PUBLIC RESEARCH AND PRIVATE DEVELOPMENT: PATENTS AND TECHNOLOGY TRANSFER IN GOVERNMENT-SPONSORED RESEARCH*

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The year 1980 marked a sea change in U.S. government policy toward intellectual property rights in the results of government-sponsored research. In two statutes passed that year,[1] Congress endorsed a new vision of how best to get these research results utilized in the private sector. Previous legislation had typically encouraged or required that federal agencies sponsoring research make the results widely available to the public through government ownership or dedication to the public domain.[2] But

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[1] The two statutes are the Stevenson-Wydler Technology Innovation Act of 1980, Pub. L. No. 96-480, 94 Stat. 2311-2320 (codified as amended at 15 U.S.C. §§ 3701-3714 (1994)), and Act of Dec. 12, 1980, Pub. L. No. 96-517, 94 Stat. 3015-28 (codified as amended at 35 U.S.C. §§ 200-211, 301-307 (1994)) (commonly known as the Bayh-Dole Act).

[2] See, e.g., Federal Nonnuclear Energy Research and Development Act of 1974, Pub. L. No. 93-577, § 9, 88 Stat. 1878, 1887-1891 (codified as amended at 42 U.S.C. § 5908 (1994)); Federal Coal Mine Health and Safety Act of 1969, Pub. L. No. 91-173, § 501(c), 83 Stat. 742, 799 (codified as amended at 30 U.S.C. § 951(c) (1994)); Foreign Assistance Act of 1969, Pub. L. No. 91-175, § 104, 83 Stat. 805, 806 (codified as amended at 22 U.S.C. § 2179(b) (1994)); Water Resources Research Act of 1964, Pub. L. No. 88-379, § 303, 78 Stat. 329, 332, repealed by Water Research and Development Act of 1978, Pub. L. No. 95-467, § 410(a), 92 Stat. 1305, 1316; National Traffic and Motor Vehicle Safety Act of 1966, Pub. L. No. 89-563, § 106, 80 Stat. 718,

in this new vision, public ownership of research results was equivalent to "dead-hand" control,[3] and the public domain was a treacherous quicksand pit in which discoveries sink beyond reach of the private sector. If the results of federally-sponsored research were to be rescued from oblivion and successfully developed into commercial products, they would have to be patented and offered up for private appropriation.

This new strategy was touted as serving a number of converging goals. It would ensure effective transfer and commercial development of discoveries that would otherwise languish in government and university archives. It would reinvigorate U.S. industry by giving it a fresh infusion of new ideas that would en-

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721 (originally codified as amended at 15 U.S.C. § 1395(c)), repealed by Act of July 5, 1994, Pub. L. No. 103-272, § 7(b), 108 Stat. 745, 1379, 1385; Appalachian Regional Development Act of 1965, Pub. L. No. 89-4, § 302(d), 79 Stat. 5, 20 (codified as amended at 40 U.S.C. app. § 302(e) (1994) and terminated as of Oct. 1, 1982, pursuant to 40 U.S.C. app. § 405 (1994)); Solid Waste Disposal Act, Pub. L. No. 89-272, § 204, 79 Stat. 997, 998-999 (1965) (codified as amended at 42 U.S.C. § 6981 (1994)); Act of Sept. 22, 1961, Pub. L. No. 87-295, 75 Stat. 628, 629 (expanding saline water conversion program) (originally codified as amended at 42 U.S.C. § 1954(b)), repealed by The Saline Water Conversion Act of 1971, Pub. L. No. 92-60, § 11, 85 Stat. 159, 163; Act of July 7, 1960, Pub. L. No. 86-599, § 6, 74 Stat. 336, 337 (codified at 30 U.S.C. § 666 (1994)); Arms Control and Disarmament Act, Pub. L. No. 87-297, § 32, 75 Stat. 631, 634 (1961) (codified at 22 U.S.C. § 2572 (1994)); Helium Act Amendments of 1960, Pub. L. No. 86-777, § 2, 74 Stat. 918, 920 (codified at 50 U.S.C. § 167b (1994)); National Aeronautics and Space Act of 1958, Pub. L. No. 85-568, § 305, 72 Stat. 426, 435 (codified as amended at 42 U.S.C. § 2457 (1994)); Atomic Energy Act of 1954, Pub. L. No. 83-703, 68 Stat. 919, 944-945 (codified as amended at 42 U.S.C. § 2182 (1994)); Act of Aug. 14, 1946, Pub. L. No. 79-733, 60 Stat. 1082, 1086 (codified as amended at 7 U.S.C. § 427i (1994)) (commonly known, with the Agricultural Marketing Act of 1946, as the Agriculture Research and Marketing Act of 1946); Agricultural Marketing Act of 1946, Pub. L. No. 79-783, § 205(a), 60 Stat. 1087, 1090 (codified as amended at 7 U.S.C. § 1624(a) (1994)); cf. National Science Foundation Act of 1950, Pub. L. No. 81-507, § 12, 64 Stat. 149, 154 (codified as amended at 42 U.S.C. § 1871) (providing for disposition of rights in inventions "in a manner calculated to protect the public interest and the equities of the individual or organization with which the contract or other arrangement is executed").

[3] See Industrial Innovation and Patent and Copyright Law Amendments: Hearings on H.R. 6933 (mislabeled as H.R. 6033), H.R. 6934, H.R. 3806, H.R. 2414 (The President's Industrial Innovation Program) Before the Subcomm. on Courts, Civil Liberties, and the Admin. of Justice of the House Comm. on the Judiciary, 96th Cong. 286 (1980) [hereinafter House Hearings on President's Industrial Innovation Program] (statement of Howard W. Bremer, Patent Counsel, Wisconsin Alumni Research Foundation) (quoting United States v. Dubilier Condenser Corp., 289 U.S. 178, 196, quoted paragraph struck, United States v. Dubilier Condenser Corp., 289 U.S. 706 (1933)).

hance productivity and create new jobs. And it would ensure that U.S.-sponsored research discoveries were developed by U.S. firms, rather than by foreign competitors who had too often come to dominate world markets for products based on technologies pioneered in the United States.

The first of the 1980 statutes, the Stevenson-Wydler Technology Innovation Act,[4] made technology transfer an integral part of the research and development responsibilities of federal laboratories and their employees. While some agencies had previously viewed technology transfer as an inherent byproduct of making discoveries widely available to anyone who wanted them, it was now designated as a purposive task for agencies to pursue conscientiously and deliberately.[5] The second statute, commonly known as the Bayh-Dole Act,[6] encouraged small businesses and nonprofit organizations to patent the results of government-sponsored research by allowing them to retain patent ownership themselves, provided they were diligent about getting patent applications on file and promoting commercial development of the inventions. At the same time, the Bayh-Dole Act clarified the authority of federal agencies to apply for and hold patents, and to license their patents to the private sector on an exclusive or nonexclusive basis.[7] In 1983, President Reagan significantly extended the reach of the new policy by directing the heads of executive departments and agencies to extend the more generous title provisions that the Bayh-Dole Act had provided only for small businesses and nonprofit organizations to all government contractors, including large businesses, so that they too could own patents on inventions made in their laboratories with federal funds.[8]

Subsequent legislation has continued to broaden and fortify the emerging policy in favor of private appropriation of research

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[4] Stevenson-Wydler Technology Innovation Act of 1980, Pub. L. 96-480, 94 Stat. 2311-2320) (codified as amended at 15 U.S.C. §§ 3701-3714 (1994)).

[5] Id. § 3, 94 Stat. at 2312 (codified as amended at 15 U.S.C. § 3702 (1994)).

[6] Act of Dec. 12, 1980, Pub. L. No. 96-517, 94 Stat. 3015-3028 (codified as amended at 35 U.S.C. §§ 200-211, 301-307 (1994)).

[7] Id., 94 Stat. at 3020-3023 (codified as amended at 35 U.S.C. §§ 202-203 (1994)).

[8] Memorandum to the Heads of Executive Departments and Agencies: Government Patent Policy, Pub. Papers 248 (Feb. 18, 1983) [hereinafter Government Patent Policy Memorandum].

results. Today, we have in place a system that pervasively promotes patenting federally-sponsored inventions wherever they are made, whether in government, university, or private laboratories. Current law presumes that anyone involved in the research project who wants the discovery to be patented should prevail over the objections of anyone who thinks the discovery should be placed in the public domain, absent exceptional circumstances.[9] Thus, for example, if a contractor fails to make a timely election to retain title to the invention, the funding agency may seek a patent,[10] and if neither the agency nor the contractor has an interest in pursuing patent rights, the individual investigator who made the discovery may step in and claim them.[11] If anyone sees money to be made through patenting a government-sponsored research discovery, chances are it will be patented, so long as that person has the sophistication and resources to pursue patent rights.

Of course, resource constraints prohibit patenting many discoveries that emerge from government-sponsored research. But the discoveries that enter the public domain today are those that slip through the net of present policy, whether through oversight or through a deliberate choice to allocate resources to more promising commercial prospects. Only in exceptional circumstances does the statute acknowledge that there may be an affirmative case for putting a discovery in the public domain for the greater social good.

This is a counterintuitive policy in a number of respects. First, by allowing private firms to hold exclusive rights to inventions that have been generated at public expense, it seems to require the public to pay twice for the same invention—once through taxes to support the research that yielded the invention, and then again through higher monopoly prices and restricted supply when the invention reaches the market. Second, by calling for exclusive rights in inventions that have already been made through public funding (and thus, presumably, without the need for a profit incentive), it contravenes the conventional

[9] 35 U.S.C. §§ 202(a), (c)(2) (1994).
[10] 35 U.S.C. § 202(c)(2) (1994).
[11] 35 U.S.C. § 202(d) (1994); 15 U.S.C. § 3710d (1994).

wisdom that patent rights on existing inventions result in a net social loss ex post, a loss that we endure only to preserve ex ante incentives to make future patentable inventions. Third, by promoting the private appropriation of federally-sponsored research discoveries as a matter of routine, it calls into question the public goods rationale for public funding of research. And fourth, by providing incentives to patent and restrict access to discoveries made in institutions that have traditionally been the principal performers of basic research, it threatens to impoverish the public domain of research science that has long been an important resource for researchers in both the public and private sectors. The first two of these intuitions—that patents will require the public to pay twice for the same invention and that patent incentives are unnecessary when the government has paid for the research—were examined in some detail in the debate leading to passage of the Bayh-Dole Act. The last two, however—that private appropriation undercuts the public goods rationale for government research funding and that it impoverishes the public domain of research science—seem to have been largely overlooked.

This Article revisits the logical and empirical basis for current government patent policy in order to shed light on the competing interests at stake and to begin to assess how the system is operating in practice. Such an inquiry is justified in part by the significance of federally-sponsored research and development to the overall U.S. research effort. Although the share of national expenditures for research and development borne by the federal government has declined since 1980, federal funding in 1995 still accounted for approximately thirty-six percent of total national outlays for research and development[12] and nearly fifty-eight percent of outlays for basic research.[13] Federal policy concerning the allocation of intellectual property rights in the results of this research thus determines how a large portion of our emerging knowledge is disseminated and utilized. If we are mishandling intellectual property rights in the results of gov-

[12] National Science Board, Science & Engineering Indicators: 1996, at 4-6 to 4-7 & 107 app. tbl. 4-4. The comparable figure was 47% for 1980, the year in which the Bayh-Dole Act was passed. See id. at 107 app. tbl. 4-4.

[13] Id. at 108 app. tbl. 4-5. The comparable figure for 1980 was 70%. Id.

ernment-sponsored research, the public may be failing to get full value from its substantial investment of tax dollars in research.

But apart from the practical significance of the patent policy that governs the results of federally-sponsored research as a mechanism for achieving its own goals of technology transfer and commercial development, it is also of interest because of the light it sheds on the functions of the patent system generally. When inventions are made with public funds, equitable arguments for rewarding research performers with patent rights have lesser force than when private firms have put their own capital at risk to make the inventions, and instrumental arguments about the impact of patents on innovation are brought to the fore.[14] A standard instrumental argument for patents emphasizes their role in providing incentives to invest in the costly and risky enterprise of making inventions.[15] If competitors were free to copy successful inventions without having shared in the initial cost and risk of making them, inventing firms would be placed at a competitive disadvantage. Free copying would reduce the price consumers pay to enjoy the benefits of existing inventions, but it would also reduce the incentive to make new inventions. Thus we endure monopoly pricing of new inventions for a limited term in order to preserve incentives for firms to supply a continuing stream of new inventions on the market.

This standard argument loses much of its force in the case of inventions made with public funding. The public has paid for these inventions and has absorbed the risk that nothing would come of its investment. If existing inventions would be more widely utilized if they were disseminated free of charge, and if

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[14] The widespread willingness of employed inventors to surrender intellectual property rights to their private sector employers suggests that an allocation of intellectual property rights to research sponsors rather than to research performers is not generally considered inequitable. Just as the contributions of private employers reduce the equitable claims of employed inventors to any intellectual property that comes out of their work, the contributions of government agencies reduce the equitable claims of contractors and grantees as against the public.

[15] See, e.g., Kenneth J. Arrow, Economic Welfare and the Allocation of Resources for Invention, *in* The Rate and Direction of Inventive Activity: Economic and Social Factors 609, 616-19 (National Bureau of Econ. Research ed., 1962); William D. Nordhaus, Invention, Growth, and Welfare: A Theoretical Treatment of Technological Change 70-73, 87-88 (1969).

the government doesn't need to turn a profit on research in order to continue supporting it, perhaps the public would benefit more fully from the inventions it has paid for by putting them in the public domain, and thereby reducing the price that consumers pay for products based on the inventions in competitive markets.

In responding to this argument, advocates of private appropriation of the results of government-sponsored research make an interesting move. They set aside as secondary the standard justification for patents as an ex ante incentive to make new inventions, and shift the focus from the initial costs of making an invention to the subsequent costs of developing an existing invention into a commercial product. They argue that even after an invention has been made, further investment is necessary to refine it, test it, build the necessary facilities for production on a commercial scale, and find or create a market for it. Throughout this development process a substantial risk of failure remains. These follow-on investments may greatly exceed the value of the initial investment that created the invention in inchoate form. The government lacks the expertise and facilities to do this development work itself, and therefore needs to turn the invention over to industry at this point. Firms may only be willing to invest in the development of an invention if they hold exclusive rights, either in the form of title or an exclusive license, under a patent. As in the case of firms that make inventions, firms that develop inventions into commercial products may feel that patent rights are necessary to protect them from competition once the innovation proves successful. Inventions that are freely available to all may never find their way into commercial development.

If patents play a critical role in inducing firms to invest in commercial development even after an invention has been made, this could have important implications for the functions of the patent system outside the context of public research. There is some scholarly support for the view that the primary significance of patents lies in their impact on subsequent research and development within the new technological prospect identified in the patent rather than in their impact on ex ante in-

centives to invent,[16] but this remains a minority view among patent scholars.[17] Evidence that this function of patent rights is important in the context of inventions made through public funding might help to refocus the attention of patent scholars on the impact of patents on post-issuance incentives for commercial development.

In this Article I examine the arguments that have been advanced in favor of private appropriation of the results of government-sponsored research as a mechanism for promoting commercial development in public debates about government patent policy. In addition to assessing the logic and limitations of the arguments as a theoretical matter, I also offer some preliminary observations about the empirical record of technology transfer in the pre- and post-Bayh-Dole eras, with particular attention to biomedical research. Biomedical research provides a useful focus for a number of reasons. It is of significant interest both to research scientists working in university and government laboratories and to commercial firms, and thus provides a wealth of new scientific discoveries that are potential candidates for commercial development, as well as inputs into further research. The obvious implications of these discoveries for human health raise the stakes of getting the balance between private property and public access right, particularly at a time when public attention is riveted upon the rising costs of health care. And advances in biomedical research profoundly affect the interests of the young biotechnology industry that has grown up in the post-Bayh-Dole era as well as the more established pharmaceutical industry, thus offering an opportunity to test the impact of present policy on two very different types of firms.

Nonetheless, I acknowledge at the outset that my conclusions might be different if I were to make a similar investigation in another field. Both the pharmaceutical industry and the biotechnology industry are heavily dependent on patents, perhaps

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[16] See Edmund W. Kitch, The Nature and Function of the Patent System, 20 J.L. & Econ. 265 (1977).

