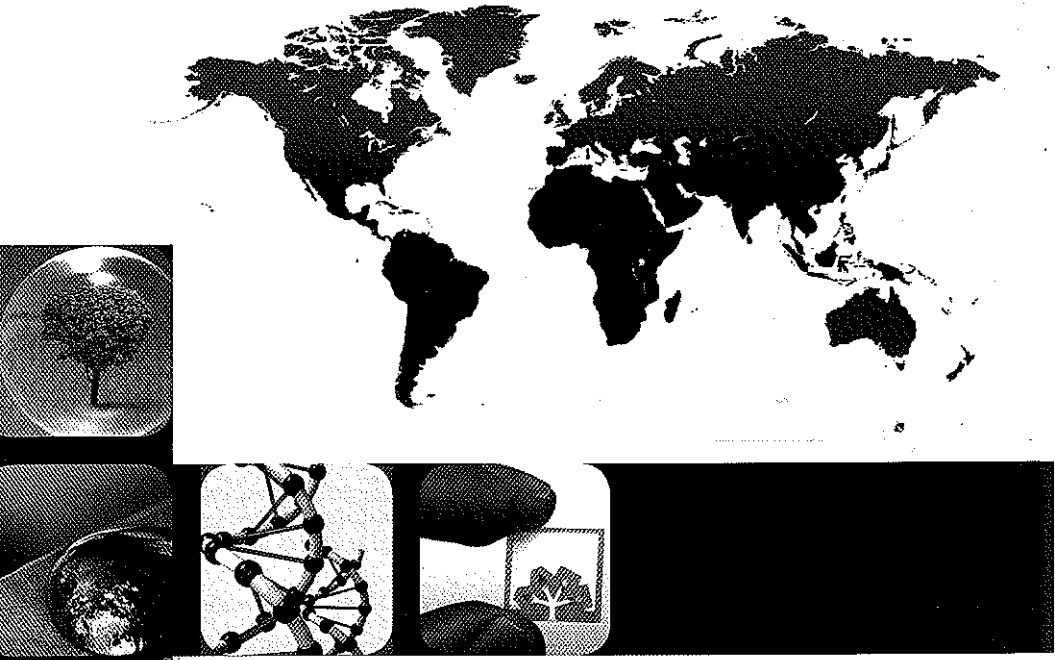
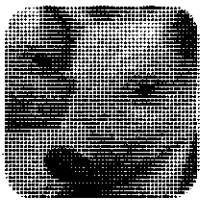




Innovations from Academic Research

THE BETTER WORLD REPORT 2009





Innovations from Academic Research That Positively Impact Global Health

2009 Edition
www.betterworldproject.net

Borman for spearheading the 2009 Edition of the
s of the AUTM Board of Trustees for their ideas,
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ies who told their stories.

ament to the efforts of institutions' technology
d staffs, who gathered and submitted these stories
ll the story of how institutions are doing their part
ot only through education but through innovation,
that we bring to light in this report.

orld Report were researched and written by
ie, Ralph Fuller, Mary Jane Roberts Henderson,
ea, David Perilstein, Lisa Richter, Julie Ritzer Ross,
ld Report was produced by The Sherwood Group,
firm serving science, technology and health care
nent staff and the communications department at
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University of British Columbia

eport is the fourth in our series of reports
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But we still have a long way to go. There are tremendous opportunities to solve medical problems in developing countries that have yet to be pursued. Indeed, the progress that has been made in improving delivery of today's medicines through programs such as the Global Fund, WHO, and the distribution of HIV/AIDS drugs through U.S. President's Emergency Plan for AIDS Relief (PEPFAR) only accentuates the inadequacy of treatments for malaria, tuberculosis, diarrheal diseases, systemic worm infections and trypanosomal parasites such as African sleeping sickness. In many cases these treatments are decades old. Some are inadequate, toxic or treacherous to administer. In other cases pathogen resistance is rendering today's treatments ineffective.

We know there's no reason, in theory, that we can't prevent and treat those diseases. Since the invention of recombinant DNA technology in 1973 there has been a revolution in the science of drug and vaccine discovery, and stunning breakthroughs in genomics and biochemistry that give us the tools to understand and harness the molecular mechanisms that underlie human disease. These advances have borne fruit in the important biotech-based drugs and biologics that have been introduced by the biotechnology and pharmaceutical industries over the past thirty years.



Health Care Systems
s Practical Assistance
und Personal Growth

Yale University

A Life-Altering Experience for All Involved

The new hospital CEOs aren't the only ones who have evolved in profound ways. For the fellows who left homes in the United States, Spain and the Philippines to spend a year or more abroad in a developing nation, the program is much like a stint in the Peace Corps.

"It's just exceptional what happens to both our health care workers and the employees they mentor," says Bradley.

Arriving in Liberia, which is just emerging from years of civil war, fellows found the country's hospitals lacked basic systems that Westerners take for granted—from running water on patient floors to an on-site incinerator for hazardous waste to a complete list of employees' names.

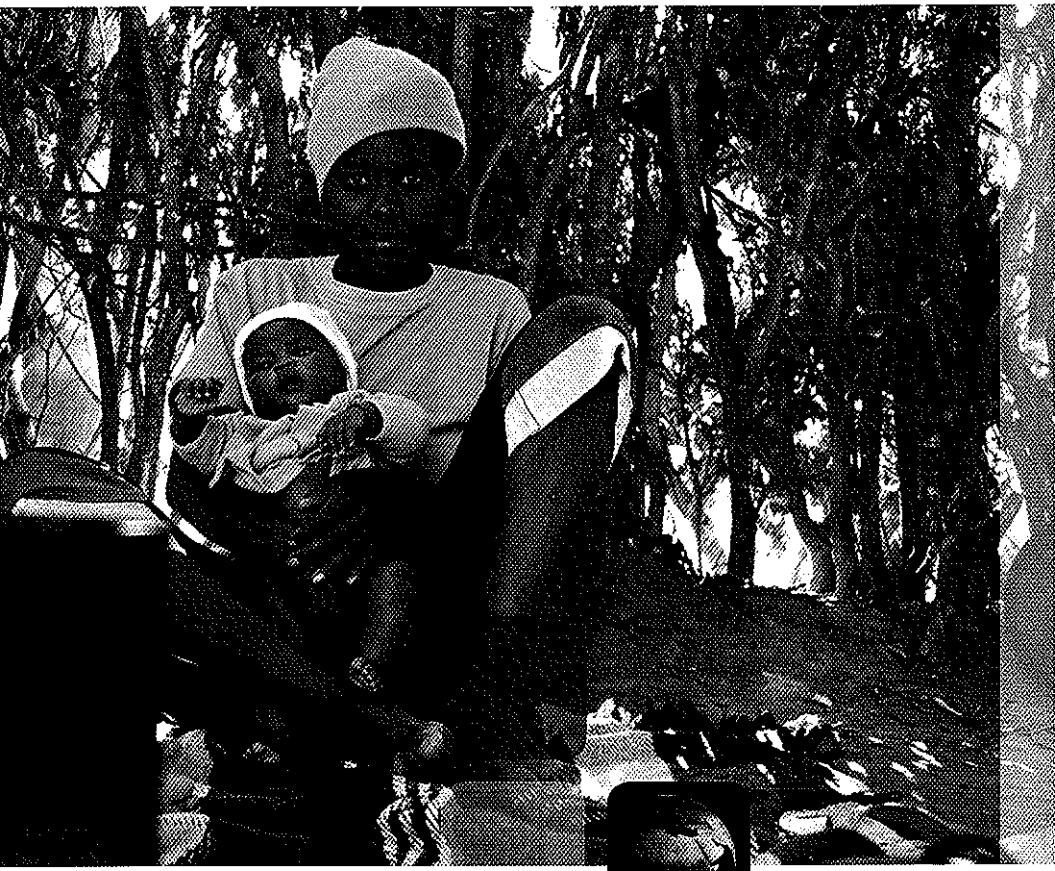
"It can be quite shell-shocking," says Bradley. "The fellows can look agog at the conditions, which can be quite frustrating."

As their work continues, the fellows experience lots of ups and downs, and admittedly, a few points where they think nothing will ever change, says Bradley, who has spent considerable time abroad as well.

"It's difficult, but in the end it's an unbelievable experience, very fulfilling," she says.

That's no doubt due to the fact that, over time, the fellows are able to affect the future of care provided to millions of Africans, many of whom face dire health circumstances. On a personal level, there is no discounting the impact of living and working among the Liberians and Ethiopians, who often express profound gratitude for the fellows' guidance.

"The people are so warm and so thankful," says Bradley. "Our fellows become a part of their families."











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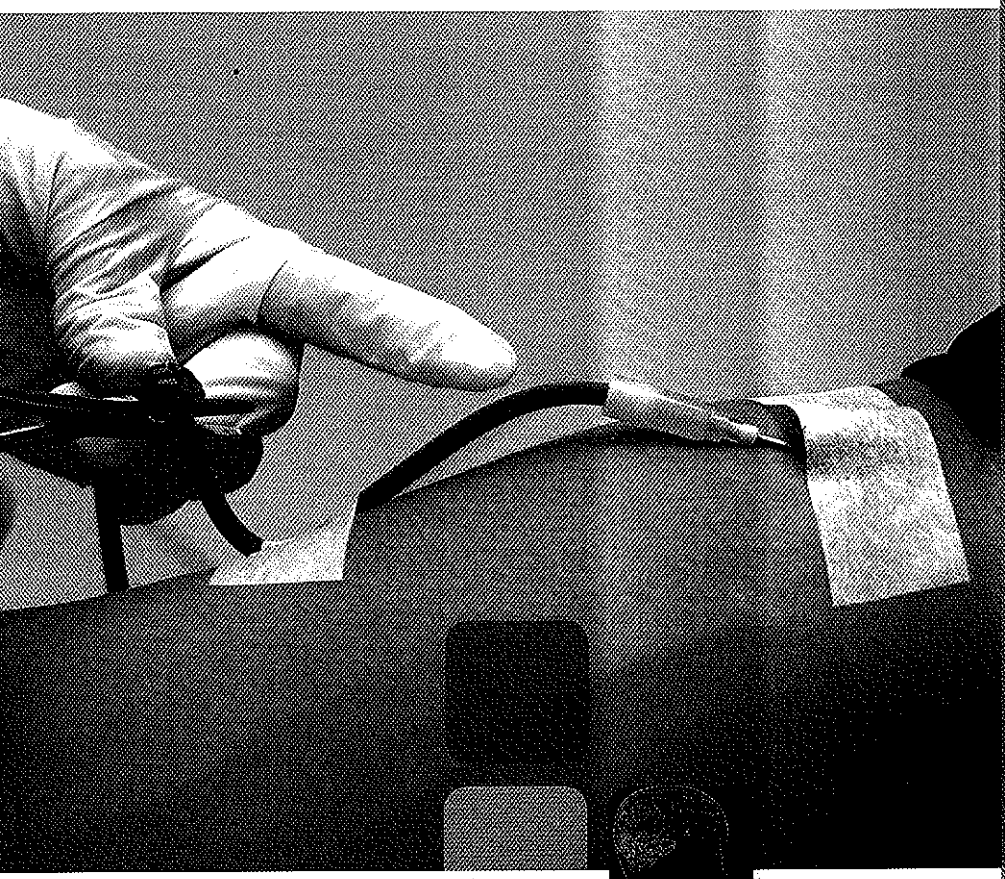
Each stove costs $25. Since this is an outrageous amount for refugees to pay, international non-governmental agencies underwrite the stoves. Amy Callis, Executive Director of the Darfur Stoves Project, works with organizations such as The Hunger Site to distribute the stoves and provide training to ensure the most efficient cooking.

There has already been a high demand for the stoves. During a three-week trial, 50 stoves were distributed and assessed. After the study, the stoves were offered for sale, and each one was bought.

This successful program could not have been possible without the collaboration of experts from various fields—Gadgil and his scientific team, Chow and his engineers and Callis' networking and communication skills. The project was executed almost entirely by volunteers. Each had their own specialty and none worked exclusively.

"We're doing what we can to relieve them from suffering, but the humanitarian crisis is extreme," said Chow. "The stoves will improve the situation but will not be an answer to the crisis." For more information visit www.darfurstoves.org.



