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Rochelle C. Dreyfuss

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In this Article, Professor Dreyfuss explores the field of collaborative research in the realm of intellectual property law. Traditionally, scientists, artists, and professors developed ideas alone, utilizing only their own knowledge and research to complete their works. Recently, however, due in part to an increasing need for specialization, the globalization of the marketplace, the rapid growth of the Internet, and an expansion in intellectual property law, collaborative production is replacing individual efforts.

Collaborative efforts have posed an array of new and challenging legal problems. Parties sometimes find themselves without a clear sense of who has rights to royalties, who can make binding decisions regarding publication or commercial exploits, or who has legal authority to build upon the work and make improvements. Additionally, collaborators may lose access to materials necessary to further future research, or discover that their contributions are not acknowledged when the work is published.

In dealing with these problems, two schools of thought have emerged. Economists, using a Coasian intuition, theorize that voluntary associations for the express purpose of producing output should lead to private allocations of accompanying intellectual property rights. Accordingly, advocates of this theory posit that legal intervention is undesirable, because parties are best positioned to make their own decisions regarding joint ventures. On the other hand, based upon their experiences watching intellectual property problems emerge over time, many attorneys believe that increasing legal intervention is necessary.

This Article proposes a series of legal rules that utilize both intellectual property law's concepts of authorship and inventorship and Coasian ideas of transactional freedom. These rules provide a benchmark for collaborative parties, thereby assisting

them in identifying issues and structuring workable arrangements. Professor Dreyfuss's proposal would also save collaborators' valuable time and resources by serving as a set of default rules. Finally, these rules, if adopted, would help courts interpret collaborative agreements in a way that best reflects the parties' intent.

Collaborative Research: Conflicts on Authorship, Ownership, and Accountability

Rochelle Cooper Dreyfuss[*]

* Professor of Law, NYU School of Law and Director, Engelberg Center on Innovation Law and Policy. Thanks to Robert Gorman, Roberta Kwall, Mark Lemley, and Diane Zimmerman for commenting on earlier drafts; to Pamela Samuelson, Suzanne Scotchmer and their Workshop on Economics of Intellectual Property in the Information Age at the University of California, Berkeley; to Thomas Dreier and Hans Ullrich and their seminar at the Max Planck Institute for Foreign and International Patent, Copyright, and Competition Law; to Michael Spence and his intellectual property seminar at St. Catherine's College, Oxford University; and most especially to the students in the Spring 1998 Innovation Policy Colloquium at N.Y.U. School of Law. This work was supported by the Filomen D'Agostino and Max E. Greenberg Research Fund of the N.Y.U. School of Law and greatly aided hy the research assistance of Keith Buell, N.Y.U. Class of '00, Charlotte Morrison, N.Y.U. Class of '99, Karin McEwen and Robert Pfister, N.Y.U. Class of '01.

> "They gave me the list. I asked these questions. The producers took the tape and I was gone. I was the face."
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> —Peter Arnett, CNN, describing his role in reporting on Operation Tailwind.[1]

The artist, starving in a garret; the dedicated scientist, experimenting in a garage; the reclusive professor, burning midnight oil in the office—these are becoming endangered species. The creative industries have evolved: collaborative production is replacing individual effort. Works of the new order are exemplified by the likes of NewStand, the television news magazine produced by teaming the cable station CNN with Time Magazine;[2] by Rent, a play created by Jonathan Larson with the help of the dramaturg, Lynn Thomson;[3] by "distance learning" initiatives at many universities,[4] and most especially, by the multi-authored articles now common in scientific journals.[5]

The reasons for this evolution are manifold. In large part, it is a consequence of intellectual limitations. In many fields—biotechnology is one example—the intensity of specialization makes it nearly impossible for any one researcher to know enough to work alone; interdisciplinary investigation is essential if the frontiers of knowledge are to be pushed forward. The globalization of the marketplace has also had an influence, for in that environment, multinational input is needed to produce goods that appeal across a broad range of cultures. Advances in the tools of creativity account for yet another part of the change. Most obviously, the growth of the internet has made long distance collaborations much easier. More subtly, the web, when coupled with advances in scanning and digitizing technologies,

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1. Felicity Barringer, *Career of a CNN Star Hangs in the Balance Over a Repudiated Report*, N.Y. TIMES, July 8, 1998, at A17.

2. *See, e.g.*, Neil Hickey, *Ten Mistakes That Led to the Great CNN/Time Fiasco*, COLUM. JOURNALISM REV., Sept.-Oct. 1998, at 26.

3. *See, e.g.*, Jesse McKinley, *Family of "Rent" Creator Settles Suit Over Authorship*, N.Y. TIMES, Sept. 10, 1998, at p. B3, col. 5.

4. *See, e.g.*, Paul Cox, *Cyberdegrees: Who Needs a College Campus? Just Log In and Start Studying*, WALL ST. J., Nov. 17, 1997, at R26.; Karen W. Arenson, *Columbia University Explores How to Profit From Educational Offerings on the Internet*, N.Y. TIMES, Apr. 3, 1999, at B3.

5. *See, e.g.*, Canon Computer Sys, Inc. v. Nu-Kote Int'l, Inc., 134 F.3d 1085, 1088 (Fed. Cir. 1998) (patent is not invalid on the ground that it names 16 inventors); Jock Friedly, *New Anticoagulant Prompts Bad Blood Between Partners*, 271 SCIENCE 1800 (1996) (noting that the number of new technology license and option agreements between industry and academia increased 63% between 1991 and 1994); Walter W. Powell, *Inter-organizational Collaboration in the Biotechnology Industry*, 151 J. INSTIT'L & THEORETICAL ECON. 197, 205 (1996) (citing an article coauthored by 45 scientists); *see also* Elisabeth Crawford, *Nobel: Always Winners, Never Losers*, 282 SCIENCE 1256, 1257 (1998) (noting that "the idea of the lone discoverer lingers on as a myth").

has created new artistic forms, such as chain novels and chain art—what might be called sequential collaboration. One author puts a story on a website, intending that others will add new plotlines and characters; an artist uploads an image, expecting it to be repeatedly downloaded, manipulated, and uploaded.[6] There is also an economic factor. As the costs of making even marginal advances surge, firms find that hiring needed expertise on a permanent basis is not as cost effective as entering into transient associations. In academia, where the push toward collaboration is especially notable, the rise in costs has been accompanied by a steady decline in public financing, leading both faculty members and university administrators to search hard for new sources of support.[7] In fields where theory and application converge, these have become easy to find, and they have led to close relationships between commercial entities and faculty working in such disciplines as medicine, chemistry, and computer science. Finally, intellectual property law has, in recent years, expanded to cover an array of creative efforts that were previously largely ignored or considered ineligible for protection. With that move, there is work that once appeared to be individually developed, which must now be viewed as multi-authored.[8]

The growth in cooperative venturing is recent, but not entirely new and, at least in some circles, neither is recognition of its importance. Economists have, indeed, coined a term—social capital—to capture the notion that within the innovative industries, production depends not only on physical capital, human capital, and financing, but also on how well individuals and institutions interact with one another to utilize these other resources.[9] But although economists are actively exploring the conditions that increase social capital, while sociologists are examining the dynamics of collaboration, and political

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6. See Margaret Chon, *New Wine Bursting from Old Bottles: Collaborative Internet Art, Joint Works, and Entrepreneurship*, 75 OR. L. REV. 257, 266-272 (1996); Michiko Kakutani, *Culture Zone; Never-Ending Saga*, N.Y. TIMES, Sept. 28, 1997, § 6 (Magazine), at 40 (discussing a chain novel instigated by John Updike and others); *International Internet ChainArt Project* (last modified Mar. 6, 1994) <http://ziris.syr.edu/chainartdocs/chainart.html> (providing examples of chain art).

7. *See generally* THE FUNDING OF HIGHER EDUCATION: INTERNATIONAL PERSPECTIVES (Philip G. Altbach & D. Bruce Johnstone eds., 1993); INTELLECTUAL PROPERTY & THE ACADEMIC COMMUNITY 6-7, 33-35 (National Academies Policy Advisory Group et al. eds., 1995) [hereinafter NAPAG REPORT].

8. *See, e.g.*, Jesse McKinley, *On Stage and Off: Suit! Anger! Agreement!*, N.Y. TIMES, Mar. 26, 1999, at E2 (reporting on Joe Mantello's claim to rights in his staging of *Love! Valour! Compassion!*).

9. *See, e.g.*, Jane Fountain, *Social Capital: A Key Enabler of Innovation*, *in* INVESTING IN INNOVATION: CREATING A RESEARCH AND INNOVATION POLICY THAT WORKS 85, 87 (Lewis M. Branscomb & James H. Keller eds., 1998).

scientists are advocating governmental policies to foster cooperative efforts,[10] sparse attention has been paid to the relationship between intellectual property law, social capital formation, and collaboration. This Article begins that investigation.

In some ways, it is not surprising that the intellectual property literature has focused so little on the special problems of collaborative work. As currently constituted, patent and copyright laws are mainly aimed at mediating between creators and outsiders who wish to use their works—that is, potential users who were strangers to the initial creative process. In contrast, the problems associated with collaborative production principally arise among the creators themselves. Of course, those who enter joint ventures need to allocate rights in their work. However, the Coasian intuition is that voluntarily associations for the express purpose of producing output should lead to private allocations of intellectual property rights in that output.[11] Indeed, there are institutional theorists who advocate a concept of communal property, protected by positive law from strangers to the community, but allocated among community members solely through private transactions.[12] This thinking is, in turn, consonant with that of the scientific community (and, presumably, other professions), where the aspiration has been to iron out difficulties among collaborators through cultural change and education,[13] perhaps with the intermediation of the institutions with which researchers deal, such as universi-

10. *See id.*; David H. Guston, *Technology Transfer and the Use of CRADAs at the National Institutes of Health*, *in* INVESTING IN INNOVATION, *supra* note 9, at 221, 234-35; Powell, *supra* noto 5.

11. *See, e.g.*, R.H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1 (1960); Julie E. Cohen, Lochner *in Cyberspace: The New Economic Orthodoxy of "Rights Management"*, 97 MICH. L. REV. 462, 473-80 (1998) (reviewing intollectual property litorature from a neoclassist economics perspective); Frank H. Eastorbrook, *Intellectual Property is Still Property*, 13 HARV. J.L. & PUB. POL'Y 108, 113-14 (1990); Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265, 266 (1977); Mark A. Lemley, *Romantic Authorship and the Rhetoric of Property*, 75 TEX. L. REV. 873, 896-98 (1997) (book review).

12. *See, e.g.*, Carol M. Rose, *The Several Futures of Property: Of Cyberspace and Folk Tales, Emission Trades and Ecosystems*, 83 MINN. L. REV. 129, 155-62 (1998) (providing, among other things, an excellent review of the literature); Keuneth W. Dam, *Intellectual Property and the Acadcmic Enterprise* 9-13 (1999) (John M. Olin Law and Economics Working Paper No. 68), *available in Social Science Research Network Electronic Library* (visited Mar. 29, 2000) <http://papers.ssrn.com/paper.taf?ABSTRACT_ID=166542>. Elinor Ostrom's empirical work on the allocation of water rights is often citod in support of such communal regimes. *See, e.g.*, ELINOR OSTROM, GOVERNING THE COMMONS (1990).

13. *See* Bruce Alberts & Kenneth Shine, *Scientists and the Integrity of Research*, 266 SCIENCE 1660, 1660-61 (1994); Jon Cohen, *The Culture of Credit*, 268 SCIENCE 1706, 1706-11 (1995).

ties, journals,[14] and funders.[15] Thus, there has been a sense in which it may be thought that all that is necessary from the standpoint of law is that rights be clearly defined and that parties enjoy the transactional freedom they need to reach satisfactory allocations inter se.[16]

All the same, there are powerful reasons to take a closer look at collaborative production and at how intellectual property law deals with it. For one, anecdotal evidence suggests that there is significant divergence between theory and reality. Allocating the incidents of ownership is not a part of the "mental furniture" of many collaborators; left on their own, parties can and do run into significant difficulties. Collaborators sometimes find themselves without a clear sense of who has rights to royalties, who can make binding decision on how their work will be published or commercially exploited,[17] or who has legal authority to build upon the work and make improvements.[18] Parties may lose access to unique materials—questionnaires, slides, cell lines, unique reagents, and genetically altered laboratory animals—that are necessary to further their research.[19] Some discover their contribution is not acknowledged when the work is published,[20] or that their continued use of collaboratively-produced material is considered plagiarism.[21]

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14. *See, e.g.*, Steven Bachrach et al., *Who Should Own Scientific Papers?*, 281 SCIENCE 1459, 1459-50 (1998); Jon Cohen, *Share and Share Alike Isn't Always the Rule in Science*, 268 SCIENCE 1715, 1715-18 (1995); Paul M. Rowe, *Encouraging Good Scientific Conduct*, 343 THE LANCET 1627, 1627 (1994).

15. *See, e.g.*, Jocelyn Kaiser, *HHS Is Still Looking for A Definition*, 272 SCIENCE 1735, 1735 (1996) (noting mixed response to recent government proposals for handling allegations of scientific misconduct); Barbara Mishkin, *Urgently Needed: Policies on Access to Data by Erstwhile Collaborators*, 270 SCIENCE 927, 927-28 (1995) (arguing for institutional policies and federal regulations regarding scientific collaborations).

16. *See* Raymond T. Nimmer, *Images and Contract Law—What Law Applies to Transactions in Information*, 36 HOUS. L. REV. 1, 12-17 (1999); NATIONAL CONFERENCE OF COMMISSIONERS ON UNIFORM STATE LAWS, U.C.C. ART. 2B PREAMBLE (Annual Meeting Draft) (1998).

17. *See, e.g.*, Thomson v. Larson, 147 F.3d 195, 199-205 (2d Cir. 1998); Richard A. Kerr, *Contacts with the West Bring Cultural Revolution: Russian and Western Earth Scientists Collaborate*, 264 SCIENCE 1277, 1277 (1994).

18. *See, e.g.*, Weissmann v. Freedman, 868 F.2d 1313, 1317-23 (2d Cir. 1989).

19. For a particularly lurid example of this problem, see Randy Kennedy, *Doctor's Effort to Move Practice Leaves Patients in a Tug of War*, N.Y. TIMES, Apr. 8, 1999, at A1 (describing a legal action by a hospital at which a federally-funded AIDS researcher had worked claiming the right te continue to consider the researcher's subjects as patients after he moved to another institution).

20. *See, e.g.*, McKinley, *supra* note 8, at E2.

21. *See, e.g.*, Marcia Barinaga, *UCSF Case Raises Questions About Grant Idea Ownership*, 277 SCIENCE 1430, 1430-31 (1997) (describing a finding by a USCF faculty panel that a faculty member committed plagiarism by individually applying for a grant based on work completed by a collaboration in which he participated resulting in the firing of the faculty member).

These episodes can, of course, be dismissed as self-inflicted (the parties should have negotiated harder or hired better lawyers). The costs they impose cannot, however, be so easily ignored, for they are borne not only by the possibly neglectful participants, but also by society as a whole. Creative production requires sophisticated and expensive resources (including public resources): suboptimal utilization of collaborative output wastes these sunk costs, leaves unrealized its full creative potential, and, in some instances, requires duplication of the same effort. Similarly, many of the individuals involved are highly trained (sometimes at public expense). Squeezing them out is a charge on the public. Curtailing their ability to do further work deprives society of their expertise; failure to acknowledge their contribution hampers their ability to get other jobs, earn promotions, or attract funding, audiences, or graduate students, putting their talents to less than the highest and best of uses. Conflict dissipates social capital. One bad experience can influence the course and terms of future dealings, as well as a party's willingness to engage in other collaborative projects. Redesigning the intellectual property system to take explicit account of collaborative production would have significant advantages. Well-designed rules reduce transaction costs by functioning as off-the-shelf arrangements or starting points for ex ante negotiations. They also serve ex post, as default rules for situations in which the parties discover that they have omitted key terms from their agreements.

Rethinking the intellectual property system in light of the increasing prevalence of collaborative production is important in other respects as well. Patent and copyright laws are aimed at protecting not only innovators, but also the public's interest in access to creative works. That is, although intellectual property systems are principally valued as mechanisms that enable innovators to earn market returns on their creative investments, they do not permit innovators to capture all of the surplus that their work generates. Another goal is to maintain a robust public domain. For example, both copyright and patent law release the ideas in protected works to the public through the idea/expression (or principle/embodiment) dichotomy; they reduce the cost of copies through the first sale doctrine; and they further protect the ability of others to innovate through the doctrine of misuse.[22] If collaborators are allowed—or required—to structure their

22. *See, e.g.*, Gottschalk v. Benson, 409 U.S. 63, 68-72 (1972) (supporting the principles/embodiment dichotomy); Baker v. Selden, 101 U.S. 99, 101-04 (1879) (identifying the idea/expression dichotomy in copyright law). On first sale, see 17 U.S.C. § 109(a) (1994) (copyrights); Adams v. Burke, 84 U.S. (17 Wall.) 453, 455-57 (1873) (patents). On misuse, see, for

relationships on their own, there is a danger that they will ignore or undermine these safeguards. Participants could, for instance, agree to distribute their results in ways that prevent others from fully utilizing their ideas, or building on their results. They might allocate the right to pursue further work in the field of the collaboration in a manner that restrains competition in innovation markets and wastes talent and training.[23] Those favoring communal solutions have tended to disregard the public aspect of intellectual property.[24] But as policymakers attempt to foster social capital by facilitating collaborative arrangements, some attention needs to be paid to protecting society from cooperation that is, in a sense, too successful.

Finally, there is the matter of misconduct. In recent years, there has been a noticeable rise in allegations concerning falsification or fabrication of research results,[25] problems which many observers attribute, at least in part, to the dilution of individual responsibility that comes along with the increase in collaborative production. At first blush, it may seem that intellectual property law would have nothing to say on such issues. Nonetheless, there is significant reason to consider such matters in a study like this one. Commentators in the scientific community have suggested that one way to reinstitute a sense of accountability is by forging a new understanding of authorship and inventorship.[26] Further, there has been considerable activity on the part of universities, journals, and funders to promote social responsibility and the communitarian norm of science (that is, to

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example, Zenith Radio Corp. v. Hazeltine Research Inc., 395 U.S. 100, 133-40 (1969) (patents); Hartford-Empire Co. v. United States, 323 U.S. 386, 406-07 (1945) (same); Lasercomb America, Inc. v. Reynolds, 911 F.2d 970, 975-79 (4th Cir. 1990) (copyrights). For analysis of the antitrust implications of licensing agreements, see DEPARTMENT OF JUSTICE & F.T.C., ANTITRUST GUIDELINES FOR THE LICENSING OF INTELLECTUAL PROPERTY (1995), *reprinted in* 4 Trade Reg. Rep. (CCH) ¶ 13,132.

23. *See, e.g.*, Proposed Final Judgment and Competitive Impact Statement, United States v. Microsoft, 59 Fed. Reg. 42,845, 42,848 (proposed Aug. 19, 1994); United States v. Microsoft Corp., 1995-2 Trade Cas. (CCH) ¶ 71,096 (D.D.C. Aug. 21, 1995) (restraining Microsoft from engaging in certain anticompetitive practices, such as restricting the vendors' ability te work with competing operating systems and to develop competing products for unreasonably long periods of time); *On Academic Authorship (RPH 2.8)* (visited Mar. 29, 2000) <http://www-portfolio.stanford.edu/100885> [hereinafter *Academic Authorship*].

24. *See* MARK A. LEMLEY, BEYOND PREEMPTION: THE LAW AND POLICY OF INTELLECTUAL PROPERTY LICENSING 111, 117-36 (1999); Rochelle Cooper Dreyfuss, *Do You Want to Know a Trade Secret? Licensing Under Article 2B of the Uniform Commercial Code*, 87 CALIF. L. REV. 191, 243-44 (1999).

25. *See, e.g.*, Richard Stone, *Baltimore Defends Paper at Center of Misconduct Case*, 269 SCIENCE 157, 157 (1995) (describing charges against an immunologist who allegedly falsified date).

26. See Mario Biagioli, *The Instability of Authorship: Credit and Responsibility in Contemporary Biomedicine*, 12 LIFE SCI. F. 3 (1998).

ensure that scientific research is accurate and shared) with intellectual property-like interests.[27] Of course, it is not necessary for the conceptualization of ownership and characterizations of interests established for these purposes to be congruent with like notions in copyright and patent law. However, it is well worth considering whether they should be. Dueling concepts of authorship and inventorship would certainly be confusing, especially given that copyright and patent rules are themselves very different from one another. More important, there is a strong sense in which the legal categories of authorship and inventorship are purely instrumental; to the extent that is so, their functionality should be influenced by all of the ways in which these terms have been vested with social significance.

Because the Coasian intuition is so strong, this Article begins by considering the strength of communal ordering regimes; that is, the contractual arrangements negotiated by the participants in collaborative projects and the intellectual property-like regimes currently under consideration by the entities with which these participants interact. Using examples of recent collaborative controversies, I demonstrate why I am not sanguine about the capacity of these private resolutions adequately to safeguard the interests of either collaborators or the public. Part II moves to a discussion of copyright and patent law. After explaining the inadequacies of the current regime, this Part discusses how the system could be restructured to handle both reputational and economic issues, to allocate rights to follow up on earlier work, to grapple with the problem of unique tangibles, and to assure accountability for the accuracy of creative output.

I. COMMUNAL SOLUTIONS

As noted in the introduction, the problems arising in collaborative research are of many types. Some questions have financial implications, others are mainly reputational; some of the issues relate to the quality of the output of the collaboration, others impact on the availability of the output as input for further creativity. Much of the current economic literature, along with some of the legal literature, on collaborative work can be taken as arguing for keeping formal legal

27. *See, e.g.*, Drummond Rennie et al., *When Authorship Fails: A Proposal to Make Contributors Accountable*, 278 JAMA 579, 582-84 (1997) (proposing a new model of authorship to promote social responsibility); *see also* EUROPEAN STRUCTURES–CHANGES AND CHALLENGES: THE ROLE AND FUNCTION OF THE INTELLECTUAL PROPERTY RIGHTS (Max-Planck-Gesellschaft 1994) [hereinafter EUROPEAN STRUCTURES]; Rochelle Cooper Dreyfuss, *The Creative Employee and the Copyright Act of 1976*, 54 CHI. L. REV. 590 (1987); NAPAG REPORT, *supra* note 7.

intervention out of the process of resolving these problems, the theory being that law can never find solutions as good as private governance systems structured by the parties themselves. There are several ways in which it is thought that this private ordering could occur—through the collaborators acting alone, or under the auspices of one or more of the several institutions with which they regularly interact. This Part examines these communal approaches.

A. First Order Solutions

It can be argued that since the essence of collaboration is agreement, the law should encourage participants to engage in what I call "first order private solutions." It should take a passive position on problems unique to collaborative research, forcing the parties to work the issues out among themselves—at the inception of the collaborative project if that is possible; later on if necessary. Not only do the collaborators have the opportunity to consider their interests with care, the solutions they arrive at are more likely to fully reflect their concerns and to be tailored to their field or employment circumstances than are rules or guidelines imposed by outsiders.