[17] For a thoughtful review and analysis of competing theories about the function of patents and their underlying assumptions, see Roberto Mazzoleni & Richard R. Nelson, Economic Theories About the Benefits and Costs of Patents (Sept. 21, 1995) (unpublished manuscript, on file with the Virginia Law Review Association).

to a greater extent than firms in other industries. In biomedical research fields researchers in government, university and commercial laboratories are often working simultaneously on the same problems, whether collaboratively or competitively, and this may have important implications for technology transfer in these areas that don't carry over into other fields where government-sponsored research more typically precedes commercial interest in a problem. But current policy is quite deliberately a unitary policy that applies the same rules to all agencies and all fields. To the extent that the rules don't fit in this particular setting, it calls into question at the very least the imperative for uniformity, even if the same rules may be working just fine in other contexts.

I. HISTORY OF CURRENT POLICY

A review of the history of government patent policy over the past half century reveals no golden age in which the results of government-sponsored research were uncontroversially dedicated to the public domain. The question of who should own title to these research results has been the subject of heated debate at least since World War II, when unprecedented levels of federal spending on research and development to support the war effort focused the attention of the federal government on the issue.

A. Title Versus License

In 1941, President Roosevelt created the National Patent Planning Commission by executive order to begin planning "for a full utilization of the Nation's expanded industrial capacity with the return of peace."[18] That Commission offered an early analysis of the role of patents in government-sponsored research in its report, "Government-Owned Patents and Inventions of Government Employees and Contractors," issued in

[18] 2 Subcommittee on Domestic and Int'l Scientific Planning and Analysis of the House Comm. on Science and Tech., 94th Cong., Background Materials on Government Patent Policies: Reports of Committees, Commissions, and Major Studies xi (Comm. Print 1976) [hereinafter Background Reports].

January of 1945.[19] In that document the Commission steered a middle course between calling for the dedication of government-sponsored research discoveries to the public domain and calling for private ownership of such discoveries. Its primary concern was to ensure that the government itself was free to use the discoveries it had paid for rather than to make those discoveries available to the public, but it also addressed the issue of preserving incentives for commercial development. The Commission observed that the government can normally protect its right to use inventions freely through prompt publication, but in some cases the government may obtain greater protection through filing patent applications.[20] The exclusionary rights conferred by a patent were only of secondary concern to the Commission. As a general rule, the Commission felt that the government should refrain from exercising the right to exclude conferred by the patents it owns and should make the inventions covered by its patents available for commercial and industrial exploitation by anyone. In some cases, however, the Commission recognized that it may be necessary for the government to offer an exclusive license in order to induce private manufacturers to commercialize an invention.[21] The Commission therefore recommended that legislation be enacted authorizing government agencies "to issue exclusive licenses in cases where it seems evident that otherwise the inventions in question will not come into general use."[22] As for inventions made by government contractors, the Commission noted that the circumstances surrounding such inventions vary greatly, and that a single set of uniform patent provisions for all government-sponsored research would be neither feasible nor desirable.[23]

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[19] National Patent Planning Commission, Government-Owned Patents and Inventions of Government Employees and Contractors, *reprinted in* Background Reports, supra note 18, at 1-12 (1945) [hereinafter Patent Planning Commission].

[20] Id. at 3.

[21] See id. at 4-5 (quoting a letter from Vannevar Bush, Director of the Office of Scientific Research and Development, dated Oct. 28, 1941, for the proposition that if the government lacks the authority to confer exclusive licenses under its patents, "when a patent is assigned to the Government, its commercial benefit may be completely lost").

[22] Id.

[23] Id. at 11.

Nonetheless, the Commission cautioned against full ownership of patents by the government, except where private ownership of such patents would conflict with the national interest.[24]

In sharp contrast to these carefully hedged recommendations of the Commission, the Report of the Attorney General to the President in 1947 recommended adoption of a uniform federal policy placing full title to inventions made by government employees or contractors in the government, subject to parsimoniously granted exceptions in emergency situations.[25] The primary concerns of the Attorney General appear to have been to recognize the public's equitable claim to inventions made at public expense and to avoid government favoritism toward particular private firms.[26] The Attorney General recommended that exceptions to the general rule of government ownership be permitted only when the contractor has made a substantial independent contribution to a prospective invention prior to the contract—a circumstance that would presumably strengthen the equitable claim of the contractor relative to the public—and the head of the agency certifies that reasonable efforts to find a contractor who will do the work under the terms of the basic patent policy have been unsuccessful.[27] Government-owned patents should generally be made available to the public through nonexclusive licensing or public dedication, and if nonexclusive licenses are not sufficiently lucrative to justify private investment in subsequent promotion and development of the invention, the government should finance these subsequent investments itself rather than grant an exclusive license.[28] Otherwise, the government would find itself playing inappropriate roles in selecting a licensee from among numerous applicants, policing the licensee's operation, and detecting and prosecuting infringers. Nor, in the view of the Attorney General, should the government

[24] Id.

[25] Attorney General of the United States, Investigation of Government Patent Practices and Policies: Report and Recommendations of the Attorney General to the President, *partially reprinted in* Background Reports, supra note 18, at 15, 17-21 (1947) [hereinafter Attorney General's Report].

[26] See id. at 17, 19.

[27] Id. at 20.

[28] Id. at 21.

charge royalties for the use of technology that was paid for with public funds. Further research should be financed through taxes rather than through revenues from government-owned patents.[29]

These two positions framed the debate in the decades that followed between advocates of a "license" policy, who urged the government to limit itself to retaining a license to use the inventions resulting from government-sponsored research, while leaving title in the contractor, and advocates of a "title" policy, who urged the government to acquire full title to the inventions.[30] Arguments advanced on both sides of the debate over ownership of patent rights in government-sponsored research discoveries tended to echo broader debates about the merits of the patent system generally. Advocates of a title policy generally feared that patent rights in the hands of government contractors would lead to concentration of economic power in the hands of large businesses, to the detriment of their smaller competitors and consumers, and believed that, even in the absence of exclusive rights under a patent, commercially significant research discoveries made in the course of government-sponsored research would be readily put to use by firms in competitive markets.[31] Advocates of a license policy sang the praises of the patent system as a stimulus to innovation, new products, and new jobs, and believed that without the promise of title to patents, the best firms would not bid on government contracts, would not bother to disclose the inventions they made with fed-

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[29] Id.

[30] For further development of the positions in this debate, see James A. Dobkin, Patent Policy in Government Research and Development Contracts, 53 Va. L. Rev. 564 (1967); William W. Eaton, Patent Problem: Who Owns the Rights?, Harv. Bus. Rev., July-Aug. 1967, at 101; H. Fredrick Hamann, Federal Patent Policy: An Instrument in the Regulation of Industry, 39 S. Cal. L. Rev. 491, 499-510 (1966); William O. Quesenberry, Government Patent Policy: Time for Compromise, IDEA, Spring 1975, at 5; Philip Sperber, Government Contracting: Perpetuating the Energy Crisis, 62 A.B.A. J. 1301 (1976); Symposium, Government Contract Patent Policy, 21 Fed. B.J. 3 (1961); Edward C. Walterscheid, The Need for a Uniform Government Patent Policy: The D.O.E. Example, Harv. J.L. & Tech., Spring 1990, at 103; Donald S. Watson, Harold F. Bright & Arthur E. Burns, Federal Patent Policies in Contracts for Research and Development, 4 Pat. Trademark & Copyright J. Res. & Educ. 295 (1960).

[31] See, e.g., Hyman G. Rickover, Government Patent Policy: Statement to the Monopoly Subcomm. of the Senate Small Bus. Comm., *reprinted in* 60 J. Pat. Off. Soc'y 14 (1978) (Dec. 19, 1977).

eral funds, and would not invest further in the development of discoveries owned by the government.[32]

Conspicuously absent from the debate were arguments for leaving government-sponsored research discoveries unpatented. Some advocates of a title policy expressed considerable mistrust of patents, yet their bottom line was that the government should hold title to patents and license them nonexclusively rather than that they should forbear from obtaining patent rights in the first place.[33] That advocates of a license policy should favor patents on the results of government-sponsored research is not surprising, but why would advocates of a title policy, who generally oppose the granting of exclusive rights to such discoveries, nonetheless favor patenting them?

One reason is to be sure that no one else may claim patent rights in the discoveries. Otherwise, the government and other consumers might be compelled to pay higher prices for the use of discoveries that the public has already paid for through tax dollars. This is not an entirely satisfactory response, inasmuch as the government may generally prevent subsequent inventors from obtaining a patent more cheaply by publishing the discovery than by patenting it,[34] and generally may not, under U.S. law, patent a previously invented discovery,[35] even if the same inven-

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[32] See, e.g., Eaton, supra note 30, at 103-04 (recounting history of arguments); Wilson R. Maltby, Need for a Federal Policy to Foster Invention Disclosures by Contractors and Employees, 25 Fed. B.J. 32 (1965) (advocating adoption of a system of rewards designed to promote disclosure); Sperber, supra note 30, at 1303-04 (advocating license policy).

[33] For example, the Attorney General's Report, supra note 25, reflects a presumption in favor of patenting the results of government-sponsored research:

> Patenting of Government inventions affords greater protection than publication of the unpatented invention, and permits controls to be imposed in appropriate cases upon the use of the invention.
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> . . . .
>
> As soon as an invention is completed under circumstances giving the United States the right to any patent rights therein, it should be covered by a patent application, unless the head of the agency finds that adequate protection of the public interest may be had by reducing the invention to practice, publishing it, and fully disclosing it to the Patent Office in such form as to make it a part of the prior art.

Attorney General's Report, supra note 25, at 22.

[34] See 35 U.S.C. §§ 102(a),(b) (1994).

[35] See 35 U.S.C. § 102(g) (1994).

tion was subsequently made again at public expense. But filing a patent application ahead of a competitor gives the prior applicant certain procedural advantages that may help in establishing priority of invention in close cases.[36] Moreover, even if a competitor files first, a subsequent patent applicant may sometimes prevail by proving an earlier date of "conception"[37] for the invention; a publication only defeats the patent claims of a competitor as of the publication date,[38] which may be significantly later than the conception date or even the patent filing date. Thus filing a patent application may offer some marginal benefit over publication as a means of preventing someone else from obtaining patent rights when priority of invention is likely to present a close question.

However trivial the benefits of patenting over publication as a mechanism for ensuring public access to the results of federally-sponsored research, it bears emphasis that advocates of a title policy during this time period generally aimed to defeat exclusive rights in the underlying inventions rather than to secure them. They saw government ownership of patents as a way of placing the underlying inventions in the public domain rather than as a way of excluding others from using the inventions.

Congress did not follow the suggestion of the Attorney General to adopt a uniform policy vesting ownership of all federally-sponsored research discoveries in the government, although over the years it did enact such a policy on a more limited basis in a number of statutes applicable to particular programs or agencies.[39] Agencies not bound by such explicit statutes had considerable discretion to choose whatever patent policy best suited their missions. Not surprisingly, there was considerable variation in the policies adopted by the different agencies.[40]

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[36] These procedural advantages are reviewed in 3 Donald S. Chisum, Patents: A Treatise on the Law of Patentability, Validity and Infringement § 10.03[1][c], at 10-33 to 10-41 (1996).

[37] 35 U.S.C. § 102(g); see also 3 Chisum, supra note 36, § 10.04, at 10-73 to 10-141 (on "conception").

[38] 35 U.S.C. §§ 102(a),(b) (1994).

[39] These statues are listed supra note 2.

[40] The policies of different agencies are collected in various sources. See 1 Subcommittee on Domestic and Int'l Scientific Planning and Analysis of the House Comm. on Science and Tech., 94th Cong., Background Materials on Government

Agencies that followed a title policy included the Atomic Energy Commission and its successor agencies ("Energy"),[41] the Department of Agriculture ("Agriculture"),[42] the Department of Health, Education, and Welfare ("HEW"),[43] the Department of the Interior ("Interior"),[44] and the National Aeronautics and Space Administration ("NASA").[45] Agencies that followed a license policy included the Department of Defense ("DoD")[46] and the National Science Foundation ("NSF").[47]

B. The 1963 Presidential Memorandum

President Kennedy attempted to achieve a greater degree of uniformity in government patent policy, subject to specific statutes governing particular agencies, in a 1963 Presidential Memorandum and Policy Statement.[48] This policy statement, the result of an intensive study by the Office of Science and Technology with the help of those agencies having research and development programs,[49] took a middle ground between a title policy and a license policy, attempting to balance the need for private incentives to encourage development and use of inventions against the need to promote competition in industry.[50] It identified a number of circumstances that would call for title in

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Patent Policies: Presidential Statements, Executive Orders, and Statutory Provisions 61-85 (Comm. Print 1976) [hereinafter Background Laws]; Ralph C. Nash, Jr. & Leonard Rawicz, Patents and Technical Data 74-92 (1983); Dobkin, supra note 30, at 570-91.

[41] Energy was bound to follow a title policy under the terms of the Atomic Energy Act of 1946 and the Atomic Energy Act of 1954, codified as amended at 42 U.S.C. § 2181 (1994).

[42] Agriculture was bound to "mak[e] the results of research and investigations available to the public through dedication, assignment to the Government, or such other means as the Secretary shall determine" by the terms of the Agriculture Research and Marketing Act of 1946, codified as amended at 7 U.S.C. § 427i(a) (1994), and a similar provision codified as amended at 7 U.S.C. § 1624(a) (1994).

[43] Dobkin, supra note 30, at 580-81.

[44] Nash & Rawicz, supra note 40, at 78.

[45] Dobkin, supra note 30, at 574.

[46] Id. at 586.

[47] Nash & Rawicz, supra note 40, at 79.

[48] Memorandum and Statement of Government Patent Policy, 28 Fed. Reg. 10,943-10,946 (1963) [hereinafter 1963 Presidential Memorandum].

[49] Nash & Rawicz, supra note 40, at 92-93.

[50] 1963 Presidential Memorandum, supra note 48, at 10,944.

the government, including: (1) where a principal purpose of the contract is to create products or processes intended for commercial use by the general public; (2) where the research directly concerns the public health or public welfare; (3) where there has been little significant experience in the field outside of government-funded research or the government has been the principal developer of the field and the acquisition of exclusive rights might confer on the contractor a dominant position in the field; and (4) where the contractor is operating a government-owned facility or coordinating and directing the work of others.[51] Heads of agencies and departments retained authority to allow contractors to acquire greater rights than a non-exclusive license, either at the time of contracting or after the invention has been identified, if "necessary . . . to call forth private risk capital and expense to bring the invention to the point of practical application."[52] On the other hand, where the contract research is to build upon existing technology to develop information, products or processes for use by the government, and the contractor has acquired technical competence and established a nongovernmental commercial position in the field, the contractor would normally acquire title, subject to a non-exclusive, royalty-

[51] Id. at 10,944. The rationale for these exceptions is not entirely clear. Perhaps the first exception, where a principal purpose of the contract is to create products intended for commercial use by the general public, reflects a sense that the equitable claim of the government to own what it has paid for is stronger when the patented invention is something that the government deliberately set out to procure for the public benefit than it is when the patented invention is an unintended byproduct of research procured for some unrelated governmental purpose. The second exception, where the research directly concerns the public health or welfare, seems to reflect a concern that privately held patents will harm the public by restricting the availability or raising the price of new medical advances or other discoveries of direct relevance to the public welfare. The third exception, where the field has been dominated by government-funded research and development and exclusive rights might confer a dominant position on the contractor, seems to echo the concerns expressed in the Attorney General's Report, supra note 25, that allowing contractors to retain patent rights will lead to industrial concentration or put the government in the unseemly position of favoring a particular contractor, while allowing for a different rule in cases where there has been significant private sector R&D in the field. See Attorney General's Report, supra note 25, at 19. The fourth exception, where the contractor is operating a government-owned facility or coordinating and directing the work of others, again appears to apply a title policy to cases in which the government's contribution looms large relative to the contractor's.