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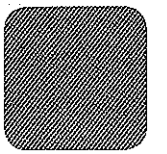









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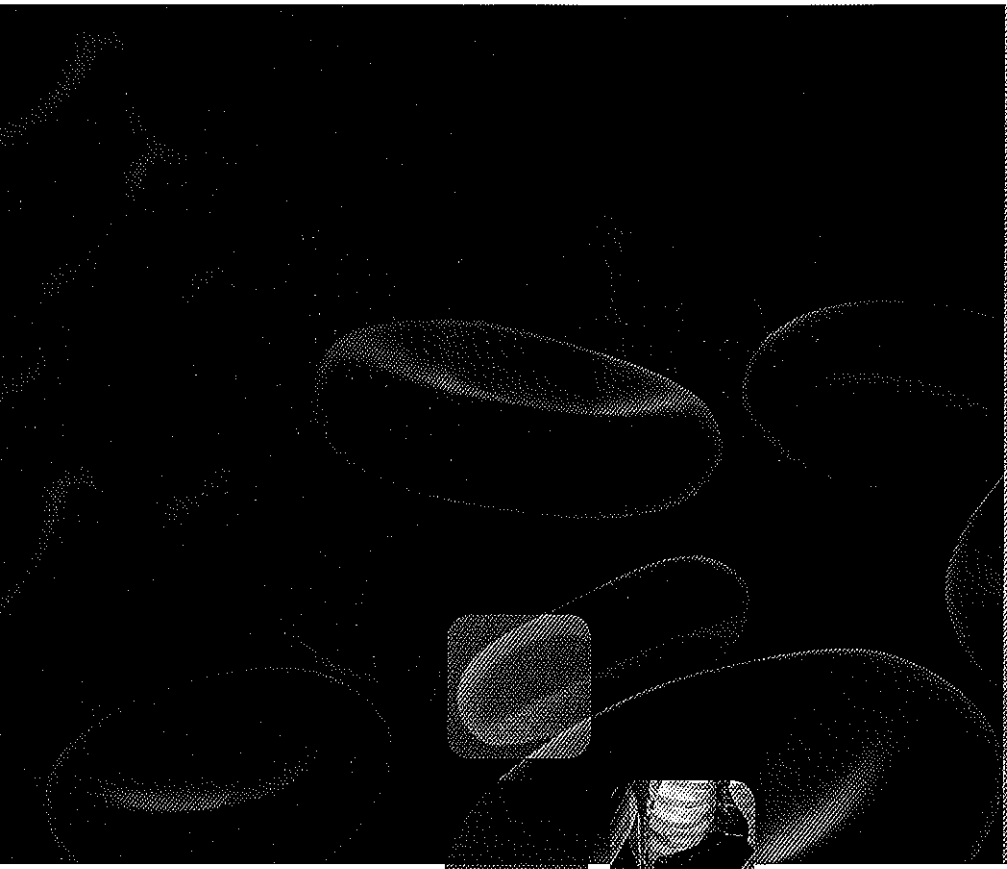

Researchers Invent an Intelligent System for is and Hemofiltration

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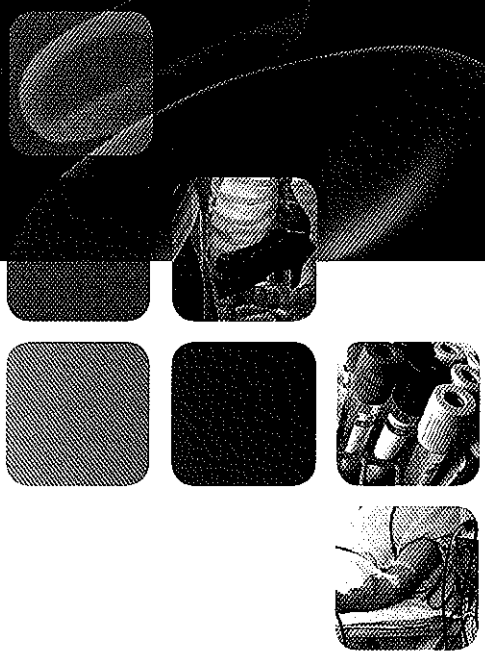



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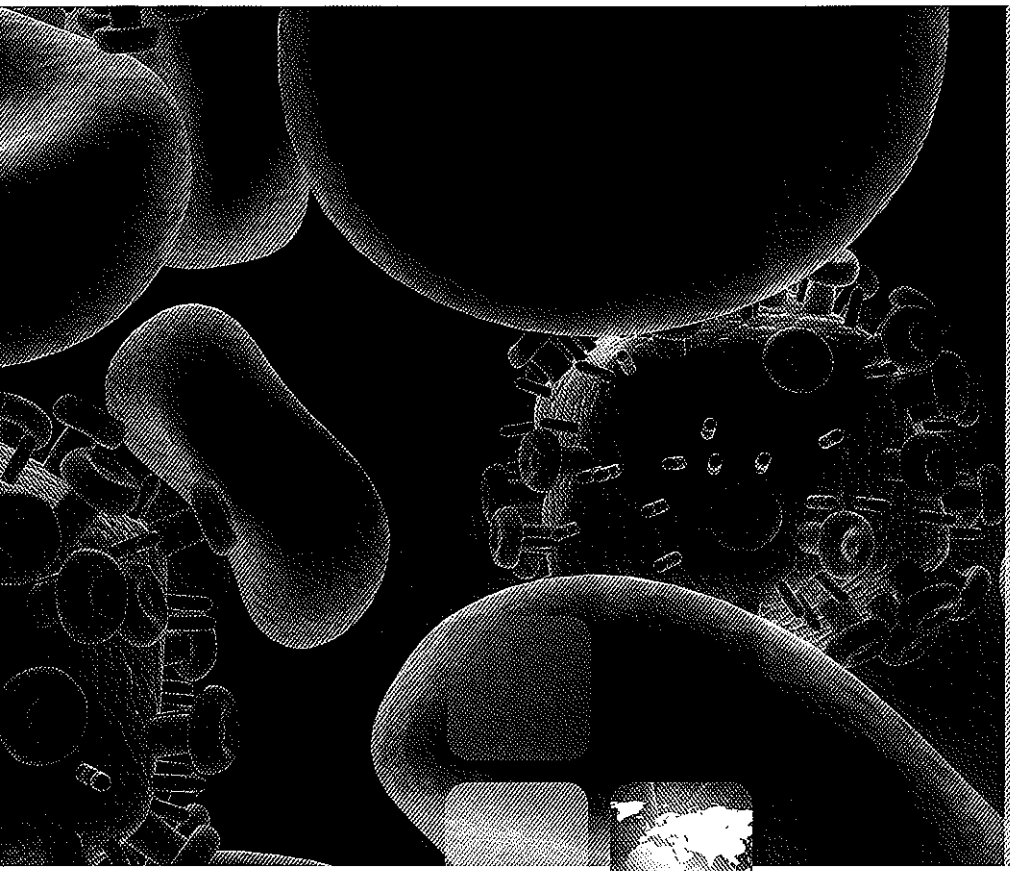
Continuing research includes applications in the poultry industry with turkeys, chickens, and ducks, as well as work with swine to investigate substitution of greater amounts of enzyme for more and more of the inorganic phosphate supplements. Additional work at Cornell has included improving the enzyme's resistance to the heat and moisture encountered during the pelleting process.

Within the phytase research programs, Lei has had "the opportunity to teach students that technology can make a real impact—research is not just about writing papers," he says. And he has been pleased with the experience of working with commercialization partner, Phytex. "There is a great role for university professors and industry to work together as a team."



Once-a-Day HIV Meds ality of Life and Hold Developing Countries









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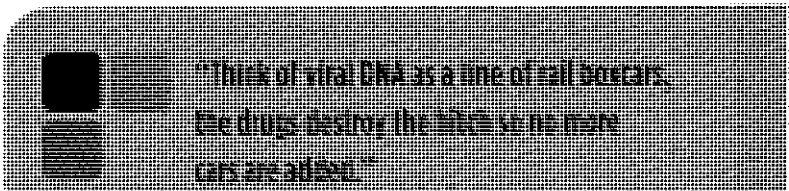
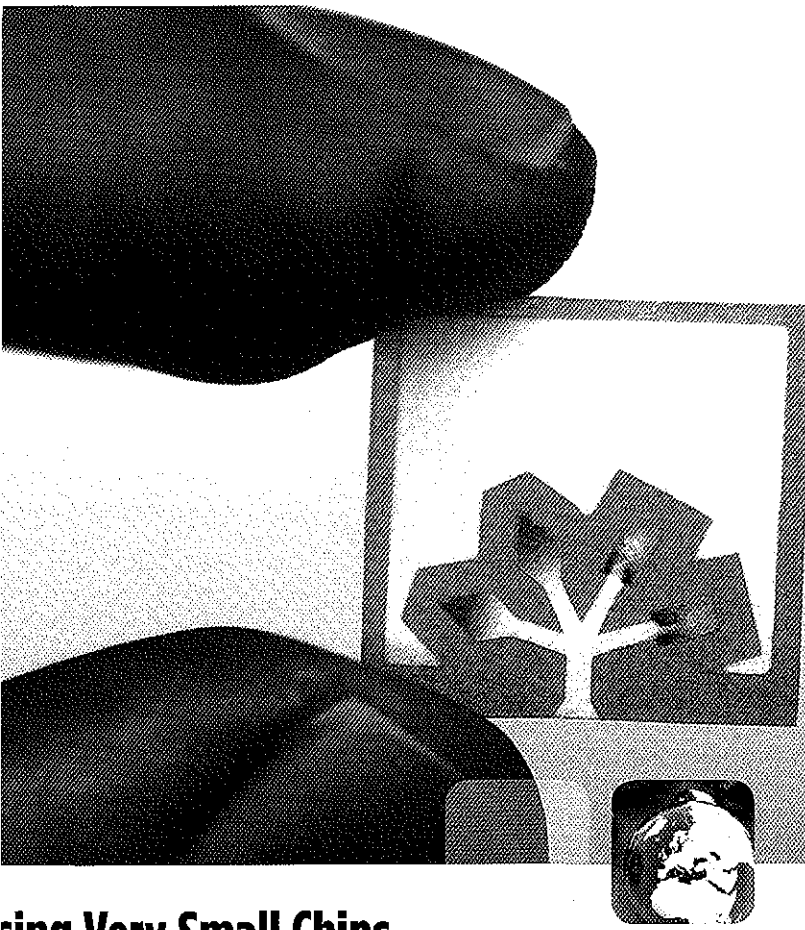
Today's combined efforts of Emory, Gilead, Merck and Bristol-Myers have saved millions of lives worldwide.

Although these results are very gratifying, this is far from the end of the story. Emory researchers are expanding their search for more lifesaving drugs. The new Emory Institute for Drug Discovery will open either late fall or early winter of 2009. Within its walls, scientists will attack several diseases with an unfailing determination to stop their trek across human lives. "We may not make a fortune, but we will make a difference," smiles Liotta. Indeed, sir, you already have.













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A Laboratory Full of Rising Stars

As an educator at the Massachusetts Institute of Technology (MIT) and now at Harvard, Whitesides has mentored countless up-and-coming scientists, researchers and entrepreneurs. Two of those students, Hayat Sindi and Jim Barber, are central players in the formation of DFA (other principals include Carmichael Roberts, Ph.D., co-founder and board member, and Isaac T. Kohlberg, Harvard's Senior Associate Provost and Chief Technology Development Officer).

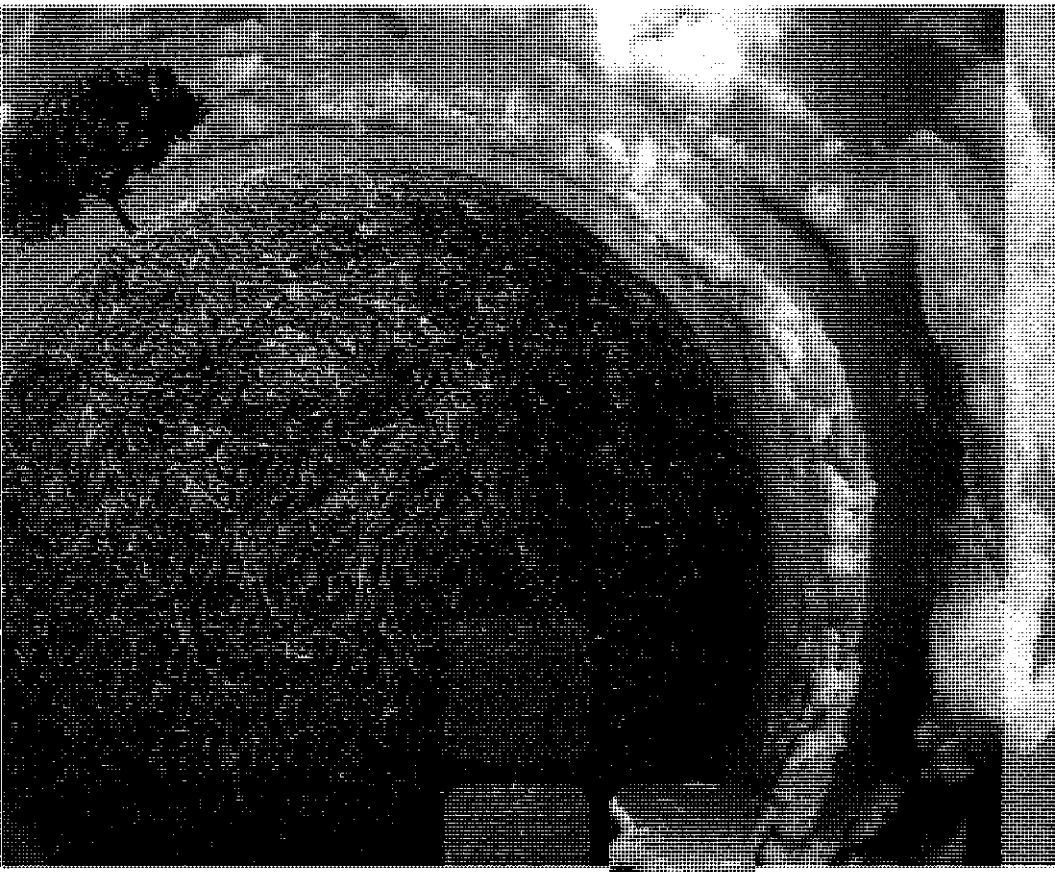
Hayat Sindi

Sindi, of Saudi Arabia, came to Harvard as a visiting scholar specifically to work with Whitesides. She found in him both a mentor and a kindred spirit.

"From the time I was a young girl, I knew I wanted to make a difference in the universe," Sindi says. "I really admired scientists, and I knew I wanted to dedicate my time and education to helping others."

Whitesides encouraged Sindi, the first woman in the Persian Gulf area to hold a doctorate in biotechnology, to enroll in a Harvard Business School course on commercializing science. She formed a multidisciplinary team that not only wrote a business plan for DFA, but also worked tirelessly to compete in both the 2008 MIT $100,000 Entrepreneurship Competition and Harvard Business School's 12th Annual Business Plan Contest. In an unprecedented sweep, DFA took top honors at both competitions, marking the first time MIT would award its grand prize to a not-for-profit team.