Much of the support for this position comes from the economic literature, which suggests that private agreements are better than public regulation at reaching socially optimal solutions to allocative problems. Suzanne Scotchmer, for example, has investigated how patent rights are assigned as between a pioneer inventor and those who improve upon and expand the work.[28] In her view, the agreements most likely to allocate patent rights in a manner that promotes both the groundbreaking inventions that open up new fields, and also improvements, that is, the follow-on efforts that turn these groundbreakers into viable commercial products, are those that are entered into ex ante. At that time, she reasons, the parties' investment position and information base are likely to be fairly symmetric; no one participant is in a better bargaining position than any of the others. Further, every party can make a credible threat to pull out because no one has sunk significant costs that would be nonrecoverable if the collaboration were to fail. Parties in this position are likely to reach an accom-

28. *See* Suzanne Scotchmer, *Protecting Early Innovators: Should Second-Generation Products Be Patentable*, 27 RAND J. ECON. 322 (1996); Suzanne Scotchmer, *Standing on the Shoulders of Giants: Cumulative Research and Patent Law*, 5 J. ECON. PERSP. 29, 30 (1991); Ted O'Donoghue et al., Patent Breadth, Patent Life, and the Pace of Technological Progress (I.B.E.R. Working Paper No. 95-242) (1995).

modation that reflects the input that each expects the others to put into the collaborative effort.[29]

Even if the parties cannot agree on particular issues beforehand, many argue that solutions adopted at a later time are also likely to be closer to the social optimum than those that are imposed by law. Robert Merges, for example, has studied the problem of blocking patents. Blocking patent problems arise whenever a technology is protected by more than one patent, and the patents are owned by different parties. No one party can use the technology without the agreement of the others; third parties cannot utilize it without agreements from all the patentees. In these cases, the time for ex ante agreements has passed, so the Scotchmer solution, of negotiating cross-licenses before costs are sunk, is no longer possible. Nonetheless, Merges finds good reasons for allowing (better, encouraging) the parties to privately reach accommodation—in the case of his work, accommodation that take the form of patent pools: agreements on the terms on which existing rights will be licensed along with procedures to determine rights to utilize any new materials that pool members discover.[30]

Merges' reasons are several. First, he finds that transaction costs are lower in private dealings. The parties' own experience and expertise allow them to evaluate one another's contributions accurately. As a consequence, outside experts, adjudicators, and the procedures and costs they entail are not necessary. Because a pool requires each party to acknowledge that the others are repeat players, they all come to realize that absolutely accurate assessments of value are not always needed–they know that what comes around goes around; on average, returns will reflect contributions. Most important to Merges is the fact that pools improve information flow and create bonds fruitful of further cooperation.

Collaboration is, of course, not a pool: parties are not agreeing to long-term arrangements that will survive future developments in the field. Nonetheless, the factors that keep pool participants cooperative, that push them to compromise and to share information, exist for collaborators as well. Walter Powell's work on the sociology of collabo-

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29. *Cf.* Nancy Morawetz, *Bargaining, Class Representation, and Fairness*, 54 OHIO ST. L.J. 1, 2-3 (1993) (noting the effect of information and valuation asymmetries in class action settlements).

30. *See* Robert P. Merges, *Contracting into Liability Rules: Intellectual Property Rights and Collective Rights Organizations*, 84 CALIF. L. REV. 1293 (1996).

rative research in biomedicine supports the point.[31] Because biomedicine is one of the fields where intellectual limitations make it impossible for any one person to know enough to advance the science, typical papers have large numbers of coauthors. At the same time, however, the field moves fast. It is not commercially feasible for entities, like pharmaceutical houses, to hire whole working groups because the skill set necessary to complete one project is not the same as what is needed for another. Collaborations therefore fluctuate—a competitor in one area may be a collaborator in another. Continuous involvement in collaborative efforts is, however, critical to both commercial success and career advancement.

The question, then, is how an individual (or a research entity) can join these large efforts and move easily from collaboration to collaboration. In Powell's view, the rapidity of change in this field also makes it difficult for each participant to fully evaluate the substance of potential collaborators' work. Without reputation in science to rely upon, what becomes important is reputation as a collaborator. Those with the greatest expertise at managing collaborations–at undertaking the activities that promote private agreements–can leverage their expertise to become more centrally connected. Thus, there is significant social pressure on participants to take positions on contested issues that allow their collaborations to work out smoothly–to compromise and to share, to solve problems internally.

Private solutions offer advantages that go beyond their superior ability (relative to legislatures) to create nuanced rules tailored to the participants' interests. Legislative action often triggers obligations nnder international agreements;[32] these obligations are not implicated by private agreements. In the case of international collaborations, private contracts can also avoid the need to decide nasty conflicts questions. There are, for example, significant national differences on when copyrighted work is considered for hire (making the employer the author).[33] Similarly, some countries are more tolerant than others of the effects that private agreements can have on third-party utilization of creative works.[34] A contract allocating rights, and specifying

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31. *See* Powell, *supra* note 5; Walter W. Powell et al., *Interogranizational Collaboration and the Locus of Innovation: Networks of Learning in Biotechnology*, 41 ADMIN. SCI. Q. 116 (1996).

32. *See, e.g.*, Agreement on Trade-Related Aspects of Intellectual Property Rights, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, Art. 33 I.L.M. 1197 (1994) (requiring all members to enact and enforce minimum levels of copyright, patent, trademark, and trade secrecy protection).

33. *See, e.g.*, Itar-Tass Russian News Agency v. Russian Kurier, Inc., 153 F.3d 82, 88-89 (2d Cir. 1998). The work for hire doctrine is discussed in the text *infra* Part II.A.1.a.

34. *See, e.g.*, F. Guedy v. J.-P. Harmand, Court of Cassation, 1st Ch. Civ., appeal no. X 92-18.627 (3 July 1996) (displaying that French law determines authorship status of computer

under whose laws undecided issues will be adjudicated, could obviate much of the need to make difficult choices among conflicting national legal regimes.

But despite these many theoretical advantages, experience demonstrates that, as a practical matter, private solutions will not always be effective. Some collaborations will fall apart and the infighting among collaborators will waste resources, delay progress, strip researchers of credit, or leave them in a position where they cannot use their expertise and training.[35] The full extent of such problems is difficult to document. Although there are certainly many public breakdowns, many more are kept confidential, possibly because of their reputational implications and the loss of collaborative opportunities that publicity might entail.[36] And, clearly, it is not possible to know how many projects never get started because the potential participants cannot agree on terms. The reasons for failed collaborations are, however, not so difficult to discern. Innovative enterprises are fundamentally different from the fields that have served as the focus of most economic research and theorizing: outcomes are more uncertain, cooperative efforts are more often multicultural and interdisciplinary, valuation is especially complex, and transaction costs are uniquely high. None of these problems is made any easier by the fact that many scientists and artists have cultural aversions to lawyers and legal matters.[37]

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program and its documentation through textual analysis rather than contract construction). *See generally* J.H. Reichman, *Overlapping Proprietary Rights in University-Generated Research Products: The Case of Computer Programs*, 17 COLUM.-VLA J.L. & ARTS 51 (1992).

35. *See, e.g.* Novell Inc. v. Timpanogos Research Group, Inc., 46 U.S.P.Q. 2d 1197, 1217 (D. Utah 1998) (involving an ex-employer barring computer programmers from working on a new project); Jennifer Kulynych, *Intent to Deceive: Mental State and Scienter in the New Uniform Federal Definition of Scientific Misconduct*, 1998 STAN. TECH. L. REV. 2 (describing an allegation of misconduct involving Francis Collins); Eliot Marshall, *Fight Over Data Disrupts Michigan State Project*, 251 SCIENCE 23, 23-24 (1991) (describing delays in the Sudan Project, an international parasitology study funded by the National Institutes of Health caused by the sequestration of data by a graduate student who claimed to have received inadequate credit); Wade Roush, *Secrecy Dispute Pits Brown Researcher Against Company*, 276 SCIENCE 523, 523-24 (1997) (describing claims that a clinic was closed in retaliation for paper publication); *see also* Jane Smith, *Gift Authorship: A Poisoned Chalice?*, 309 BRIT. MED. J. 1456, 1456-57 (1994) (providing statistics on scientific papers credited to a laboratory head who had not made any substantive contribution to the work). *See generally* Rochelle Cooper Dreyfuss, *Trade Secrets, How Well Should We Be Allowed to Hide Them: The Economic Espionage Act of 1996*, 9 FORDHAM INTELL. PROP. MEDIA & ENT. L. J. 1 (1998); James H.A. Pooley et al., *Understanding the Economic Espionage Act of 1996*, 5 TEX. INTELL. PROP. L.J. 177, 217-18 (1997).

36. For example, since the piece I wrote on work for hire, *see* Dreyfuss, *supra* note 27, various university administrators and faculty have contacted me for confidential discussions of ongoing problems.

37. *See* Friedly, *supra* note 5 (quoting Joyce Brinton, director of Harvard University's Office of Technology and Trademark Licensing, as saying "the last thing a scientist wants is for some-

The dimension of the uncertainty problem is illustrated by the dispute that arose between two prestigious scientists, Robert Gallo of the National Cancer Institute and Luc Montagnier of the Pasteur Institute. The two did little more than exchange virus samples—not an uncommon form of collaboration in science. In this instance, however, their work led to the identification of the AIDS virus, opening the door to the development of a diagnostic test and a vaccine. The parties had not anticipated this outcome—indeed, the jointness of their discovery may have been the result of inadvertent cross contamination. But however the problem arose, the resulting dispute over credit and patent rights drew in their institutions as well as other scientists. The controversy took a long time to resolve. During the time it was pending, research was delayed and goodwill between important organizations was compromised.[38]

Why did not these scientists iron out potential problems at the time they first exchanged samples, as economists would predict? The answer, perhaps, is that the innovation game is fundamentally different from activities like farming, mining, and manufacturing. In most economic sectors, ex ante agreements are not very difficult to reach because the objectives of cooperative ventures are known in advance. Although there may be unanticipated difficulties, even the general contours of potential problems are fairly foreseeable. In contrast, unpredictability is an inherent feature of innovation. As F.M. Scherer has demonstrated in his studies of the profitability of technological and cultural endeavors, there is wide dispersion in the benefits generated by innovative activity. Indeed, the benefits can deviate so much from distributions of profit in other areas that the diversification strategies commonly used to reduce investment risk in other industries are not effective with respect to innovation.[39] But if passive investors cannot manage to lay off risk, then it cannot be expected that the parties actively engaged in the enterprise will do much better. Since they cannot predict with any degree of certainty that their work will

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one to come with 16 pages of contracts to sign"); *see also* Dale L. Carlson & James R. Barney, *The Division of Rights Among Joint Inventors: Public Policy Concerns After* Ethicon v. U.S. Surgical, 39 IDEA 251, 259 (1999) (suggesting that small inventors may not have access to attorneys when decisions whether to collaborate are made).

38. *See* Lawrence K. Altman, *The Doctor's World: Cooperation vs. Competition*, N.Y. TIMES, Apr. 14, 1987, at C2; Lawrence K. Altman, *French Sue U.S. Over AIDS Virus Discovery*, N.Y. TIMES, Dec. 14, 1985, at 1; Philip J. Hilts, *U.S. Drops Misconduct Case Against an AIDS Researcher*, N.Y. TIMES, Nov. 13, 1993, at 1; Nicholas Wade, *Method and Madness: The Vindication of Robert Gallo*, N.Y. TIMES, Dec. 26, 1993, § 6 (Magazine), at 12.

39. *See* F.M. Scherer, *The Innovation Lottery*, *in* EXPANDING THE BOUNDS OF INTELLECTUAL PROPERTY: INNOVATION POLICY FOR THE KNOWLEDGE SOCIETY (Rochelle Cooper Dreyfuss et al., forthcoming, Oxford University Press).

pay off, it will not be apparent to them–as it was not to Gallo or Montagnier–when it is worth incurring the costs of fully negotiating the terms of association. And even where it is clearly worth negotiating, the participants may not be able to foresee what information or products will be developed, what contributions each will have made in developing that information or product, or whose expertise will be relevant to future development. Yet, without that knowledge, it is not possible to allocate rights and responsibilities in a just, coherent, or efficient manner.[40]

The problems associated with the multicultural or interdisciplinary nature of collaboration are equally evident. They can, for example, be seen in the fate of a project conducted by a group of Russian and western earth scientists. The group came together to survey the continental crust and to analyze data that had been generated during underground chemical and nuclear tests set off by the Soviet Union in the early 1970s. The idea was to use the Russian data and knowledge of geography, along with western data processing equipment, financing, and expertise. The scientists were apparently in agreement on issues like study design—the Russian scientists were, in fact, eager to learn new ideas and western approaches. The agreement fell apart on the question of exploiting the findings. The Russians turned out to be under much more pressure to utilize the results for financial gain than were their western connterparts. In addition, the hierarchical system of Russian science mandates that scientists give some credence to theories propounded by senior colleagnes. As a result, the parties found that they could not agree on when, what, or where to publish. Since the seismic experiments themselves were not to be repeated, the dispute over how the information would be used was especially keen.[41]

Here again, it is hard to fault the parties for failing to reach agreement in advance of their collaboration. It would have been difficult for western scientists, familiar with very different publication conventions, to predict that their colleagues would want to pay homage to scientific theories long rejected—and equally hard for those steeped in that tradition to imagine doing otherwise. And although this particular problem may appear unique, there are many potential stumbling blocks that are quite common. Examples familiar to those

40. For another example of a dispute arising in this accidental way, see *University of Colo. Found., Inc. v. American Cyanamid Co.*, 196 F.3d 1366 (Fed. Cir. 1999), describing how university researcher learned in 1993 that one of the parties to an intellectual friendship had patented the researcher's work back in 1981.

41. *See* Kerr, *supra* note 17; *see also Academic Authorship*, *supra* note 23.

reading this article include the order in which names are put on jointly authored papers, the level of contribution a reader needs to provide in order to "make" the list of acknowledgments, the degree of relevance required of a paper to merit its citation.[42] And, of course, parties who are working in different places and at different times, have yet another problem with which to contend: they lack the continuity of contact that, in some cases, helps participants arrive at consistent outlooks on how their work will be credited, shaped, finalized, and utilized.[43]

Closely related to the difficulty of predicting outcomes and sources of friction are problems of valuation. Commentators such as Rebecca Eisenberg and Michael Heller have convincingly argued in connection with their work on the biotechnology industry that blocking problems arise, in part, because the potential value of rights in new discoveries is hard to determine and rights holders tend to overestimate the potential of their own work.[44] As the literature on the settlement of litigation suggests, when parties are far apart on valuating outcomes, resolution is all but impossible.[45] Eisenberg and Heller examined the licensing of existing works; presumably, agreements requiring the evaluation of potential output are even more difficult to achieve. Matters are further complicated by the fact that collaborators in the creative sector are often working with different metrics. For example, many academic collaborators consider early publication to be the central concern. Their commercial partners may feel differently. They may see publication as compromising patent rights, disclosing trade secrets, or creating evidence that could be used against them in

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42. *See, e.g.*, Lisa M. Krieger, *Squabble Delays Publication of Valuable AIDS Data*, S.F. EXAMINER, Mar. 23, 1988, at 3A (reporting that research of the Kinsey Institute about human sexual behavior remained unpublished because the researchers could not agree on whose name should appear first on the publication); *cf.* John Ziman, *Why Must Scientists Become More Ethically Sensitive Than They Used to Be?*, 282 SCIENCE 1813, 1813-14 (1998) (describing distinct cultural traditions within science).

43. *See, e.g.*, Jon Cohen, *Quick Work Draws Scientific Praise, Colleagues' Complaints*, 273 SCIENCE 1798, 1798 (1996). The field of study can also influence the ease with which transactions can be accomplished. In the computer hardware field, for example, cross licensing is relatively common. Yet it is questionable to extrapolate this experience to other fields, *see, e.g.*, Dam, *supra* note 12, at 11-12. Transaction costs in computer science are especially low because computer engineers routinely use the internet to search for information, determine its intellectual property status, and consummate transactions. It is not necessarily the case that information in every field is or will become accessible in this way.

44. *See* Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 SCIENCE 698, 698-701 (1998).

45. *See, e.g.*, Robert D. Cooter & Daniel L. Rubinfeld, *Economic Analysis of Legal Disputes and Their Resolution*, 27 J. ECON. LIT. 1067, 1069 (1989); W. Cris Lewis & Tyler J. Bowles, *The Economics of the Litigation Process and the Division of Settlement Surplus: A Game-Theoretic Approach*, 6 J. LEGAL ECON. 1, 5-6 (1997).

tort cases.[46] Valuation in this sector can also be something of a moving target in that both the commercial and reputational value of a work can change as the field to which it pertains becomes more or less "hot."[47]

And then there is the matter of transaction costs. It is, of course, familiar to Coasian theorists that they must take account of the fact that transaction costs in the real world are not zero. However, this issue has special force in connection with innovation, where many of the matters that require agreement are too new or unique to be covered by legal rules and where much of the potential subject matter of agreement is valuable in large part because one side holds it in secret.

As to the newness issue, consider one of the most curious problems arising in connection with collaborative work: quality control. CNN and Time, Inc. experienced this problem in their first major collaboration, a broadcast and article alleging the use of nerve gas in Vietnam, a story which proved to be false.[48] A similar instance in scientific research is exemplified by a controversy that arose out of a collaboration between molecular biologist David Baltimore, immunologist Thereza Imanishi-Kari, and others, where an allegation was

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46. In the United States, patent applications can be filed up to a year after publication. *See* 35 U.S.C. § 102(b) (1994). Trade secrets are, however, unenforceable as soon as they become public, *see, e.g.*, UNIFORM TRADE SECRETS ACT § 1(4) (amended 1985), 14 U.L.A. 438 (1990). And in many countries, there is not even a grace period for patents—publication bars the issuance of a patent on all work described. *See* Rudolf Krasser, *The Importance of an Extensive Period of Grace for the Commercial Exploitation of the Results of Scientific Research*, *in* EUROPEAN STRUCTURES, *supra* note 27, at 169; *see also* Friedly, *supra* note 5 (quoting a New England Journal of Medicine survey of 210 biotechnology companies that fund academic research that 34% had disputes with their academic partners over intellectual property rights); Roush, *supra* note 35; Diane Leenheer Zimmerman, *Scientific Speech in the 1990s*, 2 N.Y.U. ENVTL. L.J. 254, 265-66 (1993); NAPAG REPORT, *supra* note 7, at 5-6. The reverse problem is not unknown: Zimmerman documents cases in which an academic collaborator was not ready to publish his work, but litigation involving a commercial participant in the research led to demands for disclosure. *See* Zimmerman, *supra*, at 264-65.

47. *See, e.g.*, Jon Cohen, *The Changing of the Guard*, 272 SCIENCE 1876 (1996) (noting that although disputes in AIDS research decreased after the Gallo affair, the reasons may have to do with a decline in the expected return on the research more than with a change in attitude). Cohen quotes David Baltimore as saying:

> I've learned that the more medically relevant the question, the worse the social behavior. When something is really hot and has direct medical relevance, people's behavior is atrocious. If you're working on something like Drosophila, people are much more collaborative and better behaved.

48. *See, e.g.*, Barringer, *supra* note 1, at A17; Lawrie Mifflin, *Time Orders Investigation on Accuracy of CNN Report*, N.Y. TIMES, June 22, 1998, at D1; Robin Pogrebin & Felicity Barringer, *CNN Retracts Report that U.S. Used Nerve Gas*, N.Y. TIMES, July 3, 1998, at A1.

made that data in one of their papers was fabricated.[49] Both incidents involved well known parties–David Baltimore is a Nobel laureate and the reporter of the CNN broadcast was Pulitzer Prize winner Peter Arnett. Both appeared to the public to be guarantors of accuracy. In neither case, however, did the party so regard himself. Peter Arnett, one of the few people intimately associated with the CNN story who was (ostensibly) not fired on account of the story, considered himself to be just "the face."[50] Baltimore saw his role as standing by his colleague, not scrutinizing the merits of the allegation. What makes these incidents curious is that the need for, and value of, quality control is certainly foreseeable. Moreover, failure to provide for adequate control has enormous reputational significance (especially for "the faces"). Thus, one would expect that this would surely be a matter carefully negotiated. Perhaps the reason it is so often ignored is that transaction costs are especially high. There are no legal background rules concerning who in a collaboration is responsible for quality. Accordingly, the parties are not alerted to consider the issue–each may, in fact, think someone else responsible. Even if they manage to consider quality in advance, the absence of a rule raises costs because there is no benchmark from which to begin to negotiate. (Further, there is no default rule to save the day when an omission comes to light.)

The second problem with transaction costs is demonstrated by another surprisingly prevalent problem: the failure of collaborators to provide for access to unique materials, such as reagents and cell lines, that those participants who wish to continue working on the project will need. The controversy over "knockout" and "transgenic" mice is illustrative. These are rodents bred with missing (i.e. knocked out) genetic material, or with novel genes transcending the usual complement. Once a mouse with a particular alteration is bred, access is essential to anyone who wants to continue to do research on conditions affected by that alteration. Accordingly, one would expect that this too

49. *See, e.g.*, Marcia Barinaga, *At Rockefeller, Wiesel is the Calm After the Storm*, 260 SCIENCE 1426, 1426-28 (1993); David P. Hamilton, *U.S. Attorney Decides Not to Prosecute Imanishi-Kari*, 257 SCIENCE 318, 318 (1992); Richard Stone, *Baltimore Defends Paper at Center of Misconduct Case*, 269 SCIENCE 157, 157 (1995); William H. Honan, *Nobelist and AIDS Researcher Is Named President of Caltech*, N.Y. TIMES, May 14, 1997, at B8; *see also* Christopher Lehmann-Haupt, *For a Scientific Team, A Case Goes Terribly Awry*, N.Y. TIMES, Sept. 14, 1998, at E6 (reviewing DANIEL J. KEVLES, THE BALTIMORE CASE: A TRIAL OF POLITICS, SCIENCE AND CHARACTER (1998)).

50. Arnett and CNN have, however, since decided to part company. *See* Bill Carter, *Arnett in Agreement to End His 18-Year Career at CNN*, N.Y. TIMES, Apr. 20, 1999, at C8.

would be an issue the parties would certainly resolve.[51] Their failure to do so may, again, partly be attributed to the absence of background rules.[52] Here, however, there is also another complication—Kenneth Arrow's disclosure paradox.[53] That is, the party who has such a mouse, or knows that it can (or how it can) be bred, is in possession of valuable secret information on potential research projects. Revealing too much during the negotiation phase is risky: if the negotiations fail, the competitive advantage represented by the secret may be lost. But, as we see, not revealing the information is also problematic. In Arrow's standard analysis, the buyer will discount the amount of the offer to account for the risk that the secret will turn out to be valueless, with the result that the holder receives less than full value for the information. Here, an issue of importance is not agreed upon in advance.

