Should AIDS Research Be Regulated? A Manhattau Project for AIDS aud Other Policy Proposals

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INTRODUCTION

Since the early 1980's, uniyersities, prıvate pharmaceutical companies, and the federal and state governments have searched for drugs effective ın the treatment, prevention, and cure of acquıred ımmune deficıency syndrome ("AIDS").[1] While a number of drug treatments have been marketed durıng thıs perıod, no effective vaccınation or cure has been discovered. Casualties related to AIDS have mounted quıckly, and estimates of the number of persons currently ınfected, as well as projections of future ınfection, are daunting.[2] AIDS ıs currently the number one killer of both men and women aged twenty-five to forty-four ın many large U.S. cities.[3] Increasıng numbers of people with AIDS ("PWA's"), or people who have tested positive for the HIV vırus, are engaged ın a psychologically devastating race with the research and development clock, over which they have little or no control.[4]

Frustration about the sluggısh progress of AIDS research[5] has coalescɛd ınto especıally potent political action. AIDS activısts have been able to galvanize political forces ın unprecedented ways, largely because of several peculiar characterıstics of the disease. The perıod between ınfection and manifestation of symptoms of AIDS ıs long. Typıcally, studies cıte the

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1. For a detailed examınation of the hıstory of the development of AIDS and varıous prıvate and public respouses ın the area of drug treatment, see Steven R. Salbu, *AIDS and Drug Prıcıng: In Search of a Policy*, 71 WASH. U. L.Q. 691, 691-99 (1993) [heremafter Salbu, *AIDS and Drug Prıcıng*]. Beeause the hıstory of the pharmaceutical ındustry ın relation to the AIDS crısıs ıs examıned ın thıs earlier work, I refer readers there ın order to avoıd redundancy.

2. The Centers for Disease Control estimate that over one-half million Amerıcans will be diagnosed with AIDS, and at least 330,000 Amerıcans will have died from AIDS by 1995. *Id.*, Amanda Husted, *CDC: 330,000 Amerıcans Will Die from AIDS by 1995*, ATL. CONST., Jan. 15, 1993, at D3.

3. Richard M. Selik et al., *HIV Infection as Leading Cause of Death Among Young Adults ın U.S. Cities and States*, 270 JAMA 2991 (1993). AIDS ıs the leading eause of death of men aged 25-44 m 64 U.S. cities, and of women aged 25-44 ın nıne U.S. cities. For further demographıc ınformation regarding AIDS mortality and nıorbidity rates relative to other diseases as of February, 1993, see *Profile of the AIDS Pandemıc, 1993*, GENESIS REP., Feb. 1993, at 36.

4. For an autobıographical account of one couple's experıence, see PAUL MONETTE, BORROWED TIME: AN AIDS MEMOIR (1988).

5. Followıng the Ninth International Conference on AIDS, held ın Berlin durıng the summer of 1993, Dr. Michael H. Merson, Director of the AIDS Program of the World Health Organızation, described AIDS research progress as "desperately slow." Lawrence K. Altman, *Little Progress Seen ın Effort to Crack AIDS Puzzle*, N.Y. TIMES, June 12, 1993, § 1, at 5.

average time from infection to appearance of symptoms as ten years.[6] Moreover, incidence of AIDS has been pronounced among male homosexuals, a group whose political presence has become increasingly well organized since the Stonewall riots introduced the gay rights movement in 1969.[7] Because a large segment of persons at risk are politically well organized,[8] and because many people diagnosed as HIV-positive remain healthy, able, and motivated to activism for many years,[9] political pressure for more effective research and development of AIDS drugs has been significant.[10]

While criticism of both public and private responses to the AIDS epidemic has been multi-faceted,[11] one crucial concern has been the perception that progress has been impeded by a failure to organize collaborative research efforts with reasonable speed.[12] In 1988, activist and author Larry Kramer berated Tony Fauci, Director of the National Institute of Allergy and Infectious Diseases, for failing to allocate expediently hundreds of millions of dollars, and for failing to establish promptly a system for testing experimental drug treatments on willing subjects.[13] While some critics have

