law and must be supported by clear and convincing evidence. Nat'l Recovery, 166 F.3d at 1195. The test for enablement requires a determination of whether any person skilled in the art can make and use the invention without undue experimentation. In re Wands, 858 F.2d 731, 737 (Fed.Cir.1988). A conclusion of nonenablement must be based on the evidence as a whole. *Id.*

[78] The enablement requirement is met if the description enables *any* mode of making and using the invention. Johns Hopkins Univ. v. CellPro, Inc., 152 F.3d 1342, 1361 (Fed.Cir.1998) (emphasis added). The fact that some experimentation is necessary does not preclude enablement. Atlas Powder Co. v. E.I. du Pont De Nemours & Co., 750 F.2d 1569, 1576 (Fed.Cir.1984). "[I]t is imperative when attempting to prove lack of enablement to show that one of ordinary skill in the art would be unable to make the claimed invention without undue experimentation." Johns Hopkins Univ. v. Cellpro, 152 F.3d 1342, 1360 (Fed.Cir.1998). "The test for undue experimentation is not merely quantitative, since a considerable amount of experimentation is permissible, if it is merely routine, or if the specification in question provides a reasonable amount of guidance with respect to the direction in which the experimentation should proceed to enable the determination of how to practice a desired embodiment of the claimed invention." *Id.*

[79] In addition to the enablement requirement, the claims of a patent must be adequately supported by the written description of the inventions set forth in the patent specification to comply with the first paragraph of section 112. *See* Reiffin v. Microsoft Corp., 214 F.3d 1342, 1345 (Fed.Cir.2000). This requirement exists "to ensure that the scope of the right to exclude, as set forth in the claims, does not overreach the scope of the inventor's contribution to the field of art as described in the patent specification." Reiffin, 214 F.3d at 1345 (citations omitted). The written description requirement is broader than merely explaining how to make and use the invention; the applicant must also convey with reasonable clarity to those of skill in the art that, as of the filing date, he or she was "in possession" of the invention. Purdue Pharma L.P. v. Faulding, Inc., 230 F.3d 1320, 1323 (Fed.Cir.2000) (citation omitted). To do so, the patent specification must "describe an invention and do so in sufficient detail that one skilled in the art can clearly conclude that 'the inventor invented the claimed invention.' " Regents of the Univ. of Cal. v. Eli Lilly & Co., 119 F.3d 1559, 1566 (Fed.Cir.1997) (citation omitted). While the disclosure need not parrot the language of the claims, "one skilled in the art, reading the original disclosure, must immediately discern the limitation at issue in the claims." Purdue Pharma, 230 F.3d at 1323 (citations omitted). Thus, even if the specification enables one skilled in the art to make and use the invention, it may still fail to meet the requirements of s. 112. *See* Vas-Cath, Inc. v. Mahurkar, 935 F.2d 1555, 1561-62 (Fed.Cir.1991); Application of Barker, 559 F.2d 588, 593 (C.C.P.A.1977). The specification must support the full scope of the patent claims and must " 'describ[e] the invention, with all its claimed limitations ....' " Eli Lilly, 119 F.3d at 1566 (citation omitted).

Title 35 U.S.C. s. 112, second paragraph, states, "The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention." *Id.* The definiteness requirement of s. 112, second paragraph, forces a patentee to draft claims with clarity and precision. *See* In re Borkowski, 57 C.C.P.A. 946, 422 F.2d 904, 909 (C.C.P.A.1970). Section 112 sets forth two requirements: (1) that the claims be drafted with precision and definiteness, and (2) that the claims be directed to the subject matter that the applicant regards as his or her invention. In re Borkowski, 422 F.2d at 909 ("If the scope of the subject matter embraced by a claim is clear, and if the applicant has not otherwise indicated that he intends the claim to be of different scope, then the claim does particularly point out and distinctly claim the subject matter which the applicant regards as his invention.")

(citation omitted).

Compliance with this aspect of section 112 is considered necessary to preserve the notice requirement of a patent. Solomon v. Kimberly-Clark Corp., 216 F.3d 1372, 1379 (Fed.Cir.2000) ("As has been noted in the context of definiteness, the inquiry under 35 U.S.C. section 112, paragraph 2, now focuses on whether the claims, as interpreted in view of the written description, adequately perform their function of notifying the public of the patentee's right to exclude."). The skilled-artisan standard is used when analyzing claim language for a section 112, second paragraph analysis. Atmel Corp. v. Info. Storage Devices, Inc., 198 F.3d 1374, 1378 (1999) (noting that "[a]s a general matter, it is well-established that the determination whether a claim is invalid as indefinite depends on whether those skilled in the art would understand the scope of the claim when the claim is read in light of the specification.") (citation omitted). Further, a claim that is inconsistent with the specification may make the claim take on an unreasonable degree of uncertainty. *See* In re Cohn, 58 C.C.P.A. 996, 438 F.2d 989, 1000-01 (C.C.P.A.1971).

[80] The test for determining whether a claim meets the definiteness requirement is "whether one skilled in the art would understand the bounds of the claim when read in light of the specification." LNP Eng'g Plastics, Inc. v. Miller Waste Mills, Inc., 275 F.3d 1347, 1359 (Fed.Cir.2001); Amgen, Inc. v. Chugai Pharm. Co., 927 F.2d 1200, 1217 (Fed.Cir.1991). The degree of precision with which the claims must be stated to meet the definiteness requirement "is a function of the nature of the subject matter." Miles Labs. v. Shandon Inc., 997 F.2d 870, 875 (Fed.Cir.1993). Thus, "the amount of detail required to be included in claims depends on the particular invention and prior art, and is not to be viewed in the abstract," but rather in conjunction with the specifications of the patent. Shatterproof Glass Corp. v. Libbey-Owens Ford Co., 758 F.2d 613, 624 (Fed.Cir.1985).

Defendants raise challenges under section 112 to claims 5, 6, 9, and 11 of the '505 patent and claims 1, 6, 7, 10-13, and 15 of the '230 patent. For the most part, Defendants' attacks object to a term or phrase used in a claim or claims on the basis that the term or phrase is indefinite, not enabled, or insufficiently described by the patents. Given the nature of Defendants' challenges, the court's analysis with respect to a particular term applies to all claims in which that term appears, so the court will consider the disputed terms seriatim.

1. The Term "Microenvironment"

[81] The term microenvironment appears in claims 5 and 6 of the '505 patent and claims 6 and 7 of the '230 patent. Genpharm argues that claim 5 of the '505 patent, like all other claims in which the term "microenvironment" appears, is invalid under 35 U.S.C. s. 112 for indefiniteness because the term "microenvironment" is unclear. However, none of the arguments marshaled by Genpharm provides the required clear and convincing evidence to support invalidity of the claims including the term "microenvironment" for failure to comply with section 112. The fact that the word "microenvironment" appears only in the claims of the patents carries no weight. The examiner allowed the claims that include it to be issued and presumably was convinced that the claims were supported by the specification, particularly the inventors' explanation of their understanding of how the invention works and their references to "micro-pH," (*see* P1, col. 3:13-col. 4:2; P2A, col. 7:51-col. 8:65). *See* Mas-Hamilton Group v. La Gard, Inc., 21 F.Supp.2d 700, 717 (E.D.Ky.1997) ("There is a heavy presumption against [Defendants] in arguing that the patents and claims do not comply with 35 U.S.C. s. 112 where the Examiner reviewed the adequacy of the descriptions and found the patent descriptions to be definite and allowed the patents thereafter."). The fact that more specific methods of measuring the pH of the microenvironment are not discussed in the patent likewise carries no weight, when those skilled in the art would understand how to make such measurements.

Dr. Story testified at trial that the term "microenvironment" is not defined sufficiently and one skilled in the art would not know how to measure the pH of the microenvironment and would have been unable to determine the bounds of those claims. (Story Tr. 4665:12-4666:3.) However, Dr. Story did not conduct any literature searches to ascertain the meaning of the claim terms. (Story Tr. 4823:25-4824:5.) Dr. Story admitted that he gave his opinion based only on personal knowledge and that he did not "speak for the world." (Story Tr. 4829:25-4830:2; 4912:15-4913:6.) There is ample evidence that the terms "micro-pH" and "microenvironment" were known and understood by those skilled in the art at the time of the patents. Even Dr. Marshall, Genpharm's expert, recognized that by 1986 it was known that pharmaceutical dosage forms could have an "alkaline microenvironment." (P1299, Rep. No. 4, at 3, 5, at Ex. 10.)

The record shows that "microenvironment" and "micro-pH" are terms known in chemistry in general both before and after the filing date of the '505 patent, in the fields of immunodiagnostics, (P1305 at 20-21, published in 1984), resins for carbonless paper, (P1303, col. 5:5-12, published in 1987 but filed in 1985), as well as pharmaceutical sciences, (*see e.g.,* P1304, col. 2:63-67; P1309; P1310 at 42). (*See* Lovgren Tr. 4459:14-21.) For example, International Patent WO 84/02193, which was published on June 7, 1984, states, "In another embodiment, the porous structure of the support can create a micro-pH environment different from the pH of the solution." (P1305 at 20, ll. 29-32; Story Tr. 4911:19-4912:14.) Mead Corporation filed a patent on November 13, 1985, that states, "While reference is herein made to the bulk pH of the reaction system, those skilled in the art will appreciate that it is the pH in the microenvironment of the enzyme that is critical." (P1303, col. 5:5-12; Story 4825:20-4826:7.) An article dated October of 1987 and published in the Proceedings of the National Academy of Sciences, Exhibit P768A, also describes determining the microenvironment pH in a pharmaceutical device using microelectrodes. (Davies Tr. 793:11-20; P768A; *see also* Davies Tr. 1113:12-1114:16.) A 1989 article from the *International Journal of Pharmaceutics,* a peer-reviewed journal, states, "The pH at the surface of a dissolving compact was estimated using an adaptation of the dissolution apparatus and a micro-pH probe," (P1309 at 225; Story Tr. 4824:6-16, 4825:9-13), and a later article in that same journal in 1998 notes that "Doherty and York (1989) proposed that formulation buffers can be incorporated to modify the microenvironmental pH in order to control the solubility of the drug in the diffusion layer." It also states, "[f]or this reason, in this study pharmaceutical additives have been included in formulations in order to modify the microenvironmental pH." (P1310 at 42; Story Tr. 4827:6-4828:2.) Genpharm's attempt to dismiss these references on the basis of their precise publication dates misses the point. Astra does not cite these sources to show the state of the art for novelty or obviousness purposes, but rather to show that the concepts of microenvironment and micro-pH had meaning to those skilled in the art in that period. By the time a publication is distributed to those working in the relevant fields in, say, 1987, the court may presume that knowledge sufficient to understand that document is already present and had existed among those expected to read it for some time before that publication.

Despite these disclosures, at trial Dr. Story expressed the concern that a microenvironmental pH is "a term which can mean anything anyone wants it to." (Story Tr. 4822:9-4823:24.) In the context of a defense under section 112, however, the court is concerned with what the inventors conveyed about the meaning of the term in the claims and patent specifications. The '505 patent explains microenvironmental pH, and the court finds that a formulator reading the patent at the time of filing would understand the term and how it is determined. The '505 patent explains that ARCs should be added to the core region so that the "micro-pH around each omeprazole particle" is greater than pH 7. (P1, col. 3:43-44.) A formulator would understand that description to refer to the immediate surroundings of the omeprazole particles, in other words, the "environment right near it, immediately adjacent to it." (Langer Tr. 318:17-24; *see also* Langer Tr. 589:7-21; Pilbrant Tr. 1336:16-22; Auslander Tr. 2691:3-7.) In 1986 a formulator also would understand that the

microenvironment of a given formulation is dictated by processing ingredients and conditions. Because microenvironmental pH concerns the immediate vicinity around the omeprazole particles, the specific steps taken to measure micro-pH must depend on how the formulation is made.FN90 (Langer Tr. 619:1-19; Davies Tr. 889:14-24; *see also* Pilbrant Tr. 1498:12-23.) The exact "size" of the microenvironment depends on the way the core is formulated, including the substances in it. (Davies Tr. 1173:8-1176:24.) For example, in Andrx's and Genpharm's products, the ARCs and excipients are dissolved in water, along with suspended micronized omeprazole particles, and then sprayed onto sugar seeds. Accordingly, the region around the omeprazole particles in those formulations is represented by all the excipients in that omeprazole-containing layer, excluding the sugar seeds. (*See* Auslander Tr. 2691:3-17.) In any event, the exact depth of the microenvironment is irrelevant in the absence of any proof-and Genpharm has provided none-that the number any scientist assigns to the concept will significantly influence the value of the pH measured. (*See* P1, col. 3:37-47.) Dr. Story's conclusory testimony that the term "can mean anything anyone wants it to," (Story Tr. 4823:6-7), only stands for the proposition that scientists may have different views about some theoretical aspect of the microenvironment, but it hardly establishes by clear and convincing evidence that those different theoretical views would have any impact on the value measured, or present any problem measuring the pH of the pH-buffering alkaline compound or ARC in the core that "render[s]" the specified pH to the microenvironment of the omeprazole that "comprises" the core.

FN90. Defendants try to suggest that Drs. Langer and Davies attached certain numerical dimensions for microenvironment, regardless of the sample. This is a distortion. Drs. Langer and Davies clearly stated that the identity of the microenvironment depends on how the formulation is made. (Langer Tr. 619:19; Davies Tr. 1284:20-1285:9.) Consequently, it is no surprise that depending on the formulation the microenvironment *could* include 10 microns, 20 microns, or even 100 microns. That testimony of Drs. Langer and Davies is also consistent with the testimony of Dr. L ovgren, who explained that "microenvironment" is not necessarily measured in nanometers, microns, or centimeters; it is a concept that tells the formulator to measure the pH in the vicinity of the omeprazole particles in the formulation. (Lovgren Tr. 4460:25-4461:3, 4461:22-4462:4.)

Dr. Lovgren testified that he measured the micro-pH of omeprazole, as well as other benzimidazoles, before the application for the '505 patent was filed, (Lovgren Tr. 4460:4-4462:7), and the '505 patent explains to a formulator how to measure the pH of the omeprazole in the microenvironment: look at the environment around the omeprazole particles when small amounts of water are added. (P1, col. 3:38-47.) Dr. Auslander understood that teaching, (Auslander Tr. 2603:23-2605:9), and Drs. Langer, Davies, Pilbrant, and Lovgren concurred, (Langer Tr. 728:18-729:1; Davies Tr. 1146:19-1147:8; Pilbrant Tr. 1690:17-1691:22; Lovgren Tr. 4459:8-10.) No special apparatus is required to measure microenvironmental pH, provided that the pH of the appropriate "mixture" is measured. Contrary to the arguments raised in Defendants' briefs, Dr. Auslander was not concerned about the kind of electrode used to measure micro-pH. (Auslander Tr. 2584:11-16.) Dr. Lovgren explained that normally microenvironment is determined using some type of pH electrode and that such measurements are a conventional technique. (Lovgren Tr. 4459:22-4460:3.) Dr. Davies harvested very small samples from the tiny pellets in various Defendants' products; therefore, it made sense to use a microelectrode for his work because he wanted to measure the pH of a small amount of material in a small amount of water, as required by the patents. (Davies Tr. 4204:21-4205:3.) For the foregoing reasons, the court concludes that Defendants have failed to demonstrate the invalidity of claims 5 and 6 of the '505 patent and claims 6 and 7 of the '230 patent under section 112.

