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COLLEGIALLY AND COLLABORATION IN THE AGE OF EXCLUSIVITY

Lawrence M. Sung*

INTRODUCTION

As we begin to embrace the promise of technology advancement in the new millennium, public concern continues to grow over the potentially stifling impact of intellectual property rights on basic scientific research and development. In particular, the scope of U.S. patent protection has increasingly become a target of criticism. For example, an evolving discontent, which has captured a great deal of news media attention in recent days, recognizes the apparent use of patents to fence off vast

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See, e.g., Human Genome Protest—Breaking the Genetic Code Will Test Patent Laws, FRESNO BEE, Jan. 5, 2000, at B6 ("As university scientists pore over the findings of the Human Genome Project, will they have to hire a patent lawyer to make sure their own work doesn't begin to encroach on someone's intellectual property? Will the very purpose of patenting—to justly reward pioneering research and to encourage new discoveries—help or hurt efforts to convert the genetic information into medical treatments? At this point, there is reason for both profound concern and excitement at the explosion in knowledge about how the human body functions. The Patent Office should rigorously and cautiously approach every application that seeks to corner the genetics market.... If today's patent laws begin to thwart tomorrow's genetic discoveries, Congress has a problem that will rival the complexity of the genome itself.").
amounts of deoxyribonucleic acid (DNA) sequence information being gathered for genetic data mining efforts in the intense initial phase of commercial bioprospecting.\(^2\) These and other anxious observations have fueled charges that patents are hampering scientific progress by impeding access to fundamental information or blocking the legitimate use of basic experimental tools (or enabling technology), particularly in academic or other non-commercial endeavors.\(^3\)

Such actions, if true, would certainly run afoul of the underlying public policy of the U.S. patent laws. At its heart, the patent system seeks to promote innovation by providing inventors with an

\(^2\)See, e.g., Justin Gillis, *Md. Gene Researcher Draws Fire on Filings: Venter Defends Patent Requests*, Wash. Post, Oct. 26, 1999, at E01 (reporting criticism by academic researchers, among others concerned over the filing in one month by Celera Genomics Corp. (Rockville, Maryland) of 6,500 provisional patent applications to gene sequences). Despite the assurance by Dr. J. Craig Venter, President and Chief Scientific Officer of Celera, that the complete human genetic sequence would be made available without charge sometime during 2000, doubts regarding the benevolence of the company’s research activities find support in the twenty to thirty thousand provisional patent applications to gene sequences Celera expects to file by the completion of its human genome project. *Id.* Furthermore, in the end, the greatest commercial value involving genetic information might not lie with the actual DNA sequences, but on the methods invented to ascribe meaning to that information. *See* Justin Gillis, *A Gene Dream*, Wash. Post, Sept. 27, 1999, at F18 (noting Celera’s recognition that “[j]ust because they intend to give away raw data...doesn’t mean they are giving away everything of value.”). Indeed, certain interested observers predicted early that the inevitable reliance on bioinformatics-related software applications to analyze DNA sequence information and identify leads for drug discovery and genetic therapy would someday create a market for efficient database browsers. *See* Lawrence M. Sung & Don J. Pelto, *The Biotechnology Patent Landscape in the United States as We Enter the New Millennium*, 1 J. WORLD INTELL. PROP. 889, 900 (1998) (comparing prospective business competition in bioinformatics software packages to the dynamics between Netscape Communications Corp. (Mountain View, California) and Microsoft Corp. (Redmond, Washington), involving methods of viewing Internet materials, or between Lexis-Nexis (Dayton, Ohio) and West Group (Eagan, Minnesota) in ways of accessing legal databases); Lawrence M. Sung & Don J. Pelto, *Bioinformatics May Get Boost From “State Street”*, Nat’l J., Oct. 19, 1998, at C28 (same).

opportunity for pecuniary reward through the government grant of temporary exclusionary rights in their inventions. The inherent emphasis on innovation is reflected in the statutory conditions for obtaining a patent, which prescribe that inventions may be patented only if they are useful, new, and nonobvious in view of known technology referred to as prior art. Moreover, patent grants are predicated upon applicants' sufficient descriptions of their inventions so that others of ordinary skill in the relevant art may recognize and practice the claimed invention. Through such disclosure requirements,
the patent laws essentially mandate that every patent provide a public platform for further innovation.\textsuperscript{10}

Given the seemingly well-balanced public policy of this legislative scheme, upon what are the recent outcries over patent protection based? Indeed, result-oriented observers might be quick to embrace the notion that the United States owes its global technology leadership role in large measure to the strength of its patent system.\textsuperscript{11} Furthermore, conventional wisdom suggests that the confidence in the consistent

most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention. The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.”)

\textsuperscript{10}\textit{See}, e.g., Brian P. O'Shaughnessy, \textit{The False Inventive Genus: Developing a New Approach for Analyzing the Sufficiency of Patent Disclosure Within the Unpredictable Arts}, 7 \textit{FORDHAM INTELL. PROP. MEDIA & ENT. L.J.} 147, 149-50 (1996) ("The patent grant is a social contract. Society defers for a limited time the right to make, use, or sell an invention that is useful, novel, and nonobvious. In exchange, the applicant provides a disclosure that teaches one of ordinary skill in the art how best to make and use that invention. As a result, society trades a period of exclusivity for a defined contribution to its body of useful knowledge. As more commonly stated, disclosure is the \textit{quid pro quo} for the patent grant." (internal footnotes omitted)) \textit{See} \textit{State Indus., Inc. v. A.O. Smith Corp.}, 751 F.2d 1226, 1235-36, 224 U.S.P.Q. (BNA) 418, 424 (Fed. Cir. 1985) ("[K]eeping track of a competitor's products and designing new and possibly better or cheaper functional equivalents is the stuff of which competition is made and is supposed to benefit the consumer. One of the benefits of a patent system is its so-called 'negative incentive' to 'design around' a competitor's products, even when they are patented, thus bringing a steady flow of innovations to the marketplace."); \textit{cited in} Craig Allen Nard, \textit{Certainty, Fence Building, and the Useful Arts}, 74 \textit{IND. L.J.} 759, 791 (1999) ("As the name 'design around' suggests, third parties, usually a competitor, may purposefully circumvent the boundaries of the patent claim and create a competitive non-infringing alternative to the claimed invention. The practice of designing around existing patents creates competitive substitutes and advances, resulting in competition among patented technologies. The public clearly benefits from such activity." (internal footnotes omitted)).

\textsuperscript{11}\textit{See} Richard C. Hsu & Jeffrey D. Tekanic, \textit{Keep a Strong Patent System}, \textit{N.Y. TIMES}, June 7, 1998, § 3, at 14 ("An important reason for America's success in the last century is that its patent system has prompted investment in technology, thus encouraging the world's best and brightest engineers and scientists to come here to work. The bottom line is that a strong patent system creates and maintains wealth, trade, investments and, ultimately, a higher standard of living. Without a strong patent system, America could be reduced to an also-ran."); cf. Francis Gurry, \textit{Symposium On Global Competition and Public Policy In An Era of Technological Integration: The New Global Technology Regime: The Evolution of Technology and Markets and the Management of Intellectual Property Rights}, 72 \textit{CHI.-KENT. L. REV.} 369, 371 (1996) ("The new significance of intellectual capital and the increased demand for intellectual property are both occurring within the context of the globalization of markets. In this process of globalization, intellectual capital has been a vector of internationalization and intellectual property has been an instrument of competitive positioning in global markets").
enforcement of patent rights likely acts as the catalyst for capital investment and industrial growth.\textsuperscript{12}

Arguably, the furor stems from growing uncertainty along at least two fronts. First, the perception exists that the otherwise generic patent laws cannot satisfactorily govern new technologies through the application of traditional legal doctrines.\textsuperscript{13} Second, unpredictable business dynamics apparently have evolved as a consequence of a seemingly irrational demand for the imprimatur of patent registration without regard to the true scope of protection.\textsuperscript{14} Ongoing scholarly and

\textsuperscript{12}See Simone A. Rose, Patent "Monopolyphobia": A Means of Extinguishing the Fountainhead?, 49 CASE W. RES. L. REV. 509, 550 (1999) ("[A]fter the formation of the Federal Circuit the number of patent applications filed increased dramatically. Patentees appeared to believe that this Circuit possessed the technical expertise to evaluate patentability during the prosecution stage and would consistently and equitably evaluate appeals from the Patent Office. Interestingly, the minor recession suffered in the 1980s had little impact on the number of applications filed. This may suggest that public sentiment about patents and/or the prosecution process more significantly impacts changes in applications filed, rather than economics, unless there is a severe economic shift").