Admittedly, there are contract strategies that are designed to ameliorate many of these problems. As Victor Goldberg has shown in his studies of film industry contracts, such devices as pay or play clauses, net and gross profit provisions, and contingency fees can bridge differences in valuation, maintain incentives and flexibility, allocate risks, and ensure that returns reflect investments.[54] Certainly, percent royalty agreements and milestone payments are familiar to the patent industries as ways to deal with various forms of uncertainty.[55] Nonetheless, these provisions have their limits. The more tailored they are, the more time consuming and expensive to negotiate. Thus, these sorts of provisions are better suited to mature industries than to emerging fields. In the film industry, for example, the products created are unique, but the problems involved in creating them are well enough known to have given rise to a series of fairly standard contractual devices. Further, since many of the parties to these transactions have track records that are strongly correlated with future payoffs, other participants can estimate the value of particular

51. *See* Cohen, *supra* note 13, at 1706 (documenting a similar problem with regard to crystallographic data).

52. *Cf.* Moore v. Regents, 793 P.2d 479, 495 (Cal. 1990) (displaying the lack of a legal rule for a patient's right to a cell line developed from his tumor).

53. *See* KENNETH J. ARROW, ECONOMIC WELFARE AND THE ALLOCATION OF RESOURCES FOR INVENTION IN THE RATE AND DIRECTION OF INVENTIVE ACTIVITY 609, 615 (National Bureau of Economic Research ed., 1962), *discussed in* Rebert P. Merges, *Of Property Rules, Coase, And Intellectual Property*, 94 COLUM. L. REV. 2655, 2657-58 (1994).

54. *See* Victor P. Goldberg, *Bloomer Girl Revisited or How to Frame an Unmade Picture*, 1998 WIS. L. REV. 1051 [hereinafter, Goldberg, *Bloomer Girl*]; Victor P. Goldberg, *The Net Profits Puzzle*, 97 COLUM. L. REV. 524 (1997) [hereinafter, Goldberg, *Net Profits*].

55. *See, e.g.*, Dean F. Vance et al., *The License Agreement Supplement*, 534 PLI/Pat 449, 453 (1998).

terms fairly accurately.[56] In contrast, collaboration often takes place in situations that are too new to have spawned off-the-shelf arrangements. And as Powell has shown, it can be hard for participants to assess the qualities (of inventiveness and creativity) that others bring to the table.[57] Finally, as Goldberg himself notes, courts confronted with even fairly standard provisions in film contracts do not always construe them correctly, nor do individuals always have confidence that they will perform as intended.[58]

Of course, the failure of ex ante negotiation does not end the inquiry into the value of private arrangements, because in theory, there is always the possibility of reaching accommodation ex post. Once again, however, there are problems, some of which are peculiar to, or more serious in, the innovation sector. Thus, ex post negotiations come after costs are incurred and secret information is revealed. Although the parties might reach agreement, the position each ends up in may be more reflective of that party's sunk costs and leverage than of the intellectual contribution made or the expertise that would be brought to further work in the field.

A flavor of this problem can be gleaned from the litigated case Thomson v. Larson involving the estate of the playwright, Jonathan Larson, and Lynn Thomson over what became the long-running and award-winning play, Rent.[59] Thomson, a professor of advanced playwrighting at New York University, had been hired by the New York Theatre Workshop (NYTW), the non-profit theater company that staged Rent, after a workshop production of an early version demonstrated that it needed a great deal of work. She and Larson spent close to a year revising the material before it was produced. When the play was later moved to Broadway, she worked on it once more. In the end, on her accounting, she contributed "up to a quarter of the musical's book, or dialogue, and about 10 percent of its music,"[60] which she thought entitled her to royalties and to credit as a joint author. After settlement efforts failed, she went to court, only to discover that Larson, as the "dominant author," had the right under the Copyright Act

56. Goldberg, for example, explains that participants are willing to give up net profit points because they recognize the value in attracting bigger stars through the offer of gross profits. *See* Goldberg, *Net Profits*, *supra* note 54, at 538-42.

57. *See supra* text accompanying notes 31-32. Arguably, it is much rarer for inventors to have successive successes than it is for movie stars.

58. *See* Goldberg, *Bloomer Girl*, *supra* note 54, at 1058-66; Goldberg, *Net Profits*, *supra* note 54, at 532-38.

59. *See* Thomson v. Larson, 147 F.3d 195, 200-07 (2d Cir. 1998).

60. McKinley, *supra* note 3. For a somewhat different version of her contribution, see *Larson*, 147 F.3d at 198 n.11 (claiming that she changed 48% of the *Rent* script).

to squeeze her out.[61] Not only did she lose the monetary and reputational benefit of her intellectual contribution, her work—indeed, the whole play—fell into a kind of void. The court's decision denying Thomson rights in Larson's work product failed to resolve the question of who had rights in Thomson's output.[62] Peace, in short, can entail significant social and personal costs.[63]

It is also the case (and this point applies to ex ante agreements as well) that society may not be best off with private agreements. Merges is careful to exclude from his argument for patent pools, arrangements that cartelize an industry, such as pools that prohibit licensing to new entrants to the field.[64] However, it can sometimes be difficult to decide when collaboration turns into monopolization. Merges, for example, provides few clues. More significant, private agreements can fall far short of monopolies, and still undermine the public interest. Indeed, this is a problem of general significance and the essence of the debate surrounding Article 2B—now UCITA—provisions originally proposed as an amendment to the Uniform Commercial Code to govern the licensing of most intangibles, and now freestanding model legislation limited to computer software.[65] Various drafts of that document have taken rather aggressive positions in favor of party autonomy, positions that will make it easy to negotiate enforceable agreements over information products.[66] But some com-

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61. *See Larson*, 147 F.3d at 200-02.

62. *See id.* at 198 & n.6; *see also infra* notes 173-92 and accompanying text (providing further discussion of *Larson*). For other controversies along these lines, see Jon Cohen, *Receptor Mutations Help Slow Disease Progression*, 273 SCIENCE 1797, 1797-98 (1996) (describing how Stephen O'Brien, who received blood samples for analysis, published his results in co-authored papers without the knowledge or permission of the co-authors); Eliot Marshall, *Dispute Slows Paper on "Remarkable" Vaccine*, 268 SCIENCE 1712, 1712-15 (1995) (identifying a student collaborator on a patent application, but not in a publication describing some of her work).

63. The parties eventually resolved their differences. The second case was dropped after the parties agreed to a confidential settlement, which included money and crediting Thomson in the playbill as dramaturg. Apparently, *Rent* will continue te use the Thomson material. *See* McKinley, *supra* note 3; *see also* Kennedy, *supra* note 19, at A1 (discussing how hospitals try to woo popular doctors, hoping to gain their rich pipeline of (AIDS) patients and research grant money).

64. Merges, *supra* note 30, at 1340, 1354-56.

65. *See The Uniform Computer Information Transactions Act* (visited Mar. 25, 2000) <http://www.law.upenn.edu/library/ulc/ucita/citam99.htm>; *NCCUSL Gives Final Approval to Model Laws on Electronic Signatures, Software Licenses*, 68 U.S.L.W. 2069-70 (1999) [hereinafter NCCUSL Approval].

66. *See, e.g.*, NATIONAL CONFERENCE OF COMMISSIONERS ON UNIFORM STATE LAWS, U.C.C. ART. 2B, § 106 & REPORTER'S NOTE 1 & PREAMBLE, at pp. 9-10 (Annual Meeting Draft) (1998). For successive drafts of Article 2B, including its transmutation into UCITA, see *The National Conference of Commissioners on Uniform State Laws: Drafts of Uniform and Model Acts* (visited Mar. 25, 2000) <http://www.law.upenn.edu/library/ulc/ulc.htm#top>.

mentators are concerned that the parties will use their new-found freedom to enter into agreements that have significant negative externalities. For example, collaborators could agree to sell only on condition that the product is used for restricted purposes, or not for resale or reverse engineering.[67] Although some of these agreements arguably run counter to specific provisions of intellectual property law or to policies inherent in case law, there is concern that courts will not always be alert to preemption issues, fail to consider limitations in intellectual property statutes as applicable to purely private agreements, or overvalue these arrangements in order to save judicial resources.[68] The result could be that safeguards, such as the first sale and fair use doctrines of copyright law, are effectively abrogated.[69] In the context of international collaborations, choice of law clauses—if held enforceable against public policy challenges—could have a similar effect because they could allow collaborators to contract out of public law that is not in their private interest.

The public weal is also not well served by "problem-free" collaborations that reduce the ability of participants to utilize the skills they developed during the collaboration. That can happen when rights to follow on are relinquished, and also when agreements are made to forebear from accepting employment by competitors of former collaborators.[70] Such agreements reduce competition in the innovation indus-

67. *See, e.g.*, ProCD, Inc. v. Zeidenberg, 86 F.3d 1447, 1448-49 (7th Cir. 1996) (upholding shrinkwrap license limiting purchaser to particular use).

68. *See, e.g.*, Dreyfuss, *supra* note 24; Mark A. Lemley, *Intellectual Property and Shrinkwrap Licenses*, 68 S. CAL. L. REV. 1239, 1248-59 (1995); David A. Rice, *Digital Information as Property and Product: U.C.C. Article 2B*, 22 DAYTON L. REV. 621, 626-29 (1997).

69. *See* 17 U.S.C. §§ 107, 109(a) (1994).

70. For a particularly egregious example, see Elizabeth K. Wilson, *Quantum Chemistry Software Uproar*, CHEMICAL & ENGINEERING NEWS, July 12, 1999, at 27, dealing with the licensing of Gaussian, a software program used in quantum chemistry. The program was originally created by John Pople, a chemistry professor who won the Nobel Prize for this work. It was further developed by Gaussian, Inc., a company Pople formed with a former graduate student, Michael Frisch. After a falling out, Pople left Gaussian, Inc. and the company now licenses the program to universities only on the condition that no competitors receive access to the software. This license is so strictly construed that Northwestern University's license was revoked when a chemistry student presented a paper supervised by a professor who was a collaborator on chemistry (as opposed to software) projects with John Pople. As a result, Gaussian is no longer generally available to researchers at Northwestern; those in the middle of projects involving its use cannot continue their work. Other universities report similar actions by Gaussian, Inc. Resolution of the conflict also required Pople to refrain from affiliating with a competitor for several years. Interestingly, the initial feud between Pople and Frisch concerned intellectual property rights as well as conflicts over the allocation of profits to graduate students and postdocs who helped in the development of the program. *See also* the practices at issue in Proposed Final Judgment and Competitive Impact Statement; United States v. Microsoft, 59 Fed. Reg. 42,845, 42,848 (proposed Aug. 19, 1994). The settlement of this dispute has foreclosed such provisions. *See* United States v. Microsoft Corp., No. CIV.A. 94-1564, 1995 WL 505998, at

tries and slow information flows. They misuse expensive resources, such as the costs of training researchers, and reduce employment mobility, which keeps wages down and makes careers in the innovation industries less desirable. These agreements also dissipate social capital in that they foreclose those with specific experience in collaborating from participating in new projects.

B. Second Order Solutions

One answer to the public aspect of these problems would be to encourage what can be called "second order solutions:" policies set by institutions that interact with the participants and share their expertise, but which are more responsive to the public interest. One obvious set of candidates for this role, at least with respect to innovations in science, include the journals and universities in which researchers publish and work. Although these entities have not each tried to solve all of the problems collaborators encounter, together they cover a broad array. This section begins by examining what their actions show about their capacity to facilitate collaboration, foster social capital, and protect the public interest.

Other potential lubricators of the collaborative process are the entities that fund it. The candidates here are both private and public: venture capitalists are typical of the former, and agencies, such as the National Endowment for the Arts (NEA), the National Institutes of Health (NIH), and the National Science Foundation (NSF), of the latter. There is a growing literature on the important role venture capitalists and their lawyers play in innovation, much of it demonstrating that those with broad experience investing and advising in particular fields can make up for the organizational shortcomings of the creative team.[71] These entities are, however, ignored for the purposes of this Article. For one, there is little reason to believe that venture capitalists would be any more public-regarding than the creative parties themselves. Moreover, a decision by collaborators to rely on venture capital signifies that they have already made the most

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*5 (D.D.C. Apr. 21, 1995); NCCUSL Approval, *supra* note 65, at 2069 (describing the FTC's concern that UCITA "would permit licensors to impose anticompetitive grantback terms in a license that would reduce the incentive to engage in research and development").

71. *See, e.g.*, Lisa Bernstein, *The Silicon Valley Lawyer as Transaction Cost Engineer?*, 74 OR. L. REV. 239, 241-42 (1995); Lawrence M. Friedman et al., *Law, Lawyers, and Legal Practice in Silicon Valley: A Preliminary Report*, 64 IND. L.J. 555 (1989); Ronald J. Gilson, *Value Creation by Business Lawyers: Legal Skills and Asset Pricing*, 94 YALE L.J. 239, 253-56 (1984); Mark C. Suchman & Mia L. Cahill, *The Hired Gun as Facilitator: Lawyers and the Suppression of Business Disputes in Silicon Valley*, 21 LAW & SOC. INQUIRY 679, 681-83 (1996).

potentially divisive decisions, such as the decision on patenting versus publishing. The second part of this section therefore focuses on public funders. As with private entities, they have expertise and flexibility to tailor agreements to the needs of the participants. But since the authority they wield is, at bottom, public, I call the policies they set "quasi private solutions."

1. Second Order Private Solutions: Journals and Universities

As noted earlier, collaborative research is not a new phenomenon. Thus, the institutions directly involved with it are already familiar with many of the key problems. For the journals, the issue of greatest concern is the quality of the material published. Accordingly, many are actively considering the CNN/Baltimore problem on accountability. Interestingly, the approach most often discussed is one that makes use of the authorship concept. For example, the Journal of the American Medical Association (JAMA) has proposed narrowing the field of listed authors in a way that assures that those who are listed will vouch for the work. Under its proposal, to be an author, each collaborator would have to fulfill two of four requirements:

1) Conception of the idea and design of the experiment.
2) Actual execution of experiment; hands-on lab work.
3) Analysis and interpretation of data.
4) Actual writing of manuscript.[72]

Other journals would go further, requiring each author to meet three of the four criteria.[73] The International Committee of Medical Journal Editors has a different formulation. It would require "each author [to have] participated sufficiently in the work to take public responsibility for the content." In addition, it would give credit only on the basis of:

> substantial contributions to [all three of the following:] a) conception and design, or analysis and interpretation of data; and to b) drafting the article or revising it critically for important intellectual content; and on c) final approval of the version to be published.[74]

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72. Barbara J. Culliton, *Authorship, Data Ownership Examined*, 242 SCIENCE 658, 658 (1988); *see also* Drummond Rennie & Annette Flanagin, *Authorship! Authorship! Guests, Ghosts, Grafters, and the Two-Sided Coin*, 271 JAMA 469, 470-71 (1994).

73. Culliton, *supra* note 72, at 658 (citing Edward Huth, editor of the Annals of Internal Medicine).

74. Richard Horton & Richard Smith, *Signing Up for Authorship*, 347 THE LANCET 780 (1996) (reprinting the Uniform Requirements for Manuscripts Submitted to Biomedical Journals of the International Committee of Medical Journal Editors (ICMJE)).

Other contributors would be listed under acknowledgments or in an appendix.[75]

Journals are also considering the problem of unique materials. As with quality, the approach they propose has the flavor of an intellectual property law. To continue with the knockout mice example, what mainly concerns the journals are conflicts among the participants as to when outsiders should have access to the animals. Scientists themselves take many different positions: some think all mice should be freely shared so that peers can verify the published work and build on it. Others believe that the difficulty in breeding these strains requires that the breeder (often a graduate student) have a period in which to study the mice on an exclusive basis. Within that group, there are those who would give the breeder such lead time only when the breeding program was not publicly funded; others would limit exclusivity to projects the breeder was actively pursuing. To reduce dissension, some journals have begun to condition publication on an agreement that all of the listed authors recognize a right in the breeder to a specified period (typically, two years) of exclusivity. After that period lapses, the mice essentially fall into the public domain: free access is required.[76]

On the university side, the issues treated are mainly financial. As noted earlier, declines in public funding have turned universities inward, to the exploitation of innovations made on campus and with university resources. In most cases where changes have been made in work product policies, they have been in the direction of increasing university control. As to patents, many universities now require faculty (as a condition of employment) and students (as a condition to enrollment) to assign all rights to inventions made with substantial university resources. In exchange, the schools agree to take administrative control (applying for patents, negotiating licensing agreements) and to share royalties with the inventors (and in some cases, with the departments in which the work took place).[77] It is also be-

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75. Some journals even now require authors to sign a statement of responsibility along the following lines:

> AUTHORSHIP RESPONSIBILITY: "I certify that I have participated sufficiently in the conception and design of this work and the analysis of the data (when applicable), as well as the writing of the manuscript, to take public responsibility for it."

Instructions for Authors, 262 JAMA 2005, 2005 (1989), *reprinted in* Biagioli, *supra* note 26, at 8.

76. *See* Cohen, *supra* note 14.

77. For example, Cornell University requires all inventors, including faculty, research assistants, graduate students, and fellows, to assign all patent rights, except those that cover inventions made on the inventor's own time and without the use of Cornell's resources. If Cornell patents the invention and exploits the patent, the inventors share 50% of the first $100,000 earned. After that, the inventors receive a 25% share; the Cornell Research Foundation receives

coming more common for universities to claim ownership in raw materials, and to use that control to assure access. For example, Harvard's policy is to permit departing participants to take copies of anything that is capable of being copied. Where copying is impossible, reasonable access is guaranteed.[78]

Similar developments are occurring with respect to copyrights. At one time, universities largely ignored copyrights, probably because scholarship rarely paid off in a financial way. The output of computer science departments led to a change in outlook and the advent of the internet, which allows universities to package and distribute teaching materials as "distance learning," further enhances their interest. Accordingly, as universities revise their policies on patents, they now

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35%, and the remainder is split 60-40 between the research unit and the University. If Cornell does not choose to pursue its rights, they revert to the inventor. *See Cornell Patent and Copyright Policies* (last modified July 3, 1995) <http://www.research.cornell.edu/CRF/IPH/IPH5.html> [hereinafter *Cornell's Policies*]. At Harvard, the university claims rights in all medical inventions and all inventions made with substantial university involvement. The first $50,000 in royalties is split 35% to the inventors, 30% to the inventors' department (with half of these funds controlled by the inventors if they remain at Harvard); 20% to the Dean for use in research, teaching, and technology transfer programs, and 15% to the President, for similar programs. Above $75,000, the inventors receive 10% less and their department 10% more. *See Harvard University Statement of Policy in Regard to Inventions, Patents and Copyrights* (last amended Aug. 19, 1998) <http://www.techtransfer.harvard. edu/PatentPolicy.html> [hereinafter *Harvard's Policies*]; *Royal Sharing Policy* (viewed on Mar. 24, 2000) <http://icg.harvard.edu/greybook/final/92.html>. Schools vary considerably in the way that they distribute their royalties and, more subtly, in the way that they define the substantiality of involvement that triggers the duty to assign. Unfortunately, because these allocations are done privately, there are no specific examples to evaluate. However, the policies themselves are available on the web. *See, e.g., Guide to the Ownership, Distribution and Commercial Development of M.I.T. Technology*, <http://web.mit.edu/afs/athena.mit.edu/org/t/tlo/ www/guide.2.html> [hereinafter *M.I.T.'s Policies*]; *Inventions, Patents, and Licensing (RPH 5.1)* (last modified Feb. 10, 1998) <http://www.portfolio.stanford.edu/101243> [hereinafter *Stanford's Policies*] (displaying Stanford University's policies); *Office for Technology Licensing: Policy on Patents and Copyrights* (viewed on Mar. 24, 2000) <http://www.techtransfer.rf.ohio-state.edu/OTTPolicy.html> (displaying Ohio State University's policies); *Rensselaer Office of Technology Commercialization: Intellectual Property Policy* (viewed Mar. 24, 2000) <http://www.rpi.edu/dept/otc/pp/fact_sheet.html> (hereinafter *Rensselaer's Policies*) (displaying Rensselaer Polytechnic Institute's policies); *Rice University Research Policy No. 303-90: Intellectual Property Policy* (last modified Mar. 2, 1990) <http://www.ruf.rice.edu/~presiden/ Policies/Research/303-90.html>; *University of California Patent Policy* (last modified Aug. 15, 1997) <http://www.ucop.edu/ott/patentpolicy/first.html> [hereinafter *Berkeley's Policies*] (displaying University of California at Berkeley's policies); *see also* NAPAG REPORT, *supra* note 7, at 37 & 39-40 (endorsing a guideline approach to sponsored research that varies depending on the degree to which the sponsor assumes full research costs). For an analysis of practices at Columbia, Harvard, Iowa State, MIT, Michigan State, Stanford, Florida, Washington, Wisconsin (Madison), Yale, and Cornell Universities, as well as the University of Stellenbosch (South Africa), see Christo Viljoen, *Intellectual Property of Universities, and the Distribution of Royalties* <http://www.sun.ac.za/kie/kie1.htm.>.

78. Mishkin, *supra* note 15, at 927-28 (arguing that public interest requires that data and materials developed with federal support be available to any scientist who wishes to extend the research after it has been published).

also consider copyrights. A few treat copyrights just like patents: they consider the faculty (or student) author as the legal author. However, they then require an assignment of rights in any work made with substantial university resources. In exchange, the university agrees to handle administrative matters and to share royalties with the creators.[79]

More common, however, are universities that make use of copyright law's work for hire provisions. These provisions (discussed in greater detail later[80]) create two ways for employers to be deemed the authors of works made by their employees. First, work created by employees in the course of employment are considered works for hire. Second, there are categories of works that can, through a signed writing, be considered for hire even when not created in the course of formal employment.[81] Some schools rely on the first provision, announcing, for example, in their employment contracts or student and faculty handbooks, a policy that work on campus is for hire.[82] There is, however, a stumbling block in using this approach, for notions of academic freedom have created considerable controversy over whether scholarship should ever be viewed as created within the scope of employment. Indeed, it may surprise more than a few academics to learn that anyone thinks academic work is for hire.[83] Because of this uncer-

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79. *See supra* note 77 (listing such policies). Some universities specifically exclude graduate student theses. *See, e.g., Rensselaer's Policies, supra* note 77. For example, the University of Illinois excludes all work prepared by students for their degrees as well as "traditional academic copyrightable works." *Illinois' Policies, infra* note 84 (stating that the exclusion does not pertain to works that are also patentable). *But see* NAPAG REPORT, *supra* note 7, at 43 (concluding that British academics should "retain ownership of copyright in their writings and other works, so that they may publish them when and where they wish, without control by their institutions").

80. *See infra* text accompanying notes 153-69.

81. *See* 17 U.S.C. §§ 101, 201 (1994).