2. The "Water Content" Claim Limitation

[82] Claim 9 of the '505 patent and claim 11 of the '230 patent are directed to a preparation where the water content of the final dosage form does not exceed 1.5% by weight. (P1, col. 17:20-22; P2A, col. 14:30-32.) Genpharm argues that the disclosures in the '505 and '230 patents, (*see, e.g.,* P1, col. 14:42-61), do not provide adequate written description under 35 U.S.C. s. 112 to support a claim limitation of water content not in excess of 1.5%. Dr. Story's criticisms were based on his assertion that the patents lack data showing the criticality of the 1.5% moisture claim limitation. However, "[t]he law imposes no obligation on a patent applicant to ... set the claim limits at the precise technological edge of the invention. A claim is not fatally indefinite for failing specifically to delineate the point at which the change in physical phenomenon occurs." Andrew Corp. v. Gabriel Elecs., Inc., 847 F.2d 819, 823 (Fed.Cir.1988).

The 1.5% limitation was present in both original specifications and claims. (P7A at 8, 32; P8A at 16, 22; P1, col. 5:63-67; P2A, col. 10:40-44.) The examiner found them to be sufficiently supported and issued the claims. Contrary to Defendants' contentions, the specification clearly discusses the added benefits of low water content in the formulation:

The stability of omeprazole pellets according to the invention was compared with that of omeprazole pellets with higher water content. Omeprazole pellets were prepared according to the invention with a water content of 1%. Two other portions of the same formulation were conditioned to a water content of 2% and 5% respectively. The three formulations, packed in tight containers not containing a desiccant, were stored for one month at +50C. After this time the packages were opened and the pellets were assayed for the amount of omeprazole by HPLC. The formulation according to the invention had an omeprazole content of 98.5% of the initial value. The other two formulations with a water content of 2 and 5% respectively were virtually totally degraded and had only trace amounts of intact omeprazole.

(P1, col. 14:46-61.) Defendants have not provided any evidence that either the '505 or the '230 patent does not adequately disclose the invention claimed in claim 9 so as to enable a person skilled in the art to practice the invention at the time the application was filed without undue experimentation. Accordingly, Defendants cannot meet their clear and convincing burden of showing that claim 9 of the '505 patent or claim 11 of the '230 patent is invalid under 35 U.S.C. s. 112.

3. Treatment of Gastrointestinal Disease

[83] Claim 10 of the '505 patent and claim 13 of the '230 patent concern a method of treating gastrointestinal disease using a composition covered by claims 1. Dr. Story provided testimony alleging that the patent lacks sufficient data showing that the formulation could be used for the treatment of gastrointestinal disease. The claims as originally filed were directed to a method of treating gastrointestinal disease. (P7A at 32; P8A at 23.) The formulation described by Example 2 of the '505 patent discloses and is not materially different from Astra's commercial product Prilosec(R), (Pilbrant Tr. 1452:14-22), and both the '505 and '230 patent specifications explain that the daily dose will depend on factors such as the individual requirements of the patient, (P1, col. 6:15-19; P2A, col. 10:56-59). There can be no question that the '505 and '230 patent specifications support the claims and that a person of ordinary skill in the art could arrive at a suitable dosage for treating gastrointestinal disease. (*See* P1299, Ex. 6 at 1 (describing clinical studies on dosage form 10-30 mg/day).) Again, Defendants have failed to present any credible evidence that claim 10 is invalid. The patent clearly enables one of ordinary skill in the art to use the formulation as claimed in claim 10 to treat gastrointestinal disease. One who infringes will not be heard to say the claimed invention does not work. E.I. du Pont De Nemours & Co. v. Berkley & Co., Inc., 620 F.2d 1247, 1258 (8th Cir.1980). Moreover, there is no requirement, above and beyond the enablement provisions of 35 U.S.C. s.

112 that would require the inclusion of such data. Here the facts are indisputable. Formulations falling within the scope of claim 10 can be used to successfully treat gastrointestinal disease.

4. Alkaline Buffering Compound in the Subcoating

[84] Claim 11 of the '505 patent and claim 15 of the '230 patent require an alkaline buffering compound in the subcoating. Genpharm argues those claims are invalid under section 112 because the use of an alkaline buffering compound in the subcoating is unsupported by the '505 patent specification. Specifically, Genpharm argues that the examples in the '505 patent demonstrate that when the subcoating contains an alkaline buffering compound, a second subcoating without an alkaline buffering compound is required. (P1, col. 6:54-65, Table 2, III, IV; P1, col. 10:22-33, Ex. 6; *see* Lovgren Tr. 4476:24-4477:10.) There can be no question that the specifications teach that the subcoating can contain a pH-buffering compound. (P1, col. 4:28-30 ("The separating layer consists of one or more water soluble inert layers, optionally containing pH buffering compounds."); P2A, col. 9:23-25.) In addition, a person of ordinary skill would be able to determine the level of buffering compound in the subcoating by routine experimentation. (Langer Tr. 436:18-437:13.) *See* Johns Hopkins Univ. v. CellPro, 152 F.3d 1342, 1360 (Fed.Cir.1998). Defendants have failed to prove invalidity of these claims by clear and convincing evidence.

5. Acid-Labile Pharmaceutically Active Substance

[85] Genpharm argues that claim 1 and all other asserted claims of the '230 patent are invalid for lack of support under 35 U.S.C. s. 112 based on the allegedly unsupported scope of the claim limitation "acid-labile pharmaceutically active substance." At a minimum, the claim term "acid-labile pharmaceutically active substance" encompasses all of the benzimidazoles set forth in the specification of the '230 patent. (P2A, col. 5:48-col. 7:58; Story Tr. 4682:3-7; Langer Tr. 556:9-558:16; Pilbrant Tr. 1547:2-7; Lovgren Tr. 4487:20-4488:6.) Genpharm argues that the three examples provided in the '230 patent are not representative of the compounds listed in the specification. Defendants rely on the testimony of Dr. Lovgren to suggest that the '230 patent is not enabled because information for formulating one benzimidazole compound allegedly cannot be extrapolated to benzimidazole compounds. Defendants fail to acknowledge that the testimony of Dr. L ovgren makes it clear that a skilled formulator would be able to extrapolate among benzimidazole compounds. (Lovgren Tr. 4488:15-24.) Dr. Lovgren explained that even though they are different substances, different benzimidazoles share many properties. (Lovgren Tr. 4489:13-17.) Defendants further assert that the three formulations exemplified in the '230 patent are not remotely representative of all the benzimidazole compounds and that those examples do not teach a formulator how to use the claimed formulations. In particular, Defendants rely on Dr. Story, who testified that "there are absolutely no examples whatsoever to demonstrate that the compound, any compound that is included under Claim 1 in fact works." (Story Tr. 4684:3-6.) In the end, Dr. Story and Defendants would have the court believe that none of the sixteen different patents and patent applications concerning benzimidazole compounds recited in column 2 of the '230 patent disclose compounds that will be biologically active. (*See* P2A, col. 1:5-11 (noting that field of invention relates to method of affecting gastric acid secretion).) Dr. Story's conclusory testimony is insufficient to establish invalidity. The court finds that Defendants have failed to meet their burden to establish invalidity of the asserted claims of the '230 patent under s. 112.

6. "Stability of the Preparation is Enhanced"

[86] In addition, Genpharm argues that claims 1 and 12 of the '230 patent and all asserted dependent claims are invalid for lack of enablement and indefiniteness under 35 U.S.C. s. 112 based on the allegedly undefined and unsupported claim limitation of enhanced stability. Dr. Story criticizes the claims because the

patent lacks data showing that "the stability of the preparation is enhanced." (Story Tr. 4581:24-4583:20.) Examples are, however, not required to satisfy section 112, first paragraph. In re Strahilevitz, 668 F.2d 1229, 1232 (C.C.P.A.1982). Accordingly, in the present case, there is no requirement that the '230 patent include any examples of stability data, as long as the disclosure enables one of ordinary skill in the art to make and use the invention. (*See* Story Tr. 4817:18-4822:8.) Defendants provide no evidence that stability is not enhanced as described and claimed in the '230 patent, and the court finds that Defendants have failed to demonstrate that the claims are not enabled.

Genpharm also argues, as it does with respect to "microenvironment," that the phrase "the stability of the preparation is enhanced" does not particularly point out and distinctly claim the invention, as required by the second paragraph of section 112. Genpharm's contentions are based on a presumption, not required by law or logic, that this phrase must have some express definition or be supported by specific, numerical tests. "Enhanced," however, has its ordinary meaning as a relative term, which directly implies a comparison. The point of comparison is plainly relative to a formulation without the claimed subcoating. This construction directly flows from the claim language. (P2A, col. 13:17-20 ("wherein the subcoating layer isolates the alkaline reacting core from the enteric coating layer such that the stability of the preparation is enhanced").) "Stability" is defined in the specification in terms of gastric acid resistance and degradation of omeprazole. (P2A, col. 10:26-28 ("Without this separating layer the resistance towards gastric juice would be too short and storage stability of the dosage form would be unacceptably short.").) Additional references to degradation and discoloration during manufacture and storage and to gastric acid resistance are also present in the patent. (P2A, col. 9:1-4, col. 3:66-col. 4:56.) The '230 patent specification further teaches that without the subcoating the enteric coating would "otherwise cause degradation/discoloration of the acid labile compound during the coating process o[r] during storage," (P2A, col. 9:1-4), and that gastric acid resistance is thereby decreased, (*see* P2A, col. 3:66-col. 4:56). Accordingly, "stability" has two points of reference: the subcoating layer cannot decrease the gastric acid resistance or accelerate omeprazole degradation. Both properties must be better-enhanced-compared to the formulation without the subcoating. *See* Seattle Box Co. v. Indus. Crating & Packing, Inc., 731 F.2d 818, 826 (Fed.Cir.1984) ("When a word of degree is used the district court must determine whether the patent's specification provides some standard for measuring that degree," such that a person of ordinary skill in the art would understand what is claimed.). In view of these standards relative to stability, and the allowance of the claims by the Patent Examiner, who presumably found them clear, it is irrelevant that there are no tests or data concerning enhanced stability and no express numerical definitions of "enhanced stability" in the patent. *See* Andrew Corp. v. Gabriel Elecs., Inc., 847 F.2d 819, 823 (Fed.Cir.1988) ("The law imposes no obligation on a patent applicant to ... set the claim limits at the precise technological edge of the invention. A claim is not fatally indefinite for failing specifically to delineate the point at which the change in physical phenomenon occurs.") No evidence in the record beyond Dr. Story's conclusory statements regarding invalidity under section 112 supports Genpharm's argument. The court finds that Defendants have failed to provide clear and convincing evidence that the examiner erred in concluding that the claims were sound and in issuing the claims of the '230 patent.

B. Anticipation

Defendant Genpharm argues that nine different combinations of the prior art render claim 1 of the '505 patent invalid for either lack of novelty or obviousness. Twelve different combinations of the prior art are asserted against the claims of the '230 patent. With respect to anticipation specifically, Genpharm argues that Astra's European Patent Application No. 0 124 495 (the " '495 patent") titled *Omeprazole Salts* and published on November 7, 1984, (*see* G345), renders claims 1, 8, 10, and 14 of the '505 patent invalid for lack of novelty. Genpharm also alleges that Astra's European Patent Application No. 0 173 664 (the " '664

patent") titled *Biologically Active Benzimidazole Compounds and Process for Their Preparation* and published on March 5, 1986, (*see* G23A), renders claims 1, 10, 12, and 13 and of the '230 patent invalid for lack of novelty.

[87] [88] A patent may not issue, and is invalid as anticipated, where the claimed invention "was patented or described in a printed publication in this or a foreign country ... more than one year prior to the date of the application for patent in the United States." 35 U.S.C. s. 102(b). It is well-settled that if a single prior art reference published more than one year before the date the patent application was filed FN91 discloses each and every limitation set forth in a claim, either expressly or inherently, the claim is invalid. In re Schreiber, 128 F.3d 1473, 1477 (Fed.Cir.1997); Verdegaal Bros. v. Union Oil Co., 814 F.2d 628, 631 (Fed.Cir.1987). When the claimed invention "reads on" a prior art reference, the invention is said to be anticipated by that reference, and any claim purporting to patent the invention is deemed invalid. *See* Atlas Powder Co. v. IRECO Inc., 190 F.3d 1342, 1346 (Fed.Cir.1999) (citing Titanium Metals Corp. v. Banner, 778 F.2d 775, 781 (Fed.Cir.1985)). To anticipate, a printed publication must also be enabling. In re Donohue, 766 F.2d 531, 533 (Fed.Cir.1985). With respect to a formulation patent claim, like many of the asserted claims of the '505 and '230 patents, the test of whether a prior art publication describes the thing that is claimed is whether that publication placed the claimed invention "in the possession of the public" as of the date the invention was made. The invention is placed "in the possession of the public" only where the reference "describes" the claimed invention to one of ordinary skill in the art-the "identity of invention" requirement-and where one skilled in the art would have been able to make it as of that time based on his own knowledge and the teaching of the publication-the "enablement" requirement. *See* Paperless Accounting, Inc. v. Bay Area Rapid Transit Sys., 804 F.2d 659, 665 (Fed.Cir.1986); In re Yale, 58 C.C.P.A. 764, 434 F.2d 666, 668-69 (C.C.P.A.1970).

FN91. In its post-trial briefing, Cheminor argues that Astra failed to demonstrate that it is entitled to the foreign priority dates for the '505 and '230 patents. The court need not resolve that issue, however, because Astra has not contested any of the prior art relied on by Defendants in this case on the basis that the *date* of publication is after the critical date. (*See, e.g.* Langer Tr. 5203:14-15 (admitting that the '664 patent is prior art to the '505 patent).)

The anticipation analysis comprises two steps. By construing the content and scope of the claims of the patents at issue, the court has already completed the first step. In the second step, the court must compare the properly construed claims to the allegedly anticipating prior art. *See* Helifix, Ltd. v. Blok-Lok, Ltd., 208 F.3d 1339, 1346 (Fed.Cir.2000). For a patent to be held invalid for prior description in an anticipating reference, there must be identity of invention between what is disclosed in the reference and the invention as claimed. Gen. Elec. Co. v. Nintendo Co., 179 F.3d 1350, 1355 (Fed.Cir.1999); Hoover Group, Inc. v. Custom Metalcraft, Inc., 66 F.3d 299, 302 (Fed.Cir.1995). Identity of invention is a question of fact. Finnigan Corp. v. Int'l Trade Comm'n, 180 F.3d 1354, 1362 (Fed.Cir.1999); Minnesota Mining & Mfg. Co. v. Johnson & Johnson Orthopaedics, Inc., 976 F.2d 1559, 1565 (Fed.Cir.1992). All of the claimed elements must be found within the four corners of that single publication, either expressly or inherently, as it is *understood* by the hypothetical person of ordinary skill in the art. *See* ATD Corp. v. Lydall Inc., 159 F.3d 534, 545 (Fed.Cir.1998); Scripps Clinic & Research Found. v. Genentech, Inc., 927 F.2d 1565, 1576-77 (Fed.Cir.1991). The person of ordinary skill in the art is a hypothetical person who is presumedto have the skill and experience of only an ordinary worker in the field but knowledge of everything known in the art. *See* Custom Accessories, Inc. v. Jeffrey-Allan Indus., Inc., 807 F.2d 955, 962 (Fed.Cir.1986).

