Undergraduate Research and Intellectual Property Rights

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***Abstract*— Most universities today have developed intellectual property policies which clearly establish ownership rights in any commercially valuable process developed by professors and graduate students in a university laboratory. Increasingly, undergraduates are also being encouraged to take an active part in research since this often encourages them to go on to graduate school. It is also, in itself, a valuable learning experience. However, little thought has been given to the ownership rights of these undergraduate researchers. Universities must recognize that undergraduates may have ownership rights in research and must deal with this fact. A number of strategies for doing so are presented.**

***Index Terms*—Engineering education, intellectual property, research, undergraduate.**

I. Introduction

THE PROBLEM of intellectual property rights in research done at universities is one which has attracted a great deal of attention [1], [2]. Traditionally, this discussion has focused upon allocating rights among the university faculty and staff who do the research, the university which provides the laboratory space and employs the researchers, and the external funding entities (corporate or governmental), if any. Over the years, a variety of both patent and copyright law doctrines have been developed and applied to these relationships which have helped to clarify this allocation of rights. Most universities today have developed intellectual property policies which establish clearly who owns what rights in any commercially valuable process that may be developed in a university laboratory. Commonly such policies deal with who has the right to patent or copyright a particular discovery, determines who has the right to publish the details of any discovery, and allocates royalties derived from any discovery among the various potential claimants. Increasingly, universities see the intellectual property created by their faculty and staff members to be a valuable university asset and in order to ensure that the university has at least some share in this asset, many universities require that all university research staff sign contractual agreements regarding intellectual property as a condition of employment. In such cases, these contracts will specify in detail the allocation of all rights in any research which may be done in the course of employment. In other institutions, intellectual property rights may be incorporated by reference into employee contracts. Often a faculty or staff manual will contain the university policy and the contents of such a manual will be explicitly or implicitly deemed to be incorporated into the employment agreement [3]. In those institutions which have not adopted such specific written policies, patent and copyright law will still set some standard by which potential claimants will have their rights allocated. As regards discoveries which are copyrightable, the "work for hire" doctrine, as developed in statutes and case law, will generally regulate how the intellectual property rights will be allocated between institutions and employee researchers [4]. In regard to patentable discoveries, the "workplace doctrine" will perform a similar function [5]. In all of these various scenarios, however, there is in common the fact that the researchers are paid by the institution to do the research which may lead to a valuable discovery, and, therefore, an employee–employer or independent contractor–purchaser of services relationship exists at law.

In recent years, attention has been drawn, as well, to the intellectual property rights of graduate students working in university laboratories. In some universities, graduate students in engineering and the hard sciences are either explicitly employed by the university as research assistants or are receiving financial aid conditioned upon their doing such research. Those universities have, in general, therefore, modified and extended their written intellectual property policies to apply to such graduate students [2]. Here again, it is normal to require graduate students to sign agreements setting forth the respective rights of all parties to any research done by these graduate students. In the cases where such written agreements are not used, the tendency of the law has, in many cases, been to treat such graduate students as employees and treat them no differently from faculty or professional staff. Thus, under most university policies, graduate students are either required to sign agreements regulating their claims to intellectual property rights in any discoveries made by them or in collaboration with them. In universities which do not have such written agreements, either directly or indirectly, then property rights will generally be allocated by application of such doctrines as the "work for hire" or "workplace" doctrines already mentioned. Indeed, recently a great deal of attention has been focused on such agreements and the rights of graduate students as a result of the criminal prosecution of a graduate student in Florida for theft of intellectual property developed in a university laboratory [6].

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While much attention has been given to the rights of faculty and graduate students, little, if any, thought has been given to the rights of undergraduate students. The reason for this may be quite simple. The assumption has long been that research at universities is done by faculty, professional staff, and graduate students. Traditionally, undergraduates, particularly at research universities, have had little or no role in research. This, however, is changing. Increasingly, undergraduates are spending more time in university research laboratories. This change is attributable to a number of things. First, in the past few years the National Science Foundation has taken steps to encourage undergraduate involvement in science and engineering research, such as the creation of the Research Experiences for Undergraduates (REU) Program [7]. In fact, the NSF has gone so far as to indicate that applicants for funding in many categories of research awards will be favored in their applications if they include plans for involving undergraduates in their research plans [8]. The theory underlying these NSF initiatives is that an undergraduate research experience is one of the most effective techniques for attracting gifted undergraduate students to graduate school in mathematics, science, and engineering [9]. Given the current national demand for students in these subject areas, undergraduate research is seen as a national priority. A similar attitude is evidenced in a program of the Department of Energy called the "Science and Engineering Research Semester" (SERS).