\textsuperscript{13}See Peter Weissman, Computer Software As Patentable Subject Matter: Contrasting United States, Japanese, and European Laws, 23 AM. INTELL. PROP. L. ASS'N Q.J. 525, 527 (1995) ("The statutory language used to define patentable subject matter in the United States has not changed significantly since it was first developed over 200 years ago. Consequently, once technology expands into formerly unimaginable domain, intellectual property laws must similarly adjust in order to either provide or preempt protection. However, where law-making bodies do not act, courts and administrative agencies, such as the Patent and Trademark Office, are left with the difficult task of applying antiquated laws to new technologies. Often, this procedure is analogous to fitting a square peg into a round hole. One area in which courts have been faced with unforeseen scientific advances is in the field of computer-related inventions"); see also Peter Drahos, Biotechnology Patents, Markets and Morality, 9 EUR. INTELL. PROP. REV. 441, 443 (1999) ("A crucial aspect to the expansion of the patenting in biotechnology has been the development of juridical arguments and theories that have enabled applicants for biotech patents to overcome existing bars. One of the interesting things is that, while these arguments are often analytically weak, they have been readily accepted by the patent community in the name of adapting the patent system to changing circumstances of technology and innovation").

\textsuperscript{14}See Robin Marantz Henig, The Rush to Claim a Little Slice of Life, WASH. POST, Jan. 9, 2000, at B05 ("Never before has our 210-year-old patent law been contorted in quite this way, protecting discoveries instead of inventions, biological information instead of machines. At the U.S. Patent and Trademark Office, more than 10,000 provisional patent applications for various segments of the human genome are awaiting action. The applications come from Celera and its two main for-profit competitors, Human Genome Sciences Inc. (which, like Celera, has its headquarters in Rockville) and Incyte Pharmaceuticals Inc., based in Palo Alto, Calif. In all but a handful of cases, no one at these companies yet understands the function, usefulness or commercial value of the genetic material for which patent applications have been made. The applications serve simply as place holders").
other public debates over the effect of patent protection on computer software and biotechnology innovation help inform such perspectives.\(^{15}\)

This article takes a somewhat different approach in addressing the innovation issue, and instead considers the impact of the laws governing intellectual property rights in the United States on the collegiality and collaboration of researchers. The first section of this article introduces the criticality of these relational aspects to the dynamics of scientific progress. Next the article reviews and assesses the patent law jurisprudence on invention, and more particularly, that regarding joint invention. The article continues with a discussion of how the legal standards of inventorship under the patent laws might affect the research and development conducted at various public and private institutions, academic or otherwise. Of the many technologies possibly implicated in similar fashion, the medical and pharmaceutical arts will form the primary context for the discussion in this article.\(^{16}\)

\(^{15}\)See Teresa Riordan, The Government Will Take A Second Look At A Patent It Issued For A Year 2000 Software Program, N.Y. TIMES, Dec. 27, 1999, at C5 (quoting U.S. Senator Charles Schumer (D-NY) on the subject of software patents as “one of the most vexing issues facing Congress this year and in the next few years. As a country, we value intellectual property rights. But the recent expansion of what is patentable could have a detrimental effect on the technological expansion of our economy.”); Denise Caruso, Concern Is Growing Over People And Companies That Are Stockpiling Patents To Be Used As Competitive Weapons, N.Y. TIMES, Feb. 1, 1999, at C4 (“Ideas are given their literal currency through patent and copyright laws, originally intended to stimulate innovation by protecting inventors from idea snatchers and allowing them to profit more easily from their talents. But some experts worry that an increasing number of individuals and companies are perverting that original purpose with increasingly specious claims to ownership, as well as by stockpiling patents into competitive arsenals”); see generally Michael A. Heller & Rebecca S. Eisenberg, Can Patents Deter Innovation? The Anticommons in Biomedical Research, 280 SCI. 698 (May 1, 1998). Intellectual property issues have also come to the fore in the context of global commerce. See Jennifer Bjorhus, Putting a Price on Intellectual Property, OREGONIAN, Nov. 14, 1999, at E1 (“Intellectual property is one of three broad subjects on the agenda for the World Trade Organization’s meeting Nov. 30 to Dec. 3 in Seattle. The topic creates one of the deepest fault lines between the agency’s industrialized and developing member nations”).

\(^{16}\)See generally Harold C. Wegner, PATENT LAW IN BIOTECHNOLOGY CHEMICALS & PHARMACEUTICALS (2d ed. 1994) (providing a detailed and comprehensive consideration of the application of the patent law to specific fields of technology).
BACKGROUND

Science As a Collective Endeavor
While some might characterize all innovation as collaborative, the mark of true collaboration should be the act of information exchange, irrespective of the relative contribution of the actors. For example, a lone scientist relying upon the teachings of published literature depends no less on the benefits of another’s information than a team scientist that works as part of a research and development group. However, only in the latter scenario does the sharing of knowledge appear to take place. In any event, this article will focus on those relationships where a presumptive multilateral benefit accrues to all participants.

Few, if any, generalizations seem appropriate regarding the relative merits of individual versus team effort toward advancing the state of the art. Success stories in both regards are sufficiently replete throughout scientific history to set aside the significance of the

17See Robert Merton, On the Shoulders of Giants: A SHADEAN POSTSCRIPT 31 n.3 (1965) (“If I have seen further it is by standing on ye sholders of Giants.” (quoting Letter from Sir Isaac Newton to Robert Hooke (Feb. 5, 1675 or 1676))).
18See Edward F. Sherry & David J. Teece, Some Economic Aspects Of Intellectual Property Damages, 573 PRAC. L. INST./PAT. 399 (1999) (“The paradigm of thought seems to be the ‘better mousetrap,’ where a lone inventor, drawing on material which is unquestionably in the public domain, develops a new design which can be built by nearly anyone, using existing unpatented technology. In such a context, the patent in question is a key enabling patent which is roughly coextensive with the economic value-added of the new product (and any infringing products). Nowadays the old paradigm cases tend to be relatively rare. Most commercially valuable innovations are due to the contributions of a number of factors. Most technical progress is incremental in nature. Every innovation ‘stands on the shoulders of’ earlier innovations, and often makes extensive use of complementary assets and complementary technology.”); Mark A. Lemley, The Economics of Improvement in Intellectual Property Law, 75 TEX. L. REV. 989, 1010 (1997) (“In some sense, any invention, no matter how pioneering, can be thought of as an improvement on prior work.”).
19See Rebecca S. Eisenberg, Patents and the Progress of Science: Exclusive Rights and Experimental Use, 56 U. CHI. L. REV. 1017, 1066 (1989) (“[T]he prospect theory [in favor of coordination of research initiatives by patent holders] is primarily concerned with promoting efficiency in research, while the argument for individualism and independence takes the promotion of scientific progress to be an unqualified goal. Thus it might be argued that even if greater scientific progress could be achieved through independent research initiatives in a system of free access to prior discoveries than through coordinated research efforts in a system of exclusive rights, the additional progress to be expected in the former type of system would not justify its greater costs in wasteful duplication of research effort.”).
comparison.\textsuperscript{20} Still, the continuing establishment and maintenance of dedicated research and development centers appears to reflect a conventional wisdom that recognizes the present value of facilitating collaboration.\textsuperscript{21}

\textsuperscript{20}When asked to identify the greatest inventors in history, most tend to recall individuals. \textit{See}, e.g., \textit{Heroes \& Villains; Those Who Shaped The World's History, For Better Or Worse}, N.Y. Post, Jan. 1, 2000, at 12 (listing Thomas Edison, Alexander Graham Bell, Henry Ford, and Wilbur and Orville Wright, among others). However, the focus on such icons belies the reality that an overwhelming majority of inventions result from team effort. \textit{See} Douglas Baldwin, \textit{The Patent and Technology License}, 576 \textsc{Prac. L. Inst./Pat.} 629, 632 (1999) ("In the past, most commercially important technology was developed by individuals, or by corporate research. It was substantially developed by a single entity [with as little outside input or content as necessary]. Today, that is no longer true. Today, most commercially important technology is an amalgam of inputs from several sources, as, for example academic or government research, with commercial company development, collaboration by two or more companies or by merger. Commercial development may be completed by an established company or by a new company set up specifically to exploit the technology—often with venture capitalist involvement.").