[52] 1963 Presidential Memorandum, supra note 48, at 10,944.

free license in the government.[53] Contractors retaining more than a nonexclusive license were to provide written reports to the government on their commercial use of the inventions, and the government retained "march-in" rights to terminate their exclusivity if they failed to take effective steps to bring the invention to practical application within three years.[54] Government-owned patents were to be made available "through dedication or licensing."[55] Finally, the 1963 Presidential Memorandum called for the Federal Council for Science and Technology ("FCST"), in consultation with the Department of Justice, to prepare annual reports concerning the effectiveness of the policy and to make recommendations for revision in light of experience.[56]

The 1963 Presidential Memorandum left agencies with considerable discretion to handle patent policy as they saw fit and did not bring about uniformity among agencies directly. But the delegation to FCST of the authority to monitor and review implementation and recommend changes led to further study of the issue by government patent administrators and ultimately created an organized constituency for law reform. In 1965, FCST established a Committee on Government Patent Policy to acquire and analyze information on the operation of the policy.[57] The Committee in turn commissioned Harbridge House to conduct an extensive study of federal patent policy.[58]

C. The Harbridge House Study

The Committee asked Harbridge House to investigate the effect of patent policy on (1) industry participation in government

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[53] Id. at 10,945. If the contractor did not have a sufficiently established commercial position in the field, the determination of rights ordinarily was to be deferred until after the invention had been identified. Id.

[54] Id.

[55] Id.

[56] Id. at 10,946.

[57] See Federal Council for Science and Technology, Combined Report on Government Patent Policy 2 (Dec. 31, 1973; Dec. 31, 1974; Dec. 31, 1975; and Sept. 30, 1976) [hereinafter 1976 FCST Combined Report].

[58] See 1 Harbridge House, Government Patent Policy Study, Final Report for the FCST Committee on Government Patent Policy ii (1968) [hereinafter Harbridge House Report].

R&D programs; (2) commercial utilization of government-sponsored inventions; and (3) business competition in commercial markets.[59] Harbridge House conducted an eighteen-month empirical investigation and produced a four-volume report with carefully hedged conclusions about each of these inquiries. Much of the nuance was lost, however, in the significance attached by others to the Harbridge House findings.

The authors of the Harbridge House report highlighted as their most significant finding that commercial utilization of government-sponsored inventions was very low, regardless of who held title: Only 12.4% of a sample of government-sponsored inventions that were patented in the years 1957 and 1962 had actually been put to use, and only 2.7% of such inventions were playing a critical role in the commercial products in which they were incorporated.[60] Focusing more narrowly on the commercial utilization of government-sponsored inventions by contractors with prior experience in the field of the invention, they found that the rate of utilization was 23.8% when the contractor held title to the invention and 13.3% when the contractor did not hold title.[61] Although these figures were subsequently invoked in justification of legislation granting contractors title to government-sponsored inventions,[62] it should be noted that eighty-three percent of the contractor inventions included in the Harbridge House data had been funded by DoD under contracts and policies that would have permitted the contractors to retain title if they had so elected.[63] The subset of inventions on which the contractors did not hold exclusive rights were pre-

[59] Id.

[60] 4 Harbridge House Report, supra note 58, at 3-4.

[61] Id. at 18 tbl. 15.

[62] See, e.g., Government Patent Policy: Hearings Before the Subcomm. on Science, Research and Tech. of the House Comm. on Science and Tech., 96th Cong. 4 (1979) [hereinafter 1979 House Patent Policy Hearings] (statement of Sen. Harrison H. Schmitt); 1 Government Patent Policies: Institutional Patent Agreements: Hearings Before the Subcomm. on Monopoly and Anticompetitive Activities of the Senate Select Comm. on Small Bus., 95th Cong. 373-98 (1978) [hereinafter 1978 Senate Select Committee Hearings] (statement of Howard Bremer, Patent Counsel, Wisconsin Alumni Research Foundation).

[63] 4 Harbridge House Report, supra note 58, at 6 tbl. 2 (indicating that 2,862 out of a total of 3,454 inventions studied were sponsored by either the Army, Navy, or Air Force).

sumably those with the least commercial potential, and it is thus unsurprising that they were not heavily utilized commercially.[64]

The Harbridge House authors concluded that their data could not resolve the debate between advocates of a title policy and advocates of a license policy on a uniform basis:

> Significantly, the evidence does not indicate that either title or nonexclusive licensing is uniformly the best way to promote utilization. There are areas of technology where title is required for utilization; areas where title would inhibit it; and a large area—inventions with no commercial application—where neither title nor license will promote utilization.[65]

This conclusion was supported by the results of follow-up interviews with contractors and licensees. These interviews revealed that firms vary greatly in the importance they attach to patent rights in making decisions about whether to participate in government contracts and whether to develop commercial products, and that other factors, such as the limited commercial potential of the inventions, often dominate decisions about commercial development.[66] The Harbridge House authors also noted wide variation among government agencies in the nature of their missions, the types of research they sponsor, and the proximity of sponsored inventions to commercial applications, as well as in the technological sophistication of the industries most likely to make use of the inventions and the attitudes of firms in such industries toward patents.

Although the Harbridge House authors did not endorse a broad policy of leaving title to government-sponsored inventions in the contractor, they indicated that granting exclusive rights to contractors would promote utilization better than acquisition of title by the government in some situations, including "[w]here the invention is commercially oriented but requires substantial private development to perfect it, applies to a small

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[64] This was how the Committee on Government Patent Policy interpreted the data. See Committee on Government Patent Policy of the Federal Council for Science and Technology, Report and Recommendations on Government Patent Policy, *reprinted in* Background Reports, supra note 18, at 143, 152 (1968) [hereinafter 1968 FCST Patent Policy Report].

[65] 4 Harbridge House Report, supra note 58, at 4.

[66] See id. at 42-55 (surveying predominant attitudes of firms in study).

market, or is in a field occupied by patent sensitive firms and its market potential is not alone sufficient to bring about utilization."[67]

D. The NIH Medicinal Chemistry Program

One of the most illuminating aspects of the Harbridge House Report for purposes of understanding the role of patents in biomedical innovation was a case study of the impact of NIH patent policy in the 1960s on the willingness of pharmaceutical firms to collaborate with investigators in universities and hospitals who had developed new compounds in the NIH-funded medicinal chemistry program.[68] During the relevant time period HEW regulations applicable to NIH gave the Assistant Secretary for Health and Scientific Affairs broad authority to determine the disposition of patent rights in inventions arising from sponsored research.[69] Prior to 1962, pharmaceutical firms had routinely screened compounds developed by NIH-funded investigators for biological activity, at no charge, without signing any agreements with either the investigator or NIH regarding rights to inventions discovered in the course of screening.[70]

In 1962 NIH began requiring pharmaceutical firms to sign a patent agreement before the firms could screen compounds developed with NIH funds.[71] The agreement restricted the ability of firms to disclose the results of testing, obligated them to re-

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[67] 1 Harbridge House Report, supra note 58, at vii. This conclusion may be particularly pertinent to a consideration of appropriate mechanisms for technology transfer in biomedical research, inasmuch as such research often yields inventions requiring substantial private development to bring to market, and the firms most likely to undertake this development—biotechnology firms and pharmaceutical firms—are highly patent sensitive.

[68] Id. at 42-47; 2 Harbridge House Report, supra note 58, at 2-40. This episode was also thoroughly investigated and reported by the Comptroller General of the United States. See Comptroller General of the United States, Report to the Congress: Problem Areas Affecting Usefulness of Results of Government-Sponsored Research in Medicinal Chemistry, *reprinted in* 1978 Senate Select Committee Hearings, supra note 62, at 103-46 (1968) (attachment 3 to the testimony of Norman Latker) [hereinafter Comptroller General's Report on Medicinal Chemistry].

[69] The text of the regulations adopted in 1955, along with revisions in 1957 and 1958, is set forth at 2 Harbridge House Report, supra note 58, at 4-8 fig. II-3.

[70] Id. at 12.

[71] Id. at 12-13 fig. II-7.

port all results promptly to the investigator for use by the Public Health Service in filing patent applications, restricted the firms' rights to obtain patents on new uses of the compounds, and gave the government a nonexclusive, royalty-free license under the firms' patents with the power to sublicense for governmental purposes.[72] Prior to 1966, NIH also required that firms contracting with NIH-funded investigators agree to license the government and other parties under any background patents necessary to practice foreground inventions developed under the contract.[73]

The new agreement had a dramatic impact on collaborations between pharmaceutical firms and NIH-funded investigators. The firms almost unanimously rejected the agreement, citing concerns about loss of prospective proprietary rights, contamination of in-house research through exposure to government-sponsored research, and loss of control over testing and reporting results.[74] The firms stopped screening NIH-sponsored compounds, resulting in an abrupt restriction in the sharing of information and materials between NIH investigators and pharmaceutical firms, to the detriment of the medicinal chemistry program.[75] The situation was finally resolved in 1968, following an investigation by the Comptroller General of the United States. In addition to revising the terms of the patent agreements that had met with such strong resistance from pharmaceutical firms, HEW agreed to use a revised standard institutional patent agreement ("IPA") granting patent rights to universities with approved patent policies so that the universities could transfer exclusive rights in new compounds to firms for commercial development.[76]

The Committee on Government Patent Policy analyzed the results of the Harbridge House study in a 1968 report.[77] The Committee concluded that "the study results provide no basis

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[72] Id. at 13 fig. II-7 (reproducing patent agreement).
[73] Id. at 14.
[74] Id. at 15.
[75] See id.
[76] Comptroller General's Report on Medicinal Chemistry, supra note 68, at 109.
[77] See 1968 FCST Patent Policy Report, supra note 64, at 143-82.

for changing the basic principles of the Presidential Policy,"[78] and that "a single 'title' or 'license' policy would not be in the public interest, whether applied to a government-wide policy or to the policy of any particular agency."[79] In particular, the Committee found that the Harbridge House data generally supported the normal acquisition of title by the government whenever the purposes of the contract are "public-oriented."[80] It expressed concerns, in light of the Harbridge House report on the reactions of the pharmaceutical firms to NIH's patent position in its medicinal chemistry program, that the Presidential Memorandum and Policy Statement directing the government to take title to inventions under contracts relating to public health or public welfare might lead to "participation problems."[81] Even so, the Committee believed that these problems could be dealt with under provisions of the Policy permitting departures from the ordinary rule under "exceptional circumstances."[82] Nonetheless, the Committee recommended that the policy be modified to allow contractors to take title, or to allow the government to grant exclusive licenses when it holds title, in appropriate cases.[83]

E. The 1971 Presidential Memorandum

President Nixon implemented the suggested changes in a revised Presidential Memorandum and Policy Statement on government patent policy in 1971.[84] The revisions facilitated the allocation of exclusive rights in government-sponsored inventions to private firms in a number of ways. They clarified the authority of government agencies to grant greater rights than a nonexclusive license, either to call forth private risk capital to bring

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[78] Id. at 143.

[79] Id. at 144.

[80] Id. at 175.

[81] Id.

[82] Id.

[83] Id. at 176-77.

[84] Memorandum and Statement of Government Patent Policy, 36 Fed. Reg. 16,887 (1971) [hereinafter 1971 Presidential Memorandum]. Differences between the 1963 and 1971 Presidential Memoranda are analyzed in Nash & Rawicz, supra note 40, at app.12 to app.18.

the invention to practical application or to recognize the relative equities of the contractor and the agency, even in cases where the invention was not the primary object of the research contract.[85] The revisions allowed the government to use its march-in rights to compel contractors to grant exclusive as well as nonexclusive licenses.[86] They allowed agencies to revoke nonexclusive licenses held by contractors in order to grant exclusive licenses where necessary to encourage commercialization of the invention.[87] Finally, they explicitly authorized exclusive licenses under government-owned patents.[88]

Meanwhile, further pressure to enhance mechanisms for private appropriation of the results of government-sponsored research came from the Commission on Government Procurement, established by Congress in November 1969 to study and recommend methods to promote the economy, efficiency, and effectiveness of procurement by the Executive Branch of the federal government.[89] Among the problem areas highlighted for the attention of the Commission in the House Report accompanying the legislation that set its mandate was the issue of patent rights in government-sponsored inventions.[90] The House Report explicitly noted that the 1963 Presidential Memorandum had been given a mixed reception and that Congress had reviewed the issues on occasion, without conclusive results.[91] The 1971 Presidential Memorandum came down in the middle of the Commission's brief tenure, and the Commission in its report to Congress noted that "it is premature to disturb this latest effort by the President to achieve a more workable patent policy."[92]

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[85] 1971 Presidential Memorandum, supra note 84, at 16,890.

[86] Id. at 16,891.

[87] Id.

[88] Id.

[89] Act of Nov. 26, 1969, Pub. L. No. 91-129, §§ 1, 2, 1969 U.S.C.C.A.N. (83 Stat. 269) 293, 293-94. In 1972, the Commission delivered a four-volume report to Congress containing 149 recommendations, including 16 recommendations pertaining to patents, technical data and copyrights. See 1976 FCST Combined Report, supra note 57, at 5, 134-267 app. E. Portions of the Commission's 1972 report pertaining to government patent policy are reprinted in Background Reports, supra note 18, at 185-206.

[90] H.R. Rep. No. 91-468 (1969), *reprinted in* 1969 U.S.C.C.A.N. 1350, 1377-1378.

[91] Id. at 1378.

[92] Commission on Government Procurement, 1972 Report, *partially reprinted in*

Nonetheless, the report makes plain that the Commission would have gone much farther in the direction of leaving title to patents with contractors and promoting the exclusive licensing of government-owned patents. Indeed, some of the language of the report implies that the reason for implementing the 1971 Presidential Memorandum promptly was so that the process of gathering data on its inadequacies could get underway.[93]

The Commission went on to sketch out an alternative approach to government patent policy to be considered "[i]f evaluation of experience under the revised Presidential policy indicates a need for further policy revisions."[94] The alternative approach would involve repealing all existing statutes governing the allocation of patent rights in government-sponsored research and enacting a uniform, government-wide policy through legislation that would generally leave title in the contractor,

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Background Reports, supra note 18, at 185, 192.

[93] For example, the report states:

> Reservations have been expressed as to whether the Presidential policy is the optimum policy. A system which generally allows contractors or inventors to obtain commercial rights subject to a strengthened march-in rights procedure under the control of a central board may hold greater promise of fulfilling the goals of patent policy. However, these reservations should await the test of actual experience.
>
> Experience may prove the Government should not routinely take principal rights in all of the situations listed in section 1(a) of the Presidential policy.

Id. at 193-94. The Commission was particularly skeptical about the heavy reliance in the 1971 Presidential Memorandum on the use of deferred determinations for granting rights to contractors:

> Reliance on deferred determinations and after-the-fact disposition of patent rights has several potential shortcomings . . . [including] deferred utilization, increased administrative costs, and a lessening in the willingness of some firms to participate in Government research work.
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> . . . .
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> More importantly, the long processing periods inherent in a deferred determination policy will often delay prompt development and utilization of Government-sponsored inventions, since a participating contractor would wish to establish his rights before investing his risk capital. Utilization could also be adversely affected by the administrative burden of petitioning the Government for exclusive commercial rights and the probable requirement that the contractor file patent applications to protect the property rights during the petition period.

Id. at 194 (footnote omitted).

[94] Id. at 195.

subject to a fortified system of government march-in rights.[95] This policy would be subject to two exceptions. First, the Commission saw no need for granting the contractor title or exclusive rights in cases where the government intends to fund development of the invention to the point of commercial application.[96] Second, in striking contrast to the ultimate terms of the Bayh-Dole Act, the Commission noted that:

> [I]f the contract is with an educational or other nonprofit organization utilization would not be fostered by granting the contractor title unless it was determined that inventions likely to flow from a given contract will be promoted in a manner consistent with the objectives of utilization and maintenance of competition.[97]

Thus, although the Commission was prepared to endorse a presumption in favor of granting commercial rights in government-sponsored inventions to commercial contractors at the time of contracting, it was not willing to endorse the same a priori presumption in favor of universities.