"By formulating a business plan for a nonprofit company, the group was pushing to change the opinion in the marketplace that it isn't all about making money...it's also about saving people's lives," says Sindi.



ower of Centia Moves ergy Closer to Reality









arolina State University

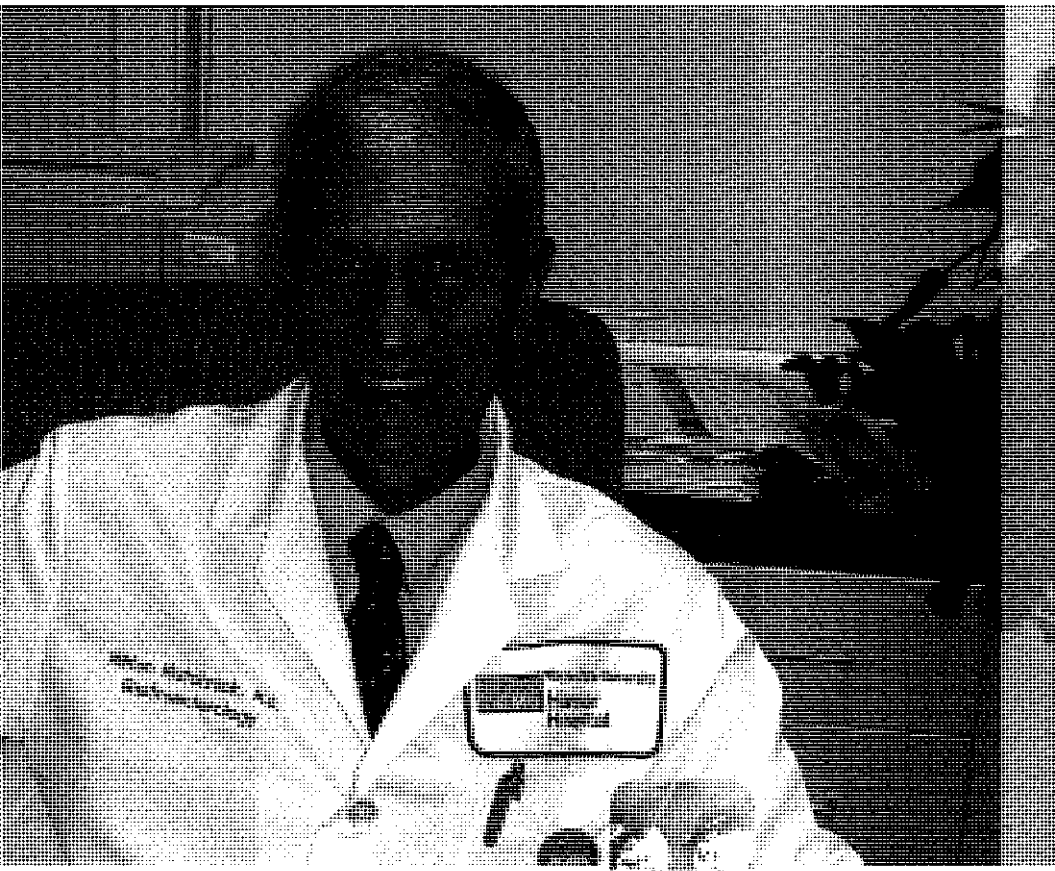
Diversified Energy Corporation specializes in transitioning alternative and renewal energy technologies into viable commercial products. Currently, Centia is one of four technologies in the company's portfolio. "It's still at benchmark scale in nature, but it's sexy, and we're doing the necessary R&D now to have it commercially ready by 2013," says Jeff Hassannia, vice president of business development at Diversified.

The key advantages of fuel products rendered from the Centia process, according to Hassannia, are:

1. No external hydrogen is used which means no fossil fuels are needed to produce the biofuel.
2. The jet fuel made in this process contains the necessary aromatics so there is no damage to engine seals and valves.
3. Diversified Energy incorporates a glycerol burner (another technology in its portfolio) into the process to increase the energy conversion efficiency.

N.C. State made 2008 its "Year of Energy" to highlight its commitment to energy conservation and the development of alternative and renewable energy sources. The university was recently selected by the National Science Foundation to lead a national research center tasked with revolutionizing the nation's power grid. This Engineering Research Center for Future Renewable Electric Energy Delivery and Management (FREEDM) will be headquartered on N.C. State's Centennial Campus and will be supported by an initial five-year, $18.5 million grant.

N.C. State's Office of Technology Transfer is hopeful that Centia will prove to be an important contributor to America's quest for energy independence and will prove crucial to bridging the gap between fossil fuels and the new generation of clean and renewable energy sources.



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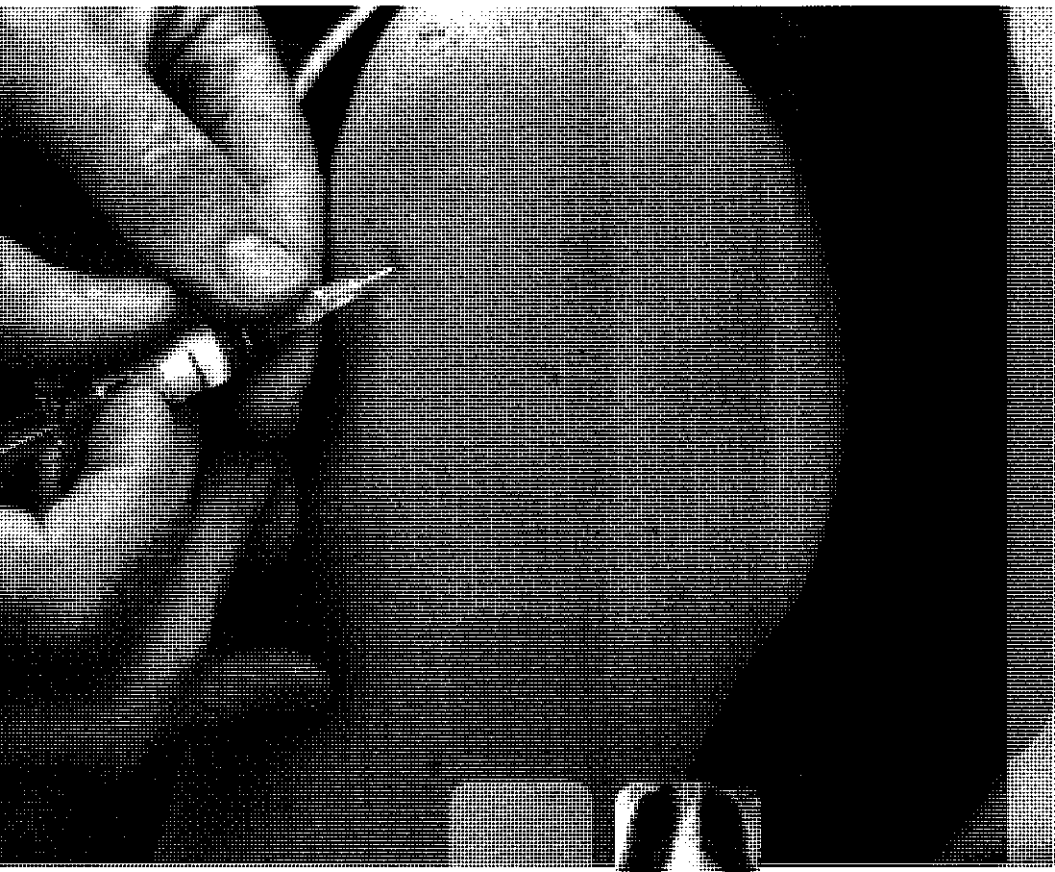
"Zadaxin's original approval in China was for monotherapy treatment of Hepatitis B," notes Randy McBeath, SciClone's Vice President of Marketing. "That began in 1996 and continues today. Since then, Zadaxin's value as an immunity enhancer has been built upon. Today it's also used in China to treat liver cancer and problems of post-surgical infection."

He adds: "Some Asian countries use it to fight Hepatitis C. In Italy, it is employed as an adjuvant drug with both flu and B Virus vaccinations – it lessens the risk of patients with compromised immunity systems developing the virus."

SciClone has continued to seek Zadaxin applications within the U.S. and Europe. In late 2008 the company received FDA approval to begin Phase III trials of Zadaxin's use for treating malignant melanoma – like liver cancer, a disease in which in which patients' immune systems play key roles, McBeath notes.

As for Mutchnick, he's moved on. "I'm out of the thymosin game," he says. And despite thymosin's heavy utilization in China, Wayne State University receives minimal royalties for Mutchnick's thymosin work. "We file patent applications in many countries, with royalties from successful therapeutic products put back into research," Reinhart says, "but in this case we didn't get a patent in China. We're very happy that research out of our university is helping people. I just wish we had filed in China."



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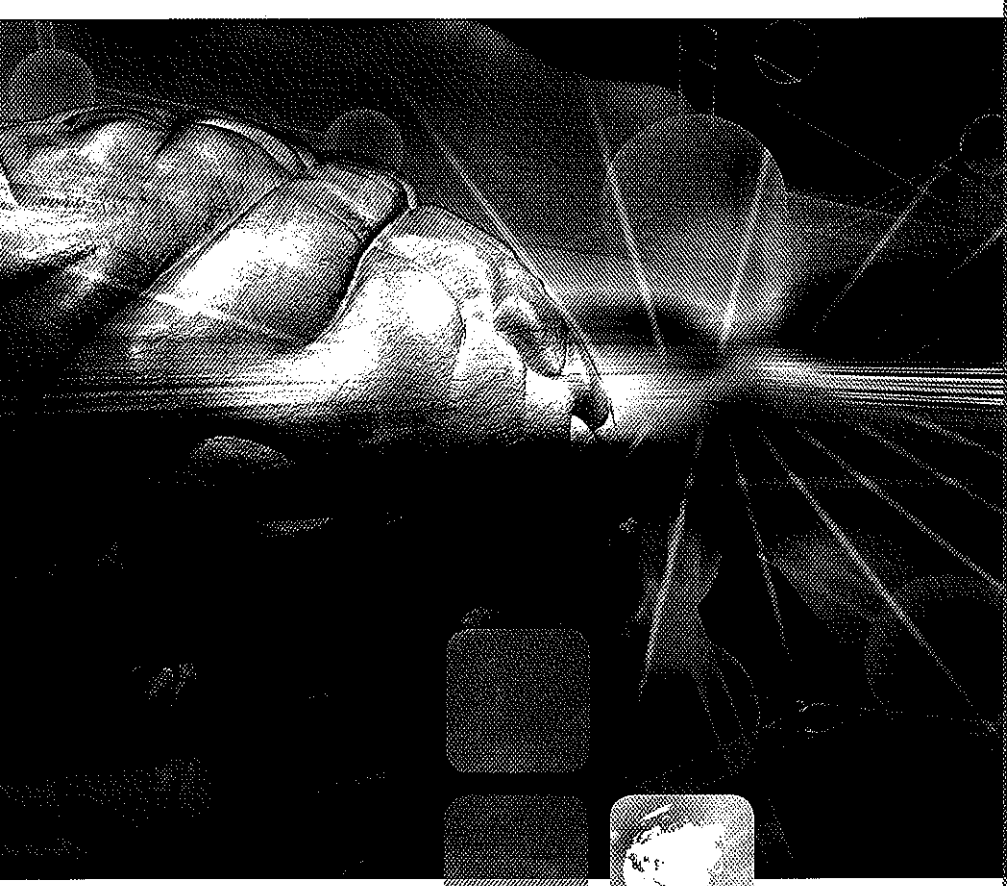
Identifying Vaccine Components

By 2006, the Lewinsohns had identified a dozen antigens that showed sufficient promise, leading OHSU to file a provisional patent application. The following year, in late 2007, OHSU officials signed an exclusive license with Aeras to allow the nonprofit research organization to use those antigens in the development of new vaccines. "From the initial discussions with Aeras, which occurred at the 2007 AUTM Annual Meeting, they were excited about the opportunity to in-license and work on these antigens," says Andrew Watson, Ph.D., Licensing Associate in OHSU's office of Technology & Research Collaborations. Aeras, which is funded primarily by the Bill & Melinda Gates Foundation and the Dutch government, was founded in 2003 with the goal of developing a more effective TB vaccine by the middle of the next decade. "OHSU is pleased to be a partner in helping achieve this objective and meeting the global need for low-cost or at-cost vaccines, especially in the developing world," says Watson.

Along with addressing a vital public health need, the market incentives are substantial. The potential payoff, depending upon the type of tuberculosis vaccine developed, ranges from $450 million to nearly $1 billion annually, according to a 2006 analysis by BIO Ventures for Global Health, a Washington, D.C.-based nonprofit organization.

Aeras, based in Rockville, Md., has numerous vaccine development resources at its disposal, including clinical trial facilities and a manufacturing plant. "We actually act almost like a small biotech, even though we are a non-profit," Fulkerson says. "We can do more of vaccine development in-house than most big companies can."

The nonprofit foundation is pursuing a number of vaccine strategies, some of which are already in the earliest stages of clinical trials. Aeras officials also have started working with the 12 antigens they've







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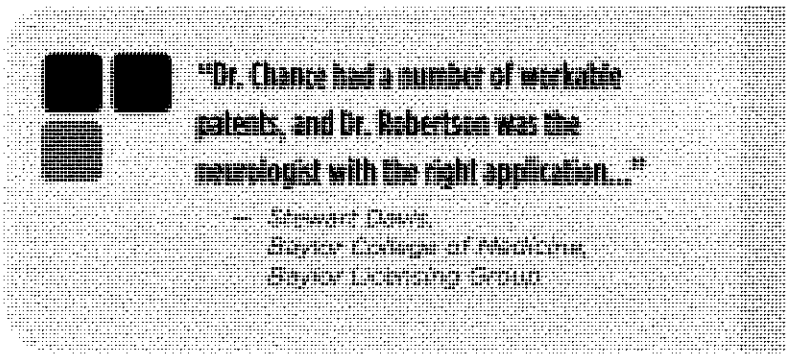
measure light reflection. "We developed a prototype that runs proprietary software," he continues. "The software does the measuring and automatically adjusts measurements according to an algorithm we devised."

The Infrascanner™ unit itself comprises a sensor and an off-the-shelf, hand-held personal digital assistant (PDA) that runs the proprietary software and operates on the Windows Mobile platform. Like the device developed in Chance's laboratory, the device relies on the differential light absorption of the injured versus the non-injured part of the brain. A healthy, normal brain displays light absorption that is symmetrical in the right and left hemispheres. However, when there is internal bleeding, the higher concentration of hemoglobin present results in a greater absorbance of light and commensurate reduction in the reflected component. This difference is detected by the unit's sensor component, which is placed symmetrically on the skull lobes.

By using the principle of diffused optical tomography, the Infrascanner™, via the proprietary software, converts the differential optical data into interpretable results. Communication between the sensor and PDA components occurs via the Bluetooth™ wireless protocol.