\textsuperscript{21}\textit{See} W. Fritz Fasse, \textit{The Muddy Metaphysics of Joint Inventorship: Cleaning Up After the 1984 Amendments to 35 U.S.C. § 116, 5 \textsc{Harv. J.L. \& Tech.} 153, 159-60 (1992) ("Total innovation is usually increased by the sharing of knowledge and ideas among members of a research team. Thus, to achieve the goal of maximum innovation, the patent system should foster actual collaboration among researchers. This collaboration will lead to more joint inventive work and the development of more patentable inventions." (internal footnotes omitted)). To promote research and development interactions between federal laboratories and industry, the Federal Technology Transfer Act of 1986, Pub. L. No. 99-502, 99th Cong., 2d Sess., 100 Stat. 1785 (1986) (amending 15 U.S.C. §§ 3701 \textit{et seq.}), was enacted to increase the exchange of knowledge and personnel on collaborative projects through Cooperative Research and Development Agreements (CRADAs). \textit{See} Thomas N. Bulleit, Jr., \textit{Public-Private Partnerships in Biomedical Research: Resolving Conflicts of Interest Arising Under the Federal Technology Transfer Act of 1986, 4 \textsc{J.L. \& Health} 1, 8 (1990) ("Under a typical NIH CRADA, a government scientist collaborates on a specified research project with a company scientist (the 'investigators'). The company might also fund one or more research fellows to work with the government's principal investigator on the research project. The company may also contribute other resources, such as additional research scientists, supplies or operating expenses. In exchange for this support and participation, the company obtains rights—typically an exclusive license or an option to an exclusive license—in any invention produced under the collaboration."). Similar considerations have been raised regarding international technology collaborations. \textit{See} Stacey M. Berg \textit{et al.}, \textit{Panel Hearing on Foreign Research Alliances, 5 J. Proprietary Rts.} 35, 35 (1993) ("At a panel hearing before the Science Subcommittee of the House Committee on Science, Space and Technology on October 28, 1993, proponents of scientific research alliances between foreign corporations and U.S. universities testified that such alliances are crucial to prepare students to compete in a global economy. Susan Wray, Director of Patent, Copyright and Technology Licensing for the University of Florida, attributed the superiority of the U.S. university system to the universities' abilities to utilize foreign research expertise. Wray emphasized the importance of fostering 'international' collaboration and exchange of ideas").
The paradigm that two minds are better than one traditionally has rested on the additive concept of background experience, not just cognitive synergy. However, reliance upon another person as an information source is increasingly unnecessary in an age where telecommunications and other information technology affords all of us an unprecedented individual portal to the world's accumulated knowledge. If such a benefit grows anachronistically, what incentive to collaborate will likely survive and predominate?

To be sure, the social aspects of collaboration play no small role. The rewards of interaction do not culminate with the successful completion of an innovative endeavor. In a recent consideration of possible motivations underlying the human resources engaged in scientific research and development, an economics scholar observed:

Science is a collective endeavor: an industry in which the work of one set of specialists serves as the input for other lines of specialized production. From a collective point of view, science can only function rationally by an efficient division of labor. If the available talents and efforts are allocated suboptimally, scientific production will not achieve collective excellence even if it is optimized from the viewpoint of the individual.

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22Cf. Laurence R. Helfer & Anne-Marie Slaughter, Toward a Theory of Effective Supranational Adjudication, 107 YALE L.J. 273, 325 (1997) (analyzing the deference given by various national courts to the decisions of the European Court of Justice and the European Court of Human Rights and commenting that "[t]he underlying premise here assumes the intrinsic value of widespread and diverse input in a deliberative process: Two minds are better than one, and fifteen minds, particularly minds from different perspectives and cultures, are better than two").

23See generally Donald S. Chisum et al., PRINCIPLES OF PATENT LAW 34-50 (1997) (discussing various theories of property rights and their implications on the patent laws); see also id. at 44 n.4 (citing Leo Katz, ILL-GOTTEN GAINS: EVASION, BLACKMAIL, AND KINDRED PUZZLES OF THE LAW (1996) for its consideration of fame and glory and the societal rules, if any, that govern these aspects).

24See Jon Cohen, The Culture of Credit, 268 SCI. 1706, 1706 (1995) ("In science, as in so many other professions, the coin of the realm is not collaborative generosity but credit—credit for individuals.... With credit from one's peers comes access to all important grant funding, easier publication in leading journals, and a steady supply of the grad students and postdocs who make the lab run").

25George Franck, Scientific Communication — A Vanity Fair?, 286 SCI. 53, 53 (1999). Professor Franck proposes that "attention," i.e., the recognition achieved as a byproduct of scientific accomplishment, forms the currency for interaction among researchers. Id. The
In considering scientific progress through the metric of inventive acts, another scholar has echoed these sentiments:

We all recite the myth of the lonely intellectual. Yet, creativity, with all its need for retreat and isolation, is not a lonely act after all. If great inventors like Edison or Bell had one overriding form of genius, it was a genius for forming communities of open and inventive collaborators around themselves. These scholars, too, treasured community.\textsuperscript{26}

Accordingly, to the extent that collaboration constitutes an integral force in the progress in the scientific and engineering arts, the success of this interaction depends upon the nature of collegiality that exists.\textsuperscript{27} In turn, the degree of such collegiality rests upon the ability of members of these communities to agree and adhere to recognizable standards of conduct that promote collaborative behavior.\textsuperscript{28} In this regard, the U.S. patent laws are implicated, at least in part.\textsuperscript{29}

health of scientific progress, according to Professor Franck, depends upon the ability of members of the scientific community to strike the appropriate balance between the investment and return of individual attention. \textit{See id. at 55.} \textsuperscript{26}


\textit{See Cohen, supra note 24, at 1706 ("Scientific ideals call for collaboration and sharing. But in today’s competitive scientific enterprise, a tremendous premium is placed on individual credit, setting the stage for conflict").} \textsuperscript{27}

\textit{See id. ("[A]ll researchers know, whether they've been taught in a class or simply assimilated the relevant principles from those around them, that a scientist is supposed to respect the collaborative nature of the process: Credit is to be shared appropriately; the findings of others—even from competing labs—are to be cited; students are to be treated generously; materials and data are to be shared freely. Somewhere, somehow, every scientist learns those largely unwritten rules").} \textsuperscript{28}

\textit{For an excellent scholarly consideration of the relative merits of intellectual property protection of biotechnology by trade secrets as opposed to patents, see Dan L. Burk, Misappropriation of Trade Secrets in Biotechnology Licensing, 4 Alb. L.J. Sci. & Tech.} 121, 141-42 (1994) ("Although trade secrecy may be the required or desired form of intellectual property protection, the characteristics of the biotechnology industry reviewed above pose certain problems for this type of protection. First, the prevalence of strategic alliances in this industry means that a great many trade secrets will be licensed to partner firms, and a high frequency of agreements alone will increase the likelihood of trade secrets disputes. More importantly, however, these secrets will change hands in a young industry that has little experience or case law to guide it in fashioning or interpreting such agreements.... The academic roots of the biotechnology industry may also pose special problems. The professional norms of the scientific community have long required that scientists share data and
The significance of inventorship to the patent system is an issue upon which there is a dearth of debate. The vestments that the title of inventor bestows include the recognition of ingenuity manifested through social contribution, and the warrant of ownership in definable intellectual property. Whereas the first aspect can elevate the peer status and collaborative capital characterized as scientific attention, the second highlights a potential gain generally measured in harder currency. Unlike mere attribution, therefore, the inventorship designation embodies a pecuniary benefit, the magnitude of which tends toward direct proportionality with the likelihood of controversy.

Many scientists could argue that until very recently, the attention achieved through publication attribution sufficed to foster collegiality, and thus, collaboration within their circles. In the same breath, such materials with one another, both to allow repetition and validation of reported results and to facilitate new discoveries. Indeed, many peer review journals require the authors of papers published in those journals to make their biological materials freely available. University researchers have routinely supplied other researchers with requested materials and have expected to have their own materials requests freely fulfilled in return. Such free exchange of materials and data is generally incompatible with the requirements of trade secrecy. This may make trade secrecy difficult in research ventures involving universities. And as former academic researchers enter commercial firms, their continued desire to publish and exchange research results with colleagues may compromise the trade secret position of their new employer.