In 1973 the Administrator of General Services promulgated new regulations implementing the 1971 Presidential Memorandum.[98] While the new regulations were pending, a Justice Department memorandum called into question their validity, absent legislative authorization, under a constitutional provision reserving to Congress the power to dispose of property belonging to the United States.[99] Ralph Nader's organization Public Citizen, Inc., filed lawsuits challenging provisions of the regulations authorizing exclusive licensing of federally-owned patents[100] and providing standard patents rights clauses in govern-

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[95] Id.

[96] Id. at 196.

[97] Id.

[98] See Federal Property Management Regulations Amendment, 38 Fed. Reg. 3328 (1973); Federal Procurement Regulations Amendment, 38 Fed. Reg. 23,782 (1973).

[99] Department of Justice Memorandum from Roger C. Cramton, Assistant Attorney General, Office of Legal Counsel, to Bruce B. Wilson, Deputy Assistant Attorney General, Antitrust Division, on Constitutionality of Proposed Regulations Granting Contractors Greater or Principal Rights in Patents Arising out of Government Research and Development Contracts (Oct. 10, 1972), *reprinted in* 119 Cong. Rec. 40,417-20 (1973).

[100] See Public Citizen v. Sampson, 180 U.S.P.Q. (BNA) 497 (D.D.C. 1974).

ment contracts.[101] Although both lawsuits were ultimately dismissed for lack of standing on the part of the plaintiffs,[102] they raised unresolved questions about the legality of achieving the desired transformation in patent policy through administrative regulations without new legislation.[103]

Partly in response to these constitutional concerns and partly in response to the recommendations of the Commission on Government Procurement, the Committee on Government Patent Policy of the FCST prepared a draft bill to establish a uniform federal patent policy by statute.[104] This uniform policy would have given government contractors an option to acquire patent rights on inventions made in the course of government-sponsored research,[105] authorized exclusive licenses under government-owned patents,[106] and codified the policy previously established by executive order of vesting title to the inventions made by government employees in the course of their employment in the government.[107] This draft bill was forwarded to the Office of Management and Budget and to the Director of the Office of Science and Technology Policy, but the administration never sought to introduce it in Congress.[108] A similar bill was in-

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[101] See Public Citizen v. Sampson, 379 F. Supp. 662 (D.D.C. 1974).

[102] One district court granted plaintiff's motion for summary judgment, invalidating the regulations on the ground that they were not authorized by Congress. Public Citizen v. Sampson, 180 U.S.P.Q. (BNA) 497 (D.D.C. 1974). This decision was reversed without opinion on appeal. Public Citizen v. Sampson, 515 F.2d 1018 (D.C. Cir. 1975). A different district court judge granted defendant's motion to dismiss for lack of standing. Public Citizen v. Sampson, 379 F. Supp. 662 (D.D.C. 1974). This disposition was affirmed without opinion on appeal. Public Citizen v. Sampson, 515 F.2d 1018 (D.C. Cir. 1975).

[103] In 1976, another federal district court held invalid for lack of congressional authorization Exec. Order No. 10,096, 15 Fed. Reg. 389 (1950), which called for government ownership of inventions made by federal employees. Kaplan v. Johnson, 409 F. Supp. 190 (N.D. Ill. 1976). This decision was reversed on the merits on appeal. Kaplan v. Corcoran, 545 F.2d 1073 (7th Cir. 1976).

[104] See Federal Council for Science and Technology, Committee on Government Patent Policy, Draft Bill Entitled "Federal Intellectual Property Policy Act of 1976," *reprinted in* 1976 FCST Combined Report, supra note 57, at 82-119 app. D.

[105] Id. at 99-102 (§ 311 of the draft bill).

[106] Id. at 108 (§ 401(c) of the draft bill).

[107] Id. at 104-05 (§ 322 of the draft bill).

[108] The University and Small Business Patent Procedures Act: Hearings on S. 414 Before the Senate Comm. on the Judiciary, 96th Cong. 51 (1979) [hereinafter Senate Bayh-Dole Hearings] (statement of Elmer B. Staats, Comptroller General of the

troduced by Representative Thornton in the 95th Congress[109] but no hearings were held on it.[110]

F. The Domestic Policy Review and President Carter's Industrial Innovation Program

Further support for legislation to promote the private appropriation of government-sponsored research results came from the Domestic Policy Review on Industrial Innovation, initiated by President Carter in 1978 to identify and recommend Government actions to encourage increased industrial productivity and innovation.[111] The Industrial Advisory Subcommittee on Patent and Information Policy, a group created as part of the Domestic Policy Review and consisting primarily of patent lawyers from industry,[112] recommended that commercial rights to government-supported research be transferred to the private sector, either through transfer of title or through exclusive licenses to patents, subject to a nonexclusive license in the government.[113] The Subcommittee generally objected to government ownership of patents, indicating that the government could disclose information to the public through publication without obtaining patents,[114] that "the Government obtains patents on technology which, in the opinion of the private sector, does not provide an attractive business opportunity,"[115] and that if the government stopped filing patent applications it would

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United States).

[109] H.R. 6249, 95th Cong. 1 (1977).

[110] Senate Bayh-Dole Hearings, supra note 108, at 51 (statement of Elmer B. Staats, Comptroller General of the United States).

[111] See Advisory Committee on Industrial Innovation, Industrial Advisory Subcommittee on Patent and Information Policy, Report on Patent Policy (1979), *reprinted in* Advisory Committee on Industrial Innovation: Final Report, at 147 (1979) [hereinafter Domestic Policy Review Final Report], and *in* House Hearings on President's Industrial Innovation Program, supra note 3, at 787 app.1.

[112] The membership list is set forth in House Hearings on President's Industrial Innovation Program, supra note 3, at 788 app. 1.

[113] Domestic Policy Review Final Report, supra note 111, at 155-56; House Hearings on President's Industrial Innovation Program, supra note 3, at 797-98 app.1.

[114] Domestic Policy Review Final Report, supra note 111, at 156; House Hearings on President's Industrial Innovation Program, supra note 3, at 797 app.1.

[115] Domestic Policy Review Final Report, supra note 111, at 156; House Hearings on President's Industrial Innovation Program, supra note 3, at 798 app.1.

free up resources of the Patent and Trademark Office that could be redirected toward reducing its backlog.[116]

The work of the Domestic Policy Review culminated in an October 31, 1979, address to Congress by President Carter, in which he announced his administration's support for legislation setting a uniform government patent policy as part of a wide-ranging initiative to promote industrial innovation.[117] The administration's ultimate proposal did not go quite as far as the Industrial Advisory Subcommittee on Patent and Information Policy would have wished, but it did provide for the retention of patent ownership in the results of government-sponsored research by small businesses and universities, and exclusive licenses to other contractors in specific fields of use that they agreed to commercialize, all subject to a nonexclusive license and march-in rights in the government.[118]

The provisions restricting the rights acquired by large business contractors, aimed at forestalling concerns about the impact of the change on economic concentration in industry,[119] drew opposition from groups in the bar[120] and industry, who favored allowing all government contractors, large or small, to retain patent ownership.[121] Thus the treatment of large business contractors presented a political dilemma. On one hand, al-

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[116] Domestic Policy Review Final Report, supra note 111, at 157, House Hearings on President's Industrial Innovation Program, supra note 3, at 798-99 app.1. Even for inventions made by government employees at government expense, the Subcommittee members were "divided about equally between those who feel that the government employee should have title to the invention, and those who feel that such inventions should be transferred to an independent, nongovernmental organization, . . . or auctioned to the private sector or transferred to the private sector in some other manner." Domestic Policy Review Final Report, supra note 111, at 156; House Hearings on President's Industrial Innovation Program, supra note 3, at 798 app. 1.

[117] Industrial Innovation Initiatives: Message to the Congress on Administration Actions and Proposals, Pub. Papers 2070, 2071 (Oct. 31, 1979).

[118] See H.R. 6933, 96th Cong., §§ 383, 384, 386, 387 (1980).

[119] House Hearings on President's Industrial Innovation Program, supra note 3, at 17, 19 (testimony of Ky P. Ewing, Jr., Deputy Assistant Attorney General, Antitrust Division).

[120] Id. at 125 & 159 app. 3 (statement of Donald R. Dunner, President, American Patent Law Association).

[121] Id. at 555, 557 (statement of Dr. James D. D'Ianni, President, American Chemical Society).

though these contractors often retained title to patents under prevailing administrative practice, particularly when the funding agency was DoD, any legislative endorsement of this practice was vulnerable to challenge as a giveaway of government rights to wealthy corporations at the expense of consumers and taxpayers. On the other hand, legislation that gave large business contractors less than full title to patents would leave many contractors worse off than before, and was thus sure to draw opposition from industry trade groups and their patent lawyers.

G. The Bayh-Dole Bill

Meanwhile a different approach, focusing exclusively on small business and non-profit contractors, passed the Senate in a bill introduced by Senators Birch Bayh and Robert Dole.[122] The Bayh-Dole bill made no provision at all for large business contractors, whose rights would continue to be determined under the policies of the various agencies funding their research. According to a contemporary newspaper account, the sponsors of the bill said that to include large businesses would invite automatic defeat of the bill in response to consumer advocates and antitrust lawyers.[123]

Apparently the immediate trigger for introduction of the Bayh-Dole bill was frustration on the part of universities with changes in the way HEW and DoD handled patent rights in their inventions. The change at HEW followed a relatively harmonious decade after the agency responded in the late 1960s to sharp criticism from the General Accounting Office of its handling of patent rights in the NIH medicinal chemistry program.[124] The agency response was to allow universities with approved technology transfer capabilities to retain title to patents

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[122] S. 414, 96th Cong. (1980).

[123] Bradley Graham, Patent Bill Seeks Shift to Bolster Innovation, Wash. Post, Apr. 8, 1979, at M1, *reprinted in* Senate Bayh-Dole Hearings, supra note 108, at 29-30. This account was included in the record at the request of Senator Dole, in the presence of Senator Bayh. See id. at 28-29.

[124] See Senate Bayh-Dole Hearings, supra note 108, at 52, 57 (letter from Elmer B. Staats, Comptroller General of the United States, to Sen. Birch Bayh, July 17, 1979, and enclosed summary of patent policies and practices of agencies). This episode is discussed supra notes 68-76 and accompanying text.

and to grant exclusive licenses to industry under the terms of Institutional Patent Agreements ("IPAs").[125] IPAs conferred rights in universities on a prospective basis, without the need for case-by-case requests for a government waiver after an invention had been made, thereby eliminating uncertainty and bureaucratic delays for universities that sought patent rights.

Then, in a 1978 draft report, HEW's Office of General Counsel recommended that use of IPAs be reconsidered on the ground that they encourage exclusive licensing and thereby limit the agency's control over the availability and cost of HEW-supported inventions.[126] Around the same time, the HEW general counsel's office began taking longer to review case-by-case requests for a waiver of government patent rights after inventions had been made. These developments caused concern that HEW might be reverting to its pre-1968 policies[127] and created pressure for legislation that would make permanent and nondiscretionary the arrangements that the agency had previously implemented on a discretionary basis.

The change in DoD policy took place against the backdrop of an agency policy that generally allowed contractors with an established commercial position in the field to retain title to patents prospectively under the terms of their contracts.[128] The distinction between contractors with and without an established commercial position in the field tracked the language in Section 1(b) of the 1963 and 1971 Presidential Memoranda on patent policy. This policy satisfied commercial contractors, but it left universities unhappy because, lacking an established commercial position, they had to seek patent rights on a deferred basis after inventions had been identified and disclosed. For years DoD got around this difficulty by using a "special situa-

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[125] See Senate Bayh-Dole Hearings, supra note 108, at 37 (testimony of Elmer B. Staats, Comptroller General of the United States). See generally The Role of the Federal Laboratories in Domestic Technology Transfer: Hearings Before the Subcomm. on Science, Research and Tech. of the House Comm. on Science and Tech., 96th Cong. (1979) [hereinafter The Role of Federal Laboratories] (discussing technology transfers between federal labs, private industry, and universities).

[126] See Senate Bayh-Dole Hearings, supra note 108, at 37, 48 (testimony of Elmer B. Staats, Comptroller General of the United States).

[127] Id. at 37.

[128] This discussion is drawn from the testimony of Elmer B. Staats. Id. at 38, 60-62.

tions" provision in the Presidential Memoranda to put a title-in-contractor clause in contracts with qualifying universities and nonprofit institutions who had approved patent policies. But the regulations were revised in August of 1975 to discontinue the "special situations" exception.[129] Under the new rules universities had to show an established technology transfer program in the particular field of technology of the sponsored research, not merely an approved patent policy, in order to get prospective title retention clauses in contracts. The result was an eighty percent increase in deferred determinations of title to inventions for DoD in 1976.[130] Requests for title were generally approved, but they took time, and the additional bureaucratic hurdle was annoying to universities.[131]

The Bayh-Dole approach was popular with universities, who claimed that a clear policy giving them patent rights at the time of contracting would facilitate their efforts to transfer technology to industry. It was also popular with small businesses, who justified their favored position under the bill on the grounds that they received discriminatory treatment under the prevailing discretionary policies of the various agencies, that they were in fact more innovative than their larger competitors, and that patent rights would allow them to compete more effectively with larger firms.[132] Large businesses and their representatives would have preferred legislation that granted them comparable rights,[133] but they were often able to obtain such rights from their

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[129] Id. at 60.

[130] Id. at 62.

[131] See id. at 38, 60-62.

[132] See, e.g., House Hearings on President's Industrial Innovation Program, supra note 3, at 241-75 (testimony of Eric P. Schellin, National Small Business Association, Small Business Legislative Council, American Society of Inventors, and National Patent Council); Senate Bayh-Dole Hearings, supra note 108, at 95-110 (testimony of Patrick J. Iannotta, President, Ecolotrol, Inc.; Arthur S. Obermayer, President, Moleculon Research Corp.; and Walter D. Syniuta, President, Advanced Mechanical Technology, Inc.).

[133] See House Hearings on President's Industrial Innovation Program, supra note 3, at 95-96 (testimony of Donald R. Dunner, President, American Patent Law Association); id. at 632-33 (testimony of Harry F. Manbeck, Jr., General Patent Counsel, General Electric Co.); id. at 863, 872 (statement of the National Association of Manufacturers); id. at 897 (letter from Robert A. Roland, President, Chemical Manufacturers Association, to Rep. Robert W. Kastenmeier, Chairman,

sponsoring agencies under existing administrative policy, and at least for the time being they were unable to obtain them from Congress. A proposed amendment to the Bayh-Dole bill that would have granted title to large business contractors was defeated by a vote of 60-34 in the Senate.[134] Even without such a provision, the new law would do nothing to worsen the position of large businesses, and it might open the door to expanding its provisions to cover them in the future.

The Carter administration argued unsuccessfully that an omnibus bill was needed to properly balance tradeoffs among competing interests.[135] The Bayh-Dole bill was only a partial solution that did nothing to unify patent policy across agencies; indeed, if the rights of large contractors were still to be governed by the inconsistent practices and policies of the various agencies, a new set of statutory rules applicable only to nonprofit institutions and small businesses would merely add a twenty-seventh policy to the twenty-six inconsistent sets of rules and regulations already on the books.[136]

But the Bayh-Dole Act as passed by Congress was silent on the rights of large business contractors. And although bills aiming to unify the treatment of large and small contractors were introduced in subsequent Congresses,[137] to this day it is only by virtue of a Memorandum to the Heads of Executive Departments and Agencies signed by President Reagan in

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Subcommittee on Courts, Civil Liberties, and the Admin. of Justice of the House Comm. on the Judiciary, June 2, 1980).

[134] Letter from Sen. Gaylord Nelson, Chairman, Senate Select Comm. on Small Bus., to Rep. Robert W. Kastenmeier, Chairman, Subcomm. on Courts, Civil Liberties, and the Admin. of Justice of the House Comm. on the Judiciary (June 9, 1980), *reprinted in* House Hearings on President's Industrial Innovation Program, supra note 3, at 877-78.

[135] House Hearings on President's Industrial Innovation Program, supra note 3, at 42 (testimony of Ky P. Ewing, Jr., Deputy Assistant Attorney General, Antitrust Division).

[136] House Hearings on President's Industrial Innovation Program, supra note 3, at 618 (testimony of Jordan J. Baruch, Assistant Secretary of Commerce, Office of Productivity, Technology, and Innovation).