Under the principles of inherency, if the prior art necessarily functions in accordance with, or includes, the claimed limitations, it anticipates ... the discovery of a previously unappreciated property of a prior art composition, or of a scientific explanation for the prior art's functioning, does not render the old composition patentably new to the discoverer.

[89] Atlas Powder Co. v. IRECO Inc., 190 F.3d 1342, 1347 (Fed.Cir.1999). Newly discovered results of known processes directed to the same purpose are inherent and unpatentable. *See* Bristol-Myers Squibb Co. v. Ben Venue Labs., 246 F.3d 1368, 1376 (Fed.Cir.2001) (citing In re May, 574 F.2d 1082, 1090 (C.C.P.A.1978)). Whether a person ordinarily skilled in the art would have recognized the inherent characteristics of the functioning of the prior art is irrelevant, if those inherent characteristics indeed exist. *See* Atlas Powder, 190 F.3d at 1349 ("Insufficient prior understanding of the inherent properties of a known composition does not defeat a finding of anticipation.") (citing Titanium Metals, 778 F.2d at 782).

[90] The court finds that Defendants have failed to prove facts that show clearly and convincingly that any single reference, read as one of ordinary skill in the art at the time of the invention would read it, describes each and every element of any claim of the '505 or the '230 patent. The first prior art reference that Defendants sponsor in support of their anticipation argument is Astra's European Patent Application No. 0 124 495 A2 (the " '495 patent") titled *Omeprazole Salts* that was published on November 7, 1984. (G345.) Arne Brandstrom is the only inventor listed on the '495 patent, which describes salts of omeprazole and discloses processes for their preparation, pharmaceutical compositions containing such salts, and their use in medicine. (Story Tr. 4593:4-8; G345, Front Page.) The court finds that the '495 patent does not disclose an inert subcoating disposed on the core, (*see* Langer Tr. 5025:14-18); therefore, the '495 patent does not anticipate the claims of either the '505 or the '230 patent.

The '495 patent is not a formulation patent; no formulations are described on page 7 or any other place in the specification of that patent except for the examples. (Lovgren Tr. 4546:5-4547:8.) Example 12 of the '495 patent is the only solid dosage formulation actually exemplified in the patent, and there is no subcoat in that example. (Story Tr. 4792:25-4793:22; Langer Tr. 5037:1-2; Lovgren Tr. 4547:22-4548:6.) Instead, Example 12 uses an enteric coating placed directly on the omeprazole salt-containing core. (Langer Tr. 5036:12-25; Lovgren Tr. 4548:6-8.) Thus, the '495 patent teaches omeprazole salt formulations that are enteric-coated but do not employ a subcoating. (Langer Tr. 5030:10-5031:1, P111 at 6.) When the '495 patent refers to gelatin capsules, it does not call them subcoatings. (Story Tr. 4790:12-14.) The '495 patent also does not describe a subcoating anywhere in the disclosure. (Story Tr. 4790:5-11; Langer Tr. 5025:14-18.)

Set forth below is the portion of the '495 patent disclosure that Defendants focus on for their invalidity assertion:

Soft gelatine capsules may be prepared with capsules containing a mixture of the active compound or compounds of the invention, vegetable oil, fat, or other suitable vehicle for soft gelatine capsules. Soft gelatine capsules are preferably enteric coated as described above. Hard gelatine capsules may contain enteric-coatedgranules of the active compound. Hard gelatine capsules may also contain the active compound in combination with a solid powdered carrier e.g. lactose, saccharose, sorbitol, mannitol, potato starch, corn starch, amylopectin, cellulose derivatives or gelatine; the hard gelatine capsules are preferably enteric coated as described above.

(G345, 7:1-10.) Defendants argue that the excerpt describing enteric coating filled capsules discloses a

subcoating. However, based on the ordinary meaning of the terms "subcoating" and "capsule," the patent specifications and the file histories for the '505 and '230 patents, the foreign proceedings raised by Genpharm, and other extrinsic evidence, the court has previously held that the term "subcoating," as it appears in claims 1 of the '505 and '230 patents does not include gelatine capsules. *See supra* Part II.D.2. To the person of ordinary skill at the time of the patents, then, the '495 patent would have been understood to describe formulations that do not include a subcoat, and the '495 patent fails on the "identify of invention" prong of the anticipation test. The court concludes that the '495 patent does not anticipate claims 1 of the '505 and '230 patents because it does not describe the "subcoating" required by the claims. As for the remaining asserted claims of the '505 and '230 patents, all claims require the subcoating of claims 1(b), or, in the case of the process claim, the application of such a subcoating. Therefore, the '495 patent does not anticipate any of the asserted claims in the '505 or '230 patents. *See* Intermatic Inc. v. Lamson & Sessions Co., 273 F.3d 1355, 1369 (Fed.Cir.2001).

The second reference that Defendants assert anticipates the claims of either the '505 or the '230 patents is Astra's European Patent Application No. 0 173 664 (the " '664 patent") titled *Biologically Active Benzimidazole Compounds and Process for Their Preparation* that was published on March 5, 1986. (G23A.) The '664 patent publication describes salts of benzimidazoles and discloses processes for their preparation, pharmaceutical compositions containing such salts, and their use in medicine. (G23A, Front Page.) The '664 patent and the '495 patent have the same disclosure regarding soft and hard gelatine capsules.FN92 (Story Tr. 4801:20-25.) The primary distinction for the purposes of this case is that the '664 relates to more stable benzimidazoles other than omeprazole. (Lovgren Tr. 1682:16-18, 1729:10-17.) For the same reasons the court finds that the '495 patent does not anticipate the claims of the '505 and '230 patents, the court also concludes that the '664 patent does not anticipate the claims of the '505 and '230 patents. The '664 patent does not disclose a subcoating as required by claims 1(b) and all the other asserted claims of the '505 and '230 patents. *See* Intermatic Inc., 273 F.3d at 1369.

FN92. In its Notice of Certification in this case, Andrx admitted that the '664 patent does not disclose a formulation with a subcoat. (P111 at 6; *see also* Langer Tr. 5030:10-5031:1.)

C. Obviousness

Defendants Andrx, Genpharm, and Cheminor have alleged that the asserted claims of the '505 and '230 patents are invalid for obviousness under 35 U.S.C. s. 103. Genpharm argues that either the '495 patent or an article by Pilbrant and Cederberg, Exhibit K58, when taken in combination with any one of four other references renders the asserted claims of the '505 patent invalid for obviousness. (*See* Story Tr. 4577:4-4578:5.) Defendants apply those same obviousness arguments to the asserted claims of the '230 patent. The only difference is the substitution of the '664 patent for the '495 patent.

1. Evidentiary Challenges

[91] The obviousness analysis begins with a key legal question-what is the invention claimed? Panduit Corp. v. Dennison Mfg. Co., 810 F.2d 1561, 1567 (Fed.Cir.1987). Courts are required to view the claimed invention *as a whole*. *Id*. Another preliminary inquiry is-what is the prior art? It must be known whether a patent or publication is in the prior art under 35 U.S.C. s. 102. Panduit Corp., 810 F.2d at 1568. Unlike the references Defendants relied on as prior art in support of their anticipation defenses, Astra challenges the authentication and publication status of two of the references relied on in support of the obviousness defenses. The two challenged references discussed by Dr. Story and relied upon by Defendants, TC-5,

Exhibit G919, and *Up-to-Date,* Exhibit G918, are excerpts of Japanese-language documents. The court reserved ruling as to their admissibility and relevance during the trial. Genpharm seeks to have these two exhibits admitted, and urges the court to hold these two documents are invalidating prior art. Astra objects to these two documents on several bases. First, Astra argues that discovery failures with respect to the *Up-to-Date* writing made it impossible for Astra to utilize its rights under Federal Rule of Evidence 106 to complete the record with additional portions of *Up-to-Date* not relied on by Genpharm that are relevant to the case. Therefore, Astra seeks preclusion under Rule 403 of the excerpts of the *Up-to-Date* writing on which Genpharm relies. The court finds that Astra has failed to demonstrate prejudice sufficient to warrant preclusion and denies Astra's motion. Astra was free to designate other portions of the document for admission. Astra has clearly known of the existence of the *Up-to-Date* writing for many years in the context of other litigation, and Astra failed to raise the issue that the *Up-to-Date* writing was an excerpt either during the deposition of Dr. Story or in Dr. Langer's rebuttal expert report.

[92] Second, Astra argues that Defendants have failed to demonstrate the authenticity of Exhibits G918 and G919, so they are inadmissible. Federal Rule of Evidence 901(a) provides that "the requirement of authentication or identification as a condition precedent to admissibility is satisfied by evidence sufficient to support a finding that the matter in question is what its proponent claims." The court finds that both TC-5 and *Up-to-Date* are authentic pursuant to the ancient-documents rule. Rule 901(b)(8) says that authentication requirements are satisfied by "[e]vidence that a document or data compilation, in any form, (A) is in such condition as to create no suspicion concerning its authenticity, (B) was in a place where it, if authentic would likely be, and (C) has been in existence for 20 years or more at the time it was offered." These requirements may be met by circumstantial evidence. United States v. Natale, 526 F.2d 1160, 1173 (2d Cir.1975).

Originals of both TC-5 FN93 and the *Up-to-Date* writing were found by counsel for Genpharm in a place they would likely be-Shin-Etsu's principal place of business. *See* Burgess v. Premier Corp., 727 F.2d 826, 835 (9th Cir.1984) (authenticating documents found in Defendants' warehouse). Counsel for Genpharm obtained a copy of TC-5 from Shin-Etsu's headquarters office in Tokyo, Japan. (Pan Decl. para. 4.) The *Up-to-Date* writing was located at Shin-Etsu's laboratory and was brought to Shin-Etsu's headquarters for inspection by counsel. (*Id.*) The originals of the writings are in a condition as to not create any suspicion of authenticity, (*see* Pan Decl. para.para. 4, 6, 8), and the court finds that there is sufficient evidence that the documents were created more than twenty years ago for purposes of authentication. The dates of the documents, along with their appearance and the testimony of Mr. Harold Zeller, establish that the documents are more than 20 years old. TC-5 is dated 1975/1978, and *Up-to-Date* was dated 1969. Mr. Zeller has been the United States distributor of Shin-Etsu's HPMC for thirty years. (Zeller Tr. 4713:13-4714:17.) Zeller identified the "75.9" on the back of the TC-5 writing as indicative of the date of the brochure-September 1975. (Zeller Tr. 4727:1-5.) While the dates on the documents alone may not be sufficient to authenticate the documents, there is independent, corroborating evidence of the condition of the documents that supports the finding that the documents are more than twenty years old. When the originals of the writings were inspected at Shin-Etsu's headquarters in Japan, both documents were in such a condition that they appear to have been read a number of times, with wrinkling of the cover and certain pages, and pages that are slightly torn. (Pan Decl. para. 6.) The *Up-to-Date* document had almost no binder left, and its pages were a yellowish color, and the corners of both covers are folded back. (Pan Decl. para. 8.) On the basis of these facts, the court finds that Defendants have established the authenticity of the TC-5 and *Up-to-Date* writings pursuant to Rule 901(b)(8). Since both documents have been authenticated pursuant to Rule 901(b)(8), they are admissible under the ancient document exception to the hearsay rule provided by Rule 803(16). The court admits Exhibits G918 and G919 in their entirety.

FN93. TC-5 is the trade name used by Shin-Etsu chemical, a Japanese manufacturer, to describe their low viscosity HPMC. (Zeller Tr. 4714:18-25.)

[93] In the event of their admission, Astra also argues that Defendants have failed to prove that Exhibits G918 and G919 qualify as "publications." To qualify as prior art, a reference must be a "printed publication" under the statutory definition of that term. The question of whether a document is a "printed publication" is a legal determination based on underlying issues of fact, and must be decided on a case-by-case basis. *N*. Telecom, Inc. v. Datapoint Corp., 908 F.2d 931, 936 (Fed.Cir.1990); In re Hall, 781 F.2d 897, 899 (Fed.Cir.1986). A document may be deemed a printed publication "upon a satisfactory showing that such document has been disseminated or otherwise made available to the extent that persons interested and [of ordinary skill] in the subject matter or art, exercising reasonable diligence, can locate it and recognize and comprehend therefrom the essentials of the claimed invention without need of further research or experimentation." In re Wyer, 655 F.2d 221, 226 (C.C.P.A.1981); *see* Carella v. Starlight Archery & Pro Line Co., 804 F.2d 135, 139 (Fed.Cir.1986); Massachusetts Inst. of Tech. v. AB Fortia, 774 F.2d 1104, 1109 (Fed.Cir.1985). "Cataloging a paper in a technical or scientific library makes the publication sufficiently accessible to those interested in the art to satisfy the requirements of s. 102(b)." Friction Div. Prods., Inc. v. E.I. DuPont De Nemours & Co., 658 F.Supp. 998, 1008 (D.Del.1987) (citing In re Hall, 781 F.2d at 900).

Having established authenticity, Defendants rely on three alternative theories to prove that TC-5 and *Up-to-Date* are publications: affirmative testimony and documents presented to the court, admissions by Astra, and adoptive admissions by Astra. However, the court finds that the Defendants have failed to establish that these two documents were available to the public prior to the date of the patents. The three alternatives, whether considered alone or in combination provide no credible evidence of publication. There is no evidence in the record of how many copies of these writings were ever made, whether the excerpts Genpharm proffered here are from a draft or a final version, whether either writing was made available to the public, whether anyone who received a copy was restricted in his or her use of it, or how well indexed and available to the public either of them was in any library, if in fact any library received them.

Defendants rely on the testimony of Mr. Zeller concerning the publication of TC-5; however, Mr. Zeller's testimony fails to prove anything useful with respect to those Japanese documents. Mr. Zeller has been distributing Shin-Etsu products for many years, (Zeller Tr. 4713:13-23), but he has never seen an original of the Japanese language TC-5 writing that Defendants rely on in that entire period, (Zeller Tr. 4732:9-11). In fact, Mr. Zeller testified at trial that he had never seen The TC-5 document, even though the cover page and unidentified translated portions of it were sent to his company in November 2001, apparently by counsel for Cheminor. (Zeller Tr. 4745:23-4746:3.) The copy of the portions of TC-5 that Mr. Zeller had in his files had a translation attached from 1989. (Zeller Tr. 4738:21-4740:15, 4745:23-4746:3.) Mr. Zeller testified that Biddle Sawyer's general practice between 1969 and 1986 was to request brochures from Shin-Etsu and to provide them to potential users and consumers. (Zeller Tr. 4715:2-4716:1.) However, he also stated that he never had any Shin-Etsu TC-5 brochure prior to 1989. (Zeller Tr. 4748:1-4748:4.) After looking at the TC-5 brochure, Mr. Zeller could not be more specific than to say that it is prior to the 1990s. (Zeller Tr. 4732:4-8.) The graphs and data in the brochures are not unique to any particular brochure, and Mr. Zeller could not use them to date the writings. (Zeller Tr. 4731:5-4732:8.) Further, Mr. Zeller's attempt to establish a "business practice" of widely distributing such pamphlets to customers failed. The only substantive information he provided regarding the use of Shin-Etsu pamphlets was that "[i]n the early days it was more of a missionary project in that companies were not familiar with Shin-Etsu." (Zeller Tr. 4715:15-4716:1.)