Compare Franck, supra note 25, at 55 ("Publication establishes intellectual property. Published information may thus not be used as a means of production without the user's acquiring a license to do so. The license for using somebody else's information productively is obtained through transfer of some of the attention earned by the citing author to the cited author. Citation thus reflects the preparedness to pay on the part of those using information productively, by crediting to somebody else the productive impact of the cited information on one's own work.")., with Sandip H. Patel, Note, Graduate Students' Ownership and Attribution Rights in Intellectual Property, 71 Ind. L.J. 481, 484 n.7 (1995) (reporting various examples of multimillion dollar royalty fees obtained by universities from patent licenses with private corporations to technology invented by university researchers).

See Jackie Hutter, Note, A Definite and Permanent Idea? Invention in the Pharmaceutical and Chemical Sciences and the Determination of Conception in Patent Law, 28 J. Marshall L. Rev. 687, 725 (1995) ("Moreover, increased emphasis on collaborative efforts directed toward the commercial development of novel, but not yet applied, technology will likely result in a greater number of cases in which researchers contest inventorship. That is, the parties participating in joint research may claim ownership of the invention separately and in conflict with one another").

See Eisenberg, supra note 19, at 1046-48 ("The idea of enforcing exclusive rights against researchers fundamentally conflicts with traditional scientific norms calling for free dedication of new knowledge to the scientific community.... At a functional level, the contradiction between scientific communism/communality and the grant of exclusive rights in
voices might also lament that the face of basic research and development has changed due to the expansion of intellectual property rights, particularly through assertive patent enforcement in a seemingly unprecedented manner.\textsuperscript{33} The U.S. patent laws, which are designed to promote innovation, should facilitate and not hinder the vehicles for progress, such as collegiality and collaboration.\textsuperscript{34} With these principles in mind, the question of the impact of patent protection on collaborative behavior warrants a closer scrutiny of the law governing inventorship.

Conception As the Touchstone of Invention

Whether express or implied in its distinct statutory provisions, U.S. patent law begins with an act of invention, and perhaps equally important, the designation of an inventor.\textsuperscript{35} The procurement of a patent right cannot proceed absent at least one inventor.\textsuperscript{36} The legal

new discoveries under the patent system reflects divergent perspectives on how best to promote scientific progress. The patent laws rest on the premise that granting exclusive rights in discoveries will promote progress; the normative authority of scientific communism/communality derives at least in part from the assumption that this same goal will be better served by granting free access to such discoveries.” (internal footnotes omitted)).

\textsuperscript{33}See Patel, \textit{supra} note 30, at 484-85 (“Today, our nation’s universities provide essential and cutting-edge technological innovation that once could be found only in industry or government laboratories. The growth of the university as the birthplace of many inventive discoveries over the past two decades has brought recognition, prestige, and money to these schools. Universities consequently approach today’s advances with the hope of educational and monetary achievement conceivable twenty-five years ago. One need look no further than the comprehensive university intellectual property guidelines to see that administrators recognize the prizes that are now customary with major advances. The growing university practice of producing and selling technological advances is a benefit to university budgets, yet does not come without special problems.” (internal footnotes omitted)).

\textsuperscript{34}See Fasse, \textit{supra} note 21, at 207 (“Because a mutual exchange of ideas and information among inventors results in increased aggregate innovation, a collaboration requirement of this nature serves to further a fundamental policy goal of the patent laws. To foster collaboration, the law must require and reward inventive work that is in fact the product of joint efforts”).

\textsuperscript{35}See 35 U.S.C. \textsection 101 (1994) (“Whoever invents or discovers any new and useful process, machine, manufacture, composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title”).

\textsuperscript{36}See 35 U.S.C. \textsection 111 (1994) (“An application for patent shall be made, or authorized to be made, by the inventor, except as otherwise provided in this title, in writing to the Commissioner.”); see also 35 U.S.C. \textsection\textsection 117-118 (1994) (providing for application by persons other than the inventor in the limited circumstances of death or incapacity of the inventor, or an uncooperative inventor, respectively).
significance of the inventor and the propriety of his or her claim to such a status cannot be overstated.\textsuperscript{37}

The jurisprudence of inventorship rests upon the tenet that conception is the touchstone of invention.\textsuperscript{38} Indeed, from the earliest cases, courts have uniformly held that an inventor is a person who conceived the patented invention.\textsuperscript{39} However, the relatively static nature of the patent law principles underlying inventorship belies the long-standing discontent with their practical application.\textsuperscript{40}

The legal standard of conception can be considered the "formation in the mind of the inventor, of a definite and permanent idea of the

\textsuperscript{37}The ultimate penalty of patent invalidation may be imposed pursuant to 35 U.S.C. \$ 256 (1994) for the intentional failure to designate a true inventor of the patented subject matter. For unintentional omission of a true inventor, or for originally designating a person who is later determined not to be a true inventor, the patent may simply be corrected to reflect the appropriate inventor identification. \textit{See id.} By comparison, with respect to correction of inventorship during prosecution of the patent application, 35 U.S.C. \$ 116 requires the lack of deceptive intent in both misjoinder and nonjoinder. \textit{See Stark v. Advanced Magnetics, Inc.}, 119 F.3d 1551, 1555, 43 U.S.P.Q.2d (BNA) 1321, 1324 (Fed. Cir. 1997) (noting the difference between the two statutory provisions governing correction of inventorship). In any event, the Federal Circuit also has addressed the proper procedural aspects for the correction of inventorship. \textit{See Pannu v. Iolab Corp.}, 155 F.3d 1344, 1350, 47 U.S.P.Q.2d (BNA) 1657, 1662 (Fed. Cir. 1998) ("When a party asserts invalidity under [35 U.S.C.] \$ 102(f) due to nonjoinder, a district court should first determine whether there exists clear and convincing evidence that the alleged unnamed inventor was in fact a co-inventor.... [T]he patentee must then be given an opportunity to correct inventorship pursuant to [35 U.S.C. \$ 256].... Finally, a patent with improper inventorship does not avoid invalidation simply because it \textit{might} be corrected under section 256. Rather, the patentee must claim entitlement to relief under the statute..."


\textsuperscript{39}\textit{See} Collar Co. v. Van Dusen, 90 U.S. (23 Wall.) 530, 563-64 (1874). Indeed, one need not personally reduce to practice his or her complete conception to remain an inventor. Acts by others in certain circumstances can inure to the inventor’s benefit. \textit{See Cooper v. Goldfarb}, 154 F.3d 1321, 1332, 47 U.S.P.Q.2d (BNA) 1896, 1905 (Fed. Cir. 1993) ("In order to establish inurement, an inventor must show, among other things, that the other person was working either explicitly or implicitly at the inventor’s request. While derivation focuses on the communication of information between two parties, inurement focuses on the nature of the relationship between them. Communication of the conception by the inventor to the other party is not required to establish inurement." (internal citations omitted)).

\textsuperscript{40}\textit{See}, \textit{e.g.}, Mueller Brass Co. v. Reading Indus., Inc., 352 F. Supp. 1357, 1372-73 (E.D. Pa. 1972) (The exact parameters of what constitutes joint inventorship are quite difficult to define. It is one of the muddiest concepts in the muddy metaphysics of the patent law..."), \textit{aff’d mem.}, 487 F.2d 1395 (3d Cir. 1973).
complete and operative invention.” The courts have further explained that an idea is sufficiently “definite and permanent” when “only ordinary skill would be necessary to reduce the invention to practice,” without extensive research or experimentation. Of the positive indicia of inventorship, the ability to articulate the inventive concept is an important starting point.

The test for conception is whether the inventor had an idea that was definite and permanent enough that one skilled in the art could understand the invention; the inventor must prove his conception by corroborating evidence, preferably by showing a contemporaneous disclosure. An idea is definite and permanent when the inventor has a specific, settled idea, a particular solution to the problem at hand, not just a general goal or research plan he hopes to pursue. The conception analysis necessarily turns on the inventor’s ability to describe his invention with particularity. Until he can do so, he cannot prove possession of the complete mental picture of the invention. These rules ensure that patent rights attach only when an idea is so far developed that the inventor can point to a definite, particular invention.

Common misconceptions abound with respect to the relationship between inventorship and ownership. Whereas inventorship rests with the inventive act alone, ownership depends upon the public and private contractual rights and obligations of the inventor.