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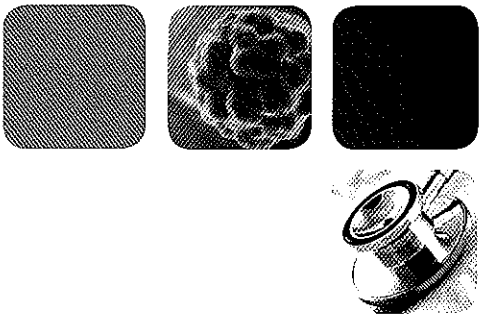



ng for a Good Clause: University Negotiates s Licensing Deal for a ation That Could Save Thousands of Lives

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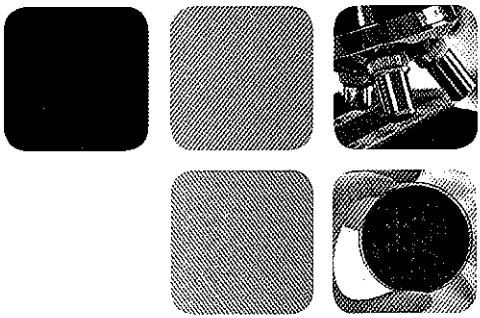

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adjunct professor on the faculty of pharmaceutical sciences at UBC and on the faculty at the British Columbia Institute of Technology in Vancouver.)

"My wife says, 'Oh no! You aren't dragging me into another one of your projects, are you?'" laughs Kishor. "I'm a pharmacist by training and I had the animal models I needed, but what I didn't have was someone to bounce ideas off of about the best formulations. And there she was, right next to me."

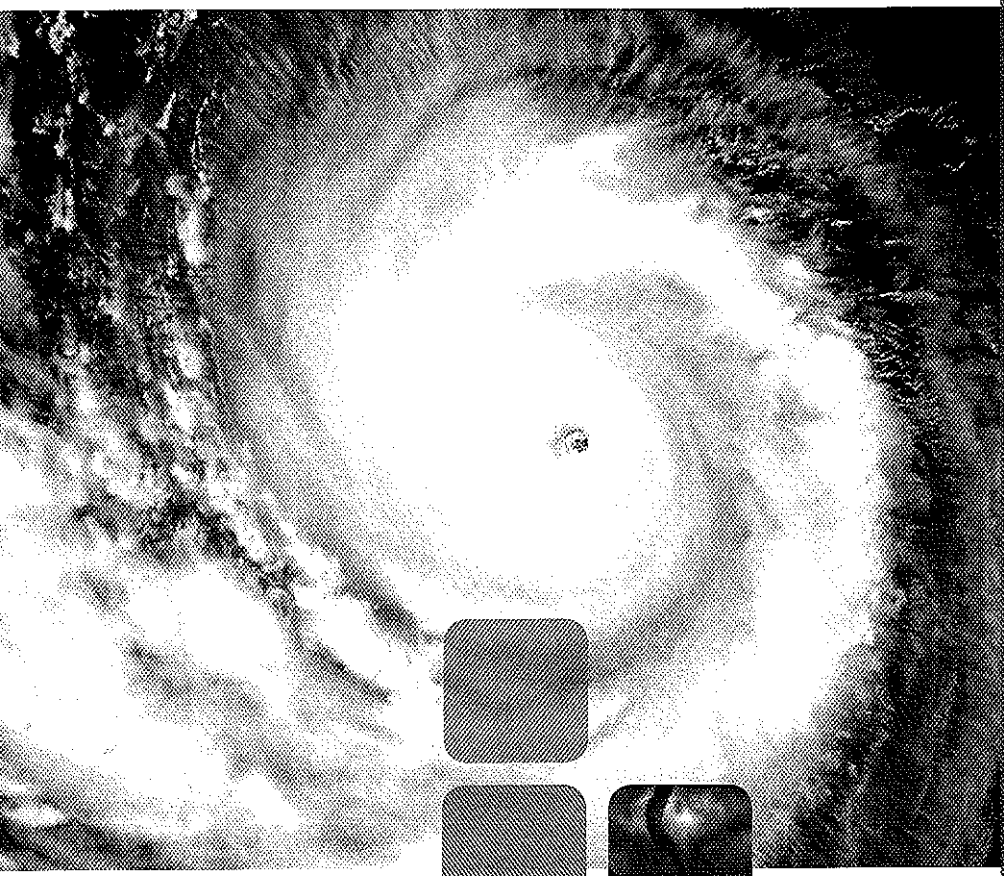
Under the Right Conditions

With the promising results in hand, Kishor contacted the UILO, which was able to negotiate its first tangible licensing deal using the newly developed global access principles.

"Originally, we were all thinking along the traditional commercial path," recalls Bell. "Our initial consultations led us to believe there might be hesitancy from industry in agreeing to these global access principles."

But Amp B was different. Because it was already approved by the FDA and in use in its intravenous form, it was a lower risk technology. But, more importantly, it could be used to treat two conditions each in a separate market, and, thus it was an easier sell. As it turns out, however, it was not difficult to find a licensing company at all, in fact, in yet another twist of fate, the licensing company found UBC.

"I'm slightly embarrassed to say that it was one of our shareholders who introduced us to this opportunity," admits Andrew Rae, president and chief executive officer of iCo Therapeutics, a Vancouver-based reprofiling company focused on redosing or reformulating drugs with clinical history for new and expanded indications. "He had heard about this technology and asked us to go out to the university and have a chat," Rae continues.











e Weather Prediction, Time Saves Lives

versity College London

Awards and Capabilities

The Tropical Storm Tracker has proved so useful to insurers that it has won two British insurance industry awards – for "Innovation of the Year" in 2004 and for "Risk Management" in 2006. A statistical analysis published in *Nature* in 2005 concluded that buyers and sellers of reinsurance could improve their returns by more than 30 percent over a period of years by using Tropical Storm Risk forecasts. This model also successfully predicted the active U.S. hurricane season in 2008.

"There are a lot of people forecasting these days," Arnott notes. "What's critical is how far out you can forecast and how accurately you can predict the damage likely to be experienced. TSR consistently has an advantage in lead time. We can usually give an extra day's notice over other systems."

Long-range forecasting, on the other hand, is more art than science—often difficult to predict with precision. When the group releases its forecasts well ahead of the season, it's not the end of the story. They continue to update them on a monthly basis.

The team provides seasonal forecasts for three regions—the North Atlantic (hurricanes), the Northwest Pacific (typhoons) and the Southwest Pacific and Southeast Indian Oceans (cyclones). Although hurricanes attract the attention in the United States, China, Japan and the Philippines actually experience more typhoons than the U.S. does hurricanes.

"This is very satisfying work," Saunders says. "It's particularly pleasing to have researched and developed a product which has helped to save many lives."



ic Tests Could Benefit he Developing World

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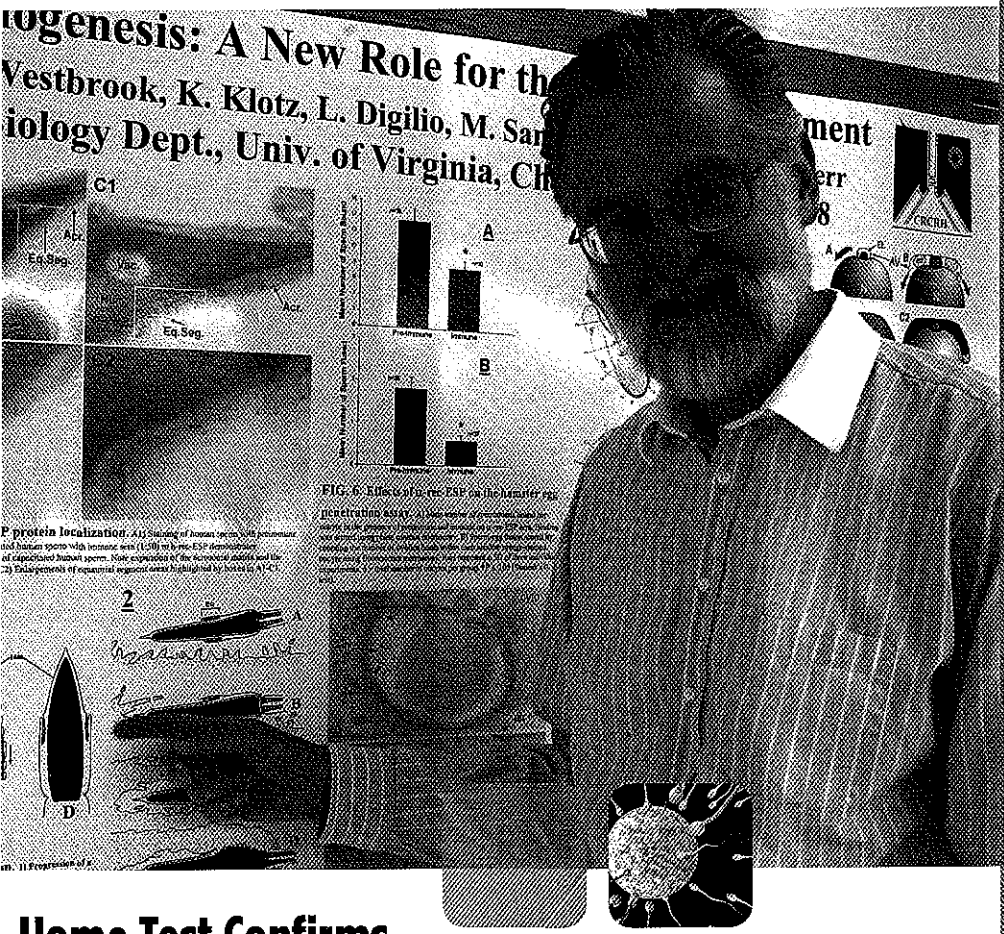
"As our corporate shareholders, they have supported us throughout the years, from the development of our platform technologies, to the launch of our first product and on through the design of our business model," said Lee. "Now, we would like to successfully implement a two-tiered pricing policy to provide the tests to the developing world at near to manufacturing cost, and work with distributors as well as non-government organizations so the FirstBurst test is applied in settings where the more than 90 million people annually infected by chlamydia can be diagnosed and treated early."



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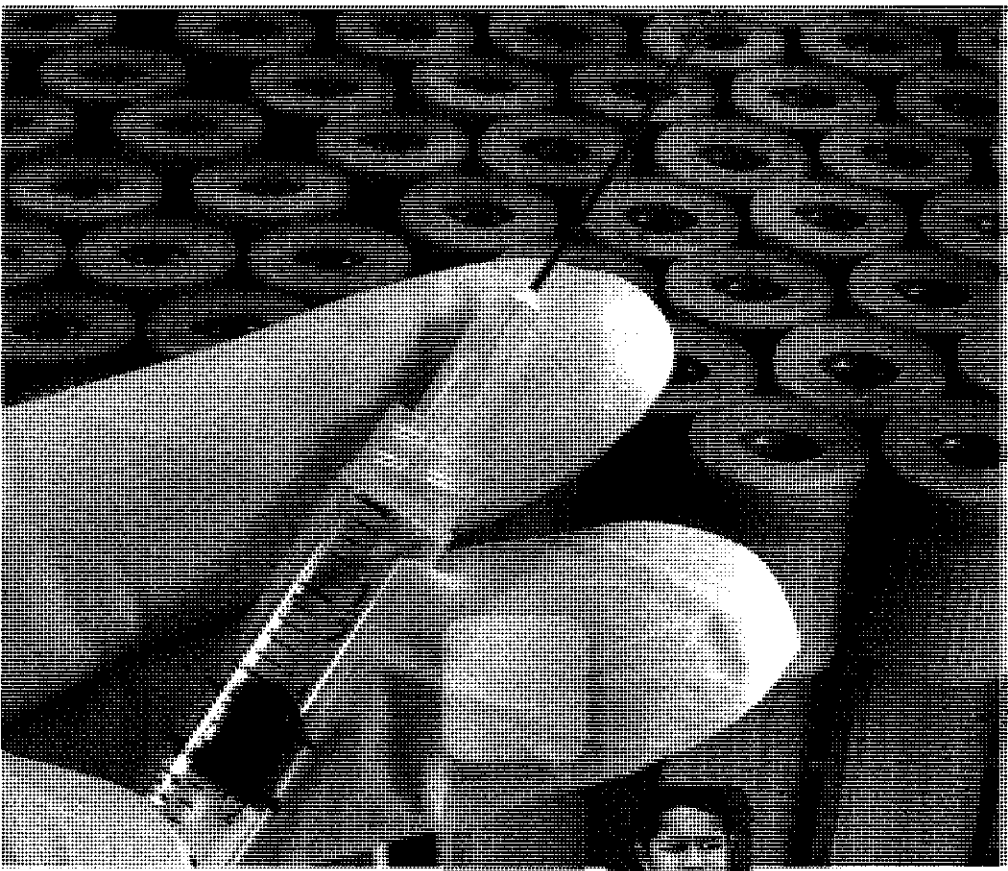
"Louis Pasteur said it best—there is no fundamental distinction between pure and applied science, there is only science in the cause of man."

the *Journal of Urology,* July 2005, shows that of 43,642 vasectomies, 1 in 238 resulted in failure or recanalization.

The inconvenience and indignity associated with returning to the physician's office or a laboratory to supply semen samples has created an environment where nearly as many as 35 percent of men do not return for their first post-vasectomy test and 72 percent of men may fail to return for their second test.

SpermCheck® Vasectomy can have a role in improving compliance and improving communication between patients and their physicians following a vasectomy. ContraVac recommends that testing at two different time intervals within the first three months following a vasectomy. Two consecutive negative results provide a high degree of certainty that a man is sterile. In addition, to detect possible recanalization, ContraVac recommends testing six months following a vasectomy with additional testing once per year for the first three years.

Herr said that research know-how developed in the course of creating SpermCheck® Vasectomy will be critical to the development of male birth contraceptive pills. "Availability of a sperm check test which can detect low sperm levels we hope will spur the clinical testing of male contraceptives for which a companion diagnostic test is also needed to monitor when men reach safe sperm levels." He believes there needs to be a seamless continuum between basic discovery, patenting and applied development. "Louis Pasteur said it best—there is no fundamental distinction between pure and applied science, there is only science in the cause of man."