82. *See, e.g., Cornell's Policies, supra* note 77; *Harvard's Policies, supra* note 77; *M.I.T.'s Policies, supra* note 77.

83. Many commentators have considered academic work to be for hire, at least in some circumstances. *See, e.g.*, Leonard D. DuBoff, *An Academic's Copyright: Publish and Perish*, 32 J. COPYRIGHT SOC'Y 17 (1985); Estelle A. Fishbein, *Ownership of Research Data*, 66 ACAD. MED. 129, 133 (1991); Todd F. Simon, *Faculty Writings: Are They "Works Made for Hire" Under the 1976 Copyright Act?*, 9 J.C. & U.L. 485, 488 (1982-83); Margaret D. Smith & Perry A. Zirkel, *The Implications of* CCNV v. Reid *for the Educator-Author: Who Owns the Copyright?*, 63 EDUC. L. REP. 703 (1991); *cf.* Sherri L. Burr, *A Critical Assessment of Reid's Work for Hire Framework and Its Potential Impact on the Marketplace for Scholarly Works*, 24 J. MARSHALL L. REV. 119, 120 (1999) (emphasizing the issue whether the work is within the scope of employment); Russ VerSteeg, *Copyright and the Educational Process: The Right of Teacher Inception*, 75 IOWA L. REV. 381, 412-13 (1990) (arguing for the rejection of the general exception of faculty work). On the other side, *see, e.g.*, Pat K. Chew, *Faculty-Generated Inventions: Who Owns the Golden Egg?*, 1992 WIS. L. REV. 259, 261-62; Dreyfuss, *supra* note 27, at 593; Sunil R. Kulkarni, *All Professors Create Equally: Why Faculty Should Have Complete Control Over the Intellectual Property Rights in Their Creations*, 47 HASTINGS L.J. 221, 223-25 (1995); Laura G. Lape, *Ownership of Copy-*

tainty, there are schools that use the second route, claiming only works that fit within the statutory categories, and treating employment contracts and handbooks as signed writings.[84] Some institutions are dealing with the problem in yet another way: they are setting up separate, for-profit entities (for example, for distance learning materials) and then hiring their faculty and students as the employees of these entities. Work in which the school wants to claim a copyright interest is produced in the course of employment for the entity.[85]

Nonpecuniary matters have received some attention as well, especially in regard to graduate students, the most vulnerable of all academicians. Thus, some schools now require appropriate acknowledgment of students' intellectual contributions. The American Association of University Professors has, for example, included in its Statement on Professional Ethics that:

> [Professors] respect the confidential nature of the relationship between professor and student. They avoid any exploitation, harassment, or discriminatory treatment of students. They acknowledge significant academic or scholarly assistance from them.[86]

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rightable Works of University Professors: The Interplay Between the Copyright Act and University Copyright Policies, 37 VILL. L. REV. 223, 264-68 (1992);; Mark L. Meyer, *To Promote the Progress of Science and Useful Arts: The Protection of and Rights in Scientific Resesarch*, 39 IDEA 1 (1998); Reichman, *supra* note 34; Philip S. Bousquet, Note, *Externally Sponsored Faculty Research Under the "Work for Hire" Doctrine: Who's the Boss?*, 39 SYRACUSE L. REV. 1351, 1378-80 (1988); Michael J. Lluzum & Daniel S. Pupel, Jr., Comment, Weinstein v. University of Illinois: *The "Work-for-Hire" Doctrine and Procedural Due Process for Nontenured Faculty*, 15 J.C. & U.L. 369, 379 (1989); *see also* Bill L. Williamson, *Abusing Students: the Ethics of Faculty Use of a Student's Work Product*, 26 ARIZ. ST. L.J. 1029, 1029-32 (1994) (arguing that law schools should adopt standards to discourage unethical faculty exploitation of research assistants).

84. *See, e.g.*, *Stanford's Policies*, *supra* note 77; *Berkeley's Policies*, *supra* note 77; *Policy on Patents and Copyrights* (viewed on Mar. 25, 2000) <http://www.vpaa.uillinois.edu/policies/patents.htm> (University of Illinois) [hereinafter *Illinois' Policies*].

85. *See* Cox, *supra* note 4, at R26. The American Association of University Professors has recently promulgated a report suggesting that however a university chooses to handle the copyright problem, it should set the policy in advance, through negotiation with the faculty, and reduce the agreement to writing. At a minimum, faculty should be given credit for their contributions as well as the rights to reproduce their own works for teaching and utilize the material in them for future works. Faculty who work on "distance-education courseware," should hold a right of "first refusal" in making new versions. By the same token, universities should be allowed reimbursement for "unusual financial or technical support" used in creating works for which the faculty retain copyright. The American Association of University Professors Special Committee on Distance Education and Intellectual Property Issues, *Distance Education and Intellectual Property*, 85 ACADEME 41, 45 (1999) [hereinafter *Academe Report*].

86. AMERICAN ASSOCIATION OF UNIVERSITY PROFESSORS, STATEMENT ON PROFESSIONAL ETHICS II (1987), *reprinted* in Williamson, *supra* note 83, at n.16; *see also Academic Authorship*, *supra* note 23 (discussing the allocation of responsibility and credit for scholarly work, and why it is difficult to determine responsibility of authorship). These schools have also acted to assure that students are assigned ouly to projects chosen for their educative value, and not on account of the commercial interest of faculty/entrepreneurs. *But see* Sandip H. Patel, *Graduate Students' Ownership and Attribution Rights in Intellectual Property*, 71 IND. L.J. 481, 507-09 (1996) (arguing that insufficient attention has been paid to this issue); *id.* at 509 n.133 (pointing out

There are also universities that are considering ways to deal with issues of accuracy and accountability. Because of concerns that universal standards on acceptable research methodology and accuracy are either not feasible or an interference with academic freedom, many institutions interested in quality rely on clearance procedures.[87] Some work on a project-by-project basis (sometimes singling out externally-funded projects for special scrutiny), or they require a submission by every principal investigator.[88] Other institutions have dealt with the problem systematically, but after the fact, with procedures put into place to investigate allegations of fraud and plagiarism as they arise.[89] Finally, there is at least one university that has realized the special problems posed by multiple authorship: Stanford's Policy on Multi-Authored Research Papers gives principal investigators and senior faculty responsibility for insuring the cohesiveness and validity of publications on which their names appear as co-authors, and all authors "shared responsibility for published results."[90] The policy declines, however, to establish guidelines on determining who should be given authorship status.[91]

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that students are rarely involved in formulating the academic policies that do exist). *Cf.* NAPAG REPORT, *supra* note 7, at 34-35 (warning that the acquisition of intellectual property rights "should not be treated as an independent measure of academic achievement" for faculty or even for the institution at which the faculty teaches).

87. Harvard's position is illustrative. The University refuses to set specific standards on the ground that global rules are not feasible and that "allowing one segment of the academic community te impose its own standard of truth on another poses greater risks." Harvard does set policy on research techniques that threaten health, invade privacy, cause pain, or interfere with the research of others. Otherwise standards are maintained by careful selection of faculty members, and by reviewing research conducted under the auspices of an external sponsor. *See Principles Governing Research at Harvard* (visited Mar. 24, 2000) <http://www.fas.harvard.edu/~research/greybook/principles.html.> Similarly, the University of California requires personal participation by an academic appointee in every project. *See Contract and Grant Manual: 1-530 Who May Submit Proposals* (visited Mar. 24, 2000) <http://www.ucop.edu/raohome/cgmanual/chap01.html#1-530>.

88. *See, e.g., Principal Investigator (PI) Status for Academic Staff* (visited Mar. 24, 2000) <http://www.cals.wisc.edu/research/pistatus.html> (University of Wisconsin-Madison). Some of these policies are required by funding agencies. *See infra* text accompanying note 133-34.

89. *See generally* Dan L. Burk, *Research Misconduct: Deviance, Due Process, and the Disestablishment of Science*, 3 GEO. MASON INDEP. L. REV. 305, 332 (1995) (examining the social controls that the scientific community has relied upon te address problems of scientific misconduct); Helen Leskovac, *Academic Freedom and the Quality of Sponsored Research on Campus*, 13 REV. LITIG. 401, 420 (1994) (summarizing a variety of mechanisms by which universities could take control over academic research).

90. *See Multi-Authored Research Papers (RPH 2.7)* (last updated Nov. 30, 1989) <http://www.portfolio.stanford.edu/100886>.

91. *See On Academic Authorship (RPH 2.8)* (last updated Sept. 1985) <http://www.portfolio.stanford.edu/100885>.

Second order private solutions to collaborative problems are, in sum, extensive and increasing. However, they too appear to be insufficient to deal with all the difficulties. Obviously, they are operative only when there is an entity with the foresight or time to identify an issue and adopt a policy to deal with it. In the aftermath of the CNN controversy, journalists have also debated authorship and its relationship to accountability, but so far, no organization has stepped in to take the kind of control that the science journals are asserting.[92] Moreover, the solutions that do exist tend to fall short. They do not deal with all the issues. For example, university policies on treating students fairly tend to deal with student participation in faculty academic research, not faculty use of students in commercial enterprises, or university ownership of inventions generated entirely by students.[93] Also, the policies that do exist are often underenforced: journals with rules on access to unique products (such as knockout mice) have not pursued even the clearest of violators. Nor is it obvious that enforcement would be effective or in the public interest. After all, if enforcement is to be truly private, i.e. extrajudicial, the obvious recourse would be to refuse to publish the future work of violators. But that might simply drive these researchers to publish in other places. Of course, journals could cooperate with one another and "black list" particular scientists. However, that would have antitrust overtones, impair expressive interests, and impose opportunity costs in the unrealized value of the undispersed knowledge.[94]

Another problem with second order private solutions is that more than one entity can formulate them and there is little reason to believe that the formulations will be coordinated, or even consistent, with each other. For example, the efforts noted above to deal with

92. *See* Christiane Amanpour, *Not All Television Correspondents Are Nincompoops*, HOUS. CHRON., July 21, 1998, at 19, *available in* 1998 WL 3589479; James O. Goldsborough, *Peter Arnett: A Good Reputation Gone*, SAN DIEGO UNION-TRIB., July 13, 1998, at B7, *available in* 1998 WL 4020020.

93. Two situations at MIT are instructive of the sorts of situations that remain unresolved. *See* Amy Dockser Marcus, *MIT Seeds Inventions But Wants a Nice Cut of Profits They Yield*, WALL ST. J., July 20, 1999, at A1; Amy Dockser Marcus, *MIT Students, Lured to New Tech Firms, Get Caught in a Bind*, WALL ST. J., June 24, 1999, at A1, *available at* 1999 WL-WSJ 5457828. The first is a problem that students who work part time are encountering: the nondisclosure agreements they sign at work can be read as preventing their completion of assignments at school, particularly those set by professors who head companies that compete with their employers (and who might have designed the homework for the purpose of uncovering trade secrets). The second concerns the hefty claims MIT has made on the commercialization of a graduate research project.

94. *See, e.g.*, Louis M. Guenin, *Publishers' Honeymoon?*, 282 SCIENCE 1267, 1267-68 (1998) (noting the costs incurred in giving scientific journals copyright ownership of the articles published).

attribution problems tend to work at cross purposes. As we saw, the journal's answer to the problem of accountability is to develop criteria that decrease the number of people credited as authors. In the university setting, however, the interest is in making sure that everyone who contributes to the work is publicly acknowledged, leading to policies that increase the number of people to whom the work is attributed.[95]

Now, some commentators have suggested that there is a cure to this problem that will satisfy both interests. Unfortunately, the cure also appears to demand more cooperation than the relevant entities might engage in voluntarily. The idea is that the scientific community develop new categories of authorship. Drummond Rennie, deputy editor of JAMA, for example, has suggested taking the "film credit" approach, where one or two guarantors would be named.[96] Like the producer and director of a film, they would be responsible for the work as a whole and would accept the obligation to follow up on any problems that surface–for example, to investigate allegations of misconduct or inaccuracy. Other contributors would receive credit for exactly what they did–the statistician would get credit as statistician in the way that the composer of the sound track of a movie gets credit as composer.[97] Another suggestion is that journals limit the number of authors to those who are accountable for the work; other contributors would be named in an acknowledgment section that would include all who "have added usefully to the work." This could include those who conceived the idea, suggested a study design, or engaged in other

95. Work on data access problems is in similar disarray. *See* Ellen Murphy, *Agencies, Journals Set Some Rules*, 248 SCIENCE 954, 954 (1990). The same has been said for university policies on misconduct. *See, e.g.*, Burk, *supra* note 89, at 321 n.89 (reviewing misconduct procedures at different universities).

96. Rennie et al., *supra* note 27, at 579.

97. *See* Fiona Godlee, *Definition of "Authorship" May be Changed*, 312 BRITISH MED. J. 1501, 1501-02 (1996); *see also* Dorothy Nelkin, *The Performance of Science*, 352 THE LANCET 893 (1998). There is an interesting parallel between the rules of the Nobel Prize committee and the film writers contract: both limit the number of authors, regardless of how many people actually contributed to the work. *See, e.g.*, Philip H. Boffey, *Science Nobels: Do They Go to the Best?*, N.Y. TIMES, Oct. 18, 1983, at C1 (noting that the graduate student who first spotted a pulsar was left out when the physics prize was awarded for the discovery of pulsars; also suggesting that when there are more than three inventors, the discovery may not be awarded a prize at all); Malcolm W. Browne, *Ernst Ruska, a German Nobel Winner, Dies at 81*, N.Y. TIMES, May 31, 1988, at D14 (noting that the 1986 prize in Physics went to only three of the many inventers of the electron microscope);. There is also often a mismatch between the recipients of the prize and other forms of recognition, *see* Browne, *supra* (prize and patent); Malcolm W. Browne, *Nobel Fever: The Price of Rivalry*, N.Y. TIMES, Oct. 17, 1989, at C1 (prize and authorship list); *see also* Alexandra Witze, *A Double Dose of Nobel Chemistry at Rice*, DALLAS MORNING NEWS, Dec. 8, 1996, at E1 (noting dispute over who is *included* in the list of prize winners).

activity that moved the project forward.[98] These ideas are fine in so far as they solve the problem that journals like JAMA care about–assuring that someone is responsible for the quality of the work published. The contributors, however, are interested in their careers. Unless their institutions are willing to consider acknowledgment or film-style credit as a valuable credential for hiring and promotion purposes, this solution to the attribution/accountability dilemma is not likely to be effective.

There is also a question whether the bodies setting these policies are public-regarding enough. Journals are essentially controlled by the scientists they serve and thus can have interests that diverge from those of the public at large. There is, for example, something unsettling about allowing them to create an exclusive rights regime in knockout mice: it is almost like having inventor groups determine the length of the patent term. For universities, the conflicts of interest are multiple. As recent attempts to unionize graduate students suggest, universities have fiscal concerns of their own, making them less than enthusiastic about giving greater recognition to the labor of students.[99] As to faculty work product, schools are caught between their commitment to academic freedom on the one hand, and pressure from commercial partners on the other.[100] Further, university-set rules that distinguish between copyrights and patents, or between copyrights in computer materials and scholarly papers, create conflicts among individual departments.[101] Worse, academics in disciplines that do not utilize physical assets can often minimize the appearance of university involvement; academics who require facilities like laboratories and

98. See Richard Smith, *Authorship is Dying: Long Live Contribution*, 315 BRITISH MED. J. 696, 696 (1997). Interestingly, what is regarded as an important contribution is also expanding. When I presented a talk based on this Article at the University of California at Berkeley, someone suggested that peer reviewers should be considered participants. Although scientists have yet to fully move to that position, the journal *Science* has recently acknowledged their contribution. *See* Floyd E. Bloom, *The Importance of Reviewers*, 283 SCIENCE 789, 789 (1999) (noting the paucity of reward for this activity).

99. The unionizing efforts of graduate students largely go to issues of compensation for teaching. *See, e.g.*, Steven Greenhouse, *Rivals Harvard and Yale Hold Labor Conferences*, N.Y. TIMES, Apr. 19, 1999, at A16. From the University's perspective, however, recognizing rights in their work raises many of the same issues. *See* Patel, *supra* note 86, at 485-88; *see also* Constance Holden, *Report Paints Grim Outlook for Young Ph.D.s*, 281 SCIENCE 1584 (1998) (noting that universities are training more Ph.D.s than there are jobs, breeding destructive competition, suppression of scientific creativity, and lowering morale); *cf.* H.R. REP. No. 105-796, at 74 (1998), *reprinted in* 1998 U.S.C.C.A.N. 639, 650 (creating special rules on the liability of universities as service providers in recognition of the "special relationship which exists between universities and their faculty members (and their graduate student employees)").

100. *See, e.g.*, Leskovac, *supra* note 89, at 409-13.

101. *See* Kulkarni, *supra* note 83, at 224 (arguing for university ownership of all intellectual property rights in faculty work product).

computers cannot. The result is that different incentives are needed in different fields to assure that all the faculty disclose to the university work that comes within its ownership policy. Finally, universities have a sort of collective action problem: those that are aggressive about arrogating to themselves rights over faculty work product, or that impose strict rules of accountability, could find themselves at the short end of the stick at faculty recruitment time.

Private solutions also suffer from a lack of comprehensiveness. Experience shows that collaborators tend to resort to court when their agreements fall apart. Cases that involve allegations of misattribution can be brought as trademark, copyright, fraud, or even qui tam actions under the False Claims Act.[102] Claims about raw data and unique tangibles can sound in misappropriation, trespass, or conversion.[103] Arguments about royalties can be styled as breaches of fiduciary duty.[104] Misconduct investigations can be challenged as slanderous.[105] As it happens, many of the disputes in science involve female and/or foreign-born scientists; members of these groups can structure their complaints as discrimination claims.[106] In many of these cases, the law involved is not well suited to deal with innovation policy. And as others have pointed out, the law on information is extremely inconsistent; the same set of facts can lead to differing results, depending on how the claim is characterized.[107] Thus, while one court decides that a collaborator is a joint author, with full rights to use the work product of the collaboration, another tribunal may be finding that sole use of collaboratively produced materials is plagiarism.[108]

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102. *See* Lanham Act § 43(a), 15 U.S.C. § 1125(a) (1994) (trademark); University of Colorado Found., Inc. v. American Cyanamid Co., 196 F.3d 1366 (Fed. Cir. 1999) (fraud); United States *ex rel.* Berge v. Board of Trustees, 104 F.3d 1453 (1997) (qui tam); *see also* Christopher P. Perzan, Note, *Research and Realtors: The False Claims Act and Scientific Misconduct*, 70 WASH. U. L.Q. 639, 648-59 (1992).

103. *See* United States v. Arora, 860 F. Supp. 1091, 1092-93 (D. Md. 1994) (describing an investigator's access to raw data preserved through NIH suit against possessor of the data for trespass); Phinney v. Perlmutter, No. 90-689 NZ (Washternay Cty. Cir. Ct., 16 Sept. 1993), *described in* Mishkin, *supra* note 15, at 928 (presenting a situation where a postdoctoral fellow made a complaint against a faculty advisor who used her data to obtain NIH grant).

104. *See, e.g.*, Speck v. North Carolina Dairy Found., Inc., 319 S.E.2d 139, 140 (N.C. 1984).

105. *See, e.g.*, Eliot Marshall, *Investigations on Trial in a Texas Court*, 283 SCIENCE 913, 914 (1999).

106. *See, e.g.*, Eliot Marshall, *Dispute Slows Paper on "Remarkable" Vaccine*, 268 SCIENCE 1712 (1995) (describing discrimination suit brought by an Indian-born female scientist on account of being dropped as an author of a paper describing research that led to a patent in her name).

107. *See* James Boyle, *A Theory of Law and Information: Copyright, Spleens, Blackmail, and Insider Trading*, 80 CAL. L. REV. 1413, 1419-22 (1992).

108. *Compare* Weissmann v. Freeman, 868 F.2d 1313, 1317-21 (2d Cir. 1989) (researcher can advance collaboratively produced work on her own), *with* Marcia Baringa, *UCSF Case Raises*

2. Second Order Quasi Private Solutions: Public Funders.

Like universities and journals, the administrative agencies that support collaborative projects are also positioned to nurture the process. Such agencies are particularly prevalent in science, where much collaborative work takes place, but the arts are also often publicly subsidized, sometimes at the federal, sometimes at the state level. As with the parties, agencies have a great deal of expertise in their fields. They are close enough to the work to be capable of developing sophisticated rules, neatly tailored to specific circumstances and disciplines. Yet, they are genuinely public bodies, more concerned with the public interest than are the parties, or their universities and journals.

A comprehensive investigation of all government programs aimed at financing collaborative research is beyond the scope of this Article.[109] Accordingly this section takes a rather quick look at a narrow slice of government sponsored research: grants by the National Science Foundation (NSF) and the National Institutes of Health (NIH) to nonprofit organizations that come within the terms of the Bayh-Dole Act.[110] Because Bayh-Dole was expressly intended to balance the interest in encouraging commercial exploitation against the interest in a rich public domain,[111] this experience represents, in a sense, the "best case scenario" for the effectiveness of public funders in mediating among collaborators, and between collaborators and the public.

Questions About Grant Idea Ownership, 277 SCIENCE 1430 (1997) (describing a finding by a USCF faculty panel that a faculty member committed plagiarism by individually applying for a grant based on work completed by a collaboration in which he participated; the faculty member was then fired).

Another second order private solution would be the formulation of professional codes, such as the one that governs the legal profession, or union agreements of the type found in the motion picture industry. Many of the professions plagued by collaboration problems have not, however, moved in that direction. For a discussion of this issue in the scientific community, see Burk, *supra* note 89, at 320-326.

109. *See generally* Rebecca S. Eisenberg, *Public Research and Private Development: Patents and Technology Transfer in Government-Sponsored Research*, 82 VA. L. REV. 1663 (1996) (examining federally funded research); Guston, *supra* note 10, at 234 (noting the cooperation efforts of economists, sociologists, and political scientists to promote innovation); *Technology Transfer Bill Introduced*, 9 J. PROPRIETARY RTS. 29 (1997) (describing effort to streamline technology-related contracting).

110. *See* 35 U.S.C. §§ 200-12 (1994). For the Regulations adopted pursuant to this statute, see 37 C.F.R. § 401 (1994). The Act also covers research contracts with small business organizations. The NSF and NIH also run research facilities of their own and deal with many of the issues discussed here with respect te their own employees. *See, e.g.*, 37 C.F.R. § 501 (1994); National Institutes of Health, Guidelines for the Conduct of Research at the National Institutes of Health (Mar. 21, 1990 and as revised, 1994). Since intramural issues are similar to those experienced within universities, they are ignored for the purpose of this section.

111. *See* 35 U.S.C. § 200.