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41See Hybritech, Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 1376, 231 U.S.P.Q. (BNA) 81, 87 (Fed. Cir. 1986) (quoting 1 ROBINSON ON PATENTS 532 (1890)).
42See id., 231 U.S.P.Q. (BNA) at 87.
44See, e.g., Ann Bartow, Inventors of the World, Unite! A Call for Collective Action by Employee-Inventors, 37 SANTA CLARA L. REV. 673, 680 (1997) (“The generally unstated assumption that institutions such as corporations or universities are the ‘real’ inventors is evidenced by the fact that the two are often used interchangeably by intellectual property law practitioners, and even sometimes scholars, despite the fact that by statute only living breathing people can be named in patents as inventors. Even those who happen to notice the difference between employee-inventors and inventor employees don’t seem particularly troubled by the distinction.” (internal footnotes omitted)).
45See Fasse, supra note 21, at 155-57 (articulating several distinctions between inventorship and ownership).
Inventorship is a title conferred irrespective of the inventor’s subsequent ownership rights. Where inventorship and ownership do not coincide, an inventor might receive no pecuniary benefit from the invention. The assignment of patent rights subject to an employment contract typifies such circumstances.

The inventor is the presumptive owner of any patent rights to the invention. All inquiries regarding patent ownership thus begin with inventorship. Absent an implied or express assignment of the patent rights, the inventor remains the holder of title to these rights. Given

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46See Beech Aircraft Corp. v. EDO Corp., 990 F.2d 1237, 1248, 26 U.S.P.Q.2d (BNA) 1572, 1582 (Fed. Cir. 1993) (“It is elementary that inventorship and ownership are separate issues. An application for a patent must be made by or on behalf of the actual inventor or inventors of the subject matter claimed therein. Thus, inventorship is a question of who actually invented the subject matter claimed in a patent. Ownership, however, is a question of who owns legal title to the subject matter claimed in a patent, patents having the attributes of personal property. At the heart of any ownership analysis lies the question of who first invented the subject matter at issue, because the patent right initially vests in the inventor who may then, barring any restrictions to the contrary, transfer that right to another, and so forth. However, who ultimately possesses ownership rights in that subject matter has no bearing whatsoever on the question of who actually invented that subject matter”).

47See Patel, supra note 30, at 499 n.99 (“This could raise ethical issues between a professor and the university. The professor motivated by altruistic rather than economic beliefs could undermine the university’s interest in the profits accompanying commercial exploitation of the invention by dedicating the invention to the public through publication.... An attempt by the university to limit the professor’s ability to disclose the invention in this manner through contractual agreements may cast doubts on the university’s goals of promoting academic freedom, generating information, and freely disseminating that information.”).

48See Richard C. Witte & Eric W. Guttag, Employee Inventions, 71 J. PAT. & TRADEMARK OFF. SOC’Y 467, 479 (1989) (reporting that roughly 80% of the patents granted during the period 1975-1984 issued to a corporate assignee); see also Bartow, supra note 44, at 682-94 (providing a scholarly critique of corporate pre-invention assignment agreements, which the author characterizes persuasively as a “misdirection of incentives to innovate”).

49See 37 C.F.R. § 3.81(a) (1999) (authorizing the issuance of a patent in the name of the assignee only if the inventor records an assignment of the entire right, title, and interest before payment of the issue fee); see also 35 U.S.C. § 152 (1994) (“Patents may be granted to the assignee of the inventor of record in the Patent and Trademark Office, upon the application made and the specification sworn to by the inventor, except as otherwise provided in this title”).

50See University Patents, Inc. v. Kligman, 762 F. Supp. 1212, 1218-19, 20 U.S.P.Q.2d (BNA) 1401, 1405 (E.D. Pa. 1991) (“Although ‘ownership’ and ‘inventorship’ are not identical for patent law purposes, they are related. Inventorship provides the starting point for determining ownership of patent rights. The true and original inventor must be named in the application for a patent and, absent some effective transfer or obligation to assign the patent rights, the original inventor owns the right to obtain the patent”).
the standard provisions in most employment contracts these days for the assignment of intellectual property rights from the author or inventor to the employer, ownership disputes between the inventor and his or her employer are relatively rare.\(^{52}\)

Instead, controversies involving issues of patent ownership, and thus inventorship, more often arise between the assignees of the patent rights, where questions exist regarding joint invention between their respective employees.\(^{53}\) Because joint inventorship can be a natural consequence of collaborative efforts, institutions might tend to discourage such behavior in favor of creating exclusive ownership of any patent rights, at the expense of overall scientific progress.\(^{54}\) Indeed, the significance of joint invention on patent rights is reflected in the ample jurisprudence and scholarship that has developed concerning this specific aspect of inventorship.

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\(^{51}\)See also Patel, supra note 30, at 493 ("Absent a preinvention assignment agreement or any other evidence that the employee was hired to invent, an employer whose employer uses the employer's resources to conceive, or reduce to practice, an invention acquires a 'shop right.'... The shop right gives the employer a nonexclusive, royalty-free, nontransferable license to make, use, and sell the invention. The doctrine does not provide the employer with an ownership interest since the employee, as the patentee, retains all other rights, including licensing and filing of infringement suits. The shop right continues for the life of the patent even if the employee-inventor leaves the place of employment." (internal footnotes omitted)).

\(^{52}\)See id. at 493-94 ("[I]n an effort to ensure ownership rights in their employees' inventions, most employers draft preinvention assignment agreements. These agreements are standard form contracts in which an employee agrees to assign rights in all inventions made during the term of employment to his or her employer in exchange for a salary and continued employment. The agreements substitute private contractual terms for the disclosure-protection balance struck in patent law.... Today, however, courts agree that an employee and employer may enter into a binding agreement where the employee agrees to assign interests in future inventions to the employer.").


\(^{54}\)See Fasse, supra note 21, at 157 ("An even starker conflict of interest occurs when inventors employed by different companies collaborate on a joint research project. Each inventor has an incentive to be recognized for his contribution. Each employer, however, has an incentive to name only its own employees in order to obtain full ownership through assignment").
By statute, a patent may issue to multiple inventors. Since the 1984 amendment to 35 U.S.C. § 116, a patent application may be filed by persons jointly even if

1. they did not physically work together or at the same time,
2. each did not make the same type or amount of contribution, or
3. did not make a contribution to the subject matter of every claim of the patent.

By virtue of joint inventorship, each owner of the corresponding patent rights (the co-inventor or assignee) is entitled to full enjoyment of those rights. For example, where Company X (to which co-
inventor A has assigned her rights) licenses the patented technology to Company Z, Company Y (to which co-inventor B has assigned his rights) has no recourse against Company Z for its otherwise infringing activities. Accordingly, the intertwining of business fates resulting from joint invention, and thus co-ownership, can facilitate somewhat intricate, and perhaps frustrating, market dynamics. 58

Scientific Collaboration and the Problem of Joint Inventorship

Like inventorship generally, the issue of joint inventorship has proven somewhat problematic for courts to articulate cogent standards, which are easily applicable to determine whether a person is a co-inventor. Although the Federal Circuit has considered numerous cases possibly implicating joint inventorship, the court set forth its clearest guidance in *Fina Oil & Chemical Co. v. Ewen*. 59 The Federal Circuit stated:

[35 U.S.C. § 116] sets no explicit lower limit on the quantum or quality of inventive contribution required for a person to qualify as a joint inventor. Rather, a joint invention is simply the product of a collaboration between two or more persons working together to solve the problem addressed. The determination of whether a person is a joint inventor is fact specific, and no bright-line standard will suffice in every case.

Nonetheless, our precedent provides guidance as to what types of acts are, or are not, sufficient in quantum and quality to establish joint inventorship. One need not conceive of the

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58 See Schering Corp. v. Roussel-UCLAF SA, 104 F.3d 341, 344, 41 U.S.P.Q.2d (BNA) 1359, 1361-62 (Fed. Cir. 1997) ("Each co-owner of a United States patent is ordinarily free to make, use, offer to sell, and sell the patented invention without regard to the wishes of any other co-owner. Each co-owner's ownership rights carry with them the right to license others, a right that also does not require the consent of any other co-owner. Thus, unless the co-owner has given up these rights through an 'agreement to the contrary,' the co-owner may not be prohibited from exploiting its rights in the patent, including the right to grant licenses to third parties on whatever conditions the co-owner chooses." (internal citations omitted)).

entire invention alone, for this would obviate the concept of joint inventorship. However, a joint inventor must contribute in some significant manner to the conception of the invention. As such, "each inventor must contribute to the joint arrival at a definite and permanent idea of the invention as it will be used in practice."60

If a person supplies the required quantum of inventive contribution, that person does not lose his or her status as a joint inventor just because he or she used the services, ideas, and aid of others in the process of perfecting the invention. However, those others may also in appropriate circumstances become joint inventors by their contributions. In addition, a person is not precluded from being a joint inventor simply because his or her contribution to a collaborative effort is experimental.