[137] See, e.g., S. Rep. No. 97-381 (1982) [hereinafter 1982 Senate Patent Policy Report]; The Uniform Science and Technology Research and Development Utilization Act: Hearings on H.R. 5003 Before the Subcomm. on Science, Research and Tech. of the House Comm. on Science and Tech., 98th Cong. 4 (1984) [hereinafter Science and Technology Research Hearings] (testimony of Rep. F. James Sensenbrenner, Jr.).

1983,[138] and quietly endorsed by Congress in an inconspicuous housekeeping provision to a 1984 change in the law,[139] that large business contractors enjoy the benefits that Congress explicitly provided only for small businesses and nonprofit organizations under the terms of the Bayh-Dole Act.

II. JUSTIFYING THE POLICY

A. Preferential Treatment of Nonprofit and Small Business Contractors

The focus on universities and small businesses as recipients of title to government-sponsored discoveries may have been primarily a matter of political expediency, but the distinction between these contractors and others was justified in the hearings on more principled grounds. The Carter administration argued that universities and small businesses would have stronger incentives than large businesses to promote widespread commercialization of inventions, and that they typically would not have sufficient market power for their acquisitions of title to raise antitrust concerns.[140] Senator Bayh noted that the practice of obtaining case-by-case waivers of title from the sponsoring agency created more of a hardship for nonprofit institutions and small businesses than for large companies because of the disparity in resources available to them.[141]

Much of the testimony in favor of allowing small businesses to retain patent rights stressed the superiority of small firms over large firms in developing new technologies and the importance of patent rights in protecting the market position of innovative

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[138] Government Patent Policy Memorandum, supra note 8, at 248 ("To the extent permitted by law, agency policy with respect to the disposition of any invention made in the performance of a federally-funded research and development contract, grant or cooperative agreement award shall be the same or substantially the same as applied to small business firms and nonprofit organizations under Chapter 38 of Title 35 of the United States Code.").

[139] See infra note 169.

[140] See House Hearings on President's Industrial Innovation Program, supra note 3, at 36-37 (testimony of Ky P. Ewing, Jr., Deputy Assistant Attorney General, Antitrust Division).

[141] Senate Bayh-Dole Hearings, supra note 108, at 41 (Sen. Bayh's response to testimony of Elmer B. Staats, Comptroller General of the United States).

smaller firms against unfair competition from big firms. Small business was the white knight of the Carter administration's strategy for improving the industrial competitiveness of the nation. It was pictured as innovative, adaptive, risk-taking, entrepreneurial and competitive, yet consistently underrated by funding agencies in their allocations of research dollars and patent rights.[142] Large business, by contrast, was pictured as shortsighted, risk-averse, and predatory, more likely to suppress new technologies than to adopt them, yet savvy and powerful in their dealings with government agencies and therefore more successful than their more worthy small business competitors in garnering government research contracts and securing patent rights in the results.[143] Granting patent rights to small businesses would enhance competition by allowing innovative firms to compete more effectively with the sluggish behemoths whose short-sightedness had led to a decline in the position of U.S. industry in world markets.[144]

But beyond these broad generalizations, the arguments for leaving title in universities were for the most part quite different from the arguments for leaving title with small business contractors. A careful consideration of the arguments suggests that, as research performers and as patent holders, small business contractors have more in common with large business contractors than they do with universities, and universities have more in common with the government than they do with small businesses.[145]

The primary case for allowing small business contractors to

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[142] See, e.g., id. at 2 (opening statement of Sen. Birch Bayh).

[143] See, e.g., id. at 95-105 (testimony of Patrick J. Iannotta, President, Ecoltrol, Inc.; Arthur S. Obermayer, President, Moleculon Research Corp.; and Walter D. Syniuta, President, Advanced Mechanical Technology, Inc.).

[144] See, e.g., id. at 259 (statement of Eric P. Schellin, National Small Business Association) ("If big business in the U.S. is so innovative, why do I drive a foreign made car, own a foreign made camera, and watch a foreign made T.V. . . . [B]ig business has only a limited ability to be innovative. Therefore, we of small business see no good reason to reward failure.").

[145] Although the terms of the Bayh-Dole Act made allies of universities and small business with respect to government patent policy, these two groups had opposing interests in other features of the Carter administration's Industrial Innovation Program, such as the proposal to require agencies funding research to set aside a portion of their budgets for research contracts with small businesses.

retain title to patents rested not on the superiority of small business to large business, but rather on the importance of exclusive rights in a discovery to motivate commercial development and the uncertainty and bureaucratic burden involved in attempting to obtain such rights from the government on a case-by-case basis after the fact. Although in theory a government agency holding title to a patent could choose the licensee that offers the most promise of successfully developing the invention into a commercial product, agencies might not be trusted to get the property into the right hands. Government agencies that are not directly involved in commercial development might lack a clear understanding of the commercial potential of the inventions that they own and motivation to find licensees. Moreover, whenever a government agency has discretion to make case-by-case decisions, delays and uncertainty are inevitable, creating administrative costs and reducing the willingness of firms to commit resources promptly to commercial development of inventions.

Nor is it clear that as a general matter there is much to be gained by giving the funding agency authority to designate a licensee other than the contractor. Some witnesses observed that the firm that makes a discovery is generally in a better position to develop it commercially than other firms that do not employ the inventor or have ready access to the unpatented know-how associated with the discovery, and also better motivated to do so.[146] When the government holds a patent on a discovery made by a contractor, all the government can offer to a potential licensee (other than the contractor) is naked patent rights, which in many cases will be inadequate to achieve meaningful technology transfer in the absence of further technical information and ongoing contact with the inventor. Allowing commercial contractors to retain title to inventions would automatically vest

[146] See, e.g., House Hearings on President's Industrial Innovation Program, supra note 3, at 163 app. 3 (appendix to the statement of Donald R. Dunner, President, American Patent Law Association) ("An invention is like a baby that requires a lot of loving care and attention to raise it to the point where it can be self-sufficient and productive. An invention is not going to reach the commercial market place without a considerable amount of effort on someone's part. This effort is most likely to be expended by its creators, the contractor.").

exclusive rights in the firm that is probably best able to bring the discovery to market, while eliminating the government as a middleman. Historically, the government has often licensed inventions on which it holds title nonexclusively to anyone who seeks a license, thereby diluting or eliminating incentives to develop patented inventions. Moreover, if the government stands in the position of licensor, it may use the license terms to impose unwelcome regulations on the developing firm, or at the very least to extract royalties that would amount to a tax on product development.

These are powerful arguments for granting title to commercial contractors, but they would seem to apply to both large and small business contractors, while having limited relevance to universities and other nonprofit organizations that, like the government, do not develop commercial products themselves. If an invention is born in the private sector, there is much to be said for a presumption in favor of letting it stay there, in the hands of the firm that will generally have the best understanding of its potential and the strongest motivation to put it to use, without imposing any further bureaucratic barriers or royalty obligations that might impede product development.

But what about an invention that was not made at an institution with the resources and capabilities to develop it into a commercial product? If title to a patent is held by a noncommercial institution, the discovery will have to be transferred to the private sector for commercial development, whether the patent holder is the government or a university. If technology transfer will be necessary in either case, is there any reason to believe that commercial development will be more likely if patent rights are owned by the university or other non-profit institution at which the invention was born than if they are owned by the government?

The argument for allowing universities to retain patent rights stressed the role of patents in facilitating technology transfer between academic laboratories and the private sector. Like the government, universities are not in a position to develop new discoveries into commercial products, but need to attract commercial licensees to invest in further development. University-owned patent rights would facilitate this process in part by pro-

viding a source of exclusive rights to assure private firms that successful products would be profitable. University-based discoveries were presented as particularly risky candidates for commercial development because they were byproducts of basic research and therefore farther removed from commercial applications than discoveries made by commercial contractors in industrial laboratories.[147]

This analysis may call for patenting inventions made in the course of government-supported research and offering exclusive rights under such patents to firms that are willing to develop them into marketable products, but it is not obvious why it calls for placing title to patents in the university rather than the government. Much of the testimony in opposition to government ownership focused on the poor track record of the government in getting its patent portfolio licensed for commercial development. At least one university representative contrasted this poor performance of the government with university success in attracting commercial licensees for those discoveries that they owned under the terms of IPAs.[148] Some witnesses attributed the difference to reluctance on the part of the government to extend exclusive licenses, which made commercial development unprofitable,[149] or to the time lags and uncertainty associated with obtaining licenses from government bureaucracies,[150] or to concern that firms would lose their exclusive position under their own background patent rights if they got involved in developing technologies related to government-sponsored research,[151] or to general mistrust of the government as a licensor.[152]

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[147] See 1978 Senate Select Committee Hearings, supra note 62, at 307 (testimony of Thomas F. Jones, Vice President for Research, Massachusetts Institute of Technology).

[148] See, e.g., House Hearings on President's Industrial Innovation Program, supra note 3, at 287-88, 354 (testimony of Howard W. Bremer, Patent Counsel, Wisconsin Alumni Research Foundation).

[149] See, e.g., The Role of Federal Laboratories, supra note 125, at 621-22 (statement of W. Novis Smith, Director of Research and Development, Thiokol Corp.).

[150] See, e.g., Senate Bayh-Dole Hearings, supra note 108, at 124-25 (response to Sen. Bayh's written questions by Arthur S. Obermayer, President, Moleculon Research Corp.).

[151] See, e.g., id. at 95-98 (testimony of Patrick J. Iannotta, President, Ecolotrol, Inc.).

[152] See, e.g., House Hearings on President's Industrial Innovation Program, supra note 3, at 293, 361-62 (testimony of Howard W. Bremer, Patent Counsel, Wisconsin

Universities also argued that they were better able than the government to transfer inventions made by their researchers to the private sector because they had greater familiarity with the inventions and better access to university inventors. Direct interaction between the inventor and the licensee is often necessary to insure effective technology transfer; universities are better able than government funding agencies to bring this interaction about.[153] University ownership of patents, with the prospect of earning royalties for the university and the inventor, would also motivate university researchers to invest time and energy in technology transfer.[154] University researchers were pictured as primarily interested in the rewards of open publication, with only limited interest in patents and collaboration with industry. Getting them to file patent disclosures requires work on the part of their institutions, and universities might be less willing to go to the trouble if they did not stand to profit from their patents. Finally, when universities are assured of patent rights in the results of federally-sponsored research, it is easier for them to attract industrial funding for related research on campus, because industrial sponsors need not be concerned that they will lose the rights to develop any commercially interesting discoveries that come out of the research (or background patent rights in their own prior research in the area) because of government patent policy.[155] Leaving title with universities would thus not only facilitate technology transfer, but would also encourage industry to share in the costs of university-based research.[156]

Curiously, although much was made of the barriers to product development arising from the unwillingness of the government to enter into exclusive licenses, some universities indicated that

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Alumni Research Foundation).

[153] 1978 Senate Select Committee Hearings, supra note 62, at 311 (testimony of Thomas F. Jones, Vice President for Research, Massachusetts Institute of Technology).

[154] Id. at 378-79 (testimony of Howard W. Bremer, Patent Counsel, Wisconsin Alumni Research Foundation).

[155] See id. at 309 (testimony of Thomas F. Jones, Vice President for Research, Massachusetts Institute of Technology).

[156] Id. at 576 (statement of Donald R. Dunner, President, American Patent Law Association).

they also preferred nonexclusive licenses and that significant portions of their patent portfolios were licensed on a nonexclusive basis.[157] Some supporters of the Bayh-Dole bill also indicated with approval that universities would have stronger incentives than large businesses to promote widespread utilization of research results.[158]

This suggests a further argument for title in universities that is somewhat at odds with the arguments based on the importance of exclusive rights in motivating product development. To the extent that opponents of private appropriation feared that vesting ownership of important discoveries in a single firm would inhibit the dissemination of new knowledge, they might be less troubled by university ownership of patents in view of the general inclination of universities toward widespread dissemination of new knowledge. Of course, when a university licenses its patents nonexclusively, it is hard to see how the patents are doing anything to increase the motivation of firms to develop commercial products; presumably product development would be at least as profitable if the nonexclusively licensed inventions were freely available in the public domain. Nonetheless, for some inventions the incentive effects of vesting exclusive rights in a single firm might not be worth the foregone benefits to the overall research enterprise of more widespread dissemination, and universities might be more likely than private firms to recognize these cases and handle them appropriately through nonexclusive licensing.

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[157] See id. at 311 (statement of Thomas F. Jones, Vice President for Research, Massachusetts Institute of Technology) (on the preference of M.I.T.); id. at 348 (statement of Arthur A. Smith, Counsel, Massachusetts Institute of Technology) (same); id. at 346-47 (statement of Clark A. McCartney, Director of Contracts and Grants, University of Southern California) (on the preference of U.S.C.); id. at 390 (statement of Howard W. Bremer, Patent Counsel, Wisconsin Alumni Research Foundation) (on the preference of the University of Wisconsin).

[158] See, e.g., Government Patent Policy Act of 1980: Hearing on H.R. 5715 Before the Subcomm. on Science, Research and Tech. of the House Comm. on Science and Tech., 96th Cong. 6 (1980) [hereinafter Government Patent Policy Act Hearings] (statement of Jordan Baruch, Assistant Secretary of Science and Technology, Department of Commerce).

B. The Statistical Argument Against Government Ownership

For both nonprofit institutions and business contractors, the primary argument against government ownership of patents was a statistical one. The government, according to the testimony of numerous witnesses, had a poor track record of getting its extensive patent portfolio transferred to industry for commercial development. Only a small percentage of its estimated 28,000-30,000 patents had been successfully licensed and exploited commercially.[159] Thus, it was argued, because of government ownership the results of government-sponsored research were languishing in the archives.

But the statistical evidence presented was inadequate to document this claim. For one thing, as noted above,[160] the government patent portfolio that provided the basis for this argument reflected a huge selection bias; it consisted largely of inventions made by contractors whose research was sponsored by DoD.[161] Under the terms of these research contracts and applicable regulations, the contractors generally could have retained title to the patents if they had wanted to do so.[162] Thus the pat-

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[159] See, e.g., Science and Technology Research Hearings, supra note 137, at 2 (opening statement of Rep. F. James Sensenbrenner, Jr.); Senate Bayh-Dole Hearings, supra note 108, at 2 (opening statement of Sen. Birch Bayh); id. at 28 (opening statement of Sen. Robert Dole); id. at 32 (opening statement of Sen. Orrin G. Hatch); id. at 46 (testimony of Elmer B. Staats, Comptroller General of the United States) (citing 1978 Federal Council for Science and Technology report on government patent policy); id. at 100-01 (testimony of Walter D. Syniuta, President, Advanced Mechanical Technology, Inc.); id. at 150 (testimony of Betsy Ancker-Johnson, Vice President of General Motors for the Environmental Activities Staff); 1979 House Patent Policy Hearings, supra note 62, at 4 (statement of Sen. Harrison H. Schmitt).

[160] See supra notes 62-64 and accompanying text.

[161] See Federal Counsel for Science and Technology, Committee on Government Patent Policy, Data Collection and Analysis Subcommittee, Statistical Report, *reprinted in* 1976 FCST Combined Report, supra note 57, at 385 app. J. That report indicated that out of an estimated 28,021 unexpired U.S. patents owned by the government as of the end of fiscal year 1976, 17,632, or 63% of the portfolio, were from the DoD, an agency that generally allowed its contractors to retain title. Id. at 440-41 tbl. I. Given that the patents remaining in the government's portfolio consisted largely of those that had already been rejected by the contractors who had made the discoveries, it is not surprising that only 282 of these patents, or 1%, were licensed. Id.