The court finds that Mr. Zeller had no specific knowledge about the particular brochure at issue here. Consequently, Defendants failed to meet their burden of establishing that TC-5 is a publication through his testimony.

Defendants also failed to provide sufficient evidence that *Up-to-Date* was a publication accessible to the public. Genpharm attempts to establish *Up-to-Date*'s status as a publication by offering a business record from the Tokyo Pharmaceutical Sciences Library as evidence that the book was purchased by the library on April 19, 1971, and was "taken out of the library on numerous occasions." (Genpharm Second Supp. Offer of Proof on the *Up-to-Date* (G25) Prior-Art Reference dated 3/8/02, Ex. 1.) This document was neither located nor disclosed during discovery; it was first provided to the court and Plaintiffs after Defendants had completed presenting evidence on invalidity of the '505 and '230 patents. Defendants rested with respect to Phase I, except for submission of limited depositions and admissions in the pleadings on March 5, 2002. (Tr. 4919:4-9.) It is unquestionable that permitting Defendants to introduce new documents into evidence after the close of their validity case to attempt to prove publication prejudices Plaintiffs; therefore, the court precludes Defendants from relying on the documents relating to the Tokyo Pharmaceutical Sciences Library.FN94 (*See* Tr. 4979-4991.)

FN94. With this ruling, the court grants in part Astra's motion to exclude new evidence offered in support of *Up-to-Date* and TC-5 after the parties rested. Specifically, the court precludes the exchange of email messages between Mr. Foster and Mr. Mieko, submitted March 7, 2002, and the five sheets of paper in Japanese submitted on March 8, 2002.

[94] Genpharm additionally argues that TC-5 and *Up-to-Date* should be considered "prior art documents" because Astra admitted these documents were "prior art documents" in various related foreign patent proceedings. First, Genpharm argues that Astra admitted that *Up-to-Date* is prior art in an amendment to the South African Patent Office. For instance, in an amendment provided to the South African Patent Office, Astra stated that *Up-to-Date* and TC-5 were among "[t]he most relevant prior art." (G693 at AA00252853-54.) Genpharm is correct that these statements made by Astra concerning certain items of prior art in foreign proceedings constitute admissions under Federal Rule of Evidence 801(d)(2); accordingly, there is no hearsay problem with the documents containing those admissions. However, Genpharm has not produced evidence sufficient to persuade the court that the standard used in these foreign patent proceedings for "prior art" is the same as that in the United States. Genpharm submitted the Declaration of David Gilson, a registered patent attorney from the Republic of South Africa, to provide the meaning of the term "prior art" under South African law and practice; FN95 however, the definition of the concept of "prior art" developed in that Declaration appears to be substantially broader than the definition applicable in the United States. According to the Gilson Declaration, the term "prior art" means the same thing as the phrase "state of the art" that appears in the relevant South African statutes. (Gilson Decl. para. 7.) The "state of the art" in South Africa "comprise[s] all matter (whether a product, a process, information about either, or anything else) which has been made available to the public (whether in the Republic or elsewhere) by written or oral description, by use or in any other way." (Gilson Decl. para. 6.)

FN95. The court overrules Astra's objection to Genpharm's submission of the Gilson Declaration pursuant to Federal Rule of Civil Procedure 44.1.

Based on the Gilson Declaration, the court is unable to find that the term "prior art" as used in Astra's

communications with the South African Patent Office is equivalent to a statement that the TC-5 and *Up-to-Date* writings are publications pursuant to United States law. The issues of fact and law in such foreign proceedings, the burdens of proof placed on the patent applicant, and the presumptions and practicalities of South African Patent Office prosecution differ from the matters before this court. The fact that Astra elected to make arguments about the failure of the documents to teach the invention of a counterpart patent does not prove that the documents are a "publication" as required by United States law. Any judgment made by Astra about whether the documents are "among the most relevant prior art" depends on the other art being considered and the law of South Africa, matters that are not addressed adequately in Genpharm's submissions. Under United States law, the party asserting invalidity on the basis of a printed publication under 35 U.S.C. s. 102 must establish the facts supporting a conclusion of invalidity by clear and convincing evidence. In sum, the brief statement by Mr. Gilson that "all matter ... which is available to the public ... in any ... way" constitutes prior art in South Africa appears on its face to be broader, and to place less burden on the person or patent office seeking to rely on the prior art, than under United States law. Consequently, the court is unable to give Astra's statements to the South African Patent Office any weight here.

[95] Defendants also seek to prove publication of TC-5 and *Up-to-Date* based on silence or statements by Astra in proceedings in the European Patent Office. Specifically, Genpharm argues that Astra "admitted" that TC-5 and *Up-to-Date* constitute "prior art" because Astra, in response to opponents' arguments against issuance of the European counterparts to the '505 and '230 patents, chose to argue against the substance of the asserted references, rather than challenge their qualifications. (*See* G857 at 00519 ('380 file history).) Genpharm asserts that this constitutes an adoptive admission by Astra. However, the fact that Astra elected to make a successful argument about the failure of the documents to teach the invention of the European counterpart to the '505 and '230 patents and did not also contest their status as prior art does not constitute an admission by Astra that the documents are prior art. *See* United States v. Flecha, 539 F.2d 874, 877 (2d Cir.1976) ("Silence is not evidence of an admission, unless there are circumstances which render it more reasonably probable that a man would answer the charge made against him than that he would not.") (internal quotations omitted). It was certainly reasonable for Astra to choose to make only one of several alternative arguments available to it in those proceedings. *See* Mannesmann Demag Corp. v. Engineered Metal Prods. Co., 605 F.Supp. 1362, 1367 (D.Del.1985). It is recognized that positions are often taken during patent prosecution out of convenience and expedience, and, therefore, such positions should not be given conclusive effect. *See* Quad Envtl. Techs. v. Union Sanitary Dist., 946 F.2d 870, 873-74 (Fed.Cir.1991). It may often be the case that it is more expedient to distinguish a cited reference than to argue that it is not prior art. Accordingly, the fact that an applicant for a patent, in responding to an Office Action, elects to distinguish a cited reference on the merits does not constitute an admission that the document qualifies as prior art for this case.FN96 Consequently, Defendants have failed to demonstrate that any of Astra's statements or silence during foreign proceedings constitute an admission that the TC-5 and *Up-to-Date* were "prior art" as that term is used in the United States.FN97

FN96. Astra rightly points out that the cases cited by Genpharm for the proposition that admissions can arise from foreign patent proceedings, Tanabe Seiyaku Co. Ltd. v. Int'l Trade Comm'n, 109 F.3d 726, 733 (Fed.Cir.1997); Buckley v. Airshield Corp., 116 F.Supp.2d 658, 668 (D.Md.2000), involved admissions as to technical facts instead of matters including legal conclusions, as Genpharm asserts here.

FN97. Genpharm also argues that Astra adoptively admitted that TC-5 and *Up-to-Date* are prior art in the United Kingdom by failing to challenge their status as prior art in a litigation. To make this assertion,

Genpharm points to a comment in a judgment on validity issued on March 6, 2002, by the British court. This court precludes Genpharm from relying on the document, which, as is clear from the date of the judgment, was not brought out during the proof in this case; rather, it was first contained in a post-trial submission made by Genpharm. Astra has had no opportunity to respond to this document with proof of its own, and the court will not permit Genpharm to rely on the document as part of its invalidity proof. In any event, the comment made by the British court is of no value to this court's determination of the publication issue under United States law. The comment cited by Genpharm simply implies that Astra did not contest publication of TC-5 or *Up-to-Date* in that litigation. However, differences in the realities of patent litigation in the United Kingdom or different legal standards for publication could well be the cause of that position. Without supporting evidence about the relevant patent law, evidentiary standards and burdens of proof, and without knowing the tactical decisions that were made during trial, the court finds that the statement has no value for this court in deciding whether TC-5 or *Up-to-Date* are prior art under United States law.

2. The Remaining References

[96] A claimed invention is unpatentable due to obviousness if the differences between it and the prior art "are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art." 35 U.S.C. s. 103(a). Obviousness under s. 103 is a legal conclusion based on certain factual inquiries. DMI, Inc. v. Deere & Co., 802 F.2d 421, 425 (Fed.Cir.1986); *see* Richardson-Vicks Inc. v. Upjohn Co., 122 F.3d 1476, 1483 (Fed.Cir.1997). These factual inquiries include: (1) the scope FN98 and content of the prior art; (2) the level of ordinary skill in the art; (3) the differences between the claimed invention and the prior art; and (4) secondary, objective considerations of nonobviousness including long-felt need, commercial success, or the failure of others. Graham v. John Deere Co., 383 U.S. 1, 17-18, 86 S.Ct. 684, 15 L.Ed.2d 545 (1966); *see* Jones v. Hardy, 727 F.2d 1524, 1529 (Fed.Cir.1984).

FN98. The scope of the prior art includes art that is "reasonably pertinent to the particular problem with which the invention was involved." Stratoflex, Inc. v. Aeroquip Corp., 713 F.2d 1530, 1535 (Fed.Cir.1983).

As is the case generally, whenever a s. 103 obviousness test is being applied, it is critical to the analysis to deliberately guard against using hindsight or the teaching of the patent in suit in arriving at the conclusions. Uniroyal, Inc. v. Rudkin-Wiley Corp., 837 F.2d 1044, 1051 (Fed.Cir.1988). The genius of invention is often a combination of known elements that in hindsight seems preordained. *See* Raytheon Co. v. Roper Corp., 724 F.2d 951, 961 (Fed.Cir.1983) ("[V]irtually every claimed invention is a combination of old elements.") (quotation omitted). If identification of each claimed element in the prior art were sufficient to negate patentability, very few patents would issue. *See* In re Rouffet, 149 F.3d 1350, 1357 (Fed.Cir.1998).

[97] To prevent hindsight invalidation of patent claims, the law requires some "teaching, suggestion, or reason" to combine the cited references. Gambro Lundia AB v. Baxter Healthcare Corp., 110 F.3d 1573, 1579 (Fed.Cir.1997). The Federal Circuit instructs that

[t]he obviousness standard, while easy to expound, is sometimes difficult to apply. It requires the decisionmaker to return to the time the invention was made. The invention must be viewed not with the blueprint drawn by the inventor, but in the state of the art that existed at the time .... That which may be made clear and thus 'obvious' to a court, with the invention fully diagrammed and aided ... by experts in the

field, may have been a breakthrough of substantial dimension when first unveiled .... It [is impermissible] to use hindsight to reconstruct the claimed invention from prior art with the invention before it and aided by [the infringer's] expert, rather than viewing the invention from the position of a person of ordinary skill at the time it was made.

Uniroyal, Inc., 837 F.2d at 1050-51 (citations omitted), *cert. denied,* 488 U.S. 825, 109 S.Ct. 75, 102 L.Ed.2d 51 (1988). When a patented invention is made by combining known components to achieve a new system, the prior art must provide a suggestion or motivation to combine. Brown & Williamson Tobacco Corp. v. Philip Morris Inc., 229 F.3d 1120, 1124-25 (Fed.Cir.2000); Interconnect Planning Corp. v. Feil, 774 F.2d 1132, 1143 (Fed.Cir.1985) (citations omitted).

[98] Whether a motivation to combine prior art references has been demonstrated is a question of fact. Winner Int'l Royalty Corp. v. Wang, 202 F.3d 1340, 1348 (Fed.Cir.2000). The motivation to combine may be found either explicitly or implicitly: (1) in the prior-art references themselves; (2) in the knowledge of those of ordinary skill in the art that certain references, or disclosures in those references, are of special interest or importance in the field; or (3) from the nature of the problem to be solved. *See* Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc., 75 F.3d 1568, 1572-73 (Fed.Cir.1996). There is no requirement that prior-art references contain an express motivation or suggestion to combine, Motorola, Inc. v. Interdigital Tech. Corp., 121 F.3d 1461, 1472 (Fed.Cir.1997), however, the mere possibility that two references could have been combined to arrive at the invention is insufficient, Gentry Gallery, Inc. v. Berkline Corp., 134 F.3d 1473, 1478 (Fed.Cir.1998); In re Brouwer, 77 F.3d 422, 425 (Fed.Cir.1996).

[99] [100] Obviousness is determined from the vantage-point of a hypothetical person having ordinary skill in the art to which the patent pertains and requires a factual determination of the level of ordinary skill in the art. In re Rouffet, 149 F.3d at 1357; Ryko Mfg. Co. v. Nu-Star, Inc., 950 F.2d 714, 716 (Fed.Cir.1991). Ultimately the court must ascertain what would have been objectively obvious to one of ordinary skill in the art at the time of the invention, not what was subjectively obvious to the inventor. *See* Ryko, 950 F.2d at 716. The hypothetical person of ordinary skill in the art is presumed to be aware of all prior art in the same or analogous fields. In re Gorman, 933 F.2d 982, 986 (Fed.Cir.1991). The level of ordinary skill in the art may be found by inquiring into: (1) the type of problems encountered in the art; (2) prior-art solutions to those problems; (3) the rapidity with which innovations are made; (4) the sophistication of the technology; and (5) the education level of active workers in the field. Custom Accessories, Inc. v. Jeffrey-Allan Indus., Inc., 807 F.2d 955, 962 (Fed.Cir.1986). All of those factors may not be present in every case, and one or more of them may predominate. Envtl. Designs, Ltd. v. Union Oil Co., 713 F.2d 693, 696 (Fed.Cir.1983).