The basic exercise of the normal skill expected of one skilled in the art, without an inventive act, also does not make one a joint inventor. Therefore, a person will not be a co-inventor if he or she does no more than explain to the real inventors concepts that are well known and the current state of the art. The case law thus indicates that to be a joint inventor, an individual must make a contribution to the conception of the claimed invention that is not insignificant in quality, when that contribution is measured against the dimension of the full invention.61

In Fina, the Federal Circuit vacated and remanded the district court's summary judgment that Dr. Abbas Razavi was the only true inventor of U.S. Patent No. 4,892,851, despite the fact that Dr. John A. Ewen had been listed on the patent as a co-inventor.62 The Federal Circuit held that the district court had erred by failing to consider

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61Id., at 1473, 43 U.S.P.Q.2d (BNA) at 1941.
62See id. at 1468, 43 U.S.P.Q.2d (BNA) at 1936 (reporting the district court's ruling that Dr. Razavi was the sole inventor of the '851 patent). The patented technology related to a metallocene catalyst used to produce syndiotactic polypropylene (SPP) and methods for making the catalyst. See id., 43 U.S.P.Q.2d (BNA) at 1937.
whether Dr. Ewen "did not at least contribute in some significant way to the ultimate conception" of the invention.\textsuperscript{63} Moreover, the Federal Circuit reiterated that Dr. Razavi had not met his burden of proving by clear and convincing evidence that Dr. Ewen "made no contribution to the conception of the invention claimed in the '851 patent or a contribution that was qualitatively insignificant."\textsuperscript{64}

Beyond setting forth the amount and character of contribution necessary among involved researchers to establish joint inventorship, the Federal Circuit in \textit{Fina} recognized that joint invention flows from collaborative efforts.\textsuperscript{65} Indeed, irrespective of whether these aspects are coexistent, collaboration is an absolute prerequisite to joint inventorship, the specific issue of which the Federal Circuit addressed in \textit{Kimberly-Clark Corp. v. Procter & Gamble Distributing Co.}\textsuperscript{66}

For persons to be joint inventors under Section 116, there must be some element of joint behavior, such as collaboration or working under common direction, one inventor seeing a relevant report and building upon it or hearing another's suggestion at a meeting.... Individuals cannot be joint inventors if they are completely ignorant of what each other has done until years after their individual independent efforts. They cannot be totally independent of each other and be joint inventors.

\textsuperscript{63} \textit{Id.} at 1474, 43 U.S.P.Q.2d (BNA) at 1942. The Federal Circuit held that "the district court applied the wrong legal standard in determining Dr. Ewen's contribution to the subject matter claimed in the '851 patent, and that under the proper standard, there existed genuine issue of material fact regarding inventorship" that made resolution by summary judgment inappropriate. \textit{See id.} at 1468, 43 U.S.P.Q.2d (BNA) at 1937.

\textsuperscript{64} \textit{See id.} at 1474, 43 U.S.P.Q.2d (BNA) at 1942. The Federal Circuit further noted that the \textit{de novo} standard of review should apply to the district court's rulings regarding conception and inventorship, which are questions of law that rest on underlying facts. \textit{See id.} at 1473 n.5, 43 U.S.P.Q.2d (BNA) at 1941 n.5.

\textsuperscript{65} \textit{See Fina Oil & Chem. Co.}, 123 F.3d at 1473, 43 U.S.P.Q.2d (BNA) at 1941 (stating "a joint invention is simply the product of a collaboration between two or more persons working together to solve the problem addressed"); \textit{Monsanto Co. v. Kamp}, 269 F. Supp. 818, 824, 154 U.S.P.Q. (BNA) 259, 262 (D.D.C. 1967) ("A joint invention is the product of collaboration of the inventive endeavors of two or more persons working toward the same end and producing an invention by their aggregate efforts").

We therefore hold that joint inventorship under Section 116 requires at least some quantum of collaboration or connection.\textsuperscript{67}

The Federal Circuit in \textit{Hess v. Advanced Cardiovascular Systems, Inc.}\textsuperscript{68} refined the joint inventorship inquiry in the context of a patent infringement suit involving a medical device known as a balloon angioplasty catheter.\textsuperscript{69} In holding that providing information regarding the state of the art does not constitute an inventive contribution,\textsuperscript{70} the Federal Circuit expressly recognized a distinction between co-invention and certain aspects of collaboration.\textsuperscript{71}

The patent-in-suit listed Drs. John B. Simpson and Edward W. Robert as the inventors.\textsuperscript{72} Drs. Simpson and Robert began developing the patented catheter while completing postdoctoral Cardiology Fellowships at Stanford University Medical Center, after observing balloon angioplasty at a medical conference.\textsuperscript{73} Following initial unsuccessful experimentation with different materials to construct the balloon, the physicians contacted Robert L. Hess, an engineer at

\textsuperscript{68}Id. at 976, 41 U.S.P.Q.2d (BNA) at 1782.
\textsuperscript{69}Id., 41 U.S.P.Q.2d (BNA) at 1787.
\textsuperscript{70}See id., 41 U.S.P.Q.2d (BNA) at 1787.
\textsuperscript{71}See id., 41 U.S.P.Q.2d (BNA) at 1782 (noting that “a[n] inventory may use the services, ideas, and aid of others in the process of perfecting his invention without losing his right to a patent”).
\textsuperscript{72}See id. at 977, 41 U.S.P.Q.2d (BNA) at 1783 (identifying U.S. Patent No. 4,323,071, which claimed a balloon angioplasty catheter, the balloon of which may be inflated after insertion of the catheter into a patient’s partially blocked artery to eliminate or reduce the blockage, or stenosis).
\textsuperscript{73}See Hess, 106 F.3d at 977, 41 U.S.P.Q.2d (BNA) at 1783 (stating that Dr. Simpson visited Europe to observe balloon angioplasty techniques pioneered by a Swiss physician, who had presented at the medical conference).
Raychem Corporation, one of the largest manufacturers of heat shrinkable materials.\textsuperscript{74}

Once Drs. Simpson and Robert described their device design and reported the difficulties they encountered, Mr. Hess proposed the use of heat shrinkable irradiated modified polyolefin tubing to construct the balloon.\textsuperscript{75} Mr. Hess also suggested the benefit of attaching the balloon to the catheter without the use of any potentially toxic adhesive chemicals.\textsuperscript{76} Following substantial additional experimentation, the physicians achieved the claimed device, in which the balloon attached to the catheter through an adhesive-free seal\textsuperscript{77}.

The Federal Circuit affirmed the district court's determination that Mr. Hess' contributions to the inventions did not constitute the conception necessary to establish joint inventorship.\textsuperscript{78} The Federal Circuit noted that Mr. Hess had provided Drs. Simpson and Robert only with information that was "well known and found in textbooks."\textsuperscript{79} Indeed, Mr. Hess did not participate in the day-to-day experimentation with the prototypes, nor did he suggest the technique used to arrive at

\textsuperscript{74}See id., 41 U.S.P.Q.2d (BNA) at 1783 (reporting that a Stanford colleague of Drs. Simpson and Robert referred them to Mr. Hess, who was then a technical liaison between the domestic and foreign operations at Raychem).

\textsuperscript{75}See id., 41 U.S.P.Q.2d (BNA) at 1783 (noting that Mr. Hess also demonstrated "how such a material could be used to form a balloon by heating the tubing above its crystalline melting point, applying pressure, and then cooling the material").

\textsuperscript{76}See id., 41 U.S.P.Q.2d (BNA) at 1783 (describing the suggestion by Mr. Hess to use "an adhesive free seal to attach the balloon to the catheter").

\textsuperscript{77}See \textit{id.} at 977-78, 41 U.S.P.Q.2d (BNA) at 1783-84 (indicating that Drs. Simpson and Robert spent four or five hours virtually every day attempting to use Raychem tubing supplied by Mr. Hess to shrink fit the balloon to the catheter shaft without using adhesives).

\textsuperscript{78}See Hess, 106 F.3d at 980-81, 41 U.S.P.Q.2d (BNA) at 1786 (affirming the district court's conclusion despite the fact that "the doctors followed and utilized some of Mr. Hess's suggestions in their extensive further research, testing and construction of their catheter").