[162] See Dobkin, supra note 30, at 586-91; Watson et al., supra note 30, at 295, 308, 320-43.

ents held by the government were for the most part those that industry had already passed up, in all likelihood because of their limited applicability to civilian commercial needs. It is hardly surprising that few firms were interested in taking licenses from the government to patents that had already been rejected by contractors that could have owned them outright if they had found them at all commercially interesting.[163] Rather than attributing the low licensing rate to government ownership or to the unavailability of exclusive licenses, one might ask why such commercially irrelevant inventions were patented at all.[164]

Agencies that were more reluctant than DoD to part with title to inventions were more successful in licensing their presumably more valuable patent portfolios, although their holdings accounted for a lesser portion of the overall government patent portfolio. For example, 325 of the 28,000 patents in the government's portfolio were from HEW, and seventy-five (or twenty-three percent) of these HEW patents were licensed as of the end of fiscal year 1976.[165]

Second, the number of patent licenses may be a misleading measure of utilization of inventions in that it overlooks both *unlicensed* development of patented inventions and development or commercial utilization of *unpatented* inventions. The former point was recognized by a number of the more thoughtful and candid observers of the government's patent licensing record. Indeed, the 1968 Harbridge House Study acknowledges in a footnote that it was "common knowledge that government-

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[163] See Government Patent Policy Act Hearings, supra note 158, at 7 (testimony of Jordan Baruch, Assistant Secretary for Science and Technology, Department of Commerce) ("The Government's patent portfolio is largely composed of patents that contractors chose not to claim, patents that were felt not to be useful even for their own business.").

[164] A number of government witnesses conceded as much in response to questions about what should be done with the government's existing patent portfolio to promote utilization of the underlying inventions. See, e.g., Science and Technology Research Hearings, supra note 137, at 8 (testimony of D. Bruce Merrifield, Assistant Secretary for Productivity, Technology and Innovation, Department of Commerce) ("Unfortunately, most of those patents are not very valuable. They should not have ever been filed; they are defensive patents that are not necessary, and that's a different problem, but also many of them now are no longer relevant in the sense that new technology has superseded [sic] them.").

[165] 1976 FCST Combined Report, supra note 57, at 440 tbl. I.

owned inventions may be used without a formal license," and that it was therefore "probable that more inventions are being used than are noted in government records, although no data were available as to the exact number."[166] Also unavailable, of course, are data on the utilization of *unpatented* government-sponsored discoveries by industry.

The same statistics on the low licensing rate for government-owned patents continued to be cited after passage of the Bayh-Dole Act in support of legislation to extend the title-in-contractor policy to other research performers.[167] Congress passed a series of amendments to the Bayh-Dole Act in 1984 extending its provisions to inventions originating at government-owned, contractor-operated facilities, repealing limitations on the permissible duration of licenses from nonprofit organizations to large businesses on government-sponsored inventions, and quietly endorsing President Reagan's memorandum extending the benefits previously provided only to small businesses and nonprofit organizations to all contractors.[168] The accompanying committee report noted with approval the success of universities in licensing their patents and entering into col-

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[166] 1 Harbridge House Report, supra note 58, at 7 n.6.

[167] See, e.g., 1982 Senate Patent Policy Report, supra note 137, at 3; Science and Technology Research Hearings, supra note 137, at 2 (opening statement of Sen. F. James Sensenbrenner, Jr.).

[168] Although the statutory provisions continue to distinguish between the rights to be accorded to small business and nonprofit contractors and other contractors, Congress indirectly endorsed the uniform treatment of all contractors under the terms of the Government Patent Policy Memorandum, supra note 8, by amending the statute in 1984 to provide:

> Nothing in this chapter is intended to limit the authority of agencies to agree to the disposition of rights in inventions made in the performance of work under funding agreements with persons other than nonprofit organizations or small business firms in accordance with the Statement of Government Patent Policy issued on February 18, 1983, agency regulations, or other applicable regulations or to otherwise limit the authority of agencies to allow such persons to retain ownership of inventions except that all funding agreements, including those with other than small business firms and nonprofit organizations, shall include the requirements established in [section] 202(c)(4) [giving the Federal agency a paid-up, nonexclusive license to the invention] and section 203 [giving the agency march-in rights in certain circumstances, including if the contractor fails to take adequate steps to achieve practical utilization of the invention] of this title..[sic] (double period in original).

Trademark Clarification Act of 1984, § 501(13), 35 U.S.C. § 210(c) (1994).

laborations with industry since passage of the Bayh-Dole Act four years earlier,[169] and contrasted this success with the relatively poor performance of the federal laboratories.[170]

C. Government as Licensor

At the same time that the government was presented as an incompetent licensor, legislative efforts were underway to expand the role of the government as a licensor of its own patents. The Bayh-Dole Act itself, while limiting the circumstances in which the federal government would hold title to patents, authorized federal agencies to apply for and hold patents and to license these patents on a nonexclusive, exclusive, or partially exclusive basis, royalty-free or in exchange for royalties.[171]

Separately, in hearings on the role of federal laboratories in technology transfer,[172] witnesses from federal agencies described institutional barriers to achieving effective technology transfer to the private sector, including the absence of a clear legislative mandate or authorization for federal laboratories to engage in technology transfer,[173] insufficient funding for technology transfer activities,[174] and a lack of professional recognition and rewards to individuals who devoted time and energy to technology transfer.[175]

Congress attempted to address these problems in the Stevenson-Wydler Act, passed the same year as the Bayh-Dole Act, which explicitly directed federal agencies to "strive where appropriate to transfer federally owned or originated technology

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[169] S. Rep. No. 98-662, at 2 (1984), *reprinted in* 1984 U.S.C.C.A.N. 5799, 5800.

[170] S. Rep. No. 98-662, at 4-5, *reprinted in* 1984 U.S.C.C.A.N. 5799, 5803-5804.

[171] Act of Dec. 12, 1980, Pub. L. No. 96-517, § 207, 94 Stat. 3015, 3023-3024 (codified as amended at 35 U.S.C. § 207(a) (1994)).

[172] See The Role of Federal Laboratories, supra note 125.

[173] Id. at 36 (statement of George F. Linsteadt, Chairman, Federal Laboratory Consortium, Naval Weapons Center).

[174] Id. at 570-71 (statement of Richard C. Atkinson, Director, National Science Foundation) (noting that laboratory directors who allocate funds to goals outside of their primary missions are vulnerable to budget reduction).

[175] Id. at 51 (testimony of Gerald E. Miller, Science Technology Coordinator, Federal Laboratory Consortium) ("I was told by my laboratory when I opted to do this for the lab that I would never be promoted again if I chose to do this. If I was willing to sacrifice my career, then go to it and be technology transfer [sic].").

career problem

to State and local governments and to the private sector" and to set aside funds from their research and development budgets to support technology transfer functions.[176] In contrast to the thrust of Bayh-Dole, which was to get the federal government out of the technology transfer loop, the thrust of Stevenson-Wydler was to engage federal agencies actively in the process of technology transfer in cases where there was no contractor to take charge of this mission itself.

Efforts to promote active federal involvement in technology transfer took a major step forward with passage of the Federal Technology Transfer Act of 1986.[177] That Act amended the Stevenson-Wydler Act to authorize government-operated laboratories to enter into cooperative research and development agreements ("CRADAs") with industry, and to agree in advance, subject to reservation of a royalty-free license, to assign patents on inventions made by federal employees to the collaborating firm and to waive any federal claims to inventions made by the collaborating firm or its employees.[178] It also pro-

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[176] Stevenson-Wydler Technology Innovation Act of 1980, Pub. L. No. 96-480, § 11, 94 Stat. 2311, 2318 (codified as amended at 15 U.S.C. §§ 3710(a),(b) (1994)). That Act also created Offices of Research and Technology Applications in the larger laboratories to evaluate new technologies and promote transfer of technologies with commercial potential, § 11(b) (codified as amended at 15 U.S.C. § 3710(b) (1994)), and created a Center for the Utilization of Federal Technology in the Department of Commerce to function as a clearinghouse for information on federal inventions and patents, § 11(d) (codified as amended at 15 U.S.C. § 3710(d) (1994)).

[177] Federal Technology Transfer Act of 1986, Pub. L. No. 99-502, 100 Stat. 1785 (1986).

[178] Federal Technology Transfer Act of 1986, Pub. L. No. 99-502, § 2, 100 Stat. 1785-1787 (codified as amended at 15 U.S.C. § 3710a(a)(1), (b)(2)-(3) (1994)). That Act also established the Federal Laboratory Consortium for Technology Transfer to promote technology transfer activities within the federal laboratories. Id. § 3, 100 Stat. 1787-1789 (codified as amended at 15. U.S.C. § 3710(e) (1994)); see also Technology Competitiveness Act, Subtitle B of the Omnibus Trade and Competitiveness Act of 1988, Pub. L. No. 100-418, §§ 5101-5184, 1988 U.S.C.C.A.N. (102 Stat.) 1107, 1426-1454 (renaming and upgrading National Bureau of Standards as National Institute of Standards and Technology with mission to enhance competitiveness of American industry and creating Advanced Technology Program to assist businesses in creating and applying generic technology and research results); National Technical Information Act of 1988, Subtitle B of the National Institute of Standards and Technology Authorization Act for Fiscal Year 1989, Pub. L. No. 100-519, 1988 U.S.C.C.A.N. (102 Stat.) 2589, 2594-2596 (amending the Stevenson-Wydler Act to permit National Technical Information Service to take actions to disseminate technical information to private sector); National Competitiveness Technology

vided for the sharing of royalties with federal employee-inventors[179] and directed agencies that do not elect to file patent applications or otherwise to promote commercialization of inventions they own to allow government employee-inventors to retain title.[180] Three years later Congress moved to promote active technology transfer from the national laboratories with passage of the National Competitiveness Technology Transfer Act of 1989,[181] which amended the Stevenson-Wydler Act to include government-owned, contractor-operated laboratories.[182] President Clinton recently signed into law the National Technology Transfer and Advancement Act of 1995,[183] further expanding the rights of private sector CRADA partners to obtain exclusive licenses, providing for the sharing of federal royalty income with

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Transfer Act of 1989, Part C of the National Defense Authorization Act for Fiscal Years 1990 and 1991, Pub. L. No. 101-189, §§ 3131-3133, 1989 U.S.C.C.A.N. (103 Stat.) 1352, 1674-1679 (amending Stevenson-Wydler Act to include government-owned, contractor-operated laboratories; to provide that operating contracts for such laboratories may establish technology transfer and dissemination of information on technology transfer as laboratory missions; and to revoke federal agencies' authority to waive technology transfer funding requirements); National Defense Authorization Act for Fiscal Year 1991, Pub. L. No. 101-510, §§ 827-828, 1990 U.S.C.C.A.N. (104 Stat.) 1485, 1606-1607 (allowing federal agencies to use partnership intermediaries to conduct collaborative research and establishing model program to study commercial use of collaborative research); American Technology Preeminence Act of 1991, Pub. L. No. 102-245, 1992 U.S.C.C.A.N. (106 Stat.) 7 (providing for transfer of scientific and technical information to National Technical Information Service, appropriating funds for Regional Centers for Transfer of Manufacturing Technology); National Defense Authorization Act for Fiscal Year 1993, Pub. L. No. 102-484, § 3135(b), 1992 U.S.C.C.A.N. (106 Stat.) 2315, 2641 (requiring Secretary of Energy to establish program to facilitate and encourage transfer of technology to small businesses).

[179] Federal Technology Transfer Act of 1986, Pub. L. No. 99-502, § 7, 1986 U.S.C.C.A.N. (100 Stat.) 1785, 1792-1794 (codified at 15 U.S.C. § 3710c (1994)).

[180] Id. § 8, 1986 U.S.C.C.A.N. (100 Stat.) 1794-1795 (codified at 15 U.S.C. § 3710d (1994)). President Reagan promptly followed with an executive order directing the heads of executive departments and agencies to "promote the commercialization . . . of patentable results of federally funded research by granting to all contractors, regardless of size, the title to patents made in whole or in part with Federal funds. . . ." Exec. Order No. 12,591, 52 Fed. Reg. 13,414 (1987), as amended by Exec. Order No. 12,618, 52 Fed. Reg. 48,661 (1987), *reprinted as amended in* 15 U.S.C.A. § 3710 app. at 312 (West 1996).

[181] National Competitiveness Technology Transfer Act of 1989, Part C of the National Defense Authorization Act for Fiscal Years 1990 and 1991, Pub. L. No. 101-189, §§ 3131-3133, 1989 U.S.C.C.A.N. (103 Stat.) 1352, 1674-1679.

[182] Id. § 3133(a)(2)(A), 1989 U.S.C.C.A.N. (103 Stat.) 1675.

[183] National Technology Transfer and Advancement Act of 1995, Pub. L. No. 104-113, §§ 4-6, 1996 U.S.C.C.A.N. (110 Stat.) 775.

laboratory scientists, and clarifying the rights of federal employees to own inventions that the agency chooses not to patent.[184]

Through these and other measures, Congress has gradually expanded the private appropriation policy that the Bayh-Dole Act endorsed for research in nonprofit organizations and small businesses to cover government-sponsored research in a wide range of settings, including intramural research in government laboratories and collaborative research between government and private laboratories. Thus while on the extramural side of federally-sponsored research Congress has urged the sponsoring agencies to forbear from asserting patent rights in favor of contractors who might develop the underlying technologies more effectively, on the intramural side Congress has urged the same agencies to become more active in patenting their own discoveries and licensing them to industry.

Since its passage in 1980 the Bayh-Dole Act has been consistently hailed as an unqualified success in stimulating the commercial development of discoveries emerging from government-sponsored research in universities.[185] Its promoters have cited the dramatic increase in numbers of patents obtained by universities,[186] the superior record of universities, as compared to the

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[184] Id. §§ 4-6, 1996 U.S.C.C.A.N. (110 Stat.) 775-779.

[185] See, e.g., The Bayh-Dole Act, A Review of Patent Issues in Federally Funded Research: Hearings on Pub. L. No. 96-517 Before the Subcomm. on Patents, Copyrights and Trademarks of the Senate Comm. on the Judiciary, 103d Cong. 1-2 (1994) [hereinafter 1994 Bayh-Dole Oversight Hearings] (opening statement of Sen. Dennis DeConcini); id. at 11 (statement of Birch Bayh, Bayh, Connaughton, Fensterheim & Malone); id. at 19-20 (statement of Daryl Chamblee, Acting Deputy Director for Science, Policy, and Technology Transfer, National Institutes of Health); id. at 31-33 (statement of Howard Bremer, Association of University Technology Managers); id. at 89-90 (statement of Barbara Conta, Director, Technology Transfer, Regeneron Pharmaceutical Corp.); id. at 100-01 (statement of Charles Vest, President, Massachusetts Institute of Technology); id. at at 104-05 (statement of Gary Munsinger, President, Research Corporation Technology).

[186] From 1980 to 1991, U.S. patents awarded to the 100 academic institutions with the greatest R&D volume increased by a factor of 3.8 from 290 to 1,112. National Science Board, 1993 Science & Engineering Indicators 430 app. tbl. 5-27. During the same time period, expenditures for R&D performed in universities and colleges, as expressed in constant 1987 dollars, increased only by a factor of 1.75, from $8.608 billion to $15.086 billion, with the federal government's share of the expenditures alone increasing by a factor of 1.5 from $5.813 billion to $8.751 billion. Id. at 332 app. tbl. 4-3.

federal government, in licensing their patents, and the explosion in collaborative research between universities and industry as evidence that the Bayh-Dole Act works in practice. Subsequent legislation has attempted to duplicate this success for government-sponsored research in other settings, including intramural research, thereby expanding the government's role as patent licensor.

III. THE EVOLVING LOGIC OF TECHNOLOGY TRANSFER POLICY

This review of government patent policy over the past fifteen years reveals a consistent, dual-pronged strategy for promoting technology transfer. One prong aims to fortify the incentives of firms to develop commercial products out of the results of government-sponsored research by clearing away bureaucratic obstacles that impede or render uncertain their access to patent rights or exclusive licenses. The other prong aims to create incentives for individual and institutional research performers that are not in the business of developing products to cooperate in the commercialization of their inventions by allowing them to own patents and to share in the resulting profits and by directing them to consider technology transfer a part of their mission. To some extent these two prongs converge, uniting research performers and innovating firms in a common goal of identifying discoveries of commercial interest and working together to develop them into products. Yet there is an inherent tension between the revenue motive of research performers, as patent owners and licensors, and the profit incentives of innovating firms as licensees.