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6. The long latency period following HIV infection increases the stakes in research that may yield effective treatment prior to the appearance of symptoms. *See* Salvatore T. Butera & Thomas M. Folks, *Application of Latent HIV-1 Infected Cellular Models to Therapeutic Intervention*, 8 AIDS RES. HUM. RETROVIRUSES 991, 991 (1992) ("The 10-year period of clinical latency following infection with the human immunodeficiency virus type-1 remains as a tremendous opportunity for therapeutic intervention."). For further discussion of latency of AIDS symptoms in persons infected with HIV, see Daniel P Bednarik & Thomas M. Folks, *Mechanisms of HIV-1 Latency*, 6 AIDS 3 (1992), and Douglas S. Goodin et al., *Long Latency Event-Related Potentials in Patients Infected with Human Immunodeficiency Virus*, 27 NEUROL. 414 (1990).

7. For example, estimates of attendance at the 1993 March on Washington for Gay Rights range from 300,000 to 1.1 million. Among the political issues considered most crucial by participants were the ban against gays in the military and AIDS funding. Frank Trejo, *Thousands March in D.C. for Gay Rights; Participants Hope to Affect Military Ban, Aids Funding*, DALLAS MORNING NEWS, Apr. 26, 1993, at 1A.

8. Steven Epstein, *Democratic Science? AIDS Activism and the Contested Construction of Knowledge*, SOCIALIST REV., Apr.-June 1991, at 35, 41.

9. *Id.* at 41-42.

10. For discussion of the political pressures of gay rights activists on the Clinton Administration, see Paul Richter, *Clinton and Gays Hold Historic Meeting*, L.A. TIMES, Apr. 17, 1993, at A2.

AIDS activism has brought the discussion of science into the public arena to an unprecedented extent. *See, e.g.*, Jon Cohen, *Debate on AIDS Origin*: Rolling Stone *Weighs In*, 255 SCI. 1505 (1992) (wherein a commentator in SCIENCE, a highly regarded academic publication of the American Association for the Advancement of Science, reacts to an AIDS theory espoused in an article appearing in ROLLING STONE magazine) [hereinafter Cohen, *Debate on AIDS*].

11. *See, e.g.*, Terence Monmaney, *The AIDS Crisis: Placing the Blame*, DISCOVER, Feb. 1988, at 60-62 (discussing critics' responses to AIDS, which have attributed delay to such phenomena as government neglect, apathy, underfunding, and media silence).

The final report of the National Commission on AIDS, commissioned in 1989 and issued on June 28, 1993, criticizes President Clinton for his sluggish response to the AIDS crisis, lack of leadership, and failure to implement coordination of AIDS activities. AIDS: AN EXPANDING TRAGEDY, Final Report of the National Commission on AIDS, June 28, 1993.

12. For discussion of criticism of failure to organize anti-AIDS programs and researeh at the federal level, see Larry Kramer, *All-Out Federal Effort Needed to Defeat AIDS*, ST. PETERSBURG TIMES, July 17, 1990, at 15A.

13. Larry Kramer, *An Open Letter to Dr. Anthony Fauci*, VILLAGE VOICE, May 31, 1988, at 18 (quoting Rep. Henry Waxman at an April 29, 1988, House Subcommittee on Human Resources meeting, "Dr. Fauci, your own drug selection committee has named 24 drugs as high priority for development and trials. As best I can tell, 11 of these 24 are not in trials yet. Why the delays? I understand the

lamented underfunding of AIDS research,[14] much criticism, like Kramer's, highlights the inefficient use of existing funds, particularly the failure to centralize and coordinate research efforts.[15]

Centralizing AIDS policy under a federal "AIDS Czar" has been explored as a means of enhancing the comprehensiveness of research and development ("R&D") efforts. The idea dates at least to 1987, when Admiral James D. Watkins became Chair of President Reagan's Presidential Commission on the Human Immunodeficiency Virus epidemic.[16] Watkins criticized the Commission's previous lack of a strategic plan and its failure to hire an executive director under his predecessor, Dr. W Eugene Mayberry Moreover, he suggested that the Federal Government under President Reagan was failing to establish a "unified comprehensive discrete policy in response to the HIV epidemic."[17] Commentators began to discuss the merits of appointing Watkins as an unofficial AIDS czar.[18]