Second, many university faculty are recognizing the instructional value of undergraduate research. Involvement of undergraduates in serious research activities is a form of "active learning," which a number of studies have indicated is more effective than traditional, "passive" undergraduate classroom instruction [10]. Third, many faculty have realized that by inclusion of undergraduates on their research teams, they are able to recruit these undergraduates as graduate students. Recent studies, including one at Purdue University [9], show that a majority of undergraduate engineering students who decided to pursue graduate work in engineering did so precisely because they had been exposed to engineering research as part of their undergraduate program. The Purdue study found that 50% of incoming graduate students had been involved in some form of research as undergraduates. Even more striking, 80% of those polled indicated that their undergraduate research experience had been a significant factor in their decision to go to graduate school. Indeed, it has been suggested that the great advantage of involving undergraduates in a laboratory experience is that it starts them early down the path of recognizing the important link between research and learning and, thereby, becomes a critical factor in instilling the notion of lifelong learning since it teaches students how to solve problems in a setting other than within the controlled parameters of the classroom [11]. Finally, there is also a practical advantage to faculty and laboratory directors using undergraduates as research assistants. Undergraduate students will often do research for credit and will not require any form of financial support, unlike graduate students who are accustomed to receiving tuition waivers and living stipends in exchange for working as research assistants. Many third and fourth year undergraduates are capable of doing serious work in a research laboratory. Since making such opportunities available to undergraduates increases the labor force available to the laboratory without significantly increasing costs and also serves to recruit these undergraduates to go on to become graduate students in the field, more and more universities—backed by the NSF and industry—have decided to encourage undergraduate involvement in university research efforts.

II. Potential Problems

The increasing use of undergraduates as research assistants, however, poses some very significant potential legal and policy problems in the allocation of intellectual property rights developed in a university setting [12]. Informal surveys by the authors indicate that many universities do not ask undergraduate researchers to sign agreements allocating intellectual property rights. In addition, traditional intellectual property law doctrines such as the "work for hire" rule in copyright law or the "workplace" doctrine in patent law will not always provide solutions in dealing with this allocation problem, since many undergraduate researchers are doing the research for academic credit and are not employed by the institution [2].

The failure to have adequate regulation of the intellectual property rights of undergraduate researchers may lead to some unexpected and ironic results. For instance, a university may have a rule that requires faculty, graduate students, and professional research staff to assign to the university all rights in any discoveries made using university equipment or on university premises. One can, therefore, imagine a situation where a university research team consists of faculty, graduate students, and undergraduate students. The faculty members and graduate students would have no property rights in their discovery, since they had prospectively assigned these to the university or its designee. The undergraduate students, however, having signed no such assignment agreement and not being covered by a legal scheme created by the "work for hire" doctrine or the "workplace" doctrine, might well be the only individuals in a position to challenge the university for a share of the property rights in the discovery [4]. Such a challenge might delay transfer of the technology from the university laboratory to the marketplace. It might even prevent publication of the results—to the detriment of the faculty and graduate students involved. Almost certainly, it could lead to litigation. The cost of such litigation, let alone its impact on faculty morale, would be significantly negative.

In order for undergraduate research efforts to pose such a serious problem in regard to the allocation of intellectual property rights, a few conditions would have to be met. First and foremost, the undergraduates who might claim rights would have to prove that their efforts were significant enough to warrant a finding by a court that they were joint authors or creators of the work in question [4]. Were the undergraduates' involvement in the laboratory limited to menial tasks, such as cleanup, it is unlikely that they could sustain any claim to a share in the intellectual property [4]. On the other hand, by limiting undergraduate efforts to perform menial tasks, the faculty member supervising the research would lose the instructional

advantages inherent in having the undergraduate play a serious role in the research. The whole point of undergraduate research is to make the student a "partner"—albeit a junior partner—in the research effort. Restricting the undergraduate's activity in the laboratory in order to limit her intellectual property rights would be an exercise in futility. It would be far better simply not to permit undergraduate involvement at all.

If one accepts, as we do, the proposition that serious undergraduate involvement in research has positive values for a university, then it is necessary to confront the legal problems such involvement presents. It is our opinion that the risk of undergraduate researchers making claims to rights in the fruits of their labors is not negligible, particularly in computer science and other types of research where even young researchers may well be able to do significant work. While it may well be unlikely that an undergraduate can make a contribution to a discovery in experimental physics sufficient to warrant allocation of intellectual property rights by a court, such will often not be the case in computer software research, for instance. One needs only to look at recent developments in software research to recognize that gifted undergraduates (even high school students) do have the capability of doing original research which might well result in commercially valuable products. Furthermore, the culture of computer science is such that young researchers may well be aware of their potential property interests and willing to prosecute these interests at law if necessary. Again, the recent history of intellectual property litigation, such as the litigation over Internet browser software, suggests that universities and university faculty must be prepared for their students to make claims to the fruits of their labors. Computer software research is, of course, only one potential field in which such a problem might occur. It could occur, in fact, in any science or engineering subject. Those who are skeptics should remember that Brian Josephson developed his Nobel Prize winning research which resulted in the "Josephson Junction" as an undergraduate at Cambridge University, or that a patent was recently granted to an Ohio eighth grader for helping to develop an innovative oil filter [13].