Defendants assert numerous references as prior art for the court to consider with respect to obviousness. In 1985, Drs. Pilbrant and Cederberg of Astra published an article in the *Scandinavian Journal of Gastroenterology* titled "Development of an Oral Formulation of Omeprazole." (K58.) Defendants argue that the Pilbrant and Cederberg article, Exhibit K58, discloses an alkaline omeprazole core and an enteric coat-all of the elements of subparts (a) and (c) of claims 1. Like the '505 patent, the Pilbrant and Cederberg article is directed to the development of an oral formulation of omeprazole. (K58 at 114.) Defendants also raise the '495 patent; they argue that the '495 patent, Exhibit G345, discloses an alkaline omeprazole salt core and an enteric coat-all the elements of subparts (a) and (c) of claims 1. Similarly, the '664 patent, Exhibit G23A, is cited by Defendants as disclosing an alkaline benzimidazole salt core and an enteric coat-all the elements required by subparts (a) and (c) of the '230 patent. Defendants argue that any of the three preceding references in combination with one of two other references, which allegedly disclose the use of an inert, water soluble subcoat, invalidates the patents. The first of those two references is United States Patent

No. 4,335,099 (the " '099 patent") titled *Employment of Enteric Coated IGA for Hypoproteinemia in* Intestinal Infectious Diseases that issued on June 15, 1982. (G32.) This patent describes a solid oral dosage form of IgA-rich (gamma)-G, an acid-labile drug that contains a water soluble subcoating between the acid labile drug core and the enteric coat. (Story Tr. 4633:10-15; G32, col. 3:68-col. 4:19.) Accordingto Defendants, the '099 patent, Exhibit G32, discloses an acid labile drug core, an inert, water soluble subcoat, and an enteric coat-that is, everything but the ARC. The second of the references discussing a subcoating is British Patent No. 760,403 (the " '403 patent") titled *Improvements in or Relating to Enteric Coatings,* which issued on October 31, 1956. (G31.) This patent is directed to improvements in enteric coating whereby the enteric film-forming substance has inert mineral solids finely dispersed through it. (Story Tr. 4641:2-10; G31, col. 2:19-27.) According to the Defendants, the '403 patent, Exhibit G31, discloses an alkaline drug core, an inert, water-soluble subcoat and an enteric coat.

[101] After considering all the testimony and the documents received into evidence, the court finds that Defendants failed to present facts that establish by clear and convincing evidence that the inventions of the '505 and '230 patents would have been obvious to a person of ordinary skill in the art. At best, the facts presented by Defendants show only that each element of the claims was in the prior art, but no reference shows all elements combined as they are in the claims of the patents, and the references do not teach or suggest combining the elements as they are combined in the claims. Dr. Story's testimony and charts are simple lists of elements selected from the prior art using hindsight without any testimony on motivation to combine those elements as he has selected them.FN99 (Langer Tr. 5035:20-5036:3.)

FN99. Dr. Story was the only witness to testify live for Defendants on invalidity issues.

Dr. Story began his validity study of the '505 patent with a copy of the patent and references selected by counsel. (Story 4804:23-25, 4805:10-14.) Dr. Story performed his obviousness analysis by hindsight reconstruction of the elements of the claims, which is not permissible. *See* W.L. Gore & Assocs., Inc. v. Garlock, Inc., 721 F.2d 1540, 1553 (Fed.Cir.1983). For example, Dr. Story started with the Pilbrant and Cederberg article and read into it the addition of an ARC to the core of an omeprazole formulation-while admitting that the reference does not expressly disclose an ARC. (Story Tr. 4599:9-12.) To find the subcoating that is not disclosed in the Pilbrant and Cederberg article, Dr. Story relied on references that had been selected for him by counsel, (Story Tr. 4805:10-4806:7), and, in some cases, he only considered isolated portions of those pre-selected references, (Story Tr. 4861:8-18.) Dr. Story cannot recall if any references came from his files or if he himself found any of those references. (Story Tr. 4806:1-7.) Neither the Pilbrant and Cederberg article nor the '495 patent suggests or discloses any of the problems associated with formulating omeprazole or gives any direction as to how to solve those problems, and the four secondary references relied on by Dr. Story do not suggest the inventions described in the '505 and '230 patents. Thus, Genpharm's expert Dr. Story incorrectly decided obviousness by choosing from a few references one element, and then picking and choosing other elements from other references, all with knowledge of the solution described in the '505 patent.

In contrast to the analysis performed by Dr. Story, Dr. Langer performed the proper factual inquiry when considering the obviousness question. He considered only the knowledge that was available when the patent was filed. (Langer Tr. 5033:7-23.) He did not reconstruct or select art knowing the inventor's solution. (Langer Tr. 5033:24-5034:7.) Instead, he considered whether each claim would have been obvious to a person of ordinary skill at the time of the patent. (Langer Tr. 5034:8-12.) Also, he considered the entire combination of the invention. (Langer Tr. 5034:13-5035:1.) He made the proper inquiry of whether there

exists in the art itself a suggestion to combine all the elements of the invention. (Langer Tr. 5035:2-10.)

Validity determinations are not "games played with pieces of paper called references and the patent in suit." Rosemount, Inc. v. Beckman Instruments, Inc., 727 F.2d 1540, 1544 (Fed.Cir.1984). Inventions are made by real people to solve real problems. *Id*. In assessing the "real world" facts, there is no better way to determine whether an invention was obvious than to see what persons skilled in the art actually did or failed to do at the relevant time. U.S. Philips Corp. v. Nat'l Micronetics Inc., 550 F.2d 716, 722 (2d Cir.1977). The record here is full of direct evidence of people who actually tried to solve the problem of formulating omeprazole. Every formulation scientist or technical witness who testified acknowledged that the task of making a stable omeprazole formulation is quite a challenge. (Carlsson Tr. 172:19-22, 179:14-21; Pilbrant Tr. 1323:25-1324:9, 1641:11-15; Lovgren Tr. 1747:4-11; Langer Tr. 295:7-23; Davies Tr. 1184:14-17; Seth C.A.9:8-10; Chen Tr. 3014:15-19; Ravinder Dep. Tr. 30:17-19; Chou Dep. Tr. 18:4-6; Weng Dep. Tr. 72:3-15; Judy Dep. Tr. 337:23-338:13.) Dr. Marshall, a highly skilled expert who was hired by lawyers for Genpharm's sister company and given the task of coming up with a formulation for omeprazole without knowing the inventors' solution, ultimately suggested a product that did not meet the '505 patent claims, despite prompting suggestions from the lawyers. Astra themselves did not come easily to the solution. To the contrary, as described in the portion of this court's opinion discussing the background of the invention, Astra struggled for several years with a number of other possible alternatives and had failures before discovering a successful formulation.

The Pilbrant and Cederberg article, Exhibit K58, refers to putting an enteric coating on omeprazole-containing granules, but it does not disclose the use of a subcoat. (Langer Tr. 5043:7-14.) Contrary to Defendants' assertions, the Pilbrant and Cederberg article also does not disclose an enteric-coated formulation containing an alkaline material. (*See* Story Tr. 4758:13-17; K58.) First, the Pilbrant and Cederberg article does not describe a commercial formulation-it refers to only around six patients treated in one trial and twelve patients in another, which does not tell a formulator anything about the process used to manufacture the granules. (Langer Tr. 5039:15-5040:4.) The Pilbrant and Cederberg article does not say anything about adding an alkaline material to the granulated enteric-coated formulation described therein, nor does it say anything about using an alkaline drug core, (Langer Tr. 5040:19-5041:13), and a formulator would not understand Pilbrant and Cederberg to describe omeprazole combined with an ARC in a granulation. In its discussion of the enteric-coated granulation, the article does not refer to a discoloration problem, let alone degradation of omeprazole when an enteric coating was applied. (Langer Tr. 5043:12-23.) The fact that the core was made using "spherical granules" does not mean an ARC was inherent; one could granulated with a neutral compound, with organic solvents instead of water, or one could do a dry granulation. (Langer Tr. 5038:23-5039:14.)

Indeed, a formulator would understand that when Pilbrant and Cederberg mean to indicate the use of an ARC, they say it. (*See* K58 at 114 (referring expressly to an omeprazole suspension in water containing sodium bicarbonate).) The disclosures in the article that Defendants point to relating to the presence of an ARC occur during the description of a very different formulation-an oral suspension administered with sodium bicarbonate, which was used to neutralize the acid in the stomach.FN100 (Langer Tr. 5040:5-18.) Pilbrant and Cederberg states that those suspensions of omeprazole with sodium bicarbonate could be stored at refrigerator temperature for a week or deep-frozen for more than a year. A formulator would not regard this as good long-term stability. (Langer Tr. 5042:2-18.) Thus, the court finds that the Pilbrant and Cederberg article does not disclose anything about the stability of omeprazole in solid form when formulated together with an ARC; moreover, the article does not suggest that adding an ARC will improve the stability of omeprazole in a solid formulation. (Langer Tr. 5042:21-5043:2.) The Pilbrant and Cederberg

article does not describe omeprazole plus an alkaline reacting compound with an enteric coat as referred to in claim 1 of the '505 patent. (Langer Tr. 5038:23-5039:7; Story Tr. 4599:9-12, 4755:21-4756:1.) FN101

FN100. Unlike the use of sodium bicarbonate described in Pilbrant and Cederberg, the ARC in the core of the formulations claimed in the '505 and '230 patents is used to stabilize the omeprazole in the formulation during manufacture and long-term storage. It is the *enteric coat* that protects the formulation from the acid in the stomach.

FN101. Contrary to Defendants' suggestion, the court cannot rewrite the Pilbrant and Cederberg disclosure based on the inventors' statement in the prosecution history of the '230 patent that the Pilbrant article describes an "alkaline drug core." (*See* P8A, Dec. 19, 1988 Amendment at 5.) Dr. Pilbrant and his colleagues knew themselves, from having actually done the work, that the cores used for the work reported in Pilbrant and Cederberg had an ARC present. However, that was private, unpublished information that plainly does not appear in the article, and the statement in the prosecution in 1988 could not add to what a skilled reader would have learned from reading the article at the time of the invention in 1986. Astra's confidential internal work cannot be used to support an obviousness analysis.

As the court has already concluded as a part of its anticipation analysis, the '495 patent does not disclose an inert subcoating. (*See* Langer Tr. 5025:14-18.) Moreover, the '495 patent is not a "formulation" patent; rather, the '495 patent describes new salts of omeprazole. (Pilbrant Tr. 1626:19-23; G345.) The formulations that are disclosed in the '495 patent include a syrup, an injectable, and only one solid dosage form, which is directly enteric coated. (Story Tr. 4792:15-4793:6.) There is no suggestion or disclosure of any problems in connection with any of these formulations, including problems from putting the enteric coat directly on the core, and the '495 patent does not state why one would put an enteric coating on a capsule rather than on an individual pellet. (Langer Tr. 5037:6-12; Story Tr. 4794:1-11.) There is no disclosure in the '495 patent that suggests the necessity of formulating the core materials such that the microenvironmental pH of the omeprazole is at least 7, so the discussion of the *alkaline* of omeprazole discloses simply that-alkalinity, but not stability through micro-pH. *See* Amazon.com, Inc. v. Barnesandnoble.com, 239 F.3d 1343, 1351 (Fed.Cir.2001) (noting that claims must be construed the same for invalidity and infringement purposes). Moreover, the '495 patent does not suggest that there is any discoloration from directly enteric coating an omeprazole salt core. (Story Tr. 4794:22-25, 4795:5-8.) The '495 patent does not state anywhere that the core attacked the enteric coat or that the enteric coat caused degradation of the omeprazole salt. (*See* G345.) Therefore, there is no motivation in the '495 patent to alter the formulation described. (Langer Tr. 5037:9-23.)

The third primary prior art reference offered by Defendants is the '664 patent. Rather than relating to omeprazole salts like the '495 patent, the '664 patent relates to more stable benzimidazoles other than omeprazole. (Lovgren Tr. 1682:16-18, 1729:10-17; G23A.) Given their similarities, the court's discussion of the failure of proof of obviousness by the '495 patent applies equally to the '664 patent. During his testimony, Dr. Story referred to an example on page 37 of the '664 patent that combined a benzimidazole with sodium carbonate, an alkaline compound, in the core. That example does not use a subcoat. (Langer Tr. 5088:3-4; G23A at 37.) The '664 patent applies the enteric coating directly on the core with no subcoating using isopodan and methylene chloride. (Langer Tr. 5088:5-10.) Moreover, the '664 patent does not disclose why sodium carbonate is present in the core in that example. (Langer Tr. 5087:25-5088:2.) Finally, like the '495 patent, the '664 patent is devoid of any disclosure suggesting that the quantity of the

alkaline compound should be calculated to ensure the stability of the benzimidazole particles by maintaining a microenvironmental pH of not less than 7.

After reviewing the primary references, the court finds that at best they disclose a core containing omeprazole, an alkaline omeprazole salt, or an alkaline benzimidazole salt, with an enteric coating. All three references fail to disclose a subcoating. The references also do not disclose the reaction between the core and the enteric coating, so they do not provide a motivation to search for a reference that would suggest the use of a subcoating to block that interaction. Finally, to the extent that the presence of an alkaline compound is disclosed by the '495 patent and the '664 patent, the court finds that the references fail to disclose sufficient information about the characteristics of that compound or the amount of alkaline material required in the formulation to disclose the required presence of an ARC as that term is defined in the claims and specifications of the '505 and '230 patents.

The Pilbrant and Cederberg article and the '495 and '664 patents provide no motivation for a formulator to alter the formulations described. Even so, Defendants identify additional secondary writings in an effort to piece together the claimed invention. The two secondary publications relied on for obviousness in Dr. Story's testimony also do not suggest the invention. United States Patent No. 4,335,099 (the " '099 patent"), Exhibit G32, does not make claims 1 of the '505 and '230 patent obvious. The object of the '099 patent is to come up with a formulation for the antibody IgA and to give that antibody orally. IgA differs from omeprazole, and what was done was different from the '505 and '230 patents. The antibody IgA is not acid sensitive; in fact, it is purified by exposing it to a great deal of acid with a pH of 4. (G32, col. 4:67-col. 5:1.) The '099 patent does not disclose acid-sensitive active ingredients like omeprazole, and the '099 patent does not have a formulation with an ARC in the core. (Langer Tr. 5084:14-5085:3, 5085:25-5086:5.) The motivation for including a subcoating in the '099 patent was not to protect the IgA from the enteric coating but, rather, to protect the IgA from the organic solvents applied in the enteric coating. (Langer Tr. 5084:8-5085:10, 5176:15-5177:16, 5179:4-12, 5183:15-5184:22.) Dr. Story stated in his expert report that the IgA antibody is very sensitive to heat and organic solvents, making it necessary to provide a protective layer between the active material and the enteric coating. (Langer Tr. 5085:4-10.) Conditions that were used to isolate the IgA antibody in the '099 patent, however, would destroy omeprazole. (Langer Tr. 5085:4-18.) With regard to the prior art, one has to look carefully at what the active substance is, (Story Tr. 4850:14-21), and the antibodies described in the '099 patent are not similar to omeprazole, (Story Tr. 4850:22-4851:3). It is quite clear from the evidence presented at trial that the antibodies described in the '099 patent are *not* acid sensitive; they are stable for hours in acid. (Langer Tr. 5172:22-5173:14, 5175:19-5176:5.) The court finds that the '099 patent would not have been referred to by someone seeking to formulate omeprazole. (*See* Langer Tr. 5183:15-5184:6.) Even if a formulator were to reference the '099 patent, that formulator would find no reference in the '099 patent to avoiding contact or reaction with the acid groups of the enteric coat, and there is no reference in the '099 patent to using the subcoating to solve any gastric acid resistance problems. (Langer Tr. 5086:6-11.) FN102

FN102. Defendants' attempt to combine the '099 patent with Pilbrant and Cederberg or the '495 or '664 patents is an improper hindsight approach. When describing appropriate materials for the subcoating, the '099 patent lists HPMC, as Defendants note, but it also lists PVP. (G32, col. 4:13-17.) Dr. Story testified that it would have been obvious to apply the PVP subcoating of the '099 patent for omeprazole. Yet, other formulators who did not know the Astra solution did not come to that conclusion. For example, formulators at Takeda warned that PVP would be incompatible with benzimidazole compounds, including omeprazole. (P923 at 2, ll. 21-24.) Dr. Story failed to account for that fact in his direct testimony, even though he relied on and quoted that information in his own expert report (*See* Story Tr. 4849:2-4850:13.)