The Bayh-Dole Act itself is best viewed as dealing with the pecuniary side of collaborative problems. Prior to its enactment, patent rights in government-funded research were held by the funding agencies themselves and licensed out on a nonexclusive basis. Although nonexclusivity was thought to promote widespread use of public technology, there was a strong suspicion that the inability to acquire protection against free riders was a drag on utilization. Licensees knew that others could acquire the same licenses they had. Accordingly, no one licensee had sufficient incentive to invest in figuring out how to commercialize government inventions or developing new markets for them.[112] The Bayh-Dole Act corrected this problem by consolidating the right to exploit in a single entity. Subject to minor exceptions, mainly directed at national security, the Act permits certain institutions—nonprofits and small businesses—to apply for, hold, and exploit patents in inventions they discover with government funding.[113] The public winds up paying twice for such inventions, by both funding them and paying supracompetitive prices to use them. However, it benefits from the commercialization efforts that the Act encourages.

But although the main consequence of Bayh-Dole is to reduce the number of entities eligible to exploit government-funded inventions, it does not completely strip others of enjoyment of them. Collaborators are protected in two ways. Each inventor has a right to a share of the royalties an invention generates.[114] Moreover, an inventor can apply to acquire rights to any patent in which neither the grantee nor the government is interested.[115] As to the public, the protections are several. First, there is always a possibility that the invention will go into the public domain: grantees must disclose all their inventions to the funding agency, but they are not, in fact, required to apply for patent protection. If they do not, then the funding agency (or another agency) may apply for the patent.[116] If neither the government nor any inventor wishes to patent, the invention becomes freely available. Second, the patents held by grantees are subject to certain conditions that promote public usage. Thus, funding agencies retain nonexclusive, nontransferable licenses to utilize the inventions they funded, so long as their use is on behalf of the United States.[117] Furthermore,

112. *See generally* Eisenberg, *supra* note 109 (discussing the free rider problem, which disincentivizes development).

113. *See* 35 U.S.C. § 202(a).

114. *See* § 202(7)(b). However, if the inventor is a federal employee rather than an employee of the grantee, the funding agency may require the transfer of rights to the grantee. *See* § 202(e).

115. *See* § 202(d).

116. *See* § 202(c)(1), (d).

117. *See* § 202(c)(4).

grantees are directed to devote a portion of the profits to further research and education.[118] Finally, grantees must report their exploitation efforts.[119] If patents are not timely exploited, then the funding agency has the right to "march-in," that is, to require the grantee to grant licenses on reasonable terms or to assert its own interest in the patent.[120]

As to nonpecuniary issues, these are generally handled by each of the agencies individually and cover all work carried out with that agency's funds. The NSF and NIH take very similar approaches.[121] On dissemination, both agencies urge researchers to publish their results and share data and similar resources with others.[122]

Both agencies have also spent significant time considering questions of accountability and misconduct and both have developed fairly elaborate policies to safeguard the quality of material published and to punish wrongdoers. Currently, primary responsibility for misconduct at the NSF resides in its Deputy Director, who deals with these issues through the Office of the Inspector General (OIG).[123] Misconduct is defined by the NSF to include "[f]abrication, falsification, or other serious deviation from accepted practices in proposing, carrying out, or reporting results from activities funded by NSF."[124] When the NSF learns of an allegation of misconduct, it looks first to the grantee institution to pursue it.[125] If the grantee does not investigate in a

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118. *See* § 202(c)(7).

119. *See* § 202(c)(5).

120. *See* § 203.

121. For the NIH's guidelines, see *NIH Grants Policy Statement: Table of Contents* (last modified May 26, 1999) <http://grants.nih.gov/grants/policy/nihgps/index.htm>. The NSF also distributes grant policy materials electronically. For example, new policies under consideration are posted at <http://grants.nih.gov/grants/policy/policy.htm>.

122. *See, e.g., NIH Grants Policy Statement: Part H: Terms and Conditions of NIH Grant Awards—Part 5 of 7* (last modified Sept. 7, 1999) <http://grants.nih.gov/grants/policy/nihgps/part_ii_5.htm>:

> It is NIH policy to make available to the public the results and accomplishments of the activities that it funds. Therefore, [principal investigators] and grantee organizations are expected to make the results and accomplishments of their activities available to the research community and to the public at large . . . Grantees are encouraged to assert copyright in scientific and technical articles based on data produced under the grant where this is necessary to effect publication in academic, technical, or professional journals, symposia, proceedings, or similar works.

See also Chapter VII: Other Grant Requirements (last modified July, 1995) <http://www.nsf.gov/bfa/cpo/gpm95/ch7.htm#ch7-54> (displaying § 734(b) of the National Science Foundation's Grant Policy Manual regarding the "Dissemination and Sharing of Research Results").

123. *See* 45 C.F.R. § 689.8 (1999) (outlining the role of the Deputy Director in handing down "dispositions" following investigations of misconduct); *NSF Grant Policy Manual*, IX-5 - IX-6, 930-33, (last modified Aug. 3, 1995) <www.nsf.gov/cgi-bin/getpub?nsf9526>.

124. *See* 45 C.F.R. § 689.1(a).

125. *See* § 689.4(a).

timely fashion, then the agency institutes its own procedures.[126] These involve notice, review of materials, interviews with parties, an opportunity to be heard, and, in appropriate cases, "full adjudicatory hearings."[127] An appeal can be taken to the office of the Deputy Director.[128] Enforcement measures, which depend on the degree of reprehensibility, include issuance of letters of reprimand, implementation of special clearance procedures for subsequent grants, grant termination, and disbarment of individuals, departments, or institutions from NSF programs.[129]

Misconduct with respect to NIH grants is handled through the Department of Health and Human Services (HHS) and its Public Health Service, under the auspices of the Office of Scientific Integrity (OSI).[130] Misconduct constitutes: "fabrication, falsification, plagiarism, or other practices that seriously deviate from those that are commonly accepted within the scientific community."[131] Like NSF, NIH makes institutions accountable on issues of misconduct.[132] NIH, however, takes a more proactive role in requiring grantee institutions to shoulder this responsibility.[133] Thus, when an institution applies for a grant, one of the steps it must take is to certify that it has developed administrative procedures to deal with misconduct matters.[134] Principal investigators must also assure the integrity of their research.[135] When allegations of misconduct arise, it is on these institution-based procedures that NIH mainly relies.[136] Institutions must inaugurate an investigation, report progress, and, ultimately, conclusions to OSI.[137] OSI, however, retains authority to initiate an independent investigation of its own and to punish conduct it deems in violation of HHS policy.[138] Appeal of an enforcement decision is to a Grant Appeals Board, which is administered by the HHS.[139] Sanctions include "plac-

126. *See* § 689.5(a).
127. *See* § 689.5.
128. *See* § 689.9(a).
129. *See* § 689.2.
130. *See* 42 C.F.R. § 50.102 (1999).
131. *See id.*
132. *See id.*
133. *See id.* (establishing that the OSI, the Office of Scientific Integrity Review (OSIR), and the Public Health Service (PHS) all have active roles in monitoring misconduct).
134. *See* § 50.103(a).
135. See § 50.103(c)(2); *NIH Grants Policy Statement: Part II: Terms and Conditions of NIH Grant Awards-Part 2 of 7* (last modified Oct. 20, 1998) <http://grants.nih.gov/grants/policy/nihgps/part_ii_2.htm>.
136. *See* § 50.103(c).
137. *See* § 50.104.
138. *See* § 50.104(6).
139. *See* 45 C.F.R. § 16.3 (1999).

ing special conditions on awards or precluding the grantee from obtaining future awards for a specified period, or actions designed to prevent future noncompliance, such as closer monitoring."[140] In addition, NIH shares information concerning misconduct with the other agencies within HHS.[141]

Despite the breadth of these procedures and the obvious attention that has been paid to many of the issues that arise in collaborative work, agency actions only go so far. Although it can be hoped that well-written policies by a few important agencies will influence other funders, there will always be collaborative work that escapes these regimes. As with second order private solutions, there can be conflict between the guidelines set by different agencies. For example, NSF's definition of misconduct is not exactly the same as the NIH's.[142] And here, too, enforcement can be a problem. As to allocating economic interests, the Bayh-Dole Act does not create a private right of action to enforce institutional claims to patent rights.[143] Nor does the Act give inventors the right to challenge the way that institutions decide to divide royalties.[144] Rather, courts have decided that Congress intended to leave such issues to the "supply and demand of the market"[145]—essentially the same solution as is advocated by the economics and property theorists. Further, as far as has been ascertained, no agency has ever exercised its march-in rights.[146] While this may mean that exploitation of government funded discoveries is now satisfactory, it

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140. *See NIH Grants Policy Statement: Part II: Terms and Conditions of NIH Grant Awards-Part 7 of 7* (last modified Oct. 20, 1998) <http://www.nih.gov/grants/policy/nihgps/part_ii_7.htm#enforcement> (discussing enforcement actions).

141. *Id.*

142. *See* Kulynych, *supra* note 35 (describing the problems of lack of consensus on a definition of misconduct within the federal agencies and the study being conducted by the Research Integrity Panel (RIP) formed by an intergovernmental entity led by the White House Office of Science and Technology Policy (OSTP)).

143. *See* Gen-Probe Inc. v. Center for Neurological Study, 853 F. Supp. 1215, 1218 (S.D. Cal. 1993) (holding that there is no private right of action under § 202 of the Bayh-Dole Act te determine who owned patent rights to an invention made with government assistance).

144. *See* Platzer v. Sloan-Kettering Inst. for Cancer Research, 787 F. Supp. 360, 368 (S.D.N.Y. 1992), *aff'd without opinion*, 983 F.2d 1086 (Fed. Cir. 1992) (holding that Congress did not intend to impose a "sharing ration or minimum share" of royalties on institutions).

145. *See id.* at 368; *see also* Southern Research Inst. v. Griffin Corp., 938 F.2d 1249, 1255 (11th Cir. 1991) (holding that an institution must exhaust administrative remedies before it can challenge allocation of rights in court).

146. *See, e.g.*, Kevin W. McCabe, *Implications of the Cellpro Determination on Inventions Made with Federal Assistance: Will the Government Ever Exercise its March-in Right?*, 27 PUB. CONT. L.J. 645, 661 (1998) (arguing that "although the Government's march-in-right might never be exercised, the mere existence of that right serves important functions, justifying preservation"); Mark Stevenson, *Technology Transfer and March-in at the National Institutes of Health: Introducing Uncertainty into an Era of Private-Public Partnership*, 50 ADMIN. L. REV. 515, 518 (1998) ("Although agencies have initiated march-in proceedings, no agency has ever fully carried out such a procedure.").

tation of government funded discoveries is now satisfactory, it can also be argued that agencies are simply not overseeing the way that their research is being utilized.

Agencies likewise have had trouble enforcing their misconduct rules. As with universities and journals, these policies can be considered genuinely communal only if they are enforceable extrajudicially. Extrajudicial enforcement is also preferable because the costs of litigation must be borne by the same budgets as the costs of primary programs. However, the only extrajudicial sanction with real bite is disbarring scientists from grant programs. That approach has untoward implications for both expressive interests and resource utilization. As we saw, NIH is now moving toward primary reliance on institutional enforcement.[147] The previous subsection demonstrated the problems with that solution.

Even in the areas where HHS is active—for example, it continues to set policy on what constitutes misconduct—it has not been very successful. For instance, it recently released a new definition of misconduct as "misappropriation, misrepresentation, and interference." The definition was immediately attacked by the National Academy of Science as overbroad. Far from worrying that enforcement would be too lenient, the Academy was concerned that by replacing the previous category of "plagiarism" with "interference," accepted research practices would come under scrutiny.[148] Nor have HHS enforcement mechanisms received good grades from the legal community. A series of predecessors to the OSI were disbanded after criticism concerning both the substance and procedure of their decision making.[149] Part of the problem may be that there is little chance for the judiciary to provide the agencies with guidance, for here too it has been difficult to structure litigation that successfully airs these issues to court.[150]

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147. *See* Department of Health and Human Services, Office of Research Integrity, Annual Report, 1994 (April 1995) (noting also the presumption is that collaborators will determine how the products of research will be shared). *See generally* Burk, *supra* note 89 (examining the difficulties inherent in having scientists and scientific research institutions police themselves from misconduct).

148. *See* Kaiser, *supra* note 15, at 1735 (discussing the controversy surrounding the proposed adoption of a new definition of "misconduct" by the Department for Health and Human Services).

149. *See, e.g.*, David P. Hamilton, *Can OSI Withstand A Scientific Backlash?*, 253 SCIENCE 1084, 1084-86 (1991) (discussing the much-criticized system of OSI investigation of scientific misconduct); David P. Hamilton, *NIH Sued Over Misconduct Case*, 249 SCIENCE 471, 471 (1990) (examining "a legal battle over whether NIH affords the subjects of [investigations of scientific misconduct] their constitutionally guaranteed rights").

150. *See* Abbs v. Sullivan, 963 F.2d 918, 927-28 (7th Cir. 1992) (finding the court without jurisdiction to challenge NIH's policy of alerting other agencies to the possibility of misconduct because the plaintiff could not demonstrate harm); *see also* United Statos *ex rel.* Milam v. Regents of Univ. of Cal., 912 F. Supp. 868, 888 (1995) (finding for the defendant on all claims

II. INTELLECTUAL PROPERTY LAW

Part I demonstrated that there are significant impediments to allowing parties to deal, on their own or with institutional help, with the difficulties arising out of collaborative work. The remaining question is whether the formal legal system can do any better. There are many potential loci of juridic intervention, but because so many of the issues we have seen sound in intellectual property, copyright and patent concepts suggest these legal avenues as the most appropriate place in which to craft a regime supportive of social capital.[151] The first section of this Part describes the relationship between current intellectual property law and collaborative problems. The second section utilizes the deficiencies in the present system as the starting point for reconceiving the law to account for contemporary methods of intellectual production.

A. Current Concepts

1. Copyright Law

Because so much collaborative work—even in the patent industries—yields copyrightable publications, copyright is the obvious place to start. Indeed, copyright is so heavily implicated in most collaborations, some of the difficulties with this regime have already been alluded to. Thus, it was noted that on two key issues in collaborations, accountability and access to unique materials, the Copyright Act has little, if anything, to say.[152] But the larger problem with current copy-

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filed under the False Claims Act because the plaintiff failed to submit "a scintilla of evidence showing that [defendant] knowingly submitted false statements to NIH").

151. There are, of course, other legal controls over collaborative work, such as employment law and antitrust law. In the United States, there is virtually no codified employment law dealing with creative issues. *See* MARK A. ROTHSTEIN ET AL., EMPLOYMENT LAW § 8.14 (1994) (discussing the rights of technical employees). However, that is not the case all over. In many European countries, for example, employment law protects the right to be compensated for creative labor. *See, e.g.*, Rudolf Krasser, *The Law Relating to Employee's Inventions with Respect to Scientists at Universities and Research Institutions*, *in* EUROPEAN STRUCTURES, *supra* note 27, at 32-33.

152. *See* 17 U.S.C. §§ 101-1101 (1996 & Supp. 1999). There are no provisions on accountability. Tangible materials are mentioned in a few sections of the Copyright Act. Section 407, for example, requires deposit of works published in the United States, unless the work is exempted by the Register. *See* § 407. Section 202 provides that ownership of any of the exclusive rights of copyright are "distinct from ownership of any material object in which the work is embodied." § 202. Section 106A creates a right to protect the integrity of physical objects. *See* § 106A. This right, however, applies only to works of visual art, which are defined as paintings, drawings, prints, or sculptures and which exist in a single copy or in a limited edition of 200 copies or fewer. *See id.*; *see also* § 101. (defining "work of visual art").

right law is conceptual. The Act's provisions on multiple authorship are based on two paradigms: such work is either produced at the instigation of an "orchestrator," who chooses individuals to work for hire on particular aspects of the orchestrator's vision, or it is produced by a single or small group of individuals, working jointly. Neither of these paradigms map well on the collaborative efforts of today.

a. Work for Hire

The general contours of the work for hire doctrine were described earlier. Under the Act, work can be classified as for hire in two ways. First, if the work is "prepared by an employee in the scope of his or her employment," it is automatically for hire.[153] To meet this standard, the creative individual must be in an employment relationship with the "orchestrator," either via a contract or as an agent. In *Community for Creative Non-Violence v. Reid*, the Supreme Court set out the factors for determining employment status, including, most importantly, the right to control and assign, and in addition, the source of skills and instruments; the ability to determine the location and the duration of the project; and the right to set the terms of performance.[154] The second way for a work to be classified as for hire is if the parties have so agreed in a signed writing. However, only certain kinds of works are eligible for being considered work for hire under this provision: specially ordered or commissioned works for use in "a collective work, as part of a motion picture or other audiovisual work, as a translation, supplementary work" (e.g. as an illustration for an existing work), compilation, instructional text, test, answer materials for a test, or atlas.[155]

Once a work is for hire under either classification, the employer is the author and owns the copyright. Certain features of copyright law, such as the special protections of the Visual Artists Rights Act (VARA) and the termination provisions, no longer apply.[156] The employee's rights are limited to those of the employment or commissioning contract.[157] In this way, all exploitation decisions are put in the

153. § 101 (defining "work made for hire" in provision (1)).

154. Community for Creative Non-Violence v. Reid, 490 U.S. 730, 751-52 (1989). To date, the Court has not set out a test for determining when the work the employee does is within the scope of employment.

155. 17 U.S.C. § 101 (defining "work made for hire" in provision (2)).

156. *See* § 106A (discussing "rights of certain authors to attribution and integrity"); § 203 (discussing termination provisions); § 304(c) (discussing "termination of transfers and licensing covering extended renewal term").

157. § 201.

hands of a single entity—the employer. There can be no residual misunderstandings about who can build on the project, for so long as that elaboration falls within the definition of a derivative work, that right is also the employer's alone.[158]

At first blush, this doctrine appears to fit collaborations perfectly, especially in light of the suggestion set out above about basing credit for collaborative work in science on the model of the film industry. After all, the film industry was one of the primary forces shaping the work for hire doctrine;[159] if these rules worked well for Twentieth Century Fox, one might think that they would also work for Twenty-first Century Big Science. In fact, aside from the obvious financial motive, the main reason that universities have been eager to apply the work for hire doctrine to faculty work product is to attain precisely the objectives that the film industry was after–to consolidate exploitation decisions in the hands of a single entity and to reduce intracollaborative friction concerning future projects involving the output.[160] With a little tweaking, the statute could achieve these same goals for other collaborative efforts as well.[161]

Greater use of this classification would further interests other than consolidation of exploitation authority. As with the journal approaches to accountability, work for hire's authorship principle protects the public by putting someone on "the hook" for the accuracy of the final product. The formalities involved in obtaining a contract (for the first type of work for hire) or a written instrument (for the second type) protect collaborators. For example, the signature requirement for the second type of work for hire acts as notice that rights in the work product will be circumscribed. It also prompts a kind of "Coasian moment" in which expectations can be thrashed out, and rights to

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158. § 106(2).

159. See Jessica D. Litman, *Copyright, Compromise, and Legislative History*, 72 CORNELL L. REV. 857, 888-93 (1987) (discussing the involvement of members of the film industry in redefining the work for hire doctrine as originally laid down in the Copyright Act of 1909); *see also* REGISTER OF COPYRIGHTS, 88th CONG., 1st SESS., COPYRIGHT LAW REVISION PART 2: DISCUSSION AND COMMENTS ON REPORT ON THE GENERAL REVISION OF THE U.S. COPYRIGHT LAW 153 (Comm. Print 1963); Anne Marie Hill, Note, *The "Work for Hire" Definition in the Copyright Act of 1976: Conflict over Specially Ordered or Commissioned Works*, 74 CORNELL L. REV. 559, 567 (1989) ("Given that 40% of copyrighted works in 1965 were 'made for hire,' artist groups and representatives of book publishers and motion picture companies hotly debated the provisions pertaining to this classification of works.").

160. *See* Alberto Bercovitz, *Rights of Universities and Research Bodies Regarding the Results of Research Conducted in Their Institutes*, *in* EUROPEAN STRUCTURES, *supra* note 27, at 99, 104-05; Kulkarni, *supra* note 83, at 238 (outlining four primary, but suspect, reasons universities offer for intellectual property ownership of faculty creations).

161. As noted above, the statute now permits only specific categories of work to be classified for hire through a signed writing; to expand work for hire to other works, the statute would need to be revised. *See supra* note 155 and accompanying text.

credit, royalties, or future creative opportunities exchanged for other forms of compensation. Expanding the categories of work that could be considered for hire under the second approach would have special advantages in the university setting, for greater use of this route would make it unnecessary for universities to rely on the controversial scope-of-employment category. More important, there would be no need to declare all faculty work prepared in connection with the university as for hire. Individual faculty working on individual projects—where the problems of collaborations do not arise—would (unless circumstances dictated otherwise) be able to retain their rights.

Repeated reference to the longstanding controversy over the classification of faculty work product is, however, a hint that there is something profoundly wrong with this approach. From a practical perspective, at least with respect to tenured faculty and their scholarship, it is hard to see in the academic relationship any of the hallmarks of employment or agency. Tenured faculty are not required to engage in scholarly activities beyond teaching; they devise their scholarly agenda on their own, and pursue it in their own time, and at places of their own choosing.[162] Normatively, interference by a university in these kind of decisions might well be considered an impairment of academic freedom.

But the larger point is instrumental. Copyright's core goal is to foster creativity, not mere investment.[163] The work for hire doctrine is, therefore, best understood as a way to put decisions on disseminating, revising, or building on works in the hands of the entity that will maximize creative value, rather than on the entity that bankrolled the production.[164] Yet, it is a rare university administrator who is in the

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162. *See, e.g.*, Hays v. Sony Corp., 846 F.2d 412, 416 (7th Cir. 1988) (high school teachers) (Posner, J.); Respect, Inc. v. Committee on the Status of Women, 815 F. Supp. 1112, 1118 (N.D. Ill. 1993). Older cases also dealt with this issue. *See* Williams v. Weisser, 78 Cal. Rptr. 542, 546 (Cal. Ct. App. 1969); Sherrill v. Grieves, 57 Wash. L. Rep. 286, 20 Copyright Office Bulletin 675, 686 (D.C. Supreme Ct. 1929); *see also* Burr, *supra* note 83, at 142 (presenting both sides of the issue); Reichman, *supra* note 34, at 79. Interestingly, the same result seems to have been reached in Britain, which also has a work for hire policy, *see* NAPAG REPORT, *supra* note 7, at 58-59; William R. Cornish, *Ownership of Copyright in the Results of Academic Research: The Position in Common Law Countries and the EC, in* EUROPEAN STRUCTURES, *supra* note 27, at 94, 95-96; *see also* Bercovitz, *supra* note 160, at 107 (discussing academic freedom point in relation to German law).

163. *See, e.g.*, Feist Publications, Inc. v. Rural Tel. Serv., Co., 499 U.S. 340, 352-55 (1991).