Finding a Path to an
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"The differences were highly, highly significant and indicated that the enterotoxins were really important," says Levine. "And if you knock them out, you get a well-tolerated vaccine strain. But one that still gives immune responses that we consider protective."

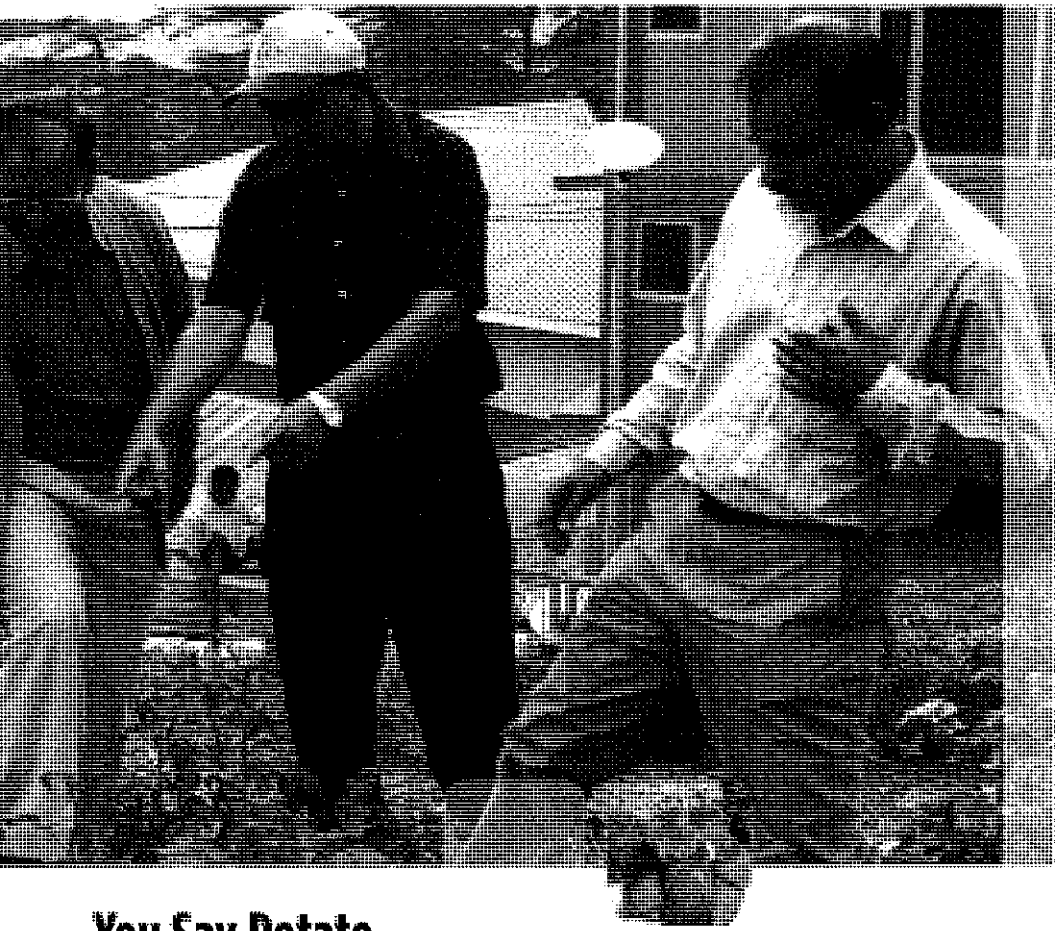
Levine's group is not the only one that PATH is working with as they pursue several research avenues toward a *Shigella* solution. Walker states that PATH has a "high level of interest" in the vaccine prototype. "The key problem that Dr. Levine's group has overcome is they've greatly increased the safety of the product," he says.

Taking Concept to Market

In the fall of 2008, PATH signed a licensing agreement with the University of Maryland, Baltimore that included nearly $2.5 million to fund a Phase 2 trial of a vaccine prototype incorporating the *flexneri* 2a strain. Typically, the University of Maryland works with scientists to identify partners for promising research projects, said Elizabeth Hart-Wells, Ph.D., executive director of Commercial Ventures and Intellectual Property at the University of Maryland, Baltimore. "This one was definitely Dr. Levine's doing to find a partner to develop this technology," she says.

The Phase 2 trial, which will involve about 60 volunteers, is slated to launch in 2009. Levine is quick to stress that he is only part of a trio of *Shigella* researchers at the center, with Eileen Barry and Karen Kotloff performing much of the heavy lifting in running the related clinical trials and engineering the vaccine prototypes.

If the *flexneri* 2a prototype continues to look promising, the next step would be to test the vaccine on a trial basis in the developing world, starting with older adults and moving down in age, as the vaccine is assessed for relative safety and effectiveness. "The *flexneri* 2a that we are looking at right now is



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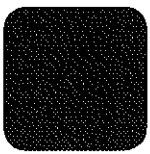



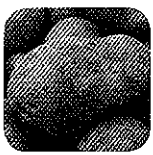

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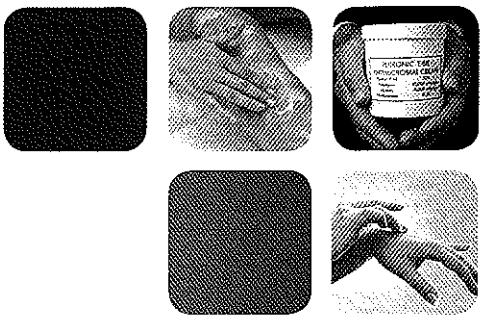
University of Virginia Patent Foundation



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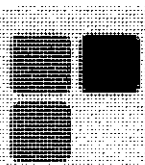
Rodeheaver hopes to continue his research on PluroGel with other applications beyond infection. He believes that he is at the beginning of a pipeline of products to enhance healing for the masses. "We can use this unique gel to carry active ingredients such as anti-inflammatory agents or whatever you think the tissue needs to heal—to improve blood flow and cellular repair of damaged tissue, and optimize the healing process."

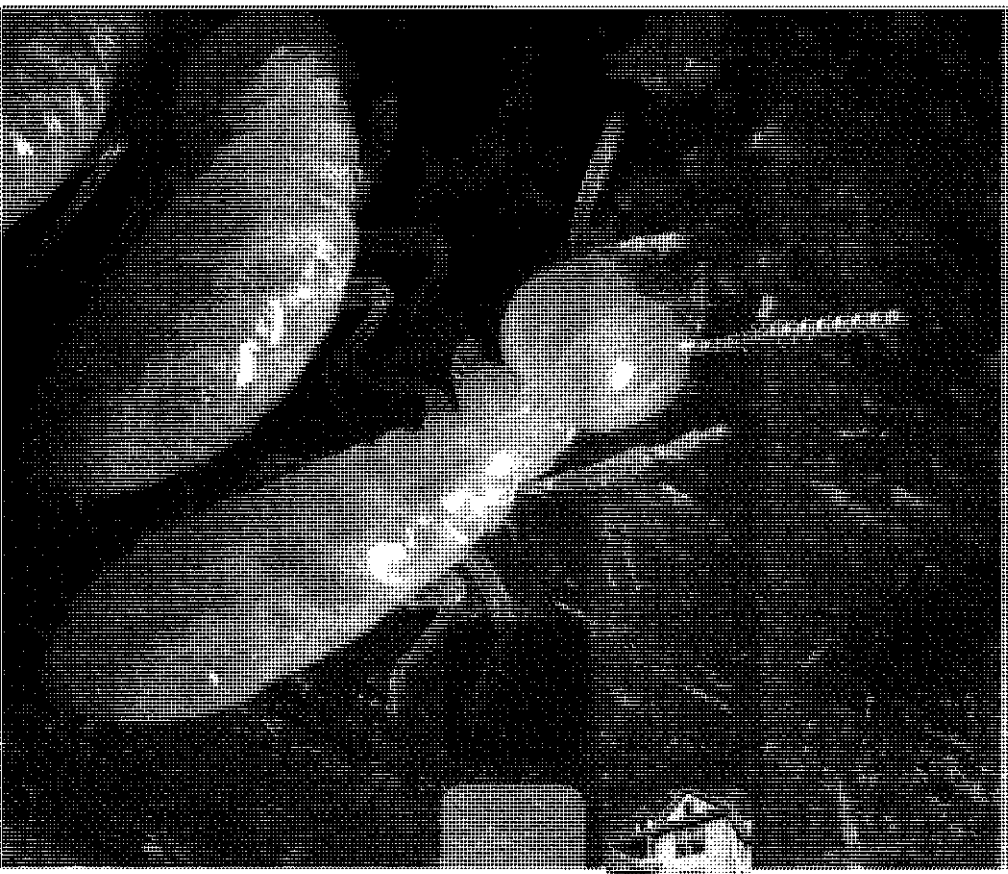
"Entrepreneurship in particular is something I see as a brand-new adventure," he says. "It's been unique and exciting."

Continued efforts will brings its benefits to patients everywhere, said Marie C. Kerbeshian, Ph.D., executive director of the Patent Foundation.

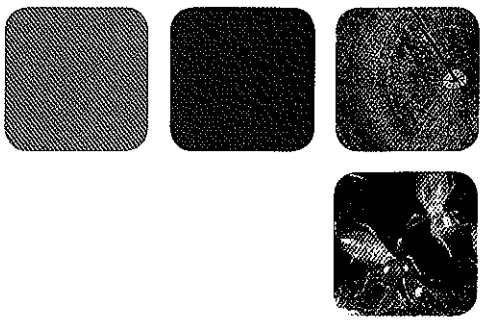


"It's important to remember that the whole motivation was driven by the patient benefit and success we achieved for patient improvement. It was not driven by any commercial incentive..."

— George T. Rodeheaver, Ph.D., University of Virginia



icon® Termite Colony Elimination System: ontrol Without Using Toxic Insecticides



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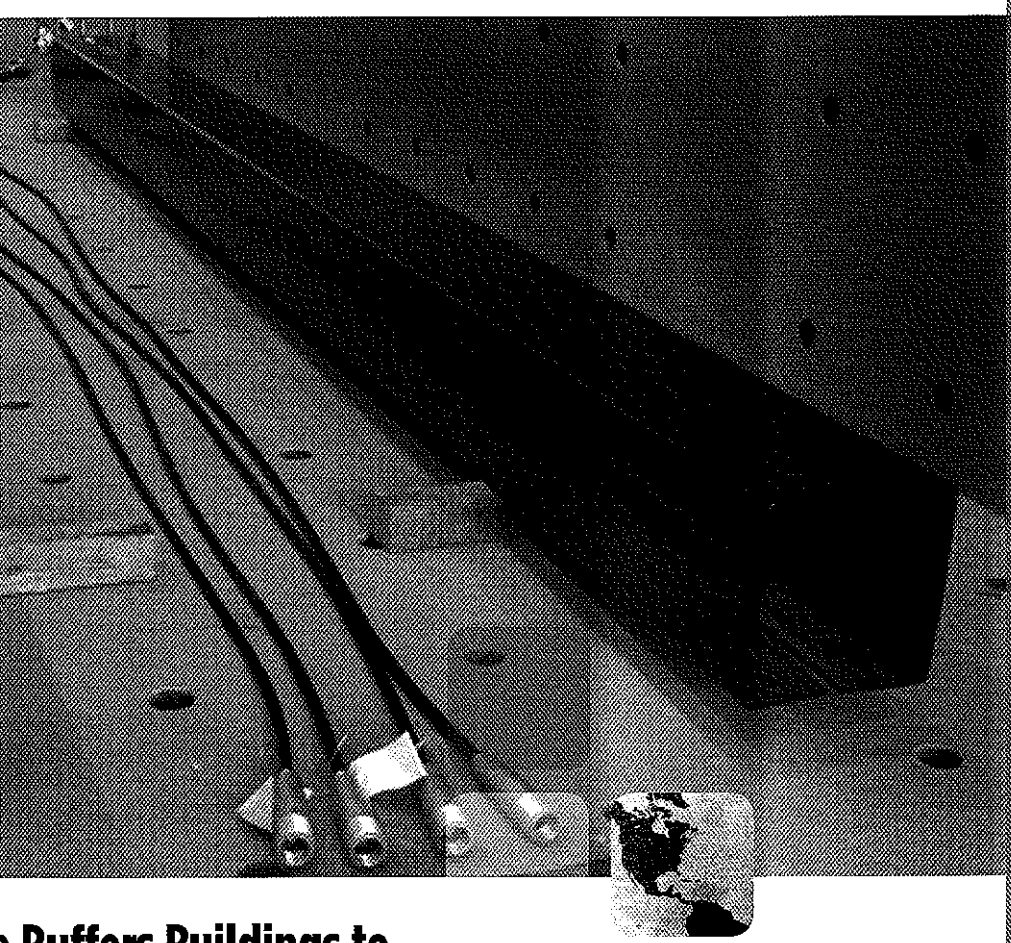
"Insects have to molt every now and then, to shed their skin so they can grow. This hexaflumuron keeps them from making a new skin. They will try to molt – the old skin is shedding, but the new skin is not coming out. It takes a while, but it kills them."

Initially, Su put wooden stakes in the ground and monitored them periodically. When he found termites had started eating the stakes, he replaced the stakes with bait made from wood material laced with the hexaflumuron. "When I tried this, it actually worked. I found that I was able to wipe out quite a few colonies of Formosan and native termites." Su refined the process, using slotted plastic cylinders placed in the ground to hold the wood and the bait material.

After the intial research, Dow AgroSciences licensed the technology and developed it into the Sentricon termite colony elimination system. Since then, Dow AgroSciences has supported Su's research. Additional work has included an electronic monitoring technique for the in-ground stations, an above-ground bait station for use where termites are found inside a structure, and use of a more potent, faster-acting chitin inhibitor.

Twelve U.S. patents for Su's inventions have been licensed to Dow AgroSciences, says Byatt. The university also applies for foreign patents in areas where subterranean termites are active and Dow AgroSciences markets termite control products.