The final secondary prior art reference is the '403 patent, Exhibit G31, which was published in 1956. The court finds that consideration of this reference in combination with the primary references also does not make claims 1 obvious. The '403 patent relates primarily to enteric coating using certain mineral solids in enteric coats. (Story Tr. 4851:6-15.) It is a reference from the "early days" of enteric-coating polymers using cellulose acetate phthalate as the enteric coating material. (Langer Tr. 5083:7-25.) The state of the art of enteric coatings in 1956 was that they did not always work as well as one wanted. Sometimes the enteric coatings never released at all. Other times they released prematurely in the stomach. The goal of the '403 patent, therefore, was to come up with a more reliable enteric-coating material. (Langer Tr. 5083:13-5084:1.) If a formulator did examine this older reference, the formulator would find that one of the examples in this patent relates to formulations of erythromycin, which, like omeprazole, is an acid labile compound. (Story Tr. 4853:10-19; Langer Tr. 5185:12-16.) In that example, the enteric coating is applied directly to the erythromycin core, and there is no disclosure in the patent that there is any discoloration or stability problem with the erythromycin formulation. (Story Tr. 4854:7-19.) In light of that example, a formulator reviewing the '403 patent would not believe that formulations involving acid labile compounds always require a subcoating. Elsewhere the '403 patent mentions that "[a] medicament which has a highly alkaline pH may conceivably attack and weaken or destroy the film-forming substance. By special handling it will still be possible to coat such incompatible drugs, as for example, by sub-coating with a compatible material and then applying an outer coating of the desired enteric coating composition." (G31 at 6, ll. 10-18.) Notably, omeprazole itself does not have a highly alkaline pH-it is acidic. Moreover, the term "compatible material" is very general and uninformative-it could be almost anything. (Langer Tr. 5082:18-5083:2.) Nothing in the '403 patent would lead the average formulator to the solution in the '505 patent. (Langer Tr. 5083:3-6.) The '403 patent does not give any indication that one would want to use a water-soluble subcoating as the compatible material referred to in the patent. (Langer Tr. 5083:7-12.) If anything, the court finds that the '403 patent would lead a formulator away from the Astra inventions. The examples in the '403 patent primarily concern enteric coating erythromycin, which is a very acid sensitive drug, yet none of the examples discloses the use of an ARC or an enteric-coated formulation that has a subcoating. (*See* G31, Examples II, V, VI at p. 3-5.)

The art as a whole teaches away from the solutions of the '505 and '230 patents. A skilled formulator would not have assumed that there was going to be a problem if an enteric coating was put on omeprazole because enteric coatings are designed to protect acid-sensitive drugs. Enteric coatings have been used with many acid-sensitive drugs over the years. (Langer Tr. 5044:2-14.) If an average skilled formulator in 1986 put an enteric coating on an omeprazole granule and found discoloration, he could have considered a number of possible causes, including the enteric coating itself, monomers in the enteric coating, other types of chemicals in the enteric coat like plasticizers, the solvent used for the coating, something in the environment such as oxidation taking place due to air, or solution effects. A variety of things could have been responsible, and a formulator would have studied all possible causes. (Langer Tr. 5044:15-5045:7.) The skilled formulator may not have expected that there would be diffusion of water of gastric juice through the enteric coating. (*See* Story Tr. 4611:24-4612:2.) If the formulator came to the conclusion that the discoloration was due to an interaction between the acid groups in the enteric polymer and the omeprazole, he may have tried applying some other enteric coats. (Langer Tr. 5045:11-22.) Enteric coats that did not have acid groups were known in 1986. (Langer Tr. 5045:23-5046:2; P.2D, col. 2:40-44.) For example, Dr. Porter's United States Patent No. 4,457,907 was cited by Defendants and talks about polymers that do not have repeating carboxylic acid groups. They were taught to be useful for erythromycin, an acid-sensitive drug. (Langer Tr. 5046:3-11, 18-20, 5047:2-21.)

Another solution for discoloration is described in a BBRC publication, Exhibit P915, also cited by Defendants, which describes using cysteine to prevent omeprazole discoloration. (Langer Tr. 5047:22-5049:5; P915 at 482.) Cysteine, which is not an ARC, could be used in pharmaceutical compositions. (Langer Tr. 5049:6-10, 5051:6-9.) A Takeda patent with a priority date of February 1, 1986, Exhibit P923, exemplifies still another possible approach of a formulator skilled in the art in the pertinent period facing problems of discoloration. According to that patent, the omeprazole content decreases and the color changes significantly during the manufacturing of the dosage form over time. (Langer Tr. 5049:11-5050:21; P923 at 2, ll. 16-30.) The patent refers to enteric coating polymers, such as cellulose acetate phthalate, hydroxypropyl methylcellulose acetate succinate and Eudragit, as having poor compatibility with components like omeprazole and causing content decrease and color change. (P923 at 2, ll. 24-30; Langer Tr. 5050:22-5051:3.) Takeda solved the problem of discoloration by using ARCs that were insoluble in water, and in some cases, ARCs that were insoluble in water in combination with cysteine. (P923 at 2, ll. 39-42.) The Take patent reference, however, does not disclose using a subcoating beneath an enteric coating. (Langer Tr. 5051:13-15; P.2D.)

Astra decided to explore using an ARC to try to solve the problem of discoloration upon long term storage. However, when Astra added enough of the ARC to solve that discoloration, a new problem, low gastric acid resistance, was created. (Langer Tr. 5051:16-5052:3; Pilbrant Tr. 1344:16-23.) Gastric acid resistance is important because the drug must be protected until it gets out of the stomach and into the intestine for release into the body. (Langer Tr. 5052:14-18.) Pharmaceutical companies, therefore, test for gastric acid resistance, and the U.S. Pharmacopeia has standards for gastric acid resistance. (Langer Tr. 5052:23-5053:3.) The Pharmacopeia test for gastric acid resistance is 90%. (Lovgren Tr. 1342:21-1343:4.) If omeprazole is released in the stomach, it is destroyed because it is an acid-sensitive compound. (Langer Tr. 297:10-17, 5052:19-22; P1013 at 8.)

A formulator concerned with gastric acid resistance might be concerned with one of two different problems-diffusion of water through the enteric coating, or an interaction between the core and the enteric coating. If an average formulator in 1986 saw a problem with gastric acid resistance and went to the literature for help, he would have found various patents like those issued to Scherer and Shin-Etsu. (Langer Tr. 5053:4-10, 5189:17-5190:5; *see* P913A; P1291.) The Scherer patent, Exhibit P913A, describes the problem of reduced gastric acid resistance due to moisture getting into the dosage form. Moisture could penetrate into the dosage unit in a variety of ways, either during manufacturing, during storage, or while going through the aqueous part of the body. (P913A at translation, p. 7.) The moisture could cause the carboxyl groups in the enteric coating to ionize and reduce the resistance to gastric acid. (Langer Tr. 5054:1-5055:7.) During the development of the omeprazole formulations using enteric-coated dosage forms, Astra learned that there was diffusion of water or gastric juice into the pellets from the media outside. (Lovgren Tr. 4932:5-23, 4935:5-15, 4935:16-4936:7; *see* P836.) Astra performed tests concerned with how much omeprazole was degraded and found in the gastric media itself and how much was degraded inside the pellets. (Lovgren Tr. 4932:5-4933:9; P836.) Dr. Story's testimony that he had never seen any evidence at all of diffusion of gastric acid or diffusion of water of gastric juice through the enteric coating, (*see* Story Tr. 4611:12-23, 4622:20-25), is inconsistent with the Scherer patent and Astra's test results. (Langer Tr. 5055:14-22; Lovgren Tr. 4932:8-4936:9; P836.) Scherer was, however, a reference that Dr. Story himself cited.

A skilled formulator would also have been concerned about whether a water soluble subcoat would be an effective barrier to deal with the permeation problem. (Langer Tr. 5056:1-16; *see* Story Tr. 4622:5-19.) Scherer's way of solving this gastric acid resistance problem was to create an acidic isolation layer, which

contained 15% to 30% acid and HPMC. (Langer Tr. 5056:17-5057:13, 5159:14-5160:4; P913A at translation p. 7.) Nothing in Scherer suggests that a water soluble subcoat would work without having acid present. (Langer Tr. 5057:14-17.) The acidic isolation layer described in Scherer would not meet the definition of an inert subcoating as defined in the '505 patent because the amount of acid present would exacerbate degradation of omeprazole. (Langer Tr. 5057:18-5058:1, 5160:9-5161:7.) The level of acid in the Scherer acidic isolation layer, 15% to 30%, is comparable to the level of carboxylic acid in an enteric coat, which the '505 patent expressly teaches will degrade omeprazole. (Langer Tr. 5057:14-5058:1.)

A Shin-Etsu patent, Exhibit P1291, also addresses the gastric acid resistance problem.(Langer Tr. 5058:13-18; P1291 at translation p. 2.) Specifically, Shin-Etsu described a problem with reduced gastric acid resistance caused by a reaction between an alkaline core and an enteric coating. (Langer Tr. 5059:3-6.) Shin-Etsu's solution to that problem was to have a subcoat that contained high amounts of a water-insoluble carboxylic acid. (Langer Tr. 5059:10-15, 5059:23-5060:5; P1291, translation at pp. 2-3.) Again, the level of acid in the Shin-Etsu isolation layer is also comparable to levels found in enteric-coating materials. (Langer Tr. 5060:18-24.) Although faced with similar problems, Shin-Etsu and Scherer do not agree. Shin-Etsu states that the benefits that they get are not obtained if high amounts of a soluble acid, like that used in Scherer, are in the subcoat. (Langer Tr. 5059:16-22; P1291, translation p. 4) ("[T]he effect of the present invention is not obtained even by including low-molecular weight acid such as citric acid in the undercoating layer.") There is no suggestion in the Shin-Etsu patent that a water soluble polymer subcoat would work without the presence of fatty acid. (Langer Tr. 5060:6-9.) Shin-Etsu's fatty acid layer described in Exhibit P1291 would not meet the definition of an inert subcoating as defined in the '505 patent because there is a large amount of water-insoluble acid. (Langer Tr. 5060:18-24.) Like the Scherer solution, the Shin-Etsu solution of adding large amounts of acid would be detrimental to omeprazole. (Langer Tr. 5060:18-24.)

When due consideration is given to other relevant prior art in the field and to the standpoint of a skilled formulator at the time of the invention, the court finds that the claims of the '505 and '230 patents are not obvious in light of the prior art references sponsored by Defendants. The court's conclusion is further supported by the work of Genpharm's expert Dr. Marshall. Against this backdrop of the prior art, the attempts by Genpharm's Dr. Marshall to solve the problems of formulating omeprazole demonstrate the nonobviousness of the inventions of the '505 and '230 patents. In 1998, Dr. Marshall was hired as an expert in Australia for litigation relating to the Australian patent that corresponds to the '505 patent. As a result of his work, six reports were generated and subsequently used in this litigation. Dr. Marshall's reports are a theoretical exercise whereby his overall objective was to prepare an adult dosage form of omeprazole. (P1299, Marshall Rep. Intro. at 4.) Throughout the exercise Dr. Marshall was asked to expand on his previous reports and was also presented with hypothetical situations. In conducting this exercise, Dr. Marshall was not allowed to carry out any testing on his proposed formulations. (Id.) He was only allowed to use information and reference materials that were available to those skilled in the art in Australia as of April 30, 1986. (Id.) Dr. Marshall's proposed formulations were submitted in the form of six expert reports. Dr. Marshall, an expert more skilled than an ordinary skilled worker in the field, was asked if he were trying to formulate omeprazole in 1986, what he would have done, what issues he would have considered, and what might have happened. (Langer Tr. 5061:15-25; P1299 at Exs. 8-10, 12.) Dr. Marshall found and relied on the Pilbrant and Cederberg article, as well as other literature, including various United States and British patents. (Langer Tr. 5062:1-8; P1299, Rep. No. 1, Ex. 5; Rep. No. 3, Ex. 8.) In his Report Number 3, Dr. Marshall was asked to find a reproducible formulation and to solve a problem of variability in the bioavailability of omeprazole, which refers to how much drug the person actually gets. (Langer Tr. 5066:4-12; P1299, Rep. No. 3, at 2, 3.) Dr. Marshall relied on thirty-eight references in his Report Number 3, and

the Pilbrant and Cederbergarticle was among them. (Langer Tr. 5063:9-14; P1299, Rep. No. 3, at 7.) Dr. Marshall looked at the literature and properties of omeprazole and suggested using an enteric-coated formulation to overcome the variable bioavailability. He also suggested a formulation based on an enteric coating of HPMCP with a plasticizer applied to spherical cores or granules in such a way as to minimize contact with moisture, particularly at low pH. He further suggested the use of an alkaline excipient to reduce any omeprazole-catalyzed hydrolysis. Notably, Dr. Marshall did not suggest using any subcoating. (Langer Tr. 5066:13-5067:6; P1299, Rep. No. 3, at 7.)

In Marshall's Report Number 4, he was told to assume three problem scenarios concerning his proposed formulation. Scenario A was that the pellets showed unsatisfactory acid resistance at the time of manufacture. In Scenario B, the pellets were satisfactory at manufacture based on physical examination, but they discolored after storage for seven days under certain conditions. In Scenario C, the pellets were discolored upon manufacture. (Langer Tr. 5068:17-18; P1299, Rep. No. 4, at 5.) For Scenario A, Dr. Marshall proposed several possible solutions. One possibility was that the enteric coat was too thin, so the solution was to make it thicker. Other possibilities included poor film characteristics and that the coating needed to age. A further possibility was that there was an interaction of the core with the enteric coating, for which Dr. Marshall suggested using ethyl cellulose, a water insoluble polymer, as a sealant to prevent moisture from moving between the core and the enteric coat. (Langer Tr. 5068:19-5069:14; P1299, Rep. No. 4, at 2-3.) As Dr. Marshall analyzed Scenario B, he suggested using dry granulation and avoiding moisture-attracting excipients. He again suggested that there could be interaction between the core and the enteric coat, which implied using a less strong base. (P1299, Rep. No. 4, 4-5, at Ex. 10.) Again Dr. Marshall considered using the water insoluble polymer ethyl cellulose as a sealant, and he also suggested masking that discoloration by adding things to the pill that would make it whitish. (Langer Tr. 5069:19-5070:9; P1299, Rep. No. 4, 4-5.) As Dr. Marshall analyzed Scenario C, he suggested there could be excessive moisture content in the core. His solutions included some of the things he discussed with Scenarios A and B. He also recommended using a vacuum to dry the dosage. He once again considered that discoloration could be due to the interaction of the core with the enteric coat, which led him to suggest using a weaker base, using a plasticizer in the coat, or using the water-insoluble ethyl cellulose as a sealant. (Langer Tr. 5070:10-24; P1299, Rep. No. 4, at 5-6.) None of the solutions proposed by Dr. Marshall in Report Number 4 involved using a water soluble subcoat. (Langer Tr. 5070:25-5071:3.)