Consider the respective interests of a university that owns a patent on a discovery and a firm that is interested in developing that discovery into a commercial product. From the perspective of the firm, the way the university-owned patent makes product development more attractive is by providing the means of excluding competitors from the market for the product. Any royalty obligation that the firm incurs under the patent does nothing to enhance the profitability of the product but is merely a tax on product development that increases costs and reduces profits. It is by charging monopoly prices without facing competition, and not by paying royalties, that the firm preserves for it-

self the rents from product development.

From the point of view of the university, on the other hand, patent royalties are a concrete measure of the success of their technology transfer efforts, as well as a revenue source. Some of the most commonly acclaimed success stories for university technology transfer involve patents that yield substantial royalty payments through nonexclusive licenses, although nonexclusive licenses do little or nothing to give licensees an advantage over their competitors and thus are unlikely to enhance the profitability of product development.[187] An outstanding example is the Cohen-Boyer patents on fundamental recombinant DNA techniques jointly owned by Stanford University and the University of California. The Cohen-Boyer patents have been widely licensed to biotechnology firms and pharmaceutical firms on terms that have been set low enough that they have generated few complaints from industry and have probably not created a significant impediment to commercial development.[188] Because of the sheer number of firms using the technology, they have brought significant revenues to their institutions,[189] yet it can hardly be argued that the patents have done anything to promote product development that would not have occurred if the patented technology had instead been placed in the public domain. The reason universities count these patents as successes is not that they have helped move the technology out to the private sector for commercial development, but rather that they have generated a lot of revenue for the institutions that own them.

Even when university-owned patents are licensed on an exclusive basis, universities covet the rents that their licensees stand to collect from product development, and they have every

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[187] Nonexclusive patent licenses may give licensees an advantage over at least some of their competitors if the number of licensees is restricted, or if some licensees enjoy preferential license terms.

[188] Interview with Katherine Ku, Office of Technology Licensing, Stanford University, in Palo Alto, Cal. (Nov. 22, 1994).

[189] See Floyd Grolle, Stanford University Office of Technology Licensing, Remarks at the National Research Council Workshop on Intellectual Property and Research Tools in Molecular Biology, Washington, D.C. (Feb. 15-16, 1996) (estimating the total income from the Cohen-Boyer patents to Stanford and the University of California as approximately $200 million over the lifetime of the patents).

incentive under the Bayh-Dole Act to try to negotiate license terms that will give them as big a share of the profits as they can get. Nothing other than forbearance on the part of universities, and resistance on the part of potential licensees, prevents universities from striking deals that would extract the full amount of rents from development of a patented product for the universities themselves, which would leave the innovating firms in exactly the same position they would be in if the discovery had been placed in the public domain.

A striking recent example that suggests this potential is the exclusive license granted by Rockefeller University to Amgen, Inc., on an obesity gene found in mice. The discovery was licensed a few months after it was published, and prior to the issuance of any patent, in exchange for a "$20 million signing bonus, includ[ing] milestone payments totaling 'several times that amount,' and unspecified future royalties" on product sales.[190] It remains to be seen whether any patent rights that Rockefeller ultimately obtains will protect Amgen from competition in the sale of any viable commercial product. A sophisticated firm was willing to take a license on these terms, and perhaps they will yet profit from the deal, but the university's appetite for the potential rents at stake can only diminish that prospect. In this sense the revenue motive of licensors is in tension with the Bayh-Dole Act's underlying goal of enhancing the incentives of licensees to develop new products.

If the only goal of university patenting were to make commercial development of university-based discoveries more attractive, and if universities were infinitely good sports with unlimited resources to devote to patenting and nary a concern for their own pecuniary interests, the technology transfer goal would be better served through nonroyalty-bearing exclusive licenses. Revenues to universities, however beneficial they may be to the overall research enterprise, do nothing in and of themselves to promote technology transfer and commercial development of products based on university research results.

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[190] See Richard Stone, Rockefeller Strikes Fat Deal With Amgen, 268 Science 631, 631 (1995); Rockefeller University Awards Amgen Exclusive License to Develop Obesity Gene, Business Wire, Feb. 28, 1995, *available in* Lexis, Nexis Library, Business Wire File.

Of course, universities would have no reason to cooperate in technology transfer on a royalty-free basis, and the Bayh-Dole Act did not ask them to make such a sacrifice. A revenue motive may have been necessary to gain the participation of universities in technology transfer, but that revenue motive inevitably operates at cross-purposes with the larger goal of promoting product development by enhancing its profitability.

By encouraging the patenting (and licensing in exchange for royalties) of discoveries that in a previous era might have been freely disseminated, the Bayh-Dole Act in effect redistributes some of the gains from innovation back upstream, charging the firms that develop commercial products and paying the universities and government agencies that made early discoveries related to the product. Whatever might be said of this redistribution from the standpoint of fairness, it would appear more likely to retard product development than to promote it.[191]

From another perspective, this redistribution may not be such a bad thing. It may be that universities spend their money in more socially valuable ways than their patent licensees (or the shareholders or customers of their licensees). It may make sense to return some of the benefits realized in the private sector from the development of new technologies back to the research enterprise that spawned them in order to create more new technologies in the future. At a time when public funding for research is increasingly hard to come by, perhaps patent royalties can become an important supplement to government contracts and grants in covering the costs of research.

There are reasons to be cautious about this line of reasoning, however. First, although it is difficult to obtain good data on costs associated with university technology transfer activities, it appears that at least so far most universities are not making money from their patent portfolios.[192] Justifications of university

[191] The revenue motive of universities might promote product development to the extent that it prompts universities and government agencies to be more aggressive about marketing their discoveries, which leads more of the discoveries to be commercially developed. But when the commercial potential of a discovery is manifest to industry, and the terms of a Bayh-Dole license do nothing to enhance the profit expectations of industry, the license may appear to industry as a tax that redistributes rents upstream to the public sector.

[192] There are few sources of data on net revenues from university licensing activities.

and public sector patenting as a source of revenue must therefore confront the sobering fact that these revenues are in most cases insufficient even to cover the costs of patenting and licensing activities. But some universities are already profiting from their patent portfolios,[193] and perhaps others will start making money as they become more sophisticated about identifying discoveries that are of sufficient commercial interest to justify the costs of pursuing patent rights and marketing these discoveries to the private sector. Nonetheless, data from the Association of University Technology Managers indicate that so far even the gross royalties collected by its members under patents are trivial in comparison to their total sponsored research

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The Association of University Technology Managers ("AUTM") gathers annual data from its members on gross royalties received, royalties paid to other institutions, legal fees expended, legal fees reimbursed, and numbers of professional and staff support full-time equivalents employed, but it does not collect data on the costs of operating technology transfer offices. See Association of University Technology Managers, Inc., AUTM Licensing Survey: FY 1994 Survey Summary and Selected Data FY 1991-FY 1994 (on file with The Virginia Law Review Association) [hereinafter AUTM Survey]. For FY 1994, AUTM United States university members reported collecting $265,932,578 in gross royalties received, paying $20,747,204 in royalties to other institutions, and expending $53,345,200 in legal fees, of which $25,600,573 were reimbursed. Id. at 28 attachment F. Subtracting royalties paid from royalties collected, and further subtracting unreimbursed legal fees, yields a net royalty figure of approximately $217 million, before subtracting internal operating costs. No data are provided on these internal costs, but AUTM reports that the U.S. university respondents employed 595.67 full-time professional equivalents and 440.41 staff support full-time equivalents. Id. at 19 attachment D. Dividing the net royalty figure calculated above by an aggregate staff of 1036 full-time equivalents (over half of which are professionals) yields net revenues of approximately $209,459.50 per staff member nationwide, before subtracting such costs as salaries, benefits, office space, and the like. This rough calculation suggests that it is unlikely that in the aggregate the system is yet doing much more than covering its costs. And given that revenues are heavily concentrated in the top ten (perhaps fifteen) institutions, see infra note 193, it is likely that most universities are at present losing money on their technology transfer operations.

[193] AUTM data indicate that in FY 1994 the top ten institutions in terms of royalties received accounted for 65% of the gross royalties received by the 159 institutions responding to the AUTM survey (in order of gross royalties received the top ten institutions are: Research Corporation Technologies (a patent management firm); University of California System; Stanford University; Sloan Kettering Institute for Cancer Research (a U.S. hospital and research institute); Columbia University; City of Hope National Medical Center (a U.S. hospital and research institute); Michigan State University; University of Washington; Iowa State University; and Wisconsin Alumni Research Foundation). Id. at 20-26 attachment E.

expenditures,[194] suggesting that these royalties are unlikely to become a significant source of research funding for universities overall in the near future. For the most part, Bayh-Dole royalties do well to pay for the costs of running the system, and the value of the system must be measured in other terms.

Second, even if university patent portfolios could become a significant source of revenue for universities, one might ask whether it is preferable to finance the operations of universities through patent royalties or through tax dollars. Royalties under Bayh-Dole patents may be thought of as a form of tax that is collected in a decentralized fashion by institutions performing government-sponsored research and imposed on specific users of the patented technologies rather than on the general taxpaying public. On the payment side, such Bayh-Dole "taxes" have the virtue of being a completely voluntary levy; no one who thinks the technology isn't worth it needs to pay. On the collection side, they have the virtue of bypassing the political process of obtaining legislative appropriations for research and the peer review process of establishing the relative worth of a particular project. But are these indeed virtues? Although in recent years it has become increasingly common to view these selection mechanisms as bureaucratic impediments to the conduct of worthwhile research, the purpose of these impediments is to identify worthwhile research, and to determine the extent to which research expenditures are justified relative to spending on competing social goals. That institutions performing research should welcome a revenue source that allows them to sidestep these selection mechanisms is unsurprising, but it is not clear that this decentralized Bayh-Dole "tax" system will give taxpayers and consumers the greatest value for their payments.

Finally, one might worry about whether the revenue incentives created for research performers by the Bayh-Dole Act are a good thing. Is the lure of patent royalties leading universities and investigators to select research projects that appear likely to yield patent rights? If so, is this quest distracting them from re-

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[194] AUTM figures for FY 1994 indicate a total figure of $421,809,878 in gross royalties received by all respondents, which is approximately two percent of the $18,213,718,418 spent by respondents on sponsored research. Id. at 32 attachment F.

search that is more valuable from a broader social perspective? Perhaps we can rely on industry to perform research that is likely to yield patentable results, and the talents and resources of universities might better be directed toward research of a more fundamental, less readily appropriable character, the benefits of which are more speculative. There is a fine line between using patents to motivate universities to cooperate in transferring research discoveries to the private sector for commercial development and using patents to motivate universities to perform research of a character that is likely to yield potential commercial products. The former motivation may change how universities disseminate the results of their research; the latter may change the character of the research itself.

IV. THE DIVERGING INTERESTS OF UNIVERSITIES AND INNOVATING FIRMS

The competing interests of universities and innovating firms under the Bayh-Dole Act erupted into open conflict in a recent controversy over patent rights in the Advanced Technology Program ("ATP") managed by the National Institute of Standards and Technology ("NIST") within the Department of Commerce. That controversy highlights inherent tensions in the current technology transfer scheme.

ATP was established in 1988 to provide assistance to business in joint research and development ventures (which might include universities and independent research organizations) aimed at creating and applying precompetitive, generic technologies to commercialize significant new scientific discoveries and to refine manufacturing technologies.[195] Although ATP was created to foster collaborative research among government, universities and businesses, from the outset the ATP intellectual property provisions highlighted conflicts of interest among these research performers.

As originally enacted, these provisions gave the federal gov-

[195] ATP was created by the passage of Subpart C of the Technology Competitiveness Act, Subtitle B of the Omnibus Trade and Competitiveness Act of 1988, Pub. L. No. 100-418, § 5131, 1988 U.S.C.C.A.N. (102 Stat.) 1107, 1439-1444 (codified as amended at 15 U.S.C. § 278n (1994)).

ernment recoupment of a share of the licensing fees and royalty payments made to any business or joint venture receiving ATP funding in proportion to the federal share of costs incurred in making the discovery.[196] Previous Congresses had repeatedly rejected such recoupment provisions in passing technology transfer legislation, including the Bayh-Dole Act, and the ATP recoupment provision was ultimately repealed in the American Technology Preeminence Act of 1991.[197] The accompanying Senate Report noted that "the concept of recoupment presents serious administrative problems and is a significant deterrent to the participation of private companies in the ATP."[198] These difficulties with recoupment had been repeatedly and persuasively presented to prior Congresses in hearings on technology transfer legislation.[199] That a federal recoupment provision was in-

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[196] Id. § 5131, 1988 U.S.C.C.A.N. (102 Stat.) 1441.

[197] American Technology Preeminence Act of 1991, Pub. L. No. 102-245, § 201(c)(6)(A), 1992 U.S.C.C.A.N. (106 Stat.) 7, 17.

[198] S. Rep. No. 102-157, at 15-16 (1991), *reprinted in* 1992 U.S.C.C.A.N. 19, 34.

[199] See, e.g., 1979 House Patent Policy Oversight Hearings, supra note 62, at 11 (statement of Sen. Harrison H. Schmitt) (maintaining that mandatory government royalty unnecessarily duplicates federal income tax); id. at 26 (statement of James E. Denny, Assistant General Counsel for Patents, Department of Energy) (asserting that recoupment should take place only on selective basis); id. at 29 (statement of Donald R. Dunner, President, American Patent Law Association) (emphasizing the difficulty of assigning value to particular inventions for recoupment purposes); Senate Bayh-Dole Hearings, supra note 108, at 100 (testimony of Patrick J. Iannotta, President, Ecolotrol, Inc.) (noting possibility of disparate treatment of small and large companies under a recoupment scheme); id. at 150 (statement of Betsy Ancker-Johnson, Vice President of General Motors for the Environmental Activities Staff) (expressing concern about administrative costs of recoupment); id. at 160 (statement of Hyman G. Rickover, Director of the Division of Naval Reactors, Department of Energy) (outlining government administrative costs of recoupment); id. at 212 (statement of Niels Reimers, Manager of Technology Licensing, Stanford University) (contending that taxes on profits provide sufficient revenue to make recoupment unnecessary); id. at 215-16 (statement of Julius Jancin, Jr., Vice President, American Patent Law Association) (same); House Hearings on President's Industrial Innovation Program, supra note 3, at 160 (statement of Donald R. Dunner, President, American Patent Law Association) (asserting that government receives full return on investment when hardware is delivered); id. at 463-64 (testimony of Paul Gomory, Counsel to Association for the Advancement of Invention and Innovation) (maintaining that recoupment is a disincentive to contract); cf. 1979 House Patent Policy Hearings, supra note 62, at 50-51 (statement of Gardner Stacy, President, American Chemical Society) (indicating that American Chemical Society supports recoupment through royalty); Senate Bayh-Dole Hearings, supra note 108, at 223 (testimony of Eric P. Schellin, Chairman of the Board of Trustees, National Small

cluded in the 1988 legislation, and remained on the books for three years, testifies to the continuing equitable appeal of allowing the government to share in the profits made on technologies developed in part at public expense.

At the same time that Congress repealed the recoupment provision, it also amended the statute to provide that title to any intellectual property arising from ATP assistance "shall vest in a company or companies incorporated in the United States."[200] The exclusion of foreign companies was unsurprising in light of the consistent jingoistic, international-competitiveness rationale underlying technology transfer policy since the Bayh-Dole Act. But the focus on "companies" appeared to represent a departure from the favored position occupied by universities and other nonprofit institutions under Bayh-Dole. Over the strenuous objections of these nonprofit research institutions,[201] NIST construed this language to "prevent universities and other nonprofit organizations from obtaining title to inventions arising under the ATP."[202]

Former Senator Birch Bayh, one of the original sponsors of the Bayh-Dole Act, echoed the outrage of universities in testimony at oversight hearings on the Bayh-Dole Act held shortly after NIST announced its interpretation of the statutory language:

> [U]nder the Bayh-Dole Act the universities have demonstrated that they can be tremendously creative in developing new technology and working with private industry to commercialize it. They should not be discouraged from continuing to play that

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Business Association) (indicating that small business would insist upon recoupment because it "is used to paying its own way").

[200] American Technology Preeminence Act of 1991, Pub. L. No. 102-245, § 201(c)(6)(C), 1992 U.S.C.C.A.N. (106 Stat.) 7, 17 (codified as amended at 15 U.S.C. § 278n(d)(11) (1994) (quoted language in original)).