164. *See, e.g.*, Dreyfuss, *supra* note 27, at 605-06; Lape, *supra* note 83, at 263-67; *cf.* Weinstein v. University of Ill., 811 F.2d 1091, 1094 (7th Cir. 1987) (noting that faculty ownership is an academic tradition) (Easterbrook, J.); Hanns Ullrich, *Rules on Ownership and Allocation of Intellectual Property in R&D Collaborations Between Science and Industry–Some Principles of Comparison, in* EUROPEAN STRUCTURES, *supra* note 27, at 138, 154-55 (making the same point about patentable work product).

position to be a good value maximizer. Put more generally, the simple fact is that most collaborative projects are nothing like movies. Of course, a few are. The CNN situation is an example; Arnett's work probably was for hire. The Larson case might also have been avoided had the hiring of the dramaturg been handled differently. In both these cases, the employee was basically fulfilling the vision of the employer. Armed with that vision, the employer was, perhaps, best positioned to take responsibility for the work (certainly, Peter Arnett thought so). However, as we saw in the discussion of Powell's work, many projects proceed as collaborations for the very reason that no entity possesses the skill set necessary to complete the entire project. If that is so, then it makes little sense for the law to behave as if there were a participant with sufficient understanding of the whole to make the right exploitation decisions, to vouch for correctness, or to make as good a future use of any element of the whole as the one who created that element in the first place.[165] In the case of sequential collaborations—chain novels, chain art, and the like, such an assumption is especially inappropriate. In these works, there is no unified vision—the whole idea is to see what output eventuates in the absence of such a vision.

The work for hire doctrine has a few other deficiencies as well. One of the major sources of protection for tangibles is the right of integrity found in VARA.[166] But that provision is not applicable to works for hire. To be sure, copyright also protects tangible products through its deposit requirement. Deposit, however, only applies to published works; the materials that are the subject of collaborative disputes (cell lines, reagents, etc.) are problematic precisely because

165. A concrete example is helpful. Compare the work of the composer of a motion picture sound track to the contribution that a statistician makes to a medical study. In the case of the composer, the point of the music is to emphasize the theme and mood of the film. The work is acceptable and complete when it does that; final say about what goes into the film belongs to the studio, or its representatives, the producer and director. Since completion is a subjective determination of the studio, it is the studio that should be looked at by the public as responsible for the work. In the case of the statistical analysis, however, acceptability depends on whether the statistician has correctly applied statistical tools to the data presented. Whether another entity—the statistician's university or the project's principal investigator—"wanted" that result is completely irrelevant to the question whether the work is satisfactory. Thus, while the public may be able to look to the university or the principal investigator to determine whether the statistician is a good collaborator, it cannot view the university or principal investigator as the guarantor of the statistical analysis. Nor can the public count on anyone other than the statistician to make further productive use of the work—no one else understands it the way the statistician does. *Cf.* Graham v. James, 46 U.S.P.Q. 2d 1760, 1764 (2d Cir. 1998) (finding that because a computer programmer was an independent contractor, he was allowed to revise and improve his product).

166. *See* 17 U.S.C. § 106A(a)(3) (1999).

they are not easily reproduced.[167] Furthermore, the theory of requiring a contract or a signed writing is that the requirement gives potential employees leverage with which to protect their rights. But in many collaborative situations, the parties have other relationships with one another that turn the signature into an inadequate bargaining tool. In the university setting, for example, untenured faculty may have difficulty refusing to sign.[168] Certainly, the students and research fellows who are often the protagonists of these disputes might be too concerned about getting their degrees or employment references to negotiate forcefully.[169]

b. Joint Authorship

It might be thought that if the problem with work for hire is that it imposes a hierarchical relationship among participants that distorts the account of their intellectual contributions, then the solution is to consider collaborators joint authors of their work product. Under the Act:

> A joint work is a work prepared by two or more authors with the intention that their contributions be merged into inseparable or interdependant parts of a unitary whole.[170]

All of the authors of joint works co-own the copyright in their work, meaning that each has a right to fully exploit it without the permission of other authors.[171] The financial interests of each participant is protected through a duty to account.[172] Joint authors can assign their rights to one another, permitting exclusivity to be achieved when

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167. *See* § 407. Deposit has other limitations: it applies only to U.S. works and is subject to exemptions. *See id.*

168. *See, e.g.*, Williamson, *supra* note 83, at n.17 (describing what he calls a "sensationalized Canadian case" where an associate professor shot four professors to death for forcing him to add their names to a paper).

169. Disputes involving students and postdocs include the David Baltimore case where the allegations were made by Margaret O'Toole, *see supra* text accompanying note 49; the Michigan study described in Marshall, *supra* note 35; *see also* United States *ex rel.* Berge v. University of Ala., 104 F.3d 1453, 1456 (4th Cir. 1997); Weissman v. Freeman, 868 F.2d 1313, 1323 (2d Cir. 1989) (holding that a former medical resident was entitled to use work product prepared with professor). *See generally* Williamson, *supra* note 83; Patel, *supra* note 86, at 506; Krasser, *supra* note 151, at 26, 32-33.

170. *See* 17 U.S.C. § 101.

171. *See* § 201(a).

172. *See* Community for Creative Non-Violence v. Reid, 846 F.2d 1485, 1498 (D.C. Cir. 1988), *aff'd on other grounds*, 490 U.S. 730 (1989). A joint author can, however, waive moral rights without consulting with co-authors. *See* 17 U.S.C. § 106A(e); *see also* Roberta Rosenthal Kwall, *How Fine Art Fares Post VARA*, 1 MARQ. INTELL. PROP. L. REV. 1, 43-51 (1997) (discussing the scope of moral rights protections of copyrights and the impact of the waiver provisions in the Copyright Act).

needed. But by giving full rights of authorship to each of the parties ab initio, each participant enters negotiations with power to bargain for a legal environment appropriate to his or her needs.

Inspection of the case law reveals, however, that there are problems with the joint authorship approach as well. Larson, the case over the rights to the musical Rent, is a good example.[173] As we saw, the dramaturg, Thomson, claimed that the effort she expended in bringing the workshop version up to Broadway standards entitled her to be considered an author of the work.[174] The court disagreed. It laid out a two-part test:

> A co-authorship claimant bears the burden of establishing that each of the putative co-authors (1) made independently copyrightable contributions to the work; and (2) fully intended to be co-authors.[175]

While the parties conceded that Thomson's contributions to the work were copyrightable, she lost on the second issue. Reasoning that Larson was the "dominant author,"[176] the court focused exclusively on evidence of his intent.[177] Finding that in both his understanding with Thomson and his agreement with NYTW, Larson retained all decision making authority; that in the playbill he had listed himself as author and Thomson as dramaturg; that he made agreements with third parties alone; and that in dealings with Billy Preston, an earlier collaborator, and with others, he had adamantly opposed sharing authorship credit, the court held Larson to be the sole author.[178]

Although the outcome of this case may seem reasonable, the opinion is worrisome in many ways. Most obviously, it failed to settle

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173. Thomson v. Larson, 147 F.3d 195, 197-98 (2d Cir. 1998).

174. Thomson was initially hired by the New York Theatre Workshop (NYTW) with a contract that provided that she would provide dramaturgical assistance and research in exchange for "a fee" of $2000 "in full consideration of the services to be rendered." Thomson would also receive billing credit as "Dramaturg." The agreement was silent as to any copyright interests or any issue of ownership with respect te the final work. Thomson had no agreement with Larson. When the play was moved to Broadway, Thomson signed a second contract with NYTW paying her $10,000 plus a nominal $50 per week for her dramaturgical services. *See id.*

175. *Id.* at 200. The test was drawn from an earlier Second Circuit case, also on the authorship of a play, Childress v. Taylor, 945 F.2d 500, 504-05 (2d Cir. 1991), and is supported by Professor Paul Goldstein's treatise, *see* 1 PAUL GOLDSTEIN, COPYRIGHT § 4.2.1.2 (1996). It has been followed by courts in other circuits. *See, e.g.*, Erickson v. Trinity Theatre, Inc., 13 F.3d 1061, 1068 (7th Cir. 1994); BTE v. Bonnecaze, 43 F. Supp. 2d 619, 622 (E.D. La. 1999); Cabrera v. Teatro Del Sesenta, Inc., 914 F. Supp. 743, 764 (D.P.R. 1995).

176. *See Larson*, 147 F.3d at 202.

177. Intent could only be inferred from the evidence, as Jonathan Larson died the day before the play opened (and well before it won a Pulitzer Prize for Drama, four Tony awards, six Drama Desk Awards, three Obeys and the Best Musical Award from the New York Drama Critics Circle). *See* Joanna Coles, *Author Author?*, THE GUARDIAN, Apr. 15, 1998.

178. *See Larson*, 147 F.3d at 202-05. He also promised Thomson that he "would never say that I wrote what you did." *Id.* at 207.

the status of the Thomson contributions. Does the Larson copyright encompass this work? If so, on what theory? (No one had claimed that the work was for hire). If the copyright is Larson's, does Thomson have an implied license to use her own material? Alternatively, is it Thomson who holds the copyright in her materials and Larson who has the license to use it? If the case had not settled, would the Thomson contributions to Rent now be beyond the use of everyone?[179] Given the rich resources that can be produced by collaborative efforts, there is a need for more direction on how the contributions of non-statutory authors can be utilized.

Equally troubling is the intent element of this two-part test. That intention is relevant is clear from the statute. However, the statutory reference to intent is quite different from the court's. Under the statute, there must be an intent to merge the works into an "inseparable or interdependent parts of a unitary whole";[180] according to the Second Circuit, there must be an intent to be co-authors.[181] The court's test creates a great deal of mischief, for it allows one collaborator—the dominant party—to lure others into contributing material to a unitary work, all the while withholding the intent to share in its economic and reputational benefits. Admittedly, the court realized that purely subjective judgments should not be enough to deprive creators of the benefits of their work.[182] However, the objective standard the court utilized is no help at all. In *Larson*, several of the factors—Larson's dealings with Billy Preston, his contract with NYTW, how he held himself out to third parties, how he eventually listed Thomson in the playbill—were not necessarily known to Thomson at the time she began to work on *Rent*. Thus, there was no way that she could have discovered in advance that she and Larson held very different ideas about authorship.

The *Larson* court apparently took this position in order to "guard against the risk that a sole author is denied exclusive authorship status simply because another person render[s] some form of assistance."[183] But the fact that someone *wants* to be a sole author does not necessarily mean that the person has the *skill* to be a sole author. It is difficult to see why any one collaborator's intentions about sole

179. According to the court, the issue of whether a contributor who made more than a *de minimis* contribution to an author's work retains any interest in that work had not been presented to the trial court. *See id.* at 206.

180. *Id.* at 199.

181. *Id.* at 201.

182. *Id.*

183. *Id.* at 202 (citing Childress v. Taylor, 945 F.2d 500, 504 (2d Cir. 1991)).

authorship should count if the work produced requires the intellectual effort of others. To put this another way, when more than one person works on a project, there is always risk that the incidents of authorship will be misallocated; the question is where the risk of error should fall. In the court's view, it should fall on the side of sole authorship, but it did not explain why. In fact, a strong argument can be made for allowing the risk to fall the other way, in favor of joint authorship. If the goal of the law is to realize all of the benefits from sunk creative efforts, to give creators the benefits of their reliance interests, and maximize the incentives to create, then the social cost of incorrectly stripping someone of authorship is higher than the cost of incorrectly classifying someone as a joint author. The costs of joint authorship are actually rather low. Dissemination is maximized: because every author has the power to fully utilize the work, no one can veto another's exploitation decisions. And because every author must account for uses, no one can grab an unjust share of the rewards. In contrast, the costs of sole authorship are fairly high. The decision to consider one participant a non-author strips that individual of everything: non-authors do not enjoy the power to use the work and they do not receive any of the profits that utilization generates. The court's rule therefore requires potential collaborators to discount their expected benefits by the probability of being deprived of all their rights. It reduces the incentive to create, the incentive to cooperate, and decreases dissemination of the work.

The court's solicitude for sole authorship is also somewhat curious, for those wanting sole authorship status can easily protect themselves. They can refrain from getting involved in unitary works that merge diverse contributions. Or, if they do not wish to forgo the benefits that come from working with others, they can enter into side agreements with their collaborators–a process that should be relatively easy for dominant players.[184] Indeed, one of the most jarring aspects of Larson (and its predecessor Childress v. Taylor) is the contrast between second-category work for hire and this vision of joint authorship. In the work for hire case, significant legislative efforts were made to give workers notice and bargaining leverage. In the joint authorship context, rather similarly situated collaborators get neither.

184. Admittedly, the *Childress* court considered the use of contracts to protect the interests of contributors. *Childress*, 945 F.2d at 507. However, the Second Circuit thought that the nondominant party should bear the onus of entoring into negotiations. *See id.* at 507. But as the anecdotal evidence reported here demonstrates, that is a very tall order. Indeed, the Copyright Act has a variety of provisions based on the assumption that authors lack the power to protect themselves. *See, e.g.*, 17 U.S.C. § 201(b) (1996) (writing requirement); § 203(a) (1996) (termination).

The intent standard is especially hard to understand in light of the court's other requirement, that each party make a copyrightable contribution. That standard does not flow inevitably from the statute anymore than does the definition of intent. For example, the late great copyright scholar Melville Nimmer would have even granted joint authorship status to de minimis contributors.[185] In Childress, the Second Circuit noted that the statute could, in fact, be interpreted to include someone who furnished nothing other than the idea for the work.[186] This approach has an important advantage in that it promotes creative output by providing incentives not only to express, but also to have thoughts worth expressing, and to transfer those thoughts to someone who can express them.

Nonetheless, the Second Circuit decided to require that each author make a copyrightable contribution. Interestingly, the court's decision is in harmony with (but not identical to) the journal proposals on authorship. As we saw, conception of the idea and design of the experiment, while currently sufficient involvement in a project to make the list of authors, would not be enough under these approaches. Like the Second Circuit, these journals are presumably aware that but for conception and experimental design, the reported results would not exist. However, they understand that there are sometimes instrumental reasons for downplaying these contributions when determining authorship. For the scientific community, the utilitarian goal is to achieve accountability.[187] In the Second Circuit's case, the stated reason is to "prevent some spurious claims by those who might otherwise try to share the fruits of the efforts of a sole author."[188] Given that this test, on its own, would screen out the editors and other minor contributors that the Second Circuit appears to be particularly concerned with,[189] one wonders why it also felt the need to adopt such a flagrantly one-sided test on intent.[190]

But the bottom line is this: if the Second Circuit's test on joint authorship is the law of the land (the Supreme Court has not spoken to the issue), then joint authorship is not an appropriate way in which

185. See 1 DAVID NIMMER & MELVILLE B. NIMMER, NIMMER ON COPYRIGHT § 6.07, at 6-20 (1999). For a deeper discussion of this issue, see Russ VerSteeg, *Defining "Author" For Purposes of Copyright*, 45 AM. U. L. REV. 1323, 1333-37 (1996).

186. *Childress*, 945 F.2d. at 506 (relying on the theory that an "author" in this context could easily mean "originator" of an idea).

187. *See* Biagioli, *supra* note 26, at 11-12.

188. *See Childress*, 945 F.2d at 507.

189. *See Larson*, 147 F.3d at 200 (citing *Childress*, 945 F.2d at 507).

190. For a similar critique on considering chain art jointly authored, see Chon, *supra* note 6, at 271-72.

to deal with collaborations. In a way, that is a pity because the part of the test that examines the contribution of the putative co-author is resonant with policies being considered on collaboration. However, the intent test is fair only if participants in the creative process know each another's plans. Unfortunately, many collaborations have features, such as cultural differences, divergent disciplinary practices, and valuation gaps, that make misunderstanding quite likely. Further, as applied, joint authorship suffers from the same hierarchical problems we saw in work for hire, for it privileges the dominant participant (or, perhaps, the first one in the group to have considered the project). In the university setting, in science, and perhaps in other areas, collaborators can have power relationships that do not match the level of expertise and intellectual investment that they bring to their work. Certain parties—the tenured professor, the principal investigator, the head of the research group—would receive authorship status under this test to the detriment of those who did the actual work and understand it enough to vouch for it and follow it up.

Joint authorship falls short in at least two other ways as well. Although the Visual Artists' Rights Act (VARA) supplements the protection copyright offers to the tangible products of joint authors, it deals with works of visual art, not reagents, data, knockout mice, and the like, which are at the center of many collaborative disputes.[191] In addition, there is a disjunction between academic notions of plagiarism and the legal concept of joint authorship, leading to a potential trap for the unwary. That is, while it is certainly possible for someone to commit plagiarism without committing copyright infringement—by, for example, taking uncopyrightable elements, like ideas or factual research results—one could easily believe that one had full rights to unilaterally use any work in which one enjoys a copyright interest. And yet, academics have been fired by their universities for utilizing material jointly authored with others.[192] In the final analysis, joint authorship produces as many controversies as it resolves.

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191. *See* 17 U.S.C. § 106(a) (1994).

192. *Compare* Weissmann v. Freeman, 868 F.2d 1313 (2d Cir. 1989) (researcher can advance collaboratively-produced work on her own), *with* Marcia Baringa, *UCSF Case Raises Questions About Grant Idea Ownership*, 277 SCIENCE 1430, 1430 (1997) (describing a finding by a USCF faculty panel that a faculty member committed plagiarism by individually applying for a grant based on work completed by a collaboration in which he participated; the faculty member was then fired).

2. Patent Law

Superficially, patent law should also provide a substantial legal safety net to collaborative production. Congress has, in fact, made important changes to the Patent Act with the express intent of nurturing collaborative efforts and improving information flows. For example, the standard on obviousness was altered in 1984 to take account of serial collaborations—the statute now prevents early work by one group of collaborators from rendering the work of a later group unpatentable when the inventions both groups worked on are commonly owned.[193] At the same time, Congress changed the priority rules so that collaborators can use the application date of any one of the collaborators.[194] Most important for our purposes, the definition of joint authorship was changed to acknowledge the episodic nature of the collaborative process. The statute, which requires all applications to be made in the name of the true inventor,[195] goes on to provide that:

> When an invention is made by two or more persons jointly, they shall apply for a patent jointly. . . . Inventors may apply for a patent jointly even though (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) each did not make a contribution to the subject matter of every claim of the patent.[196]

In fact, while there are many ways in which the rules on inventorship are similar to copyright's rules on joint authorship, where they differ, patent law is arguably more closely attuned to the needs of collaborative innovators. As in copyright, the test of inventorship involves more than having an inchoate idea. Instead, co-inventors must jointly conceive the idea and each must make an original contribution to the final solution to the problem at issue in at least one claim in the patent.[197] Those who achieve inventorship status acquire

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193. Patent Law Amendments Act of 1984, 35 U.S.C. § 103 (1994).

194. *See* §§ 103, 120; *see also* W. Fritz Fasse, *The Muddy Metaphysics of Joint Inventorship: Cleaning Up After the 1984 Amendments to 35 U.S.C. § 116*, 5 HARV. J. L. & TECH. 153, 167-72 (1992) (discussing legal difficulties posed by joint authorship).

195. 35 U.S.C. § 111.

196. § 116. Although § 116 is slightly ambiguous, other provisions of the Patent Act make it clear that the inventors must be working together. If the inventors were independent, then the other patentability requirements and the priority rules will single out one of these independent inventors (usually the first to invent) as the only one entitled to the patent. *See* §§ 102-03.

197. *See, e.g.*, Garrett Corp. v. United States, 422 F.2d 874, 881 (Ct. Cl. 1970) (contributing a "broad idea" is not enough); Brown v. Regents, 866 F. Supp. 439, 440 (N.D. Cal. 1994) (woman who took her cat to an animal virologist claiming that it had AIDS was not a co-inventor of feline T-lymphotropic virus (FIV), the test for FIV, or methods for vaccinating cats against the virus); *see also* Moore v. Regents, 793 P.2d 479, 497 (1990) (doctors were the inventors of a patented cell

the full right to utilize the work.[198] Exclusivity can be obtained through written assignment at any time, meaning that the negotiations that the signature requirement (theoretically) instigates can take place before or after invention, application, or patenting.[199] All patents name the actual inventors: since there is no such thing as a work for hire, there is no way that an employer can suppress attribution.[200] And although joinder problems are weak grounds on which to invalidate a patent,[201] courts tend to treat nonjoinder (failure to name an inventor) more seriously than they treat misjoinder (mistakenly naming a non-inventor).[202] In that way, both the courts and the Patent Office are enlisted in the effort of safeguarding the interests of inventors in receiving the reputational benefits of their discoveries, in the interests of the public in having names to associate with discoveries and in knowing where to find the information that may be necessary to follow up on the work described in the patent.

Patent law even has something to say on tangibles used in connection with patented works. The disclosure requirement forces applicants to reveal enough information to enable those with ordinary skill in the art to make the invention and to practice it. The statute further requires the inventor to reveal the best mode for using the invention.[203] In cases where products needed to meet these requirements cannot be duplicated by following written direction, the material must be deposited in government-approved depositories and made available to those wishing to follow up the work.[204]

But as good as patent law might look in theory, it too has its difficulties. Most troublesome are the effects of its rules on exploitation. Thus, each person who qualifies as an inventor can fully exploit

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line grown from patient's T-lymphocytes). *See generally* 1 DONALD S. CHISUM, CHISUM ON PATENTS, § 2.02[2], at 2-5 (1999) (discussing joint invention).

198. *See* 35 U.S.C. § 262.

199. *See* §§ 261-62; *see also* § 152 (patents can be issued to assignees).

200. In cases where the invention is subject to assignment but an inventor refuses to apply for a patent, the application can be made by the assignee–but only as agent for the inventor; the true inventor's name will ultimately appear on the patent. Legal representatives of dead inventors also have the power to apply. *See* §§ 117-18.

201. *See, e.g.*, Jamesbury Corp. v. United States, 518 F.2d 1384, 1395 (Ct. Cl. 1975); *see also* 35 U.S.C. § 256 (allowing correction to save a patent, if error occurred without deceptive intont).

202. *See, e.g.*, Mueller Brass Co. v. Reading Indus., 352 F. Supp. 1357, 1372 (E.D. Pa. 1972), *aff'd*, 487 F.2d 1395 (2d Cir. 1973); Fasse, *supra* note 194, at 163.

203. *See* 35 U.S.C. § 112.

204. *See* 37 C.F.R. §§ 1.801-.809 (1999) (PTO regulations on the deposit of biological materials); CHISUM, *supra* note 197, § 7.03[5], at 7-92; *see also* Scripps Clinic & Research Found. v. Genentech, Inc., 927 F.2d 1565, 1579 (Fed. Cir. 1991) (deposit to meet the best mode requirement). In addition, the Commissioner can order the applicant to furnish a model of the invention. *See* 35 U.S.C. § 114.

the invention and there is no duty to account.[205] Although there is some dispute on this point, each owner also appears to have a right to assign the patent to others.[206] Further, enforcement actions require all patentees to participate in the suit, but courts are reluctant to name absentees as involuntary plaintiffs.[207] Statutory coinventors are, therefore, at one another's mercy.[208] If they cannot manage to cooperate, they and their assignees can easily compete the price of embodiments down to cost. Finally, there is a common law shop right doctrine, which gives an employer a nonexclusive license in any inventions made with his or her resources.[209] Although the employer is only allowed to use the invention for business purposes and shop rights are not assignable, they can be transferred in connection with the sale of the business. As a result of such sales (or, more commonly, mergers), competition from an ex-employer can be far more substantial than the patentee may have anticipated at the time the invention was made.