III. Possible Solutions

If one accepts that the increasing use of undergraduate students in university research laboratories does, in fact, pose a problem as to the allocation of intellectual property rights in university research, what, then, is the solution to the problem? The simplest solution, of course, would be to accept that undergraduates do have intellectual property rights in research discoveries to which they contribute. At those universities which permit faculty and student researchers to retain exclusive rights in their research, such a policy will be relatively simple to maintain. But even in such an institution, faculty and graduate student researchers must still consider what this will mean to them. If undergraduates are used as researchers and if the university permits faculty and students to retain intellectual property rights in their discoveries, then faculty and graduate student researchers will still want to regulate the allocation of those rights vis-à-vis undergraduates in their laboratories. It will be the responsibility of the faculty, in particular, to insure that the undergraduate students are aware of their rights. Furthermore, the faculty members will want both the graduate students and the undergraduate students to agree by contract to a specific allocation formula.

Take the following hypothetical case. A computer science professor has an undergraduate working with her in developing a new search engine. The professor expects that the undergraduate will make a major contribution to the development of the new program. *Before* the undergraduate begins research, the professor sits down with the undergraduate and explains the full extent of the undergraduate's potential rights in anything developed. The professor may well want to give the undergraduate a printed explanation of those rights (prepared by the University General Counsel) as well as have the undergraduate sign a written allocation agreement (also prepared by the University General Counsel). By doing this, the undergraduate will know his rights from the start and will be bound by the written agreement. By having the University General Counsel prepare the written explanation and agreement, all the parties will be assured of fair, consistent, and accurate information and treatment.

In those institutions where faculty and graduate students are required to assign by contract either all or part of their intellectual property rights to the university or its designee, then the simplest solution would again be to modify and extend this requirement to undergraduate researchers. This will be particularly important because such undergraduates may not be employees of the universities (as are faculty and most graduate students) and, therefore, not covered by such doctrines as the "work for hire" rule in copyright law or the "workplace" doctrine in patent law [4]. Here, again, undergraduates must be informed of their rights before beginning research and it would be best if consistency were achieved through the use of standardized forms.

The use of contractual agreements in dealing with undergraduates will not be completely easy, however. To be legally enforceable, a contract must have consideration [14]. When such contracts are signed by faculty and graduate students, they are signed as a condition of employment and the consideration for the employee's agreement is the employment itself and the compensation received as an employee [14]. Undergraduates, however, are often not employed by the university and do not receive compensation. Indeed, they generally pay tuition for the privilege of doing the research because they receive credit for it. Thus, in order to have adequate consideration for such an agreement, it will be necessary either to employ the undergraduate as a research assistant (on the graduate student model) or to make signing such an agreement a precondition of the undergraduate being permitted to work in the laboratory. The first possibility—employing the undergraduate—should work, but it does mean that universities and researchers will have to find funds sufficient to pay undergraduates for their research assistance. Nominal payments will not do [15].

In the event that it is the faculty member or laboratory director who initiates the contractual agreement (in those universities where faculty are permitted to retain their intellectual property rights), other problems may arise. Even

though the university may well be willing to permit the faculty member to retain rights for herself, it may be wary of permitting the faculty member to contractually limit undergraduate researchers' rights. This could be, without a university policy and monitoring, an invitation to exploitation of student researchers. Universities, in such a situation, would be well advised, as we have suggested above, to standardize such arrangements even if they have no financial interest in them.

If undergraduates are not compensated, however, then consideration must be found elsewhere. Here, consideration might take the form of permission to do research. As a precondition to this, it must be clear that the undergraduate does *not* otherwise have an entitlement to do the research, i.e., the instructor should state that admittance to the course is "by instructor's discretion" and *all* students should be required to sign the contracts and waivers. However, such a rule may well conflict with university or governing board policies regarding undergraduate rights. To require a student to assign away all intellectual property rights in work done by the student as a prerequisite to being permitted to enroll in a course, may well be viewed as antithetical to the educational mission of the university and highly exploitative of undergraduate labor. It may also not be accepted by courts as sufficient consideration to uphold the contract as valid under the doctrine of adhesion contracts. Nevertheless, until a court has ruled on this issue, this may be the best route to take. In cases where undergraduates are not compensated for doing research and universities do not use contracts but instead rely upon the "workplace doctrine" or the "works for hire doctrine" even greater problems may result [4], [5]. In these cases, universities should immediately adopt the use of contracts as detailed above.

IV. Concluding Remarks

The appropriate answer as to how to deal with the intellectual property rights of undergraduate researchers must, to a large extent, rest with each university and its research faculty and must be framed within the legal and policy context of each university. What is clearly not an acceptable answer, however, is to deal with the problem ostrichlike, by ignoring it and hoping that it will simply go away. It will not do so, and any university which attempts to deal with these problems by inaction may well find itself embroiled in lengthy and costly litigation. Universities and researchers will be far better served by taking positive actions to inform undergraduates of their rights and devising acceptable strategies *before* disputes arise. On the other hand, we must hope that most universities will also recognize that there is a great deal to be gained by undergraduate research activities. Thus, we would hope that in spite of the potential difficulties inherent in undergraduate research, university faculty and administrators will attempt to find fair and equitable solutions to the intellectual property problems that will continue to make undergraduate research a viable part of undergraduate instruction in science and engineering.

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