[201] In announcing amendments to its implementing regulations for the ATP program in January of 1994, NIST noted that it had received 40 comments on its proposed regulation on patent rights, including 39 from universities and other nonprofit organizations opposed to the proposal, and one from a business supporting the proposal. Advanced Technology Program, 59 Fed. Reg. 663, 664 (1994) (to be codified at 15 C.F.R. pt. 295.8(a)). Nonetheless, NIST felt bound by the terms of the statute to exclude universities and nonprofit entities from patent ownership. Id. at 665.

[202] Id. at 664.

> role in industry-led joint ventures as they would be if the policies at the Advanced Technology Program . . . continue to exclude them from holding title to intellectual property.[203]

Although nominally calling for Congress to stick by the original intent of the Bayh-Dole Act, this plea reveals a subtle but significant shift in the justification for granting patent rights to universities. At the time of the Bayh-Dole Act, leaving patent title in universities was primarily justified as providing an incentive for *businesses* to take an interest in developing discoveries that universities were making, and presumably would continue to make, with or without patent rights. Fourteen years later, the emphasis is on providing an incentive to *universities* to be "creative in developing new technology and working with private industry to commercialize it." If the incentives of industry remained paramount, it is by no means obvious that the allocation of intellectual property rights in ATP discoveries to businesses rather than to their nonprofit collaborators would violate the spirit of the Bayh-Dole Act. Given a private research partner in hand with an interest in developing the discovery, vesting title initially in the university rather than in the private firm would seem at first glance only to burden commercial development of the discovery with the need to obtain a license and make royalty payments to the university. That universities should challenge the ATP patent provisions as conflicting with the Bayh-Dole Act thus begs the question whether the primary purpose of that Act was to benefit universities or to enhance the commercial attractiveness of research discoveries to innovating firms.

An important goal of the Bayh-Dole Act was to eliminate the middlemen in technology transfer rather than to instate universities as technology brokers with the power to regulate and "tax" technology transfers to firms. Consider the following exchange, prior to passage of the Bayh-Dole Act, between Chairman Robert W. Kastenmeier ("K") of the Subcommittee on Courts, Civil Liberties, and the Administration of Justice of the House Committee on the Judiciary, and Howard W. Bremer

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[203] 1994 Bayh-Dole Oversight Hearings, supra note 185, at 14 (statement of Birch Bayh, Bayh, Connaughton, Fensterheim & Malone).

("B"), patent counsel for the Wisconsin Alumni Research Foundation and representative of the American Council on Education, the Council on Government Relations of the National Association of College and University Business Officers, and the Association of American Universities:

> K: S.414, by preferring universities and nonprofit institutions, small business, tends to make them the middlemen in terms of the transfer of technology?
>
> B: Yes.
>
> K: If that is the case, and really, yours is a very strong presentation for getting technology in the hands of those who will ultimately develop it, I would think that you would be led by that belief to prefer a bill which at least would enable that transfer directly to industry, the private sector, even among the largest and most efficient, in terms of their application. Yet, you apparently do not?
>
> B: In other words, you mean the exclusive licensing arrangement with the Government, directly to contractor, regardless of size?
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> K: Yes; in other words, a much more liberalized or beneficial policy with respect to transfer by title or by licensing or by whatever means, with the Federal Government directly, to large or small?
>
> B: . . . Philosophically we certainly agree with that proposition.
>
> But, as I have said, as a practical matter, and from the political climate we have seen over the past 3 years in working primarily on the Senate side with S. 414, we frankly don't think legislation which purports to transfer substantial patent right [sic] to all contractors is going to fly. And if such legislation does not fly, how many more years have we lost in establishing an effective innovation policy?
>
> . . . .
>
> That is why we strongly advocate a piecemeal approach to the situation; passage of H.R. 2414 [the Carter administration's

> proposed bill] initially; gain the experience with that bill, to show its salutary effects upon the [technology] transfer; and then expansion of that bill to embrace other government contractors.[204]

It is not entirely clear that Bremer and Kastenmeier are on the same wavelength in this colloquy; Kastenmeier's questions appear to be directed at eliminating universities as middlemen in technology transfer, while Bremer's responses appear to endorse a policy of leaving title with all government contractors, presumably including universities as well as businesses. Nonetheless, Bremer seems to concede, at least "philosophically," that technology transfer would be more readily achieved if title to patents could vest initially in private firms rather than in university or nonprofit "middlemen," although such a straightforward approach would not "fly" politically in 1980. Better to get there on a "piecemeal" basis, beginning with title in universities, and subsequently giving title to private firms.

If, as of 1980, title in universities was not an end in itself, but rather a first step toward getting private firms the exclusive rights that they needed to encourage commercial development of research discoveries, one might expect that vesting title initially in private contractors to discoveries arising in the course of collaborative research involving both universities and the private sector would be a logical next step for Congress to take a decade later. Viewed from this perspective, a rule that compelled private contractors to look to their university collaborators for licenses under university-owned patents, rather than granting them full title, might seem like a throwback to the pre-Bayh-Dole era, when private firms were not allowed to own patents in the results of government-sponsored research, and hardly like a fulfillment of the spirit of Bayh-Dole.

Universities further claimed that denying them intellectual property rights would diminish their incentives to participate in ATP research. But this argument also represents a significant and troubling departure from the original justification for leaving title to patents with universities under the Bayh-Dole Act.

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[204] House Hearings on President's Industrial Innovation Program, supra note 3, at 362.

In 1980, universities also invoked an incentive-based argument in favor of retaining patent rights, but in a somewhat less venal form. Rather than claiming that they would lose interest in *performing federally-sponsored research* unless they stood to profit from the resulting patents, they claimed that they would lose interest in *pursuing patents* unless they could retain ownership themselves. They presented themselves and their researchers as primarily interested in doing basic research and publishing their research results rather than in obtaining patents. It was the commercial firms that might develop university-based discoveries into marketable products that insisted on patent rights, not the universities themselves. But without patent ownership, universities would have no incentive to urge their researchers to take time away from their academic work to make invention disclosures, file patent applications, and cooperate in finding and educating commercial licensees who would take their discoveries out of the laboratory and into the stream of commerce.

Consider the following statement of Thomas F. Jones, Vice President for Research at MIT, also representing the Association of American Universities, the National Association of College and University Business Officers, the American Association of State Colleges and Universities, and the American Council on Education, in Senate hearings in 1978:

> The university, by its very nature, is oriented to basic and fundamental research as an integral part of its education process. The university is not and should not be a business or commercial enterprise. It does not develop products nor sell goods. Inventions made in the performance of Government-sponsored research are usually incidental to that research; that is, byproducts rather than specified objectives. . . .
>
> . . . .
>
> To translate technologically useful concepts created at the university into commercially viable developments from which the public can directly benefit requires a considerable amount of additional development, testing, and marketing.
>
> . . . .

> . . . To encourage industry to spend this time, effort, and money, it is often essential to offer prospective licensees sound patent protection, coupled with reasonable license terms. . . .
>
> . . . .
>
> . . . It is feared that title in the Government would have a depressing effect on the amount and quality of invention disclosures from inventors since there would tend to be fewer incentives for the considerable additional effort needed over and above merely a legal compliance with the provisions of the research contract.
>
> For example, my staff works at encouraging the filing of disclosures. University scientists, by the nature of their personal dedications, do not think in terms of patents and commercialization until we stimulate them to do so.[205]

If fifteen years ago the point of granting universities patent rights was merely to motivate institutions and individuals who would otherwise have been indifferent to commercial considerations to go with the technology transfer program and provide a source of exclusive rights for industry, one might expect that universities would happily yield patent rights to their commercial research partners on ATP projects. In this way they could rid themselves of the worldly distraction of filing patent applications and seeking commercial licensees. Their present indignation at the ATP patent regulations calls for some explanation.

Perhaps the simplest explanation is that the Bayh-Dole Act gave universities a revenue motive to pursue patent rights, and this revenue motive has taken on a life of its own, unmoored from its original justification of inducing indifferent academicians to obtain patent rights in order to safeguard the commercial incentives of industry. Property rights that are initially granted for particular instrumental purposes eventually come to be seen as entitlements of the grantee, creating expectations that are difficult to extinguish. Although only a few universities

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[205] 1978 Senate Select Committee Hearings, supra note 62, at 306-07, 309 (statement of Thomas F. Jones, Vice President for Research, Massachusetts Institute of Technology).

are actually profiting from their patent portfolios so far, many of them have great expectations, and they feel fully justified in using their patent rights to bring in as much revenue as they can. As funding for university-based research has become harder to obtain, universities may have grown reluctant to give up even the trivial revenues that they hope to earn from their patent portfolios. Moreover, university-owned patents may help to attract further research funding from firms with an interest in the patented technology in amounts that are far more significant than anticipated patent royalties on developed products.[206]

When universities sought patent rights in the pre-Bayh-Dole era, their claims stood out against a prevailing culture that promoted placing the results of government-sponsored research in general, and university-based research in particular, in the public domain.[207] Today, that culture has changed. The current presumption is that research performers who use government funds are entitled to pursue patent rights in their discoveries if they want them. When universities claim that they should own patent rights in ATP discoveries, the alternative is not dedication to the public, but outright ownership by their private-sector collaborators. A denial of patent rights to universities that participate in making patentable inventions with ATP funding may thus seem like an inappropriate allocation of research rewards to commercial firms at the expense of universities rather than a return to the public on its investment in research.

There is another argument, to which I alluded earlier, for preferring universities to their private-sector collaborators as patent holders. By the nature of their institutional mission and culture, universities may have a preference for widespread dissemination of new knowledge, while private firms might be more inclined to husband new knowledge as an exclusive resource. This difference in basic inclinations may be reinforced by differences

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[206] I have found no data on the extent to which university-owned patents have attracted industry funding of university-based research, as distinguished from royalty income, but the importance of university patents in attracting such funding has been confirmed to me in conversations with technology transfer professionals. E.g., Interview with Lita Nelsen, Massachusetts Institute of Technology, in Cambridge, Mass. (Oct. 27, 1994); Interview with Katherine Ku, supra note 188.

[207] See Rebecca S. Eisenberg, Proprietary Rights and the Norms of Science in Biotechnology Research, 97 Yale L.J. 177, 181-84 (1987).

in the financial incentives of universities on one hand and private firms on the other. Private firms that develop new technologies in fields where they have already made substantial investments and hold valuable commercial positions might sometimes find it advantageous to suppress the new technologies rather than to license them to their competitors. Universities, by contrast, have nothing to gain by suppressing new technologies, and in fact stand to lose royalties by suppressing inventions that could be widely marketed. I noted previously that when universities exploit their patents by offering nonexclusive licenses on a widespread basis the patents are not enhancing the profitability of product development. Nonetheless, there may be circumstances, particularly involving fundamental technologies with many potential applications in different firms and even in multiple industries, where widespread, nonexclusive licensing enhances the social value of the technology more than exclusive licensing, and universities may be more likely in such circumstances than private patent owners to license the technology nonexclusively. University-owned patents may thus provide a pseudo-public domain of technology that is not freely available, but is widely available to anyone who is willing to pay for it. This may be preferable to private ownership.

This argument for university ownership should seem particularly powerful in light of the stated objectives of ATP. The purpose of ATP, according to the Senate Report accompanying the American Technology Preeminence Act of 1991, is to provide federal research dollars to assist industry in developing precompetitive, generic technologies of use to a wide range of firms:

> Generic technologies are those that promise to benefit a wide range of industries and government agencies. Precompetitive R&D lies between laboratory discoveries and inventions, on the one hand, and proprietary product development, on the other. Technical work at this stage focuses on overcoming basic engineering obstacles and barriers which threaten to slow the commercialization and production of new technologies. This type of research can be long-term and risky, yet many industries and companies may benefit from the results. For this

reason, Federal support is appropriate and necessary.[208]

In other words, the reason to provide federal funds for ATP is that the proposed research is expected to yield results that will be of greatest value if they are widely used by many firms rather than exclusively appropriated by a single firm. If the aim of ATP funding is to generate research results that will be widely disseminated, university patent ownership may be more likely to bring that result about than patent ownership by private firms.

But if exclusive appropriation of ATP research results is not in the public interest, it is not clear why those results should be patented at all, whether by a private firm or by a university, rather than made freely available to all firms in the public domain.

On the other hand, if exclusive, private appropriation is expected and desirable, it is not clear why the government is paying for the research. ATP funding, with its explicit focus on the development of applied technology through collaborations with industry, has proven particularly vulnerable to challenge along these lines. Indeed, although ATP has been a cornerstone of the Clinton administration's technology policy,[209] it has come under attack from the Republican Congress as an example of "corporate welfare" and meddlesome "industrial policy" on the part of government.[210] The attack on ATP in Congress has not focused on who should own the resulting patents, but rather on whether the government should be funding the research. Nonetheless, the controversy over ATP highlights the relationship between the justification for public funding of research and the private appropriation of research results.

When research results are unlikely to be privately appropriated, the anticipated private benefits may appear inadequate to justify the investment of private funds, even though the social benefits may be significant. In such a situation public funding is

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[208] S. Rep. No. 102-157, at 3 (1991), *reprinted in* 1992 U.S.C.C.A.N. 19, 21.

[209] See, e.g., Testimony of M.R.C. Greenwood, Associate Director for Science, Office of Science and Technology Policy, before the Joint Economic Committee, 103d Cong. (June 24, 1994), *available in* LEXIS, Legis. Library, CNGTST File.

[210] See, e.g., Testimony of Hon. Dick Chrysler, before the House Committee on Science, 104th Cong. (Sept. 12, 1995), *available in* LEXIS, Legis. Library, CNGTST File; Andrew Lawler, Congress Targets Fusion, Favors NIH, 273 Science 303 (1996).

justified on "public goods" grounds. But if the character of the research and the background legal rules make it likely that the results will be readily appropriable, one might expect private funding for the research to be forthcoming if the research appears sufficiently promising. Government funding for such research is thus easily challenged as "corporate welfare" if industry would otherwise make the investment itself, or as government meddling in industrial policy if industry would otherwise not deem the investment worthwhile.

How, then, can government funding of research be justified in the Bayh-Dole era, when research performers are encouraged to patent their results and to promote their private appropriation? Public funding may still be justified under a public goods rationale if the character of the research is such that patentable outcomes are likely to be the exception rather than the rule, and the research promises substantial social benefits that cannot be captured by patent holders. Sixteen years into the Bayh-Dole era, most university-based research is undoubtedly still of this character. Patent revenues account for a trivial fraction of overall university research budgets, while public research funding remains of critical importance.

But as university patenting and private funding of university research increase, the time-honored distinction between "basic" and "applied" research is becoming ever more difficult to maintain, particularly in fields that are of significant commercial interest. As the revenue motive of research institutions impels them to pursue patent rights in the sort of early-stage research discoveries that in an earlier era they would have allowed to enter the public domain, they put pressure on the patent system to recognize patentable inventions in research results that arise further upstream in the R&D process, thereby enlarging the range of appropriable research results to include what by some measures might still be regarded as "basic" research. And as public sector research becomes more routinely appropriable, it becomes more difficult to justify public funding to support it.

CONCLUSION

The present policy of promoting patents on federally-supported inventions has become rapidly entrenched in U.S.

law, although it is not clear that this policy always serves its initial agenda of furthering the transfer of new technologies to the private sector for commercial development, particularly in the case of discoveries that are born in university and government laboratories. The recent controversy over ownership of patents on discoveries made in the Applied Technology Program highlights some of the complexities involved in technology transfer that the current policy fails to take into account.

Retreating from the policy may be difficult at this stage. Research performers have adjusted to the incentives created by current policy. When government policy creates and distributes new property rights, it is inevitable that someone will protest if those rights are later taken away. It does not necessarily follow that those property rights are on balance creating new social value that makes all of us better off.

Patents undoubtedly have a critical role to play in facilitating technology transfer in some contexts. But they can also interfere with technology transfer and with the broader goal of promoting continuing technological progress. These goals may sometimes be better served by allocating new knowledge to the public domain. Government is uniquely situated to enrich the public domain, and we should be wary of disabling the government from performing this critical function.