The result of these exploitation rules is a rivalry that is potentially so destructive, the need to consolidate rights in a single owner is overwhelming. After the fact, the temptation is to squeeze out less significant players.[210] Indeed, exclusivity is so important, investors often want it assured before significant costs are incurred. In most cases, this is accomplished by establishing an employment relationship and making the duty to assign inventions to the employer a condition of employment.[211] In that process, employees can lose out. Often

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205. *See* 35 U.S.C. § 262.

206. *See generally* Robert P. Merges & Lawrence A. Locke, *Co-Ownership of Patents: A Comparative and Economic View*, 72 J. PAT. & TRADEMARK OFF. SOC'Y 586, 588 (1990) (also citing some scant contrary authority on the issue of assigning).

207. *See* Ethicon, Inc. v. U.S. Surgical Corp., 135 F.3d 1456, 1468 (Fed. Cir. 1998) (citing Willingham v. Lawton, 555 F.2d 1340 (6th Cir. 1977)); *see also* FED. R. CIV. P. 19. For a discussion of the question whether patentees can be joined as involuntary plaintiffs, see Carlson & Barney, *supra* note 37, at 264, which notes that, traditionally, they have not been regarded this way.

208. See *Ethieon*, 135 F.3d at 1468 (citing *Willingham*, 555 F.2d at 1340); *see also* Carlson & Barney, *supra* note 37, at 260-63; Merges & Locke, *supra* note 206, at 590.

209. See CHISUM, *supra* note 197, § 22.03[3], at 22-47.

210. *See, e.g., Ethicon*, 135 F.3d at 1459. My own experience in the pharmaceutical industry is that the bench scientists are often excluded in favor of the laboratory chief, even in cases where the bench scientist had the idea, and was begrudgingly granted the time and resources with which to do the work. *See also* Patel, *supra* note 86, at 510-11 (noting that universities endanger their patents when they leave graduate students–who are not subject to the assignment provisions of faculty contracts—off patont applications); *cf.* Krasser, *supra* note 151, at 32 (noting that under German law, graduate students are not in an employment relationship with their universities, and so rights over their contributions cannot be easily asserted by claiming that they are under an obligation to assign).

211. Indeed, the vast majority of inventions appear to be subject to assignment before patent issuance, most as a result of an employment relationship. *See* Lucy Gamon, Note, *Patent Law in the Context of Corporate Research*, 8 J. CORP. L. 497, 498 (1983) (noting that patent assignment

the obligation to assign is expressed in a form contract—in the university context, for example it can be set out in the employee handbook and then incorporated into faculty contracts by reference. Such contracts are usually considered enforceable even though negotiation can be quite minimal.[212] Moreover, whatever bargaining does take place occurs at the time the employee is hired, before there is any sense on the employee's part of what might be discovered or what its value is. Thus, these cases can raise many of the same problems we saw with respect to *ex ante* private solutions. Finally, even employees who manage to avoid signing an express assignment may nonetheless find that rights in the invention belong to the employer because courts will generally imply an obligation to assign from the fact that an employee was hired for the purpose of inventing.[213] In such cases, there are no negotiations, and thus no opportunity for employees to protect their interests.[214]

Patent law has other problems as well. Obviously, it applies to only a limited number of collaborations. Although patentable work often yields subject matter within the purview of copyright, the reverse is not true, except (perhaps) in the computer industry. And because the standard of creativity is higher in patent law than in copyright law, many intellectual efforts in the patent industries are not, in actual fact, patentable. The deposit requirement is also rather circumscribed. It applies mainly to biological materials and only to products needed to make or practice the actual patented invention. It

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data show that inventors employed by others garner 75% of all patents, that 1% of the labor force receives half of all patonts, and that engineers, most of whom are employed by corporations in order to invent, obtain forty times as many patents as all other occupational groups combined); Joseph Straus, *Current Issues in Patenting Research Results Close to Industrial Application*, *in* EUROPEAN STRUCTURES, *supra* note 27, at 7, 12 & 15-16 (citing patent statistics in the United States); *see also supra* note 77 (describing relevant university policies).

212. See Wright v. United States, 164 F.3d 267, 269 (5th Cir. 1999) (holding that the United States has the right to claim ownership of an employee's invention made during working hours with government funds even though it has no interest in patenting it); University Patents Inc. v. Kligman, 762 F. Supp. 1212, 1221-22 (E.D. Pa 1991) (university claim of ownership survives motion for summary judgment); Chew, *supra* note 83, at 286-93; Donna R. Euben, *The Faculty Handbook As a Contract: Is It Enforceable?*, ACADEME: BULLETIN OF THE AM. ASSOC. OF U. PROFESSORS, Sept./Oct. 1998, at 87.

213. *See, e.g.*, Standard Parts Co. v. Peck, 264 U.S. 52, 54 (1924); *University Patents*, 762 F. Supp. at 1228 (E.D. Pa 1991); CHISUM, *supra* note 197, § 22.03[2], at 22-29.

214. Because the factors that courts consider in determining whether to imply this obligation are so similar to the factors that courts use to determine whether work is for hire under the Copyright Act, the two situations almost converge. *Compare* Community for Creative Non-Violence v. Reid, 490 U.S. 730, 751-53 (1989), *with* CHISUM, *supra* note 197, § 22.03[2], at 22-30 to 22-33 (listing factors). *See also* Chew, *supra* note 83, at 265-71 (suggesting that university faculty are not hired to invent under these factors). *But see* Patel, *supra* noto 86, at 497-501 (arguing that faculty are not hired to invent, but that the copyrighted works they produce should be considered for hire).

does not apply to information produced in the course of testing the product or to other material produced at the time the invention was made.

In the end then, intellectual property law, as currently constituted, does not go far enough to mediate the interests of collaborators. Accordingly, it is no surprise that we see so many disputes. Intellectual property law does, however, contain many useful policies and practices: a demanding test for joint authorship and inventorship that filters out contributors who are not positioned to make the best use of the work or guaranty its accuracy; some requirements that push the parties to negotiate and equalize their bargaining power; some provision for access to tangibles. The next section suggests how the current regime could be adapted to provide the legal support that collaborative production requires.

B. Reshaping the Law

At this point, a cynic might say that the problem with the law is not that it fails to properly allocate authorship, but rather that it recognizes authorship as a category at all. Thus, there is an important trope in recent copyright literature debunking the concept of "romantic authorship." The idea emerged from Michel Foucault, Jacques Derrida, and the deconstructionist movement in literary theory, which emphasizes the ambiguity of text and the audience's role in attributing meaning to it.[215] The theory has been nurtured by historians like Mark Rose, who has shown how publishers created the authorship category not because they recognized the central importance of authors, but rather to achieve pecuniary objectives–because they thought it would be politically easier to convince Parliament to enact copyright legislation if the intended beneficiaries were said to be individuals.[216] The idea was then turned into a critique of copyright law by Martha Woodmansee, Peter Jaszi, James Boyle, and others.[217] Their

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215. *See, e.g.*, Jacques Derrida, *Structure, Sign & Play in the Discourse of the Human Sciences*, *in* WRITING AND DIFFERENCE 196-231 (Alan Bass trans., 1978); Michel Foucault, *What is an Author?*, *in* TEXTUAL STRATEGIES: PERSPECTIVES IN POST-STRUCTURALIST CRITICISM 141 (J. Harari ed., 1979).

216. *See* MARK ROSE, AUTHORS AND OWNERS: THE INVENTION OF COPYRIGHT (1993); *The Author as Proprietor:* Donaldson v. Becket *and the Geneology of Modern Authorship*, 23 REPRESENTATIONS 51, 54 (1988).

217. *See* James Boyle, *The Search for an Author: Shakespeare and the Framers*, 37 AM. U. L. REV. 625, 625-27 (1988); Peter Jaszi, *Toward a Theory of Copyright: The Metamorphases of "Authorship"*, 1991 DUKE L.J. 455, 455-63; Martha Woodmansee, *The Genius and Copyright: Economic and Legal Conditions of the Emergence of the "Author"*, 17 EIGHTEENTH-CENTURY STUD. 425, 426-27 (1984).

view (very simplified) is that nothing is genuinely creative and innovative; everyone just reworks the commons. The reason copyright law has so many problems (on determining originality, infringement, and the like) is that its conceptual categories are based on false assumptions: if there is no such thing as an original work of authorship, everything (or nothing) is infringement. In a sense, the collaborative problems discussed here support this thesis. They lay the so-called creative process on the table, exposing how putative innovators do no more than bring diverse elements together to make what appear to be major creative strides.[218] Thus, even if one were to disagree with the *general* proposition advanced by the anti-romanticists, one might want to argue that intellectual property rights are inapt when applied to collaborative works *in particular*, because the notion of romantic authorship in that context is demonstrably false.[219]

It is, however, hard to know just what to make of this critique, for it fits so poorly with our intuitive sense of what goes into the creative process, matches so little with what those who innovate expect from their efforts, and accounts not at all for the attention that employers, funders, and audiences pay to resumes, publications, credits, and track records.[220] More important, this view loses sight of the instrumental goals that intellectual property laws fulfill. For example, the deconstructionists do not dispute that audiences value fresh materials. But if grazing the common is not as hard as those who believe in romantic authorship make out–that is to say, if "information products" are not as creative as intellectual property law assumes–then in a way, intellectual property law is more necessary. An aim of law, after all, is to influence people to engage in socially valued activity, presumably including (what we now might recognize as) the prosaic business of generating intellectual output. The heavy emphasis that we saw journals place on authorship shows that there is also an instrumental role for the authorship category in assuring quality, accuracy, and the accessibility of work product for further use. Finally, the commentators miss the real significance of the history Rose has uncovered. The fact that it was publishers who lobbied for copyright

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218. *See* Peter Jaszi, *On the Author Effect: Contemporary Copyright and Collective Creativity*, 1992 CARDOZO ARTS & ENT. L.J. 293, 318-19 (juxtaposing overt collaborative work with "secret collaborations").

219. *See* Thomas K. Dreier, *Authorship and New Technologies from the Viewpoint of Civil Law Traditions*, 26 INT'L REV. INDUS. PROP. & COPYRIGHT L. 989 (1995).

220. For example, the "others" referred to in the previous paragraph are probably not so happy to have had their names omitted, despite the position they take on creativity. *See* Chon, *supra* note 6, at 274-75; Lemley, *supra* note 11, at 888-95 (discussing other deficiencies in the romantic authorship critique).

protection demonstrates that technology transfer is no easy task. Even if were not necessary (or justifiable) to compensate so-called "authors," the law would still need to assure an adequate return on the investments needed to bring their products to the marketplace.[221]

As noted at the end of the previous section, intellectual property law is actually not so far off the mark. Perhaps concepts like authorship and creativity are socially constructed and bear little relationship to what actually goes on in the process of innovation, but these constructs have mediated fairly effectively with production problems over several centuries. Given the paucity of other social support for the collaborative process, intellectual property law and terminology, with all their faults, are not irrational tools with which to work. To be sure, responses built around these tools may not go far enough—intellectual property law can say little, for example, about the wisdom of pushing academics into increasingly commercial realms; nor can it prevent scientists or reporters from falsifying their data. If properly restructured, however, intellectual property law can provide default rules, set policy, and supply public interest safeguards. This section considers two different ways to achieve these objectives and then (coming full circle) examines whether the parties should be allowed to contract out of the solutions proposed.

1. Modifying Intellectual Property Law

What emerges most glaringly from this account of copyright and patent law is that the problems are not in the laws' details—there are sufficient tools to deal with collaborations. What is missing is a realistic conception of what the collaborative process can entail. Collaboration is increasing because at this point in human intellectual history, innovation may be done at a level at which individuals (and firms) lose the capacity to work alone. When many distinct contributions are required, the end result can be the complete blending of inputs envisioned by current law. However, it is just as possible that the result will not be smooth or seamless or homogeneous. It may have texture, a texture so loose that single strands can be separately identified and teased out for individual development. As now constituted, neither copyright law nor patent law takes the possibility of texture into account. Certain participants are credited with the whole cloth, while the distinctive (and distinguishable) contributions of others are

221. This intuition is, in fact, the basis of the Bayh-Dole Act. *See supra* text accompanying notes 110-12.

ignored. Failure to appreciate the texture makes parties forget that attribution issues can be tricky and that each participant may start with a different idea about how his or her strand will be further utilized. Indeed, it may be the difference between the assumed texture of collaboration and its reality that accounts for the disconnect between the public's understanding of who is responsible for accuracy and the perceptions of the individuals actually involved. What is necessary, then, is to change the texture of the law to match the texture of this new type of collaborative output. This could be done either through common law or by statute.

a. Common Law Changes

A substantial impact could be effected through judge-made law. On the copyright side, a core problem is the lacuna that can appear when the Second Circuit's test of joint authorship is used to analyze multiple-creation. That is, there are apparently multi-authored works that are not for hire because of the absence of an employment contract, agency relationship, or written commission, which are also not joint works because one participant lacked the intent to share the attributes of authorship with others. These works fall into what might be called "the Larson gap," where their legal status is indeterminate. Perhaps they are to be considered authored solely by the dominant author; perhaps they are not fully exploitable by anyone—until courts start facing the ramifications of dispositions like Larson, there is no way to be certain.

To plug the Larson gap, courts would do well to take seriously the langnage of the statute, which speaks of the intent to merge contributions, not (as the Second Circuit put it) of the intent to be co-authors. As argued above, it is hard to justify a rule protecting those who hog rights to works they were incapable of creating themselves, especially when the requirement of a copyrightable contribution adequately deals with the concern the Second Circuit articulated, preventing minor contributors from sharing in the work.[222] More important, paying attention to the statute would bring into focus the divide the legislature considered crucial, which is the divide between contributions that are "inseparable or interdependant parts of a unitary whole"[223] and those that are not. In the former case, joint authorship rules function moderately well. So long as dominant authors know

222. *See, e.g.*, Thomson v. Larson, 147 F.3d 195, 200 (2d Cir. 1998); Childress v. Taylor, 945 F.2d 500, 507 (2d Cir. 1991).

223. *See* 17 U.S.C. § 101 (1998) (providing definition of "joint author").

they cannot silently veto the expectations of others, they will be forced to lay their plans on the table and negotiate. If Scotchmer is right, each participant will wind up with benefits that reflect the value that party contributes.[224] The participants and public will, however, understand responsibility for the work is jointly held by all the authors.

But as we have seen, the problem in many corroborative disputes is that while the work product's main significance depends on multiple contributions, the parts are not inseparable and they are not interdependent for all purposes. Indeed, some of the problems that arise stem precisely from the separability of the individual contributions. It is that which makes it difficult for one party to vouch for another's work, which creates the plagiarism charges, and which fosters disputes over who has rights to continue development. In these cases, what might make better sense is to give each collaborator a separate copyright in the work for which that collaborator was responsible.[225] The separate copyrights would identify who has rights to continued use of each element and allow the public to understand who guarantees its accuracy.[226]

The separate copyrights would also address another consideration that may have been animating the Second Circuit: the concern that secondary contributors would receive too rich a reward–an undivided half interest in the entire collaborative product.[227] Here, utilization of the work will force the parties into negotiations. Again, if the

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224. Of course, it is possible that the parties will not carry their intent off and the parts won't blend. That is one reason for creating a new category of work. *See infra* text accompanying notes 231-47. On the other hand, a good case can be made for keeping things simple by allowing the parties' intent te govern.

225. Indeed, one advantage of expanding the categories of copyrightable subject matter to include things like staging is that it will make this solution increasingly available. *See, e.g.*, McKinley, *supra* note 3, at B3.

226. In the Arnett situation for example, if the reporter was, indeed, responsible only for the performance of report, he might hold a copyright only in the taped interviews; the copyright in the analysis–the script–would be held by those who produced it.

English law works essentially in this way. For example, there are two copyrights subsisting in songs, one covers the music, the other the words. *See* Copyright, Designs and Patents Act 1988 § 3 (1) ("'[L]iterary work' means any work, other than a dramatic or musical work, which is written, spoken or sung [and] 'musical work' means a work consisting of music, exclusive of any words or action intended to be sung, spoken or performed with the music."). Each work can be infringed and exploited separately. *See, e.g.*, Williamson Music Ltd. v. The Pearson Partnership Ltd., [1987] Fleet St. Rptr. 97 (finding the parody of a song a possible infringement of the musical, but not the literary, work).

227. *See, e.g.*, *Childress*, 945 F.2d at 507 ("very few editors and even fewer writers would expect the editor to be accorded the status of joint author, *enjoying an undivided half interest* in the copyright in the published work.") (emphasis added).

economists are right, the final allocation of benefits should reflect the value of each author's contribution.[228]

On the patent side, there is no Larson gap, but the salient problem is similar to the one just mentioned. The liberal test for inventorship adopted in 1984 had an unforeseen consequence with regard to ownership: under this provision, contributing to a single claim entitles a researcher to joint inventorship status in the entire patent. But since inventorship and ownership have (absent assignment) traditionally gone hand-in-hand, post-1984, a minor contributor to one claim ends up with full rights in the patent, and with no duty to account or obligation to join in enforcement actions. There are two relatively straightforward ways to attack this problem. The first is to imply a duty to account; the second, to treat patentees who do not willingly join enforcement actions as involuntary plaintiffs.[229] In these ways, destructive competition among patentees would be eliminated. A third idea, which has been proposed by Judge Pauline Newman, is to disentangle the concepts of inventorship and ownership, and to recognize separate ownership of each of the individual claims in the patent.[230] Then, the rights of one who contributes to only part of a single claim would be limited to benefits arising from the practice of that claim. As in the copyright cases, this approach would lead the parties to negotiate a fair allocation of benefits. It would identify who has rights to follow on and who is responsible for accuracy. In addition, by limiting the reach of minor contributors, this approach would alleviate some of the pressure to squeeze them out.

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228. I am particularly indebted to Roberta Kwall and Michael Spence for these ideas: the former for convincing me that blended works could be treated as the copyright statute currently provides, the latter for the suggestion of recognizing separate copyrights.

229. *See* FED. R. CIV. P. 19. Carlson and Barney take a similar view on Rule 19; they would also prohibit co-inventors from granting *ex post facto* releases. *See* Carlson & Barney, *supra* note 37, at 254-65. These suggestions are meant disjunctively, but there is reason to adopt them simultaneously. Consider the situation where there is no duty to account, but absent patentees are considered impaired in their ability to protect their own interests, *see* FED. R. CIV. P. 19(a)(2)(i), or as making defendants vulnerable to multiple liability, *see* FED. R. CIV. P. 19(a)(2)(ii). In that situation, a problem would arise if the absent patentee was not subject to the court's personal jurisdiction—a problem that is likely in patent cases, where venue depends entirely on the location of the defendant. *See* 28 U.S.C. § 1400(b) (1994). In that instance, the court may find under 19(b) that the action should be dismissed. If, however, a duty to account is also implied, the 19(b) problem is solved because the suit would go forward with present patentees regarded as holding part of the recovery in trust for the absentee.

230. *See* Ethicon, Inc. v. Unitod States Surgical Corp., 135 F.3d 1456, 1468-72 (Fed. Cir. 1998) (Newman, J., dissenting).

b. Statutory Changes

Helpful as these changes are, they may not go far enough. First, it may not always be the case that concepts of copyrightability or strategies for drafting patent claims map perfectly on the nature or value of particular contributions. Thus, these approaches might under- or over-compensate particular contributors. Second, they leave gaps of their own. For example, there may be situations were contributions are inseparable, but the parties never intended to create a unitary whole (or vice versa). Third, these approaches would do very little about protecting tangible materials or deal with shop rights and other claims (such as university claims) that are largely based on the utilization of resources. Most important, the efficacy of these approaches depends heavily on the extent to which contributors can contract in ways that lead to both full utilization of the work and effective protection of individual interests. As others have noted, dividing property interests too finely can undermine their value.[231] And as we have seen, there are reasons to think the economists are not always right about the efficiency of negotiated solutions. Accordingly, it is worth considering whether the statutes should be altered to, at the very least, create better default rules. These could retain a broad view of the property in issue, but codify as a new doctrine, a principle of proportionality. This principle would acknowledge the special texture of work produced in certain collaborative processes and would allocate rights and duties in ways that recognize the distinctive nature of each contribution.

In copyright, the idea would be to recognize a new category of multi-authored product, the "collaborative work," which would encompass works that do not qualify as for hire and do not meet the joint authorship test of unitariness. The new provision would recognize the authorship status of every participant who has contributed material to such work and give each author pecuniary interests in the work proportional to that party's input. As with compulsory license provisions, the amount of compensation would be determined through private negotiation, backed up with compulsory arbitration in case negotiations fail.[232] Authors' rights to exploit and make derivative use of the product would also be divided proportionately. Thus, each author would be allowed to utilize and develop his or her own contribution

231. *See, e.g.*, Michael A. Heller, *The Boundaries of Private Property*, 108 YALE L.J. 1163 (1999); *see also* Carlson & Barney, *supra* note 37, at 259 (arguing that the Newman idea on patent ownership is burdensome).

232. *Cf.* Ullrich, *supra* note 164, at 149-54 (proposing what he terms a "partnership model").

and to enjoy an implied (compulsory) license to utilize the work of other contributors in so far as that were necessary to fully exploit individual derivative work rights. Compensation for exercise of the license would, again, be determined by private negotiation or arbitration. Access to tangible products produced in the course of generating the work would be treated similarly, with each participant entitled to products he or she developed as well as an implied license to use the products of others when needed to fully enjoy individual rights. As explained more fully below, the system for safeguarding tangible products could be borrowed from the depository requirements of patent law.[233]

The principle of proportionality could extend to reputational interests, thereby eliminating the incentive we saw earlier to bring complicated cases that are essentially about authorship, but which sound in concepts imported from trademark and tort law.[234] One way to do this would be to borrow from patent law's treatment of inventorship. Thus, only those who make creative contributions to the work would be considered statutory authors, but the naming of all authors, along with their contributions, would be mandatory. In other words, if any one author published the entire work and attributed the work to some, but not all, of the collaborators, or failed to accurately specify the nature of each contribution, the copyright could not be enforced until the problem was corrected, for example, by the subsequent publication of a notice in the journal that published the original material.[235] Publications that are not corrected within a reasonable time could trigger a finding of copyright invalidity.

Adopting proportionality as a principle of copyright would make a significant improvement in the accountability and misconduct problems. Indeed, the approach would be quite similar to the ones that scientific journals are considering: a collaborator would have rights in, and be held responsible for, any work in which he or she enjoyed authorship status. Since, under this proposal, copyright would usually be unenforceable unless each collaborator's role was specified, each participant would know what parts of the work could be used without being accused of plagiarism. At the same time, the public would know whom to hold accountable for errors. Determining responsibility in this way has a side benefit, for it encourages participants to discuss their contributions, to expressly designate their contribution to the

233. *See infra* text in the paragraph prior to note 249.