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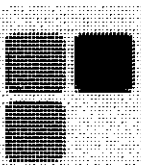
It remains to be seen, however, if the new bracing will shake up the market, because it is more expensive than the traditional methods. But Leconte thinks that even with a price premium, the market is ripe for a device such as this. Not only are building regulations getting stiffer, but manufacturers and other businesses in high-risk areas realize that investing upfront in the structure could mean avoiding costly downtime later.

"Countries exposed to earthquakes and other natural disasters are constantly seeking out ways to shelter their buildings from catastrophe," says Leconte. "Through this deal, countries will have access to high-performance protection technology."

But in addition to helping shepherd a life- and property-saving product to market, for Leconte, there is further satisfaction in knowing that he and the researchers didn't give up.

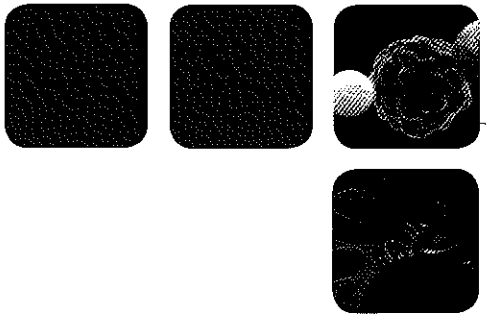
"The takeaway message in this story," says Leconte, "is to think twice before withdrawing from a potential patent....one day, you just might have a deal."



"It looked like the project was going to die. But the researchers believed so strongly in the technology that they asked to share the costs of prosecution and eventually contributed about $50,000 [Canadian] of their own money."

— Didier Leconte, Univalor





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"In this context GHR antagonists are interesting candidates," says van der Lely. "Experimental data suggest that GHR blockade, by the use of GHR antagonists, may present a new concept in the treatment of diabetic renal complications. Future studies are warranted to fully characterize the clinical potential of GHR antagonists as drugs for treatment of diabetic complications in general."

The role of GH in a variety of cancers also points to potential successful treatment by Somavert.

"A series of epidemiological analyses have linked circulating IGF-I concentrations, or IGF-I/IGFBP-3 ratios, with the risk of developing several different types of cancer, including prostate, breast and colon cancer," explains van der Lely. "With respect to modulating tumor growth once neoplastic transformation has occurred, numerous pre-clinical studies have defined IGF-I as potent growth factor for dozens of different tumor types."

"Patients immediately feel better after using Somavert. The letters have poured in from patients and their family members lauding both physical and psychological changes from using Somavert. It's very satisfying to make a difference in their lives."

— Rick Hawkings, LabNow

Production Notes

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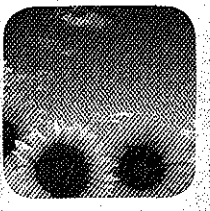
Technology Transfer is about more than transferring innovations to local communities. In some cases it is about improving lives of people who live nowhere near the university where the innovation first originated.

The 2009 *Better World Report* celebrates real world examples of technologies that directly impact the health and well being of people everywhere. Here are a few examples of the innovations profiled in this book:

- A program equips health care workers in developing nations with the skills they need to improve quality of care for the communities they serve
- A group of scientists find a creative yet simple way to make life safer for refugee women.
- Groundbreaking HIV medication that is available in developing nations as quality, low cost generics.
- A small nonprofit company with a focus on serving the developing world first
- A truly green biofuel that spares the environment while preserving the global food supply
- An "orphan drug" that truly serves the underserved
- A university that developed global access principles—guidelines for how the university provides global access to its technologies







Read more about the diversity of academic innovation and the world of technology transfer at www.betterworldproject.net.

2009 Edition
www.betterworldproject.net
ISBN 0-9778444-6-3

Reports of colonic cancer in patients with acromegaly have been increasing in frequency. van der Lely says several experiments have been performed with Pegvisomant using a variety of colon cancer models. In one study, Pegvisomant therapy reduced the volume and weight of xenografted COLO 205 tumors by 39 percent and 44 percent respectively as compared to untreated animals. In a model designed to look at colon cancer hepatic metastases, Pegvisomant was found to be an effective therapy and the combination of Pegvisomant and the commonly used Topoisomerase 1 inhibitor, Irinotecan, was found superior to either therapy alone. The growth of several breast cancer cell lines, including both estrogen receptor positive and negative representatives (T-47D, MCF-7 and MDA-MB-231) has been reported to be reduced by 42-62 percent of that observed in control animals.

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It's easy to hail any cure that relieves the suffering of many, and just as easy to overlook the treatments so crucial to so very few. They call these "orphan drugs" as though these life-saving potions for less than 60,000 or so sufferers have no place in societies with much bigger plagues. But to each individual person so afflicted, "orphan drugs" are life-changing, soul-saving, hope-charged miracles of epic proportions. One such drug is called Somavert and the life-threatening disease it attacks is known as acromegaly.

Acromegaly is a hormonal disorder that results from too much growth hormone (GH) produced by benign tumors on the pituitary gland. If these tumors bloom before the onset of puberty, the victim becomes a giant with myriad health problems. If onset is after puberty, the victim suffers from enlarged limbs and organs, including the heart, and a variety of related health consequences such as diabetes, debilitating arthritis and cardiovascular disease. Other consequences add insult to injury: bony changes can lead to disfigurement, for example, a huge protruding jaw or one super-sized limb, while the skin thickens and exudes a constant, unpleasant odor.

"Acromegaly is associated with a proven increased mortality rate," says Dr. A.J. van der Lely, a clinician in Rotterdam, Netherlands, who, along with Dr. Peter Trainer in Manchester, England, did most of the original work with the GH antagonist—called Pegvisomant and sold as Somavert by Pfizer—in acromegalic patients.

The discovery of Somavert was a huge advancement in the successful treatment of the disease.

"Currently available treatment modalities for acromegaly consist of surgery, radiotherapy and medication," explains van der Lely. "Unfortunately,

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It's less than two to three inches, but it's an amount big enough to allow buildings and their occupants to avoid a close call. That's the amount of sway allowed by a new self-recentering brace that is designed to let buildings give a little during stress—such as an earthquake—and then right itself to within a few millimeters of its starting position.

Keeping Profits and People Safe

The technology, which is the brainchild of civil engineering professors Robert Tremblay, École Polytechnique de Montréal, and Constantin Christopoulos, University of Toronto, is designed to play a critical role in maintaining a building's structural integrity, not only keeping its occupants safer, but allowing the businesses it houses to remain up and running after a natural disaster. Something that is especially critical for first-responders such as firehouses, hospitals and police departments.

"The technology provides affordable ways of achieving superior performance for structures, including buildings, subjected to extreme loading conditions," explains Didier Leconte, manager, business development, sciences and engineering at Univalor in Montréal, Quebec, Canada. "For example, those induced by earthquakes, wind storms or explosions, thus saving lives and protecting infrastructures."

Bracings are regularly used to support buildings and help them absorb energy. They are structural elements set diagonally between the floor levels to make structures resist lateral loads and shocks. Current bracings are made from steel; however, this material, when loaded beyond its limit, yields and deforms permanently. The new device, which can be used for new construction or worked into an existing building, is also made from steel but is designed to work a bit like an
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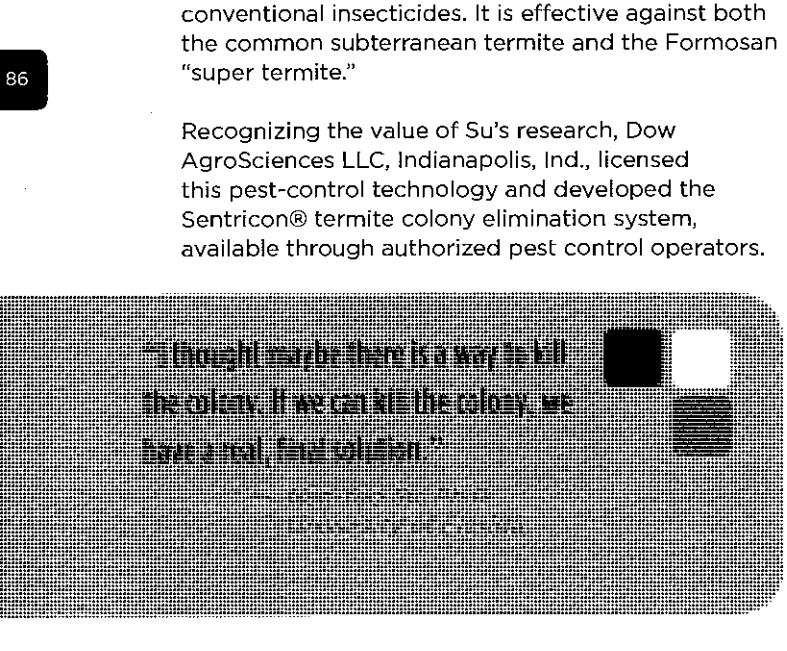
Taking advantage of termites' own biology and behavior, this innovative method of termite control uses small amounts of an insect-specific agent to kill the whole colony, reducing pesticide use by an estimated 6,000 metric tons since it was commercially introduced in 1995.

They live underground, they eat wood, and every year they cause billions of dollars in damage to wooden buildings and other structures worldwide. Subterranean termites. "You can't see them. You can't find them. They are somewhere in the soil," says Nan-Yao Su, Ph.D., professor of Entomology at University of Florida, Fort Lauderdale Research and Education Center. Su invented an environmentally sound treatment for subterranean termites that can eliminate whole termite colonies without the use of conventional insecticides. It is effective against both the common subterranean termite and the Formosan "super termite."

Recognizing the value of Su's research, Dow AgroSciences LLC, Indianapolis, Ind., licensed this pest-control technology and developed the Sentricon® termite colony elimination system, available through authorized pest control operators.



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PluroGel™, an antimicrobial gel used by the University of Virginia (U.Va.) Health System, is under review by the FDA for commercial approval, a testament to the physicians and patients who have benefited from the product and demanded that the gel be made available beyond the university hospital.

The antimicrobial gel has proven significantly more effective than existing therapies in treating severe burns and chronic wounds, such as diabetic ulcers, pressure ulcers and venous leg ulcers. The topical treatment is unique in that it thickens at high temperatures (such as body temperature) and liquefies at cooler temperatures. As a result, PluroGel effectively delivers healing medication when applied to the body but is easily removed by cool water, making it much less painful to remove than existing therapies.

The U.Va. Patent Foundation named George T. Rodeheaver, Ph.D., professor of biomedical research, U.Va. Department of Plastic Surgery, as the 2008 Edlich-Henderson Inventor of the Year for his work on the revolutionary wound-healing technology and its overriding benefit to society.

Rodeheaver began research on a burn and open wound treatment with his colleagues in the 1970s. The resulting product, PluroGel, has been successfully used to fight infection and heal burn and chronic wounds in more than 2,000 patients with superior results.

"The fact is that in our burn center, we have been able to eliminate infection, which was the leading cause of death 15 years ago. And we have had great success in healing chronic wounds, many of which (with traditional remedies) had not healed for numerous years," Rodeheaver says.

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Farmers in India and Bangladesh have become increasingly reliant on the potato over the past 50 years. Since the 1960s, Indian farmers have turned to this cash crop in lieu of more traditional crops such as buckwheat, hog millet and foxtail millet because of its high density of food per acre. Likewise, in Bangladesh, potato production has tripled since 1980. The highly nutritious potato provides essential vitamins, minerals and amino acids to the region's rice-dominated diets.

In 2007, 70 percent of India's 1.28 million hectares of potato crops were lost to late blight, a plant disease caused by a fungal pathogen. An estimated $236 million has been lost in India due to late blight infections. In Bangladesh, the disease has attacked 50 percent of potato crops, and an estimated $43 million has been lost. It is not uncommon, in either country, for a farmer's entire crop to be ruined.

Late blight is the best known as the disease behind the Irish Potato Famine of the mid-1800s. It causes potatoes and tomatoes to rot in fields or in storage. An entire crop can be destroyed within one to two weeks under certain conditions. The pathogen can survive from season to season in infected potato tubers, and infected plants produce millions of spores in wet weather conditions. Late blight is a tough disease to control, to say the least.

Farmers in India and Bangladesh attempt to control the disease with pesticides, herbicides and fungicides. These primarily subsistence farmers can barely afford the high price of these chemicals, and, often times, the plants are resistant to them. Bangladeshi farmers apply more than 20 treatments a year. This not only cuts into their profits, but also poses heath and environmental risks to the region.

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the dominant strain of *Shigella* that's a problem in developing countries," Walker said. "So even by itself, it could be a significant vaccine."

Long term, Levine hopes to cast a more protective net. Eventually, he wants to build a *Shigella* vaccine that contains several strains and ideally five significant strains. Levine asserts that if the five-strain vaccine is used broadly in the developing world, it could theoretically guard against 80 to 90 percent of all *Shigella* disease, adding, "Our goal is the definitive broad-spectrum vaccine."

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In the worldwide attempt to combat disease, shigellosis may not garner considerable public attention, but its impact is devastating, particularly on the world's poorest children. Annually, the infectious disease causes some 165 million cases of severe dysentery worldwide, including more than a million deaths, according to the World Health Organization.

The group of bacteria involved, called *Shigella,* tends to inflict the most harm in developing regions with poor sanitation, as it is spread through contaminated food or water, as well as person to person. Those who don't die from the diarrhea and severe dysentery, including bloody stool, may be ill for weeks to months. Children in their first few years of life are most vulnerable both to becoming ill and the resulting long-term effects, according to Richard Walker, Ph.D., director of the Enteric Vaccine Initiative at PATH, a nonprofit international health organization. Even children who survive the infection may suffer damage to their intestinal lining and stunted growth, among other effects, says Walker.

Meanwhile, the antibiotics traditionally used to combat the microscopic organisms are becoming less effective, says Walker. "In the developing world, since they use antibiotics so frequently, a lot of pathogens have become resistant to them. *Shigella* is becoming much more resistant."

In 2007, PATH received a $50 million grant from the Bill & Melinda Gates Foundation to help develop two vaccines—one against *Shigella,* and one to combat another diarrheal illness called enterotoxigenic *Escherichia coli* (ETEC). With the funds, PATH is providing vital seed money for some of the most promising vaccine avenues.