In his Report Number 5, Dr. Marshall was asked to explain why he picked ethyl cellulose and was prompted to list other materials that could be used. (P1299, Rep. No. 5, at 1-4.) He explained that he picked ethyl cellulose because he saw a problem with moisture and he wanted a moisture barrier. He specifically commented on the fact that ethyl cellulose was practically insoluble in water. (Langer Tr. 5072:17-21; P1299, Rep. No. 5, at 3.) Dr. Marshall also stated that other sealants could be used-polymers applied with organic solvents and some water soluble and some insoluble ones. He made the point, however, that they are all less preferred than ethyl cellulose because they have inferior water barrier properties. (P1299, Rep. No. 5, at 3.)

In Dr. Marshall's Report Number 6, he was simply asked to assume that his formulationhad unacceptable bioavailability. (Langer Tr. 5073:6-18; P1299, Rep. No. 6, at 2.) Dr. Marshall suggested that one possible cause of unacceptable bioavailability might be unsatisfactory acid resistance. (Langer Tr. 5073:19-22; P1299, Rep. No. 6, at 2.) Dr. Marshall made several suggestions to solve unacceptable bioavailability. One idea was to apply a thicker enteric coat or to improve the coating process by checking the film-coating characteristics, using other enteric-coating materials, using other plasticizers, or changing the amount of enteric coating. A third possibility related to application of the ethyl cellulose sealant. Dr. Marshall thought

about reducing the amount of ethyl cellulose and, if that was not successful, other alternatives could be a combination of an ethyl cellulose and HPMC dispersion. Dr. Marshall wanted to produce a "more leaky coat" to allow water penetration and diffusion in the gastrointestinal tract so that the omeprazole would be released. (Langer Tr. 5073:23-5074:16; P1299, Rep. No. 6, at 2-5.)

At the time that Dr. Marshall was placing himself in 1986, he was aware of certain published reports on clinical studies with omeprazole. (Langer Tr. 5074:17-22; *see, e.g.*, P1299 at Rep. No. 3, at 7.) An article by Prichard refers to clinical studies and describes enteric-coated omeprazole formulations, which when given to patients showed variable bioavailability by day 5. (Langer Tr. 5074:23-5076:3; P919 at 67.) The Prichard article discloses that with progressive days of dosing the bioavailability of the enteric-coated omeprazole formulation went up. (Langer Tr. 5076:3-6.) The Prichard article suggests that increased absorption of omeprazole might be explained because taking omeprazole had the effect of decreasing the amount of acid produced in the patient's stomach. Reduced acid would reduce destruction of omeprazole, and the authors thought this was the likely reason for the higher bioavailability. (Langer Tr. 5076:7-18; P919 at 69.) It might make sense, having read the Prichard article, to use a subcoating something like ethyl cellulose that does not release the drug as soon as it leaves the stomach because that would help avoid the most acidic part of the small intestine. (Langer Tr. 5076:19-5077:5.) Having considered all of the facts adduced on the state of the art, the disclosures in the prior art, and the work done by Dr. Marshall, the court credits the testimony of Dr. Langer concerning the validity of the '505 and '230 patents. The court finds that Defendants have failed to demonstrate obviousness by clear and convincing evidence.

3. Hager's Handbook

In addition to the documents previously discussed, Cheminor additionally relies on a partial translation of the German reference *Hager's Handbook* without providing any explanation of its relevance as a prior art document to the patents in suit. No witness testified as to these issues on behalf of Cheminor-the obviousness claim relies entirely on attorney argument. To the extent that the court is able to examine the document without the benefit of any pertinent testimony, the court finds that Hager's is merely cumulative to the other general, vague statements in other writings relied on by Defendants. There is no discussion at all in Hager's of the nature of the "non-reactive underlayers" mentioned therein. (*See* C360, para. 2.) The court finds that a formulator would understand that Hager's pertains to "water-proofing" and "sealing;" therefore, a formulator would select a component like the ethylcellulose sealant that Dr. Marshall selected.

4. Andrx

In an argument related to its noninfringement position that its ANDA products do not infringe because Andrx practices the prior art, Andrx argues that its product is disclosed in the Pilbrant and Cederberg article. Based on that assertion, Andrx concludes that because the court has found that Andrx's products infringe the '505 and '230 patents, those patents are invalid in light of the Pilbrant and Cederberg article. Andrx's argument fails. The court finds that Andrx's product is not disclosed in the Pilbrant and Cederberg article. The Pilbrant and Cederberg reference does not disclose an enteric-coated formulation containing an ARC, let alone the type or amount of ARC employed by Andrx. The Pilbrant and Cederberg article also does not disclose a subcoat, and the court has found that the Andrx product includes an HPMCP-salt subcoating that meets the limitations of the claims of the '505 and '230 patents.FN103

FN103. Andrx argues that even if a subcoating forms in Andrx's product then it would have to form in the prior art as well. The court does not agree, however. There is no evidence in the record indicating that the examples in the patent or the formulation described in Pilbrant and Cederberg contained an *in situ* formed

subcoating. In fact, the only evidence in the record indicates that a subcoating is not present in the formulations disclaimed in the patent. (*Compare* Lovgren Tr. 4440:11-4441:8) (reporting that bisected phase II type formulations did not exhibit a subcoat); *with* (Weng Dep. Tr. 62:14-64:4 (referring to neutralized HPMCP-salt layer as "pink").)

The Pilbrant and Cederberg article describes very general approaches to formulating enteric-coated dosage forms, but does not address the countless different formulation and process choices. (Langer Tr. 5133:1-24.) Since the Pilbrant and Cederberg paper does not contain detailed product and process information, any comparison between a so-called formulation in Pilbrant and Cederberg and Andrx's product is flawed. The product and process information on which Andrx relies is internal Astra information that is not disclosed in the Pilbrant and Cederberg paper. For example, the presence of excipients used to make Andrx's core region, like lactose and DHP, is not disclosed in the Pilbrant and Cederberg paper. The distribution of lactose in the core region and process conditions relating to mixing lactose with other excipients and applying lactose are also not disclosed in the prior art. Astra's confidential internal work is not in the public domain and is not available as prior art. Andrx did not present expert testimony comparing the Pilbrant and Cederberg publication to Andrx's ANDA products. The court does not credit Andrx's unsupported layer argument, and it is given no weight.FN104

FN104. Andrx improperly relies on the weight percent enteric-coating solution when comparing Andrx's product to the Pilbrant and Cederberg paper. Reliance of the weight percent solution without determining the thickness of the resulting enteric coat is meaningless. Without pellet size, it is impossible to determine enteric coating thickness. When determining coating thickness, weight percentage of the coating in the composition is not enough; to determine coating thickness other calculations based on the surface area to be covered are required. (Davies Tr. 4234:2-4235:20.) The enteric coating thickness is not disclosed in Pilbrant and Cederberg and the information needed to calculate enteric coating thickness is not present.

VI. The '342 Patent

[102] The court first addressed the single claim in Astra's United States Patent Number 5,093,342 (the " '342 patent") in an Order dated July 2, 2001, which resolved a pending summary judgment motion filed by Defendant Genpharm seeking summary judgment of invalidity and noninfringement of U.S. Patent Nos. 5,599,794 (the " '794 patent"), 5,629,305 (the " '305 patent"), and the '342 patent. All three of those patents were listed by Astra in the Orange Book, and they were referred to by the parties as the "method of treatment" patents. Defendants certified in their ANDAs that the method of treatment patents are "invalid or will not be infringed by the manufacture, use, or sale" of its generic omeprazole. *See* 21 U.S.C. s. 355(j)(2)(A)(vii)(IV). Astra then filed these patent infringement suits pursuant to 35 U.S.C. s. 271(e)(2)(A), alleging that the generic omeprazole formulations for which Defendants sought approval would induce infringement of the method of treatment patents because it would be used by doctors and patients, both alone or in combination with an antibiotic, to treat infections of H. Pylori bacteria. Plaintiffs charge each Defendant with infringement of U.S. Patent No. 5,093,342 (the " '342 patent") under both 35 U.S.C. s.s. 271(b) (declaratory relief) and 271(e)(2)(A). Named Plaintiff Aktiebolaget Hassle is the assignee of United States Patent No. 5,093,342 (the " '342 patent"), which was filed in the United States on September 12, 1990. For purposes of this case, the parties have stipulated that the '342 patent is owned by AB Hassle. (4/19/02 Tr. 6085:4-10, 6095:3-5 (Cheminor excepted).) As a defense to the charges of infringement, Defendants Genpharm, Cheminor, and Andrx allege that the '342 patent is anticipated under 35 U.S.C. s.

102(b) in view of Exhibit G683 (the "Unge Abstract"). Genpharm also alleges that the '342 patent is invalid under 35 U.S.C. s.s. 101 and 112, paragraph 1. The Unge Abstract is the only prior art upon which Defendants relied.

On April 15, 2002, this court ordered an evidentiary hearing to address the validity issues with respect to the '342 patent. (Trial Tr. 5762:11-18.) At that time, the court indicated that it would rule on validity first, and address infringement issues with respect to the '342 patent only if the asserted claim of the '342 patent was valid. Defendants Andrx and Genpharm presented live expert testimony at the evidentiary hearing from Drs. Eugene Straus and Robert Shaw. Dr. Straus is an individual of at least ordinary skill in the art of treating individuals infected with H. pylori. (Straus Tr. at 5790:5-21.) Dr. Straus was qualified, without objection from Astra, to testify as an expert in gastroenterology, diseases of the digestive system, and the diagnosis and treatment of acid peptic disorders including H. pylori. (Straus Tr. 5789:13-19.) Dr. Shaw is also an individual of at least ordinary skill in the art in the treatment of individuals infected with H. pylori. (Shaw Tr. 5844:24-5849:8.) He is a staff physician in gastroenterology at the Veterans Administration Hospital in Northport, New York, who is responsible for seeing patients and teaching medical students and who has conducted research in the area of gastroenterology for at least fifteen years. (Shaw Tr. at 5844:24-5846:24.) He has diagnosed and treated many patients infected with H. pylori and is an expert in gastroenterology (Shaw Tr. 5846:25-5848:17, 5849:3-8.) Defendants also submitted designated portions of the deposition testimony of numerous witnesses.

Astra presented expert testimony from Dr. Steven J. Czinn. Dr. Czinn is a professor of pediatrics and pathology at Case Western Reserve University, as well as the Chief of Pediatric Gastroenterology at Rainbow Babies & Children's Hospital. (Czinn Tr. 5939:9-11.) He has been a practicing gastroenterologist for seventeen years. (Czinn Tr. 5941:14-15.) He was accepted by the court as an expert in the fields of gastroenterology, H. pylori, treatment of H. pylori and associated conditions, and prescribing habits of physicians in treating GI disorders and H. pylori in particular. (Czinn Tr. 5947:23-5948:8.) Astra also counterdesignated deposition testimony. After the conclusion of the evidentiary hearing, the court found by clear and convincing evidence that the asserted claim of the '342 patent was invalid because it was anticipated by the Unge Abstract. (Order of 4/22/02.) The court reserved decision on the other defenses raised by Genpharm with respect to the '342 patent. Id. The court also indicated that an opinion elaborating upon the court's reasoning would follow. For the following reasons, the court finds by clear and convincing evidence that the single claim stated in the '342 patent is invalid as anticipated under 35 U.S.C. s. 102(b).FN105

FN105. Because the court finds that the sole claim of the '342 patent is invalid as anticipated, the court need not consider Genpharm's alternative arguments in support of invalidity.

The only remaining asserted method of treatment patent to be addressed by the court at this time is the '342 patent. The '342 patent generally relates to the use of omeprazole in the treatment of certain infections and gastrointestinal disorders caused by the bacterium Helicobacter pylori, or H. pylori-an extremely common infection of mankind. (Czinn Tr. 5942:12-16.) H. pylori was discovered by researchers working in Australia in 1982. (Czinn Tr. 5942:18-25.) The bacterium has been referred to by several names over the years. One of the early names was Campylobacter pylori. Since that time, however, it has been renamed Helicobacter pylori or H. pylori. (Shaw Tr. 5852:12-15.) H. pylori was found to reside in the stomach lining and is now understood to be a causative factor in the onset of many types of gastritis-inflammation of the stomach wall-and peptic ulcer disease. (Czinn Tr. 5942:13-16.) The majority of duodenal ulcers and gastric ulcers

are caused by H. pylori, which also inevitably leads to gastritis, and, over a prolonged period of time, can lead to gastric cancer. (Czinn Tr. 6007:24-6008:24.) H. pylori infections are not only related to gastrointestinal diseases. There are reports in the literature that H. pylori also causes dermatological conditions, psoriasis, rosacea, and atopic dermatitis. (Czinn Tr. 6009:3-7.) H. pylori has also been linked in coronary artery disease in some reports. (Id.)

A. Claim Construction

The '342 patent has only one claim: "A method for the treatment of Campylobacter infections comprising administering to a patient suffering therefrom an amount of [omeprazole] or a pharmaceutically acceptable salt thereof sufficient for the treatment of said infection. (G5, col. 4:62-67.) In its Order of July 2, 2001, denying Genpharm's motion for summary judgment, the court construed claim 1 of the '342 patent as follows: "the '342 patent claims 1) the administration of omeprazole alone 2) for the express purpose of treating H. Pylori." (7/02/01 Order at 11.) Further, the court found:

Within this context, the term "treatment" must be construed to reflect the purpose that animates the claim, and must therefore contain a limitation of purposeful directedness toward H. Pylori or an H. Pylori-associated condition. This limitation is essential to distinguish uses of omeprazole that are directed to a different purpose (and that are subject to prior patents, such as the '431 patent) but that would nonetheless have an incidental effect on any H. Pylori condition existing in the patient.

(7/02/01 Order at 10-11.) The court adopts its earlier claim construction of the '342 patent with one revision. The court finds that the term "comprising" in claim 1 does not limit the claim to administering omeprazole *alone* to treat H. pylori. *See* Georgia-Pacific Corp. v. United States Gypsum Co., 195 F.3d 1322, 1327 (Fed.Cir.1999) ("The transitional term 'comprising' ... is inclusive or open-ended and does not exclude additional, unrecited elements or method steps."). In accordance with this court's findings concerning the meaning of the term "comprising" in the claim and the parties' stipulation that the claim encompassescombination therapies, the court construes claim 1 of the '342 patent as follows: the '342 patent claims 1) the administration of omeprazole, either alone or in combination with other substances, 2) for the express purpose of treating H. pylori.