234. *See supra* text accompanying notes 102-08.

235. Some modifications would be necessary if the right to publish anonymously or pseudononymously is to be preserved.

overall work, and to claim rights over no more than they actually contributed.

Of course, the devil in a proposal like this one is in its details. One problem is the creation of clear distinctions between the three categories of multi-authored works. It is tempting to take a page from the second category of works for hire and introduce yet another signed writing requirement—either for joint works or for collaborative works. As we saw, such formalities have attractive features in that they provide notice, an opportunity to bargain, and give even minor participants leverage. These formalities tend, however, to be problematic for creative people as many are not counseled. At the same time, the leverage that is supposedly created is often illusory. Better would be to handle the issue with presumptions. Works for hire could be left as is. There would be a presumption that other multi-authored works are joint works, not collaborative. That presumption could be rebutted with a written instrument, or—as in *Larson*—with evidence of actual negotiations, representations to others, and the like. In addition, it could be countered by demonstrating that the output is, indeed, divisible–that the strands are distinct and could be used and built upon separately. In this way, of the two rules (joint and collaborative authorship), the one most protective of collaborators and most in tune with the social interest in maximizing usage of creative materials—the joint authorship rule—would be the default position. Even though parties could vary the result by deliberate action, they could not, without a signed contract with every participant, vary them so much that particular contributors were left with nothing. Thus, dominant players like Larson could not introduce evidence negating joint authorship and wind up with plenary rights to the work of all contributors. Instead, the sort of evidence Larson presented would lead only to a finding of collaborative authorship. To be a sole author, he would have had to open a discussion on expectations with Thomson.

Next, there is the question of how much of a contribution needs to be made to entitle a participant to collaborative authorship status. As we saw in Larson and in the journal proposals on attribution, there are reasons to eliminate people who do no more than suggest inchoate ideas. On the other hand, it is certainly conceivable that important contributions will be made that are not copyrightable in the strict sense of that term. Not all collaborators participate in reducing their work product to writing, with the result that some contributions will not meet the fixation requirement of copyright law.[236] Moreover, some

236. *See* 17 U.S.C. § 102 (1998). *See generally*, VerSteeg, *supra* note 185.

concrete contributions—especially in the sciences—will not be copyrightable because they are facts, arrayed prosaically or especially efficiently.[237] However, these need not be fatal stumbling blocks. Some unfixed contributions will come within copyright because the person who fixes the work does so under the authority of the contributor. In other situations, there is a choice of approaches. One would be to borrow from the analysis of preemption issues: so long as the work came "within one of the general subject matter categories" of the statute, it would be considered within the purview of this regime, even if not copyrightable in the strict sense of the term.[238] Alternatively (or additionally), the new provision could adopt a second proportionality principle. This provision would depart from copyright tradition to create rights that are not encompassed in the statute's conception of authorship. Other important contributions—instigating the project, finding funding, providing resources, critiquing output—would be formally acknowledged and receive proportionate compensation, possibly in the form of reimbursement for expenses (plus interest).[239]

Another set of important questions concern the implied license. First, there is the issue of scope. Under the proposal, some collaborators will have limited rights to utilize the work of other contributors; the question, then, will be the ambit of this authority. Although answering that question will sometimes be difficult, it can presumably be handled similarly to the way that patent law determines the contours of a shop right[240] or an intervening right.[241] Second is the matter of compensation. Some uses would be classified as fair under the Copyright Act.[242] These should remain free, for there is no reason to treat collaborators less favorably than strangers to the creative process. While setting values on other uses will often be difficult, it will be no more so than determining damages in an infringement action or royal-

237. *See, e.g.*, Feist Publications, Inc. v. Rural Tel. Serv. Co., 499 U.S. 340 (1991).

238. *See, e.g.*, Baltimore Orioles, Inc. v. Major League Baseball Players Ass'n, 805 F.2d 663 (7th Cir. 1986).

239. *See, e.g.*, *Academe Report*, *supra* note 85, at 45 (suggesting that when faculty own copyrights in their work, universities should be reimbursed for "unusual financial and technical support"). In the academic setting, the university could be granted a right to use the matorial for instructional purposes. *See generally* Dennis Angel & Samuel W. Tannenbaum, *Work Made for Hire Under S. 22*, 22 N.Y.L. SCH. L. REV. 209, 212 (1976) (arguing that Congress specifically intended to exclude this option in the 1976 Copyright Act).

240. *See supra* text accompanying note 209.

241. *See* 35 U.S.C. § 252 (1997), *see, e.g.*, Seattle Box Co. v. Industrial Crating & Packing Inc., 756 F.2d 1574 (Fed. Cir. 1985); CHISUM, *supra* note 197, at § 15.05[2]. Another analogy may be to prior user rights under foreign patent laws.

242. *See* 17 U.S.C. § 107 (1998).

ties under the statutory licenses in the Copyright Act.[243] As noted above, a duty to bargain or accept arbitration could be imposed.[244]

Some of these ideas are foreign to copyright law, but none is completely unfamiliar. There is precedent in copyright law for requiring negotiations over royalty allocation, and backing the requirement up with compulsory arbitration.[245] The notion of holding the copyright invalid for nonjoinder is not very different from patent law. The system for correcting errors is akin to the way that copyright has handled the omission of notice.[246] Although the requirement can be criticized for allowing a single collaborator to undermine the rights of the others, it can be justified as utilizing peer pressure to deter failures of attribution (which could also be considered plagiarism). The suggested provision is, at least, softer than the comparable provision in patent law, where a patent can be held invalid as to all inventors, even in certain cases where only a single party acts with deceptive intent.[247] Here, intent is not relevant, nor is the nature of the error.

If copyright law is restructured with a proportionality principle, so too should be patent law. A statutory modification could deal not only with the problems arising from the liberal test for inventorship and the lack of a duty to account or obligation to join in suits, but also with shop rights, the problems of poorly leveraged inventors (like graduate students), and the hardship caused by the current penalties for misjoinder.[248] Under a proportionality approach to inventorship and ownership, anyone who makes the statutorily required contribution to an invention would continue to be named as an inventor. However, each contributor's rights would be limited to the claims to which that participant contributed. The contributors' reward would be determined in a way analogous to that suggested for authors. To protect rights to improve on the work, each inventor would also be granted an implied license to use other inventions protected by the patent and other patents based on the collaborative work to the extent that were required. At the same time, shop rights could be eliminated and em-

243. *See* §§ 108-20. If a suggestion that the Supreme Court made in *Campbell v. Acuff-Rose Music, Inc.*, 510 U.S. 569, 578 n.10 (1994), is adopted, imputing royalties will also become more common in certain fair use cases.

244. A duty to bargain or accept arbitration could also be used to make decisions on termination. *See* 17 U.S.C. § 203.

245. *See, e.g.*, § 115(c)(3)(D).

246. *See, e.g.*, §§ 405, 406.

247. *See, e.g.*, Stark v. Advanced Magnetics, Inc., 119 F.3d 1551, 1556 (Fed. Cir. 1997) ("One bad apple spoils the entire barrel. Misdeeds of co-inventors . . . can affect the property rights of an otherwise innocent individual.").

248. *See* 35 U.S.C. § 256 (1994).

ployers reimbursed for their resources or compensated in proportion to the benefits these resources bestowed.

Another new provision could deal with access interests in the products developed in the course of the project. There are several alternatives. One possibility would be to require, as a condition of receiving a patent, that access to unique materials be made available to all; another is to limit public access for a period of years, but to provide complete access to every collaborator. A third alternative is to grant each inventor rights in the materials that inventor developed, along with an implied license to use any product that is necessary to continue with the research which that inventor contributed to the patented product. The avenue for safeguarding these materials could be the depository system currently used for biologicals, but with access limited in a way that reflects the alternative adopted.

As to both the copyright and patent proposals, feasibility is, of course, an important consideration: problematical schemes are not usually improved by making them even more complex. The short answer is that, at least on the copyright side, many features of this proposal are similar to rules on authorship now in effect in the Netherlands. Dutch law recognizes several categories of multi-authored works and even sets out special provisions for certain works that are routinely produced collaboratively, such as films and computer programs.[249] As in the proposal here, there are situations where an author retains the right to utilize her own contribution separately, even though rights—and even authorship—of the entire work vest with others.[250] Despite their complexity, these provisions have not, apparently, engendered significant disputes.

But even if Dutch law "works" in the sense that there are no lawsuits, the suggested changes still raise concerns about technology transfer. Because the proposal recognizes categories of work that cannot be used without the creators incurring transaction costs and licensing fees, there could be some decrease in exploitation.[251] The

249. *See* Dutch Copyright Act of 1912, Arts. 5-9, 26 (creating categories of works that are separable, created by an employee, and jointly created), 45(a)-(g), 45(h)-(n), *translation in Institute for Information Law* (visited Mar. 29, 2000) <http://www.ivir.nl/final-uk1.html>.

250. *See, e.g., id.* at Art. 45(g) (giving an author right to use his or her own separable contribution to a cinematographic work, so long as exploitation of the work as a whole is not prejudiced).

251. For example, utilization of copyrighted works will decline every time a work that would have been jointly authored under current law is classified as collaborative. Significantly, Dutch law has an interesting way to guard against a major source of exploitation difficulties: the blocking-rights problem that could be created under a system like England's, where each collaborator is given rights in that party's individual separable contribution. Article 5 recognizes

question, however, is not whether this system is perfect, but whether it is better than the alternatives. Even if there are specific instances of suboptimal utilization, the suggested system is likely to produce, over all, more—or at least better—utilization than obtains under current law. For copyright, the proposal creates a default rule, that fills the gap left by *Larson*. Furthermore, the ability to recover costs should decrease the need for universities to rely on the work for hire doctrine, with the result that those best attuned to the creative issues (e.g. faculty) would largely retain control over dissemination. A similar effect will be achieved on the patent side, where the duty to account is structured in a way that permits greater recognition of the rights of minor contributors, while eliminating the risks associated with the shop right doctrine.

There are, needless to say, other approaches to collaborative products. For example, a new regime could be devised to deal exclusively with basic research.[252] I have, however, elsewhere examined the many problems entailed in adopting sui generis schemes every time existing protection is found wanting.[253] Alternatively, sets of gnidelines could be adopted that describe the way that rights and duties are to be allocated for a series of typical collaborative situations. Although the guidelines would not cover all situations, courts could be instructed to apply which ever one most closely resembled the situation at hand. This approach has been suggested in Britain on the theory that collaborations can take too many forms to be susceptible to uniform solution.[254] German law already has regulations on government-sponsored research that are tailored to specific collaborative situations,[255] and the EU has proposed a model collaborative contract to deal with specified arrangements.[256] However, as Hanns Ullrich has pointed out with respect to the EU and German approaches, there are several reasons to doubt that these models will be of much utility as applied to ad hoc collaborations, especially when the collaborators are individuals. The agreements tend to be based on the collaborative

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plenary rights in the overall supervisor of the project, as well as individual rights in each separable contribution.

252. *See* Meyer, *supra* note 83, at 31-34.

253. *See* Rochelle Cooper Dreyfuss, *Information Products: A Challenge to Intellectual Property Theory*, 20 J. INT'L L. & POL. 897, 912-18 (1988).

254. *See* NAPAG REPORT, *supra* note 7, at 38-39.

255. *See* Ullrich, *supra* note 164, at 147-49 (noting that government-sponsored research is classified according to the identity of the researchers: commercial entities or research institutions. These regulations control relations among the researchers, including their rights to use separable contributions, and also the rights of third parties to utilize their output.)

256. The model EU contract is reproduced as an appendix to Ullrich, *supra* note 164, at 158-68.

methodologies that existed at the time of the drafting. They deal—sometimes in "microscopic detail"—with the needs of the specific entities who evolved them.[257] These entities are usually large commercial enterprises that are wary of the loss of control entailed in joint ownership. Thus, while it is true that the agreements facilitate the sharing of mutually developed technologies, mutual development is not their real goal. The real goal is to subdivide the work so that sharing is minimized. Although that makes it easier for the participants to decide who owns what, these arrangements inhibit information flows among creators. Finally, these models fail to articulate a new normative view of the relationship between collaborators and a work product that none could have realized alone.

2. Contracting Out

Revising intellectual property laws to deal with collaborative work is not likely to eliminate collaborators' desire to devise agreements better tailored to their own interests. As noted, commercial entities tend to prefer—sometimes to insist upon—sole ownership of the intellectual products that their investments produce. Only sole ownership allows them to maximize their returns and control future developments. By the same token, universities are not likely to lose their interest in controlling faculty output. As we saw, there is a great deal to be said for private arrangements. But although they should be allowed as a general matter, the discussion in Part I argues for giving courts a role in scrutinizing them on fairness and public interest grounds. As to the latter, particularized discussion of specific contract provisions are beyond the scope of this paper, except to say that there are certain features of intellectual property law, such as the right of fair use in copyright, that should be considered nonwaivable.[258] Other contract provisions have minimum spillover effects on third parties, or have positive and negative externalities that balance each other out—such provisions should, absent other considerations, be enforced.[259]

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257. *See id.* at 149-51.

258. *See* J.H. Reichman & Jonathan A. Franklin, *Privately Legislated Intellectual Property Rights: Reconciling Freedom of Contract with Public-Good Uses of Information*, 147 U. PA. L. REV. 875 (1999). For an example of such laws, see Belgian Industrial Property and Copyright Law, Art. 22(1) (Jan. 1995) (barring the author of a published work from prohibiting such activities as fair use), *translated in* 31 COPYRIGHT LAWS AND NEIGHBORING TREATIES, BELGIUM TEXT 1-01, at 002-009, *in* INDUSTRIAL PROPERTY AND COPYRIGHT: MONTHLY REVIEW OF THE WORLD INTELLECTUAL PROPERTY ORGANIZATION (1995).

259. *Cf.* Reichman & Franklin, *supra* note 258, at 881, 929-30 (proposing a doctrine of "public-interest unconscionability" to review nonnegotiated licenses that impinge upon public interest safeguards in copyright law).

As to fairness, courts should certainly look at the procedure whereby intellectual property rights are transferred to determine whether the agreement is a product of genuine negotiation, or at least a meaningful opportunity to bargain. In most cases involving transfers between commercial entities or among individuals, bargaining power is likely to be equivalent, and so there should be a heavy burden on the party resisting enforcement. More difficult will be cases about agreements (usually assignments of rights) between creative individuals and business entities. If courts were to scrutinize such agreements on procedural grounds alone, the result could go too far. Because of the inequality in power, most agreements that are not the product of collective bargaining would become vulnerable to invalidation.[260] For example, the assignments in the university setting will often appear problematic because certain of the participants (untenured faculty, graduate students) have almost no bargaining power. In these instances, the many advantages to private agreements argue for supplementing procedural consideration with a look at whether the provisions are (nonetheless) substantively reasonable.

This scrutiny could be conducted by comparing questionable agreements to those that are customary in the industry or clearly the product of voluntary bargaining. In this connection, the current practices at New York University are instructive. Isaac Kohlberg, who heads NYU's technology transfer office, stresses the importance of treating collaborators fairly. Under his approach, university-based collaborators are encouraged, at the inception of their collaboration, to agree to treat all inventors equally. If no such agreement is reached, the office steps in, taking an expansive view of who counts as a creator, consistent with what is permitted by law. As to royalties, these largely redound to the direct benefit of the faculty. Thus, the university takes a 15% share to pay for overhead and for the costs of running the technology transfer office. The rest is split 50-50 as between the researchers and the university. The university's share is, however, plowed back into the enterprise: it is used to fund peer-reviewed grants that finance research aimed at commercializing other aspects of university-based research. In addition, the office encourages licensees to hire as consultants those researchers who were responsible for the licensed innovations.

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260. *See, e.g.*, Steven Cherensky, Note, *A Penny for Their Thoughts: Employee-Inventors, Preinvention Assignment Agreements, Property, and Personhood*, 81 CAL. L. REV. 597 (1993) (arguing for a "personhood" defense for individual creators accused of infringing their assignee's patent rights); *see* ROTHSTEIN ET AL., *supra* note 151.

The benefits of this system are many and synergistic. Its generosity stimulates communication between the faculty and the technology transfer office. Faculty tend to come forward and disclose their inventions, making it much easier for the university to protect its claims to work that is subject to a duty of assignment or deemed for hire.[261] With better understanding of what the faculty do, the office is better able to procure good licensing arrangements. And as the transactions the office consummates become known to the faculty, disclosure improves even more—indeed, to the point where faculty will give the university rights in non-university based output in order to utilize the expertise and facilities of the office. For better or worse, these technology transfer activities also influence scholarship. Consultantships promote information flow between the university and industry, making faculty more aware of how to shape their research to meet the needs of industry. The research fund, coupled with its peer review mechanism, further facilitates commercialization activity.

Not every university is as generous to its faculty as is NYU. Significantly, however, recently promulgated policies tend to be more generous than those adopted years ago. This trend may reflect the collective action problem noted earlier, or an understanding of the limits on enforcement. But it may also stem from recognition of the role financial rewards play in motivating commercial creativity and, equally important, from greater appreciation of the benefit of involving creators in licensing decisions and the exploitation process. If that is so, then it behooves courts to consider the details of assignment provisions, to make sure that the arrangements are ones that not only compensate the assignor at a rate that is reasonable in light of arrangements concluded voluntarily, but that also promotes usage of the intellectual property in issue by permitting those who understand the work to be involved in deciding how it will be used.

Indeed, because technology transfer has both private and public dimensions, an argument could be made that courts should always go beyond procedural scrutiny to consider whether the entity in whom rights are consolidated has the capacity and sophistication to fully exploit the work. The needs here are easy to underestimate. Small universities in particular may fail to realize that unless they have a significant amount of technology to transfer, developing their licensing "business" will not be cost effective.[262] Although such scrutiny would be

261. Kohlberg notes, however, that it would be even easier for the university to protect its interest if faculty were required to regularly disclose all creative work produced, irrespective of their view of its relationship to their employment.

262. *Cf.* NAPAG REPORT, *supra* note 7, at 39; Dam, *supra* note 12, at 2.

intrusive and sometimes inconclusive, the threat that courts could conduct this type of an investigation would likely drive the parties to make sure that their arrangements are beyond attack on technology transfer grounds. A series of safe harbors could also be adopted. The Bayh-Dole Act is something of a model. For example, agreements could be considered to pass the technology transfer test if they include march-in rights permitting assignees to reclaim intellectual property that the university does not exploit within a reasonable time. Even in the event of march-in, a university's own interest could be protected by giving it the kind of right the Act gives to the United States: a nontransferable license to use the work for its own purposes.[263]

Finally, a special word should be said about graduate students. Although this is largely speculation, it may be that one reason there are now so many disputes about authorship is that important changes have occurred in the mentoring relationship. Thus, while there has always been something of a tradition to ignore student input into faculty research, that tradition was once accompanied by the equally strong custom of advisors placing their graduate students in jobs. When job markets in academia shrank, that sense of responsibility for students' careers declined. But, unfortunately, the tradition of failing to acknowledge student input survived. Since students now need to find positions on their own, they need to receive formal credit for their work. Academics and administrators should therefore be particularly scrupulous about remembering student input when patent applications are filed and papers are published; courts should be equally careful to consider whether students have been treated appropriately.

CONCLUSION

It is with considerable trepidation that one ventures into the debate over adjusting patent and copyright law to better assure access to intellectual products, for economists have staked out a rather strong position on this issue. They theorize that legal intervention is undesirable because the parties are best positioned to maximize social welfare, and unnecessary because "the joint economic surplus to be

263. Some university policies include provisions along these lines. For example, the University of Illinois provides that rights that the "University decide[s] to abandon . . . may be assigned to the creator(s)." *See Illinois' Policies*, *supra* note 84, § 7(e). Of course, U.S. patent law could go further and demand more general exploitation of inventions. *See, e.g.*, German Patent Act § 24 (1986) (providing for a compulsory license in cases in which a patentee is not willing to license for reasonable compensation).

shared between differently situated firms [is] a sufficient incentive to make the requisite licensing negotiations succeed."[264]

In many ways, it is not surprising that economists would come to this conclusion. Intellectual production has only recently become a salient part of the economy. Questions that were once considered something of a backwater suddenly need answers, and the quickest way to formulate answers is to make broad assumptions based on experience in fields that already have been examined closely. Since transaction freedom has been the key to optimizing the production of goods and services, extrapolating that experience to information products is a logical strategy. However, it is equally unsurprising that the intuition of lawyers is different. They have watched intellectual property problems play out over time; from the controversies they have seen and the collaborators they have counseled, they are led—equally logically—to the conclusion that more legal attention is necessary. The truth probably lies somewhere between these two positions. Things are clearly not going as well as theory would predict: there are too many controversies to explain away. At the same time, the sense that things are going badly may come from focusing too heavily on disputes and too little on the areas where the market is working.

Still, the anecdotal evidence arrayed here suggests that the idea of leaving matters entirely to the market is wrong. Sometimes even efficient outcomes need assistance. Certainly, those whose experience is with the physical world know this. Even molecules do not always reach stable solutions spontaneously. Some reactions require exogenous support—energy inputs or a catalyst—to move matters over intermediate barriers. Molecules are not hampered by concerns over sunk costs, valuation problems, or interdisciplinary and cross-cultural differences. There is no inequality in their bargaining power. These factors do, however, exist among human beings. As in chemistry, help can come in the form of a catalyst—the institutions with which creators regularly deal. But in cases where there is no catalyst, or where the catalyst is ineffective, what is required is a new legal mechanism.

This article proposes such mechanisms, a series of rules that utilize intellectual property law's concepts of authorship and inventorship, supplemented (perhaps) with a principle of proportionality. These rules would instantiate norms reflective of the complex texture of modern collaborative work products. Ex ante, they would help the parties identify issues and provide a benchmark, thereby helping potential collaborators structure workable arrangements on their own.

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264. *See* Dam, *supra* note 12, at 11.

Ex post, they would preserve social capital by acting as default rules. They would also help courts interpret what the parties have done in a manner that properly reflects their intent. By situating these rules within copyright and patent law, the public-regarding components of intellectual property law are incorporated, with the result that the public interest in access to new ideas and development opportunities is also protected.

The problems that bedevil collaboration are common around the globe. Indeed, some of the problems arise because of cultural clashes. Thus, there is a strong sense in which these suggested principles should be internationalized. Unfortunately, the problem of harmonizing intellectual property rules is a difficult one. Many countries take an author-centered approach that does not allow for the categorization of authorship suggested here. Some do not recognize waivers of the public-regarding exceptions to copyright rights; others determine authorship from textual analysis, not contractual agreement. Of course, the increased globalization of creative production may create strong incentives to overcome these objections. The rise in the protection of nonpersonally-authored works such as data bases, along with the (re)entry of deconstructionist sensibilities into continental discourse, could also lead to a reassessment of the concept of authorship. Thus, the international aspects of this problem must be left to another day.