\textsuperscript{79}See \textit{id.} at 977, 41 U.S.P.Q.2d (BNA) at 1783 (reciting the admissions by Mr. Hess that "the basic principles which I taught them"—involving heating the tubing 'above its crystalline melting point, expanding it while your [sic] maintaining the pressure'—were 'in various published textbooks and the like' and 'was a generally known process to a number of companies.'); cf. Pannu \textit{v.} Iolab Corp., 155 F.3d 1344, 1351, 47 U.S.P.Q.2d (BNA) 1657, 1663 (Fed. Cir. 1998) ("During the meeting with Link, Pannu was doing more than simply providing Link with well-known principles or explaining the state of the art; he was contributing his ideas concerning the snag-resistant elements to a total inventive concept. Because it is undisputed that the invention was conceived while Link and Pannu were engaged in a collaborative enterprise and it is further undisputed that Pannu conceived significant aspects of the invention, Pannu is certainly at least a co-inventor").
the final successful balloon design. Therefore, the appellate court held that the district court was justified in its conclusion.

Still another approach to designating inventorship arose in Ethicon, Inc. v. United States Surgical Corp. In Ethicon, the inventorship dispute arose in a patent infringement suit involving an endoscopic surgical tool known as a trocar. The patent-in-suit listed InBae Yoon as the sole inventor of a new safety trocar. As the exclusive licensee of this patent, Ethicon sued U.S. Surgical for infringement.

Four years into the litigation, U.S. Surgical became aware of Young Jae Choi, an electronics technician who had worked with Dr. Yoon on several projects, including the development of the patented safety trocar. U.S. Surgical agreed to pay Mr. Choi to assist in its defense against the Ethicon lawsuit, and for Mr. Choi's grant of a retroactive license to practice any safety trocar technology he invented.

See id. at 978, 41 U.S.P.Q.2d (BNA) at 1784 (mentioning the technique of "free-blowing," which Drs. Simpson and Robert use to develop the patented balloon catheter).

See id. at 979-80, 41 U.S.P.Q.2d (BNA) at 1785-86 (reiterating that the burden of proof on the issue of misjoinder or nonjoinder of inventors is clear and convincing evidence, a heavy burden, and that the district court was not clearly erroneous in concluding that Mr. Hess did not establish joint inventorship).


See id. at 1459, 45 U.S.P.Q.2d (BNA) 1545, 1546-47 (Fed. Cir. 1998) (describing a trocar in further detail as an instrument comprised of an outer sleeve surrounding a shaft, one end of which has a sharp blade), cert. denied, 119 S. Ct. 278 (1998). A surgeon can use the blade to make a small incision in the wall of a body cavity, such as the abdomen, and insert the trocar. See id., 45 U.S.P.Q.2d (BNA) at 1547. The trocar shaft can be retracted to leave the hollow outer sleeve, through which the surgeon can insert tiny cameras and other surgical tools for the operation. Id., 45 U.S.P.Q.2d (BNA) at 1547.

See id., 45 U.S.P.Q.2d (BNA) at 1547 (identifying U.S. Patent No. 4,535,773, which claimed a safety trocar designed to prevent injury to an internal organ upon the puncture of the body cavity the trocar blade).

See id., 45 U.S.P.Q.2d (BNA) at 1547 (reporting the filing of suit in 1989 by Ethicon against U.S. Surgical for infringement of claims 34 and 50 of the '773 patent).

See id., 45 U.S.P.Q.2d (BNA) at 1547 (stating that Mr. Choi, "who had some college training in physics, chemistry, and electrical engineering, but no college degree," was not paid during his 18 months of work with Dr. Yoon, and that Dr. Yoon did not inform Mr. Choi of the patent application or issuance or the designation of Dr. Yoon as the sole inventor).

See Ethicon, 135 F.3d at 1546-47, 45 U.S.P.Q.2d (BNA) at 1547 (indicating that in exchange, U.S. Surgical agreed to pay Mr. Choi contingent on its ability to continue to practice and market the invention).
U.S. Surgical moved to correct the inventorship of the patent-in-suit to include Mr. Choi as a co-inventor.\textsuperscript{88} The district court granted this motion after an extensive hearing.\textsuperscript{89} U.S. Surgical next moved to dismiss the patent infringement suit given its retroactive license.\textsuperscript{90} The district court also granted this motion and dismissed the suit.\textsuperscript{91}

The Federal Circuit affirmed the district court's ruling that Mr. Choi was a co-inventor of certain claims of the patent-in-suit based upon a "rule of reason" analysis in which the record contained sufficient corroborating evidence of joint inventorship.\textsuperscript{92} Furthermore, the Federal Circuit upheld the dismissal of the lawsuit because Ethicon failed to join Mr. Choi as a co-owner of the patent.\textsuperscript{93}

In dissent, Judge Pauline Newman challenged the propriety of construing 35 U.S.C. § 116 to vest a co-inventor of certain claims of a patent with joint ownership, which amounts to "an undivided interest in the entire patent" carrying "an unencumbered and unfettered right to alienate an interest in the entire patent."\textsuperscript{94} In particular, she noted with respect to the 1984 amendment to 35 U.S.C. § 116 that:

This amendment did not also deal with the laws of patent ownership, and did not automatically convey ownership of

\textsuperscript{88}See id., 45 U.S.P.Q.2d (BNA) at 1547 (specifying the motion by U.S. Surgical to correct inventorship under 35 U.S.C. § 256, claiming that Mr. Choi was a co-inventor of claims 23, 33, 46 and 47 of the '773 patent).

\textsuperscript{89}See id., 45 U.S.P.Q.2d (BNA) at 1547 (reporting the district court's finding that Mr. Choi had provided an inventive contribution to the subject matter of claims 33 and 47).

\textsuperscript{90}See id. at 1459-60, 45 U.S.P.Q.2d (BNA) at 1547 (contending that as a joint owner of the patent, Mr. Choi granted U.S. Surgical a valid license under the patent).

\textsuperscript{91}See id. at 1460, 45 U.S.P.Q.2d (BNA) at 1547 (providing the basis for the appeal by Ethicon to the Federal Circuit).

\textsuperscript{92}See Ethicon, 135 F.3d at 1464, 45 U.S.P.Q.2d (BNA) at 1551 ("Under the 'rule of reason' standard for corroborating evidence, the trial court must consider corroborating evidence in context, make necessary credibility determinations, and assign appropriate probative weight to the evidence to determine whether clear and convincing evidence supports a claim of co-inventorship." (internal citation omitted)).

\textsuperscript{93}See id. at 1467-68, 45 U.S.P.Q.2d (BNA) at 1554 ("[A]s a matter of substantive patent law, all co-owners must ordinarily consent to join as plaintiffs in an infringement suit. Consequently, "one co-owner has the right to impede the other co-owner's ability to sue infringers by refusing to voluntarily join in such a suit."") (citation omitted)).

\textsuperscript{94}See id. at 1468, 45 U.S.P.Q.2d (BNA) at 1555 (Newman, J., dissenting) ("[W]hether or not Mr. Choi made an inventive contribution to two of the fifty-five claims of the '773 patent, he is not a joint owner of the other fifty-three claims of the patent. Neither the law of joint invention nor the law of property so requires, and indeed these laws mandate otherwise").
the entire patent to everyone who could now be named as an inventor, whatever the contribution. The amendment simply permitted persons to be named on the patent document, whether as minor contributors to a subordinate embodiment, or full partners in the creation and development of the invention. The ownership relationships among the persons who, under § 116, could now be recognized as contributors to the invention, is irrelevant to the purpose of the amendment of § 116, and to its consequences. Section 116 has nothing to do with patent ownership.

ANALYSIS AND IMPACT

The pronouncements of the Federal Circuit in *Fina* and *Kimberly-Clark* concerning the severe potential legal consequences (i.e., vesting of ownership through inventorship) of collaboration arguably fuel anxieties over the exchange of information between researchers. With the nature of any collaborative exchange being a relevant factor to consider, no degree of temporal interaction seems immune from constituting an inventive contribution. Accordingly, from the institutional perspective focusing on the ownership of patent rights, prudence might demand the imposition of outright restrictions on extramural collaboration by its researchers in the absence of express allocations of the prospective exclusive rights. The implementation

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95 See id. at 1470, 45 U.S.P.Q.2d (BNA) at 1556 (Newman, J., dissenting); see also id. at 1471, 45 U.S.P.Q.2d (BNA) at 1557 (Newman, J., dissenting) (“After the major change that the 1984 amendment to Section 116 made in ‘joint invention,’ by authorizing the naming of any contributor to any claim of a patent, the legal premise that each named person had made a full and equal contribution to the entire patented invention became obsolete. It is not an implementation of the common law of property, or its statutory embodiments, to treat all persons, however minor their contribution, as full owners of the entire property as a matter of law. The law had never given a contributor to a minor portion of an invention a full share in the originator’s patent. By amending Section 116 in order to remove an antiquated pitfall whereby patents were being unjustly invalidated, the legislators surely did not intend to create another inequity. Apparently no one foresaw that judges might routinely transfer pre-1934 ownership concepts into the changed inventorship law.” (internal citations omitted)).