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Shigella Vaccine

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Similar to the convenience women have with home pregnancy tests, SpermCheck® Vasectomy allows men to check their post-vasectomy fertility status in the privacy of the home. The device tests sperm in the ejaculate without necessitating a trip to the physician's office or a laboratory with semen samples, as has traditionally been required to confirm sub-fertile sperm levels.

SpermCheck® Vasectomy is one of several products founded on technology developed by John C. Herr, Ph.D., professor, University of Virginia (U.Va.) Department of Cell Biology and director of the U.Va. Center for Research in Contraceptive and Reproductive Health. It is the first immunodiagnostic test to receive FDA clearance for monitoring sperm count after vasectomy.

With the at-home device, the paradigm for post-vasectomy sperm monitoring now shifts from the microscope to a simple, easy to use, highly sensitive, hand-held device that affords privacy and cost savings. "This is particularly important on a global basis where access to post-vasectomy testing is much more difficult," said Edward J. Leary, president and CFO of ContraVac Inc. a U.Va startup company. A number of global organizations, including the World Health Organization, have expressed interest in SpermCheck® Vasectomy for this reason.

"SpermCheck® Vasectomy is the result of many years of basic scientific research coupled with clinical chemistry know-how," said Herr. A 20-year collaboration with Stuart S. Howards, M.D., professor, U.Va. Department of Urology, began with a shared interest in studying the effect of anti-sperm antibodies. In the course of research, Howards pointed out that a simple test for sperm monitoring would be helpful. The challenge, said Herr, was to find a suitable biomarker. The interdisciplinary clinical collaboration included work with Charles J. Flicklinger, M.D., professor emeritus, U.Va. Department of Cell Biology.

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Chlamydia trachomatis ***is an enormous global public health problem—infecting more than 90 million annually in both the developed and developing world.***

As the most prevalent bacterial pathogen causing sexually transmitted disease (STD), chlamydia frequently causes Pelvic Inflammatory Disease (PID) and its long-term consequences, which include chronic pain, ectopic pregnancy and infertility. It also can cause sterility in woman and it is the main cause of blindness in babies in the developing world. The World Health Organization (WHO) recognizes it as a major cause of disability in affected communities in Africa, the Middle East, Central and Southeast Asia.

The infection is difficult to diagnose, with around 70 percent of female carriers and 50 percent of male carriers showing no symptoms. But if detected early, the disease is very easy to treat with one antibiotic pill.

"Now, we would like to successfully implement a two-tiered pricing policy to provide the tests to the developing world at near to manufacturing cost, and work with distributors as well as non-government organizations so the FirstBurst test is applied in settings where the more than 90 million people annually infected by chlamydia can be diagnosed and treated early."

— Helen Lee, Ph.D., University of Cambridge

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On the Tropical Storm Tracker map at University College London's TropicalStormRisk.com, the weather disturbances show up as colored lines—from green for tropical depressions through blue, two yellows, orange and red, to purple for Category 5 hurricanes, cyclones and typhoons.

Tropical depressions, tropical storms, hurricanes, typhoons, cyclones, European windstorms: They're all variations of big wind disturbances and they're all the focus of scientists at Tropical Storm Risk (TSR) and EuroTempest, Ltd., ventures developed from work by Professor Mark Saunders and his fellow climate researchers at the university's Aon Benfield UCL Hazard Research Centre.

Using sophisticated computer models, the University College London (UCL) team works to assess storms' strength, where they will go, when they will get there – and what damage they're likely to cause. While Tropical Storm Risk tracks extreme weather events worldwide, EuroTempest focuses on the destructive wind storms that often sweep onto the European continent off the north Atlantic.

Advance Warning

"Time saves lives," says Michael Arnott, Senior Business Manager at University College London's Technology Transfer Office. "For specific weather events, these ventures can predict extreme weather behavior up to five days in advance. This can warn people to evacuate and it can alert governments and relief organizations to mobilize medical and food supplies.

"Even when there are shelters, people need to know to go to them."

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That chat eventually resulted in iCo acquiring the worldwide exclusive rights to iCo-009, iCo's oral formulation of Amp B, in May 2008.

In return for the worldwide right to develop and sell the oral formulation in the developed world as a treatment for blood-borne fungal infections, iCo Therapeutics agreed to ensure the availability and accessibility of a suitable formulation to countries in the developing world to treat leishmaniasis.

"This is basically a win-win," says Rae. "The fact that the product really only requires a candy-wrapper lipid and has been tested and approved makes it lower risk and fits our business model. Plus, it is suitable for two noncompeting markets."

Further, says Rae, because one of those markets is the developing world, additional funding for the reformulation may be available from what he calls the super philanthropies, some of which are targeting neglected diseases. But it's not all about money, says Rae, the true value of the product lies in its potential to impact society, and the good will that results.

"There is a natural inclination in the health care industry to do well," says Rae. "As health care providers, we are proud to see products improve the quality of life."

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Whenever Mommy and Daddy start talking about work, 6-year-old John Paul Wasan is quick to quip, "Oh, no! Not that science thing again!"

But the tedious dinner conversation that Ellen and Kishor Wasan's son is so eager to change is actually about an exciting discovery—the reformulation of a drug called amphotericin B (Amp B) that could save the lives of many little boys—as well as men, women and children around the world. And its journey is filled with all the elements of a good children's story—unsung heroes, Lady Luck and kinship working together to stand up for the underdog and fend off evil intruders.

Only in this tale, the "bad guy" is *Leishmania donovani,* an insidious parasite that invades white blood cells, infiltrates vital organs and can ultimately lead to severe infection and death. And the good guys are the researchers, university staff and students, and licensee of the technology that are working together to ensure that, if the promising new "science thing" that the Wasans are working on pans out, it could impact patients dealing with systemic fungal infections and the more than 350 million people from 88 countries—most of whom are in the developing world—affected by a deadly parasitic disease that causes visceral leishmaniasis.

The Perfect Storm

The story starts, in part, with a small band of idealistic students at the University of British Columbia (UBC) in Vancouver, Canada. In 2005, they formed a chapter of the Universities Allied for Essential Medicines (UAEM), an organization that works with student and faculty groups across the U.S., Europe and Canada to construct new approaches to developing and delivering public health goods.

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Colorectal cancer is a leading cause of cancer-related deaths worldwide and claims about 677,000 men and women annually, according to the World Health Organization. This cancer burden can be decreased if cases are detected and treated early. Unfortunately, most individuals over 50 avoid the unpleasant and invasive tests that can screen for colorectal cancer or precancerous growths—until now.

A new 3-D Virtual Colonoscopy, also known as computed tomography (CT) colonography, is changing the way people view colorectal screening. It is expected to become more commonly used than a conventional optical colonoscopy thanks to its non-invasive nature. The procedure takes less than 15 minutes and typically requires the patient to drink a contrast solution, which eliminates the need for a harsh purgative prior to the scanning. The patient, without being sedated and after a small tube is inserted in the rectum to inflate the colon with CO_2, lays on his/her back and stomach while a CT scan takes pictures of the abdomen and pelvis in several seconds.

This fast, safe and cost effective procedure is based on patented diagnostic 3-D imaging software, techniques and a computer system developed by a Stony Brook University research team led by its inventor, Arie E. Kaufman, a Distinguished Professor and Chairman of the Department of Computer Science who pioneered the field of "volumetric representation." Unlike an ordinary 2-D computer image, a 3-D volumetric representation is a stack of 2-D images laid on top of each other forming a continuous 3-D space. Development of volumetric representation, which was funded by the National Science Foundation, has led to a number of advances in software for graphics display and graphics acceleration hardware.

In the case of the 3- for use in the Unitec Administration, this technology puts the high quality 3-D con so a physician can s vs. the estimated 77 colonoscopy.

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"By offering the cap quickly, easily, inexp virtual colonoscopy throughout the wor start to save thousa early detection and

Three months after Naik and Banerjee won the business plan competition in April 2004, InfraScan incorporated and before the summer was over, the team received a $50,000 pilot investment from BioAdvance, the biotechnology greenhouse of Southeastern Pennsylvania, to fund the conduction of due diligence on InfraScan's business plan.

In January 2005, BioAdvance awarded InfraScan, Inc. an additional $450,000. The U.S. Navy and Army have also recognized the relevance of deploying Infrascanner™ technology in combat operations, providing $1.1 million in grants. InfraScan has since received several other grants, including $100,000 from a U.S. Army SBIR and $150,000 from the National Institutes of Health (NIH), and has secured additional investments from Ben Franklin Technology Partners of Southeastern Pennsylvania and the Philadelphia Industrial Development Corp.

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About 25 years ago, Alok Sharma, M.D., watched an episode of the "Star Trek" science fiction television series that featured a USS Enterprise crew member having his injured head examined with a hand-held device. Sharma thought this concept was interesting, but not something that would ever evolve beyond the science fiction realm. But Sharma was wrong: He was recently involved in a trial of such equipment at Lokmanya Tilak Medical General Hospital (Sion Hospital) in Mumbai, India, where he serves as chief neurosurgeon.

Known as the Infrascanner™, the device tested by Sharma and his team detects intracranial hematomas—blood clots on the brain's surface that result from traumatic brain injury. Computer-aided tomography (CAT) scanners are viewed as state-of-the-art technology for diagnosing brain hematomas, yet many hospitals—particularly in developing countries—do not have this equipment in place. Other facilities have only a limited number of units, and, in turn, delayed diagnosis of some patients. However, time is of the essence in intracranial hematoma cases, as outcomes have been found to be significantly better if treatment begins within one hour after head trauma has occurred. Left undetected or detected too late, intracranial hematomas can expand, compressing the brain and resulting in death. Even if death does not occur, brain function can be compromised by an intracranial hematoma of any size.

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licensed from OHSU. In the coming years, Aeras will evaluate vaccine constructs encoding the identified antigens in rodent models and then in non-human primates on the most promising candidates prior to initiating trials in humans.

Moving Forward

Collaboration is key to making the project succeed. Aeras' scientists and the Lewinsohns continue to work in partnership on the development of vaccine candidates involving these antigens. In addition, Aeras will continue to track the Lewinsohns' progress as they identify other intriguing antigens in the future. In discussing the significance of the Lewinsohns' research, Fulkerson circles back to their ability to isolate influential epitopes, or pieces of antigens. Fulkerson believes that identification of those epitopes—specifically the ones that help trigger an immune response—may open the door to a broader-spectrum vaccine, one that could contain a dozen or possibly more epitopes.

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OHSU sees the relat promising opportun the future. "Our hop and/or antigenic epi Lewinsohns, Aeras v development partne

At least from a bacterial survival standpoint, tuberculosis is the perfectly designed bug. Mycobacterium tuberculosis infiltrates the cell and then lurks within, identifiable by skin test, but not causing any symptoms.

"People estimate that one-third of the world has at least been exposed to tuberculosis," says David Lewinsohn, M.D., Ph.D., associate professor in pulmonary and critical care medicine at Oregon Health & Science University and Portland VA Medical Center. "We think that many of them are latently infected. So they have the bacteria and the bacteria is kind of there, but not causing any trouble. And 90-plus percent of the time that works just fine—people don't get sick."

When the disease does become active, though, tuberculosis can inflict significant harm—to the infected individual and others. Symptoms include chest pain, hemoptysis (coughing up blood), fever and weight loss. Someone with active disease, who goes untreated, can unknowingly infect 10 to 15 people annually by coughing, sneezing, or even talking, according to the World Health Organization (WHO).

In 2006 alone, 9.2 million people worldwide became ill and 1.7 million people died, according to WHO data. And some regions of the developing world have been particularly devastated by the bacterial infection. Five countries in Africa and Asia—India, China, Indonesia, South Africa and Nigeria—rank among the top five countries worldwide, in their total number of tuberculosis cases. The highest rate of new cases occurs in Africa, with nearly 350 cases per 100,000 population. Residents in Africa also suffer from the highest mortality rate compared with other regions of the world.

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For a scientist with an idea that might make a difference to people's lives, the path from illuminating insight to world-changing reality can be dramatic and satisfying. Or it can be filled with financial obstacles, poor execution, and disappointing results.

Since Wayne State University gastroenterologist Milton Mutchnick, M.D., first proposed using the hormone-like peptide thymosin alpha 1 to combat Hepatitis B in the mid-1980s, the drug has seen both outstanding success and somber letdown. Overseas, thymosin has become an important tool for fighting Hepatitis B, cancers and infections. Within the United States, its promise remains in doubt decades later.

Mutchnick, now Chief of Gastroenterology at Wayne State's School of Medicine, is a liver specialist who thinks the liver is a "really ugly-looking organ." But, he adds, "I have a great love for it. I find it fascinating. Among its functions, it secretes bile to help the body digest food. It filters toxins from the blood and metabolizes drugs. It has roles in blood formation and antibody creation. And it can regenerate itself."

Following his hepatology residency at Yale University, Mutchnick undertook a year of training in immunology at the University of Michigan – good preparation for an early focus on Hepatitis B and Hepatitis C.

"We file patent applications in many countries, with royalties from successful therapeutic products put back into research..."

— Fred Reinhart

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goes after the virus

The cry for alternative fuels echoes around the world. It doesn't really matter whether individual cries are in mourning the toll of global warming, or in fear of the ever-diminishing supply of fossil fuels, or both. In any case, the plaintive chorus calls for immediate relief. Now, that relief may be at hand with North Carolina State University's recent breakthrough in biofuel production, which converts vegetable oil and animal fat—even cooking grease and algae—into jet fuel, biogasoline and biodiesel using a 100 percent green process at a much reduced cost. The technology is called Centia™, a name that means "green power" in Latin.

It is not that biofuel is a new idea, but low energy yields and costly raw materials called feedstock, i.e. plants and animal fat, the most common of which is corn, have made its reality more of a dream.

"In renewable energy, we want to stay away from crop oils so that we do not compete with the food supply," explains William L. Roberts, Ph.D., Professor and Centia co-inventor, Department of Mechanical and Aerospace Engineering at N.C. State University. Indeed, grocery store chains and warehouse stores saw rising prices and even purchase limitations this year as efforts to produce biofuels began to pressure the food supply.

The first order of the day, then, for Roberts and his fellow inventors was to find a way to effectively and efficiently use feedstocks that were too low in quality for human consumption. By doing so, millions of people around the globe could then afford food staples such as flour, corn meal and vegetable oil.