The court agrees with Astra that the kind of treatment claimed in the '342 patent is limited by the prosecution history to the use of omeprazole as an antimicrobial. The patent examiner initially rejected the '342 patent claim as anticipated by or obvious over European Patent 0 045 200. (P10A, Office Action of 1/30/91, at 3.) European Patent 0 045 200 disclosed the use of omeprazole as an acid suppressant, not as an antimicrobial. In responding to the Office Action, Astra expressly stated that the '342 patent "claimed use of omeprazole as an antimicrobial agent" and distinguished the reference on that basis. (P10A, Amendment under 37 C.F.R. s. 1.111 of 7/22/91, at 3.) On this ground, the examiner granted the '342 patent. (P10A, Notice of Allowability of 8/29/91.) Accordingly, the file history expressly requires that the claim is limited to antimicrobial use. The specification also points out that the '342 patent is directed toward a use of omeprazole as an antimicrobial agent. The title of the patent is "Use of Omeprazole As An Antimicrobial Agent." (G5, col. 1:1-3.) This is reinforced by numerous explicit statements in the specification. (*See* G5, col. 1:6-11; *see also* G5, col. 1:38-52, col. 1:66-col. 2:6.) The experimental data reported in the patent specification are antimicrobial activity data. (Id. at col. 3:16-35.) There is no disclosure in the patent of any other type of treatment or use of omeprazole to treat H. pylori. (Czinn Tr. 5951:25-5952:5.)

B. Anticipation

Invalidity must be proven by clear and convincing evidence. Bristol-Myers Squibb Co. v. Ben Venue Labs., Inc., 246 F.3d 1368, 1374 (Fed.Cir.2001); Verdegaal Bros., Inc. v. Union Oil Co., 814 F.2d 628, 631 (Fed.Cir.1987). A patent is invalid under 35 U.S.C. s. 102(b) "if the invention was ... described in a printed publication in this or a foreign country ... more than one year prior to the date of the application for patent in the United States." The parties have stipulated that the foreign priority date for the '342 patent is February 9, 1999. (Tr. 6094:1-6.) The parties further agreed that by application of 35 U.S.C. s. 119, a printed publication published prior to February 9, 1998, satisfies the time period under 35 U.S.C. s. 102(b). The prior art reference before the court is cited as Unge *et al.,* "Does omeprazole, 40 mg o.m., improve antimicrobial therapy directed towards gastric Campylobacter pylori in patients with antral gastritis?", International Symposium on Omeprazole Proceedings (1988) (the "Unge Abstract"). (G683.) The Unge Abstract was admitted into evidence in accordance with a stipulation by the parties, approved by the court, that the reference meets all of the requirements of 35 U.S.C. s. 102. (Tr. 5740:21-5741:1.) Finally, the parties have stipulated that the Unge Abstract, G683, is a printed publication as of November 12, 1988, under s. 102(a) and (b). (Stipulation of 4/15/02.)

Although a patent is presumed valid under 35 U.S.C. s. 282, where the party challenging validity of the patent relies on prior art or other evidence that was not considered by the USPTO, there is "no reason to defer to the PTO." Am. Hoist & Derrick Co. v. Sowa & Sons, 725 F.2d 1350, 1359 (Fed.Cir.1984). The Unge Abstract was not cited to or considered by the USPTO in issuing the '342 patent. (*See* G5, col. 2.) A patent claim is anticipated if a single prior art reference under s. 102(b) contains each element of the properly construed claim either expressly or inherently. Verdegaal, 814 F.2d at 631; Bristol-Myers, 246 F.3d at 1374; EMI Group N. Am. Inc. v. Cypress Semiconductor Corp., 268 F.3d 1342, 1350-51 (Fed.Cir.2001). The inherent aspects of a reference are the naturally occurring results or properties of a method, process, or structure. Bristol-Myers, 246 F.3d at 1376 (antitumor effect inherent in the disclosed therapy); Eli Lilly & Co. v. Barr Labs., Inc., 251 F.3d 955, 976 (Fed.Cir.2001) (serotonin uptake inhibition is inherent biological effect of administering fluoxetine hydrochloride). As this court has previously observed, the inherent, synergistic effect of a known method of use is not patentable. (Order of 7/2/01 at 19-20 (citing Bristol-Myers, 246 F.3d at 1376).) Inherent anticipation arises when "the prior art necessarily functions in accordance with, or includes, the claimed limitations," regardless of whether persons of ordinary skill in the art would "recognize the inherent characteristics or functioning of the prior art." Atlas Powder Co. v. IRECO Inc., 190 F.3d 1342, 1347 (Fed.Cir.1999). The inherent effects or results of a process or method disclosed in a reference may be proven by extrinsic evidence, including disclosures after the priority date of the patent. Bristol-Myers, 246 F.3d at 1379-80 (noting that enablement of an anticipatory reference may be shown by later references). Reliance on extrinsic evidence is sometimes appropriate to explain the meaning of terminology in a prior-art reference raised under s. 102, *see* Scripps Clinic & Research Found. v. Genentech, Inc., 927 F.2d 1565, 1576 (Fed.Cir.1991), or to explain how such a prior-art reference discloses the enablement of an alleged invention, *see* In re Donohue, 766 F.2d 531, 533 (Fed.Cir.1985).

Contrary to Astra's arguments, the court finds that the Unge Abstract unambiguously demonstrates a specific intent to give omeprazole to a patient to treat an H. Pylori infection. (Shaw Tr. 5863:3-19.) The authors of the Unge Abstract performed the study by administering omeprazole alone *and* in combination with an antibiotic for the purpose of treating H. pylori infections. (Shaw Tr. 5863:3-19.) As Dr. Unge himself testified, the research that is disclosed in the Unge Abstract is research concerning "the effects of omeprazole on H. Pylori." (Unge Dep. Tr. 33:10-34:2; *see also* Cederberg Dep. Tr. 86:8-87:24, 91:12-22.) The purpose of Dr. Unge's study was to compare the results of "treatment" of H. pylori infections with omeprazole and amoxicillin in combination to the results when each compound was administered alone. (G683; Unge Dep. Tr. 36:6-16; Straus Tr. 5796:7-5797:7.)

The Unge Abstract describes three "treatment groups" composed of patients known to have H. pylori infections; each treatment group received a different treatment regimen. (Shaw Tr. 5857:19-5858:2.) As described in the Unge Abstract, the study was conducted on 24 human patients infected with H. pylori. (G683; Straus Tr. 5796:7-12, 5798:19-21; Shaw Tr. 5857:10-15.) The investigators divided the 24 patients into 3 groups for the purpose of comparing the effect of treatment. (G683; Straus Tr. 5796:13-16; Shaw Tr. 5857:19-5858:18.) Group 1 was treated with 40 mg of omeprazole and 750 mg of amoxicillin administered twice a day. (G683; Straus Tr. 5796:16-18, 5797:8-13; Shaw Tr. 5862:6-11.) Group 2 was treated with 40 mg of omeprazole alone. (G683; Straus Tr. 5796:19-20, 5797:8-13; Shaw Tr. 5862:6-11.) That dosage is within the amount specified by the '342 patent itself and is a sufficient amount of omeprazole for treatment. (G5, col. 3:7-10, 41-45, col. 4:17-60; Straus Tr. 5797:14-18, 5800:22-24; Shaw Tr. 5895:7-18.) Group 3 was treated with 750 mg of amoxicillin twice daily. (G683; Straus Tr. 5796:21-22; Shaw Tr. 5862:6-11.) The court finds that every element of the claim of the '342 patent is disclosed in the treatment of both Group 1 and Group 2 of the Unge Abstract. (Straus Tr. 5795:24-5798:14, 5799:7-18, 5803:22-5805:1; Shaw Tr. 5855:2-9, 5865:3-16.)

As the Unge Abstract itself makes clear from its frequent use of the term "treatment," the patients in all three groups were being treated for the purpose of reducing or eradicating H. pylori infections. (Straus Tr. 5799:7-18, 5800:22-5801:10, 5802:22-5803:21; Shaw Tr. 5860:16-24; Unge Dep. Tr. 36:6-16, 37:13-39:3; Cederberg Dep. Tr. 86:8-87:24, 91:5-22.) This is confirmed by the fact that each of the three groups was tested for the presence of H. pylori both immediately after treatment and 4 weeks later. (G683; Straus Tr. 5796:22-5797:7, 5814:18-5815:12; Shaw Tr. 5858:13-18, 5863:6-19.) All of the experts and Dr. Unge himself agree that omeprazole and amoxicillin were administered to the patients in Group 1 for the express purpose of treating H. pylori infection and that the H. pylori was eradicated in 5 out of 8 patients in that group. (Straus Tr. 5803:14-5805:1; Shaw Tr. 5864:2-6; Czinn Tr. 6069:20-6070:4; Unge Dep. Tr. 37:13-39:3; Cederberg Dep. Tr. 86:8-87:24, 91:5-22.) On cross-examination, Dr. Czinn even admitted that the patients in Group 1 were being "treated" as that term is used in the '342 patent and that the treatment of Group 1 falls within the patent. (Czinn Tr. 6062:20-6063:25.)

The Unge Abstract also discloses that the patients in Group 2 were tested for the presence of H. pylori after being given omeprazole alone. (G683; Straus Tr. 5796:7-24.) One of the 8 patients in that group showed a decrease in the number of H. pylori organisms present immediately after treatment. (G683; Straus Tr. 5812:16-5813:3; Shaw Tr. 5863:20-5864:1.) Thus, the Unge Abstract discloses the administration of omeprazole alone not only for the purpose of treating H. pylori, but also with some possibility of there being some salutary effect from the administration, albeit not as successful as in Group 1. (Straus Tr. 5812:16-5813:3; Shaw Tr. 5863:20-5864:1.) In fact, Dr. Unge confirmed that the patients in that Group 2 "control group" were "treated" with omeprazole alone as part of his research on the effects of omeprazole on H. pylori-a fact that is clear from the Abstract itself. (Unge Dep. Tr. 38:11-25; Czinn Tr. 6065:7-13.) Dr. Unge never asserted that these patients were not "treated" with omeprazole. He simply concluded that the treatment for Group 2 was not successful under his definition of success, namely, eradication of the infection. (Unge Dep. Tr. 38:11-25.) Although Dr. Czinn repeatedly insisted that Dr. Unge was only interested in "what omeprazole as an acid secretory agent does" (*see, e.g.,* Czinn Tr. 6065:14-18, 6066:25-6067:5), he offered no explanation as to why, if that was what Dr. Unge was interested in, Dr. Unge never tested how well the omeprazole suppressed acid secretion but rather tested only for the effect of omeprazole on the Group 2 patients' H. pylori infections. (Czinn Tr. 6066:7-6067:19); *accord* (Straus Tr. 5814:18-24, 5815:4-12, 5816:23-25, 5818:24-25, 5820:5-5821:2.)

The evidence does not support Astra's theory that omeprazole was given to Group 2 as a "placebo." (Czinn Tr. 6069:2-5.) Dr. Czinn's testimony on this theory lacked credibility. His testimony was undermined by his refusal to answer direct questions other than with repeated recitation of Astra's theories, (*see, e.g.,* Czinn Tr. 6058:19-6059:23, 6067:6-19, 6068:16-6069:5), and by his attempt to explain damaging statements with explanations that were directly at odds with his prior deposition testimony, (*Compare* Czinn Tr. 6076:20-6077:18; *with* Czinn Tr. 6080:1-6081:9). As Dr. Straus explained, "[a] placebo is generally an *inert* substance that you give in an experiment so that the *597 investigators or subjects don't appreciate that they are not being treated with anything active." (Straus Tr. 5801:11-17.) Omeprazole is not an "inert substance." (Id.) Rather, it is "one of the most potent materials from the point of view of its effects on the stomach." (Id.) Had omeprazole, in fact, been given to Group 2 as a placebo, there would have been no need to have those patients submit to two additional endoscopic tests, which even Dr. Czinn admitted are "not a trivial undertaking." (Czinn Tr. 6069:6-18.) Finally, the subsequent expanded report of the Unge study, Exhibit A246, clearly demonstrates that omeprazole was not administered to Group 2 as a placebo. The patients in Group 2 were given placebo tablets in place of amoxicillin, just as those in Group 3 were given placebos in place of omeprazole. (A246 at 1.)

That only one of eight patients benefited by a temporary suppression of the infection is irrelevant to the anticipation inquiry. *See* Celeritas Techs. Ltd. v. Rockwell Int'l Corp., 150 F.3d 1354, 1361 (Fed.Cir.1998) (holding that the prior art need not present the invention in a positive light, as long as all the claim limitations are explicitly or inherently disclosed in the publication). (*Cf.* Czinn Tr. 6038:10-14 ("The '342 patent does not purport to claim the optimum treatment for H. pylori but rather *a* method of treatment.") (emphasis in quoted expert rebuttal report).) The same data showing suppression of H. pylori by omeprazole monotherapy and combination therapy in the Unge Abstract were published later in a scientific journal, (*see* G42), which credited without comment the results reported in the Unge Abstract. (G42; Czinn Tr. 6019:17-20.) Other researchers published their observations about the study conducted by Unge, relying on the results as reported. (G607; Czinn Tr. 6027:3-18.) Like Dr. Shaw, those researchers understood that Unge reported suppression of the H. pylori infection in one out of eight patients in treatment Group 2. (*See* G607; Shaw Tr. 5870:24-5871:10.) There is no genuine dispute that the Unge presentation at the Monaco symposium discloses administration of omeprazole sufficient to treat H. pylori infection. Astra gave binding admissions through its 30(b)(6) witness, Dr. Cederberg, that Unge's work, as presented at the Monaco conference, shows antimicrobial effect. (Astra by Cederberg 30(b)(6) Dep. Tr. 87:10-20; 91:12-92:2.)

Although the court agrees with Astra that the '342 patent specification and prosecution history require that omeprazole be used as an antimicrobial, this does not mean that the claim actually requires any particular antimicrobial effect or result at the end of the treatment. The court finds that the Unge Abstract discloses the use of omeprazole, both alone and in combination for the express purpose of treating H. pylori infections. Relying on Rapoport v. Dement, 254 F.3d 1053 (Fed.Cir.2001), Astra argues that the Unge Abstract cannot be anticipating because the omeprazole in Unge is being used because of its antisecretory effect not its antimicrobial effect. Astra confuses the mechanism of action of the medication with the purpose of treatment. In *Rapoport,* there were two different medical conditions at issue-the underlying sleep apnea disorder and the symptoms caused by the disorder, like nervousness. 254 F.3d at 1059. In the treatment described in the Unge Abstract, it is undisputed that all medication is being prescribed to treat the H. pylori infection itself. Whether Unge may have speculated that omeprazole would treat the H. pylori infection or facilitate that treatment through its affect on the bioavailability of the antibiotic through the mechanism of its acid suppressant effect is irrelevant-Unge was treating H. pylori infections, and the disclosure of Group 2 treatment in the Unge Abstract demonstrates an actual *598 antimicrobial effect by omeprazole itself. For the foregoing reasons, the court finds that Defendants have proven through clear and convincing evidence

that claim 1 of the '342 patent is invalid as anticipated.

VII. Conclusion

The parties are ordered to submit a stipulated judgment incorporating the rulings contained in this opinion and order to the court on or before Monday, October 21, 2002. The court will then enter judgment pursuant to Federal Rule of Civil Procedure 54(b), as the court has determined that there is no just reason for delay.

SO ORDERED.

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