96 Indeed, the Federal Circuit apparently has not had occasion to carve out an express *de minimis* exception, applicable, for example, where a brief exchange between collaborators contributes to the conception of the invention.

97 See Bartow, supra note 44, at 682-94 (discussing various reasons that “maximization of institutional profits may require suppression of inventions”).
of such policies, however, would seem to chill the enjoyment of any "academic freedom" by those involved in research and development teams, commercial or otherwise.

Likewise, although Judge Newman did not elaborate, beyond the arguably unjust outcome in *Ethicon*, on the likely ramifications of the Federal Circuit's interpretation of 35 U.S.C. § 116 to accord co-ownership rights in the entire patent based upon joint inventorship of one or more of the patent claims, her alarm finds concurrence among at least some practitioners. In particular, the potential impact of the statutory scheme she criticizes can manifest a chilling effect on collegiality and collaboration among those in the research and development community. By dramatically escalating the potential harm from unforeseen joint inventorship scenarios, the legislature and judiciary might have unwittingly fostered an environment of caution and mistrust, which impinges on the intellectual freedom that drives innovation.

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99 Even as we approach breakthroughs of unprecedented proportions concerning our very essence as humans, intellectual property issues lurk in the shadows. See, e.g., Nicholas Wade, *Rivals talk of pooling work to decipher human genome*, OREGONIAN, Nov. 14, 1999, at A6 ("Talk of collaboration has flared among rivals pursuing one of biology's highest goals: decoding the human genome.... Although many of the participants agree in principle that a pooling of efforts would get the job done sooner, their desire to collaborate is tempered by rival agendas, especially on the question of access to the DNA data, and personal disagreements").

100 For a scholarly discussion of analogous policy considerations informing the application of the on sale bar under 35 U.S.C. § 102(b), see Janice M. Mueller, *Conception, Testing, Reduction to Practice: When is it Really on Sale?*, 80 J. PAT. & TRADEMARK OFF. SOC’Y 305, 308 (1998) ("A related policy concern, infrequently articulated in the Federal Circuit's on sale jurisprudence, recognizes the importance of unrestricted communication and collaboration between inventors and potential customers for their inventions. If users of the patent system come to understand that pre-critical date communications concerning an invention that is not yet developed can trigger the bar, future communications of like nature will be chilled"). See also Imron T. Aly, Note, *Seller Beware: The Scope of the On Sale Bar After Pfaff v. Wells*, 7 TEX. INTELL. PROP. L.J. 403, 424 (1999) (citing Mueller, supra).
Yet, the holding in Hess distinguishing information about the existing state of the art from an inventive contribution greatly alleviates any concern that impromptu exchanges among researchers might create joint inventorship issues. To the extent that the joint conception of inventions likely stems instead from directed (intentional) collaborative efforts as a practical matter, research and development institutions can rest better assured that adequate contractual provisions for parsing out ownership of prospective patent rights in such joint ventures can be implemented in advance.

If nothing else, anecdotal support exists for the awareness of joint inventorship concerns as a likely spirited battleground for patent litigation in the start of this new millennium. Whereas the investigation to uncover previously undisclosed prior art as the basis for an invalidity or unenforceability defense might have been the traditional strategic focus for the alleged infringer in a patent suit, the search for unnamed inventors in the midst of any collaborative efforts to achieve the patented technology is on the rise. Indeed, a natural starting point for such a search is the authorship and acknowledgement listing set forth on academic or trade publications and presentations.

Indeed, apparently once established that the contribution of a collaborator constitutes knowledge available in the prior art, the recognizable value of the contribution to the actual research effort becomes meaningless. See Brown v. University of California, 866 F. Supp. 439, 445, 31 U.S.P.Q.2d (BNA) 1463, 1468 (N.D. Cal. 1994) (holding that despite her "substantial role" in the discovery of feline leukemia virus, the plaintiff was "a nonscientist who played no role in the laboratory work involved in isolating the virus; therefore, regardless of the value of her research leads, she cannot be deemed to have contributed to the conception of the inventions covered by the patents").

With a reliable delineation of patent rights in this regard, the collegiality of institutional researchers arguably becomes indistinguishable from any other managed resource of the institution. See Carol M. Rose, The Several Futures of Property: Of Cyberspace and Folk Tales, Emission Trades and Ecosystems, 83 Minn. L. Rev. 129, 130-31 (1998) ("With property, each individual harvests the rewards of her care and effort in the management of her resources, just as she suffers the losses from her sloth and poor management; those features of property make her more likely to exercise diligence and prudence about the things she owns").

See, e.g., Brenda Sandburg, Witness Flip-Flop Spikes Patent Suit, IP Mag., Dec. 29, 1998 ("Inventor J. Timothy Rainey made American Dental Technologies, Inc. an offer it couldn't—and it didn't—refuse. For a deal valued by defense lawyers at more than $500,000, Rainey switched sides in a patent dispute by changing his testimony and dropping his claim that he had invented three dental procedures ADT said it had patented").

See Carson, supra note 97, at 266 ("The Ethicon decision will spur defendants in patent litigations to search in earnest for latent co-inventors who can absolve the defendants of their sins—past, present and future").
related to the patented technology.105 If this information does not comport with inventorship designations, a colorable basis arguably would exist for an invalidity challenge or an evolving defense created by an Ethicon-type licensing arrangement.106

Unfortunately, this patent enforcement dynamic might force institutions, and thus their researchers, to disfavor broad attribution even in otherwise scholarly publications and presentations. To the extent that such attention is an integral part of the social fabric of the scientific community, collegiality and collaboration will likely suffer to the detriment of innovation.

CONCLUSION

Scientific progress depends upon the ability of individual researchers to engage in the exchange of information free from proprietary concerns. In some cases, such interaction might result in a mere horizontal transmission of knowledge already otherwise in the public domain, which can facilitate inventive acts nevertheless. In others, the correspondence might give rise to joint invention, or serve as a foundation for future cooperative efforts in that regard. The policy goals of the U.S. patent system would seem contravened if the laws deterred collaborative exchanges in any of these scenarios.

105 But see In re Katz, 687 F.2d 450, 455, 215 U.S.P.Q. (BNA) 14, 18 (C.C.P.A. 1982) ("As an initial matter, we hold that authorship of an article by itself does not raise a presumption of inventorship with respect to the subject matter disclosed in the article. Thus, co-authors may not be presumed to be co-inventors merely from the fact of co-authorship. On the other hand, when the PTO is aware of a printed publication, which describes the subject matter of the claimed invention and is published before an application is filed (the only date of invention on which it must act in the absence of other proof), the article may or may not raise a substantial question whether the applicant is the inventor. For example, if the author (whether he is the applicant or not) specifically states that he is describing the work of the applicant, no question at all is raised. The content and nature of the printed publication, as well as the circumstances surrounding its publication, not merely its authorship, must be considered"); see also Canon Computer Sys., Inc. v. Nu-Kote Int'l, Inc., 134 F.3d 1085, 1088, 45 U.S.P.Q.2d (BNA) 1355, 1358 (Fed. Cir. 1998) ("Improper inventorship is not presumed simply because a large number of individuals are listed on the patent as joint inventors").

106 See supra notes 87-94 & accompanying text (discussing in detail the litigation strategy in Ethicon of obtaining a retroactive license from an unnamed inventor in conjunction with seeking to correct the inventorship designation of the patent-in-suit).
At present, the interface between inventorship and ownership under the patent law introduces a regrettable caution into the scientific community over attribution, which has silently served as a social currency for the exchange of ideas. Where the statutory framework begins to exacerbate the tension between commercial considerations and the open sharing of information, the patent law would appear paradoxically to have us careen backward—to a climate in which innovation is enshrouded in the darkness of secrecy and isolationism, rather than allowed to flourish in the light of collegiality and collaboration.