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In addition to helping to capitalize the new company, the MIT prize is also a harbinger of success: in its 19 years, the competition has helped create nearly 100 companies with an aggregate market capitalization of $10 billion.

Jim Barber

DFA executive director Jim Barber knows a thing or two about building value in emerging markets. After completing a doctorate in organic chemistry under Whitesides in 1980, he went on to a successful career in specialty chemicals and materials, most recently as president and CEO of Metabolix Inc., which he shepherded from a research boutique to a leader in biodegradable plastics. When that company went public in 2007, Barber seized the opportunity to once again work with his mentor.

"I had become very interested in public health and wanted to put my time and energy into that realm," he says. "DFA is the perfect marriage of a broadly applicable technology with great social need."

"Our success as a company will be measured in how broadly we can make a difference in how health care is delivered in the developing world...in how many lives we can touch with our capabilities."

— James J. Barber, Ph.D., Diagnostics-For-All

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"Diagnosis is critical,
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Of all the initiatives targeted at improving the health of the world's neediest citizens, a small nonprofit company called Diagnostics-For-All (DFA) has some of the biggest goals.

"Our success as a company," says Executive Director James J. Barber, Ph.D., "will be measured in how broadly we can make a difference in how health care is delivered in the developing world...in how many lives we can touch with our capabilities."

But improving health care in, for example, Africa, where 60 percent of the population lives in rural areas underserved by hospitals, is a colossal challenge that begs the question: Where, exactly, do you begin to make a difference?

For DFA co-founder George Whitesides, Ph.D., the answer is simple: with a diagnosis.

Introducing the Paper Lab-on-a-Chip

As a result of his groundbreaking work in microfluidics—which involves the manipulation of fluids that are geometrically constrained within a small space—Whitesides realized that he could create "simple" solutions for point-of-care diagnostics for use in resource-poor settings.

His invention, created in his Harvard University lab called The Whitesides Group, is a paper-based microfluidic chip the size of a fingernail. It works like a miniature, portable laboratory capable of testing a tiny sample of bodily fluid such as blood or urine for proteins or other enzymes that indicate health or disease.

Using a patent-pending technology, The Whitesides Group patterns the paper with water-averse polymers, forming a series of channels that guide a fluid sample to a specific location on the chip that is pre-treated with a reagent. When the reagent is exposed to the fluid sample, it results in a color change that can be read and translated into a diagnosis.

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Not so long ago, HIV sufferers took 10 to 15 pills a day and still the outcome was often bleak. Today, more than 80 percent of HIV patients take at least one of the drugs developed by Emory scientists in a single tablet, once a day. Although it's not a cure, the treatment restores life as it lowers the daily drug regimen burden, diminishes side effects, relieves disease symptoms, and adds longevity.

Emory professors Raymond Schinazi, Ph.D., Dennis Liotta, Ph.D., and researcher Woo-Baeg Choi discovered an unusual molecule, FTC (emtricitabine, sold alone as Emtriva®, with the "Em" suggesting Emory) and a chemically similar compound, 3TC (lamivudine, sold alone as Epivir®). Both drugs are in the nucleoside reverse transcriptase inhibitors class, which means they work against the enzyme that copies HIV RNA into new viral DNA.

"They are what we call DNA chain terminators," explains Liotta. "Think of viral DNA as a line of rail boxcars, the drugs destroy the hitch so no more cars are added. The virus accepts the compounds and mistakes them for normal nucleotides, but they lack a function group necessary to copy the RNA to DNA."

Typically, HIV sufferers take a three-drug combination, with Emtriva being one of the three. "Special credit goes to the scientists at Gilead," says Liotta. "They are the unsung heroes that developed a compression technique to fit a full day's dosage of all three drugs in a single tablet, and it's not a 'horse' pill."

"That's the thing, thousands of people make contributions to the ultimate success of this drug," says Liotta.

Indeed, many people the drugs to patients Bristol-Myers Squibb for the first once-a-d adults with HIV calle drugs—efavirenz (Su and tenofovir disopr combined in one tab a stand-alone therap pill burden and simp not only makes thing patients, but also gre and distribution of th ideal conditions. "Gil of work in stability st stability of the drugs storage conditions ty says Liotta.

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Meanwhile, Gilead is political and regulat countries. "If you wo might get products i but not the next," ex director of Internatic "We prefer to take th regulatory approval have sustainable acc on an uninterrupted



In the 1990s, while he was working on his Ph.D. in animal science, Xingen Lei learned that phosphorus pollution from livestock is a huge problem. When he came to Cornell University, Ithaca, N.Y., as a professor in the Department of Animal Science, his first project was to develop an enzyme that could be used as a feed supplement to alleviate this problem. His research resulted in OptiPhos, a feed supplement that can reduce phosphorus pollution from pigs and poultry by as much as 50 percent.

Necessary Nutrient

As animals grow, they need phosphorus for bone and muscle development, and to help them use the energy in their diet. Much of the phosphorus in a typical corn-soy-based diet for livestock occurs as phytic acid. Livestock with simple stomachs, such as pigs and chickens, cannot digest the phytic acid, so it is excreted.

Pigs, chickens and other simple-stomach livestock animals need to receive supplementary phosphorus in the form of inorganic phosphates, which their digestive systems easily absorb. For pigs, the cost of this phosphate supplementation is currently $2 to $4 per animal during its growth cycle, the third most costly component of the animal's feed. Inorganic phosphate is obtained from mines and is a non-renewable resource. The depletion of this resource has resulted in an increase in price per ton of phosphate from $200 or $300 to $1,000 in recent years.

Even though animals need the phosphate supplements, the phosphorous they excrete causes phosphorous pollution, taking a toll on the environment. While pig and chicken manure can be used to fertilize crops, the high level of phosphorus in the manure limits how much manure can be spread on a field. In runoff from farms wa into neighboring wa promotes eutrophica aquatic plants that c in the water, often ki

Fortunately, through abroad, phytase enz supplements to help acid in their feed int are a group of enzyr versions, but they all the phytic acid. "It's models, different en all do the same thing

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Patients waiting for a kidney transplant usually depend on dialysis to stay healthy until an organ donor can be found. They spend hours in a hospital or dialysis center several days a week so the machine can clean the toxins from their blood because their own kidneys can no longer do the job. Medical personnel carefully monitor and adjust the equipment throughout the process because even a small error could be very dangerous.

As John J. Bissler, M.D., a nephrologist at Cincinnati Children's Hospital, cared for patients in the intensive care unit, he became frustrated by the limitations of the monitoring equipment. He recognized the need for a system that accurately monitored, measured and regulated dialysis and filtration treatments. He envisioned a system that would automatically adjust dialysis or filtration when it recognized a problem instead of simply beeping. In 1988, he began assembling a team of doctors and engineers to develop an intelligent hemodialysis and hemofiltration system.

Traditional dialysis equipment works by diffusion across a membrane. On one side of the membrane is the patient's blood; on the other side is a fluid composed of sterile water and dialysate that supplies needed salts. Moving from an area of high concentration to an area of low concentration, toxins in the blood diffuse across the membrane and are washed out, while the fluids and salts diffuse into the blood. Dialysis requires frequent adjustments by personnel who must monitor the fluid removed from the patient on a regular basis. This activity leads to a significant increase in nursing care and raises the cost of the therapy. There are an estimated 1.5 million dialysis patients worldwide.

The machine Bissler invented works by hemodialysis, filtration or both. Taking advantage of new, stronger materials, his machine can force blood through a membrane that acts like a colander, straining toxins from the blood as the filters in the kidney do. The system then replaces fluids and salts and returns the blood to the body. Th highly accurate scales transducers to remov the blood at a desirec Bissler explains. "Ever dangerous. We were filtration. Tracking we problem. What we inv volumes so it is safe."

The whole system is c sophisticated softwar what's wrong. If the p the computer automa the filter is going bad and tells you how mu machine also pays att reducing the need fo possibility of human e

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Early detection and proper care is a common message used by health care organizations in their efforts to educate people and governments throughout the world about winning the war against certain cancers and other chronic diseases.

But does this message offer the same real hope of change for individuals and caregivers who live with the chronic and disabling affects of schizophrenia and other mental and neurological disorders? Early detection and proper care is less than assured. This is especially true when general practitioners and psychiatrists must rely on a century-old, highly subjective and time consuming verbal diagnosis that hopefully will help them identify the exact psychosis that is causing the delusions, hallucinations, disorganized thinking and other psychotic symptoms. This process often delays treatment and extends the suffering of millions throughout the world. Consider the facts just for schizophrenia:

- About 24 million people worldwide suffer from this treatable disorder
- Treatment is more effective in the initial stages of the disease
- More than 50 percent of persons with this disorder are not receiving appropriate care

"Our diagnostic blood test represents new hope for the millions of individuals throughout the world with schizophrenia..."

— Sabine Bahn, M.D., Ph.D., Cambridge Centre for Neuropsychiatric Research

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The humanitarian crisis in the Darfur region of western Sudan has displaced nearly 2.3 million people. While many of these individuals live within the safe confines of refugee camps, they are not always out of harm's way.

Women must venture outside camps to collect firewood to cook for their families. The sudden and drastic increase of people relying on the camps' surrounding land has taken a toll on the environment. Deforestation has left the area surrounding camps barren, and the lack of firewood causes more than 50 percent of families to miss one or more meals a week. As women spend more time outside of the camps in search of wood (a typical trip can last up to seven hours), they put themselves at risk of being raped or subjected to genital mutilation by the Janjaweed militia.

When Dr. Ashok Gadgil, Senior Scientist and Group Leader for the Environmental Energy Technologies Division at Lawrence Berkeley National Laboratory, was contacted by an officer of the United States Agency for International Development (USAID) to help refugees in Darfur, he knew little about the daily lives of refugees and wondered how a group of scientists could help better their lives.

The initial USAID proposal was to develop a compactor to turn sun-dried kitchen waste into a fuel source. On his first trip to Darfur, Gadgil concluded that there was not enough kitchen waste to provide an adequate fuel source for cooking fires. He did note that refugees cooked over three-stone fires, which transfer just five percent of heat to food. This inefficient cooking method inspired Gadgil to develop a field test in Darfur to study the efficiency of various cooking stove designs.

Researchers assessed the factors of cooking in Darfur. They worked closely with women, taking note of what they liked and didn't like about each stove

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For the African health care workers, the fellowship program can be nothing short of dramatic.

"The workers say the experience gives them hope and makes them feel good about themselves," says Bradley. "They believe they'll all be in a better place as a result."

In Stella's case, organizational changes in the operating room have given her and other surgical nurses an opportunity to shine. New operating room protocols to help reduce post-surgical infection rates – that need to be enforced by nurses – have changed the dynamics between male surgeons and female nurses.

"Here is a group of women who are in the position of telling male surgeons what to do now," says Bradley. "It has been empowering for them."

Being a catalyst for change—and equipping health care workers with the skills they need to go forward on their own – is all part of the plan for the Yale-Clinton Foundation Fellowship program.

"Our exit strategy for this program was to put ourselves out of business and move on to another country," says Bradley.

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Stella is a nurse anesthetist in Liberia, a country where women have limited social status and operating rooms have little in the way of infection control. Both have been elevated with the help of the Yale-Clinton Foundation Fellowship in International Healthcare Management, a program in which Western health care managers work side-by-side with hospital employees in developing nations to improve the quality of health care.

The premise of the fellowship, a joint effort between the Yale School of Public Health and the Clinton Foundation, is that, without strong health care systems, reducing the rates of mortality and AIDS transmission in struggling nations will be largely impossible. By tapping the knowledge and expertise of health care providers from the United States and other developed countries, the partnership seeks to improve—or, in some cases, introduce—standards of care in the hospitals of Africa and other struggling nations.

"These countries have resources, what they don't have are systems," says Elizabeth Bradley, Ph.D., associate professor and director of Global Health Initiatives at the Yale School of Public Health, who co-directs the program with Mae Podesta, country director for the Clinton HIV/AIDS Initiative in Liberia.

To strengthen those systems, the fellowship program has sent senior health care managers and post-graduate students with experience in hospital administration and public health to share their education and know-how with health care workers in both Liberia and Ethiopia. Their job is to import the best practices in hospital management from the Western World to their African counterparts, while providing leadership training to ensure improvements can be measured and sustained.

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These biopharma successes in developing new preventions, treatments and detection methods for infectious diseases such as HIV/AIDS and drug-resistant gram-positive bacteria, and proliferative diseases such as cancer, mean that there's no reason to think that neglected diseases of the developing world wouldn't yield to a comparable all-out effort. In our work at BIO Ventures for Global Health (BVGH) we've endeavored to show how biotech advances can create breakthroughs in treating neglected tropical diseases. For example, in our 2007 report, Closing the Global Health Innovation Gap, we showed that many of the molecular targets and compound libraries that have been used to create new drugs for developed world diseases are readily transferable and applicable to discovering new therapeutics for developing world diseases.

The problem, of course, is that biopharmaceutical R&D is an expensive and financially risky undertaking, and the millions of patients who might be helped have little purchasing power. So the "innovation gap" is driven by a funding gap, where the investment in R&D for neglected tropical diseases is a fraction of what's needed. Overcoming this gap will require further increases in funding for product-related R&D, where the Bill & Melinda Gates Foundation has shown tremendous leadership and what can be accomplished with focused, sustained sponsorship. In addition, the most powerful

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Dr. Christopher D. Earl is President and CEO of BIO Ventures for Global Health (BVGH), a not-f
to harness the resources of the biotechnology industry to create new medicines for infectious
breaks down barriers that hinder industry initiatives in global health product development. The
among stakeholders in industry, philanthropy, academia, and government, and catalyzes indus
new market-based incentives. Dr. Earl previously served as Managing Director of the Perseus-S
leading investor in later-stage life science companies, where he managed investments in bioph
director on portfolio company boards. Dr. Earl received a BA in Biology from the University of
Developmental Biology from Harvard University. For further information on BIO Ventures for G

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ISBN 0-9778444-6-3

AUTM extends its gratitude to the 2009 Better World Project sponsors:

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