More recently, President Clinton named Kristine Gebbie as the first official AIDS Czar, or White House "AIDS Policy Coordinator."[19] While President Clinton noted that the move was part of an initiative to "redouble our government's efforts to promote research, funding and treatment for AIDS,"[20] Gebbie's role and its attendant powers have not yet been specified. During the announcement of Gebbie's appointment, President Clinton noted that the assignment would "ensure that one person in the White House

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need to do what you call 'setting priorities' but it appears even with your own scientists' choices, the trials are not going on.") [hereinafter *An Open Letter*].

14. *See* Robert Pear, *As AIDS Money is Parceled Out, Political Questions*, N.Y. TIMES, Feb. 7, 1993, § 4, at 3 (quoting Dr. Martin S. Hirsch, director of AIDS research at the Massachusetts General Hospital, "There is not shortage of infected individuals. There is no shortage of investigators willing to test these agents. There is no shortage of agents or combinations of agents ready to be tested. The shortage is in funding capability to do these studies.").

For discussion of inadequacies in AIDS funding, see Allan M. Brandt, *AIDS: From Social History to Social Policy*, 14 L., MED. & HEALTH CARE 231, 238 (1986).

For an opposing viewpoint, see William Booth, *No Longer Ignored, AIDS Funds Just Keep Growing*, 242 SCI. 858 (1988) (discussing the rise of AIDS funding in recent years to high levels relative to overall federal health spending) [hereinafter Booth, *No Longer Ignored*].

15. *See An Open Letter*, *supra* note 13, at 18 (charging Anthony Fauci with using underfunding as an excuse for alleged incompetenee and with having failed to utilize effectively a $374 million budget allocated to AIDS treatment research over four years).

For discussion of government's failure to respond adequately and quickly to AIDS, see generally RANDY SHILTS, AND THE BAND PLAYED ON: POLITICS, PEOPLE AND THE AIDS EPIDEMIC (1987).

16. Sally Squires, *Setting the Course on AIDS: How an Admiral Turned Around the President's AIDS Commission*, WASH. POST, June 7, 1988, Health, at 15.

17. Taunya L. Banks, *AIDS and Government: A Plan of Action? Report of the Presidential Commission on the Human Immunodeficiency Virus Epidemic*, 87 MICH. L. REV. 1321, 1333 n.62 (1989).

18. *Id.* at 1334 n.69.

19. *Clinton Names Former Health Administrator as 1st AIDS Czar*, ATL. CONST., June 25, 1993, at A5.

20. *Id.*

oversees and unifies government-wide AIDS efforts,"[21] a task that could conceivably entail a wide array of possible roles and activities.[22]

The title "Policy Coordinator" suggests a role potentially limited to heading efforts towards a cohesive national strategic plan for AIDS. The moniker "AIDS Czar" certainly connotes more plenipotentiary powers. For example, an AIDS Czar, operating within the confines of an adopted plan, also could orchestrate a coordinated network of research efforts to further that plan. The notion of an AIDS Czar has sometimes encompassed extreme authority, such as the power to commandeer any publicly funded resources.[23]

A. Congressional Responses to the Call for Increased Centralization of AIDS Research

In March of 1993, in order to fill gaps and eliminate redundancies,[24] both the House and the Senate proposed versions of a National Institutes of Health Revitalization Act, providing the National Institutes of Health ("NIH") Office of AIDS Research with a full-time Director to develop a strategic plan to centralize AIDS research.[25] To ensure that distribution of funding complies with the strategic plan, the bills require NIH funds to be channeled through a centralized coordinating office before reaching research institutes.[26] Under the House version, the Director of the NIH decides how to allocate funds; under the Senate version, the Office of AIDS Research makes those

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21. Spencer Rich, *Clinton Names Health Ex-Official First AIDS Policy Coordinator*, WASH. POST, June 26, 1993, at A2.

22. In an interview following her appointment, Gebbie was quoted as stating that one of her first tasks will be to "find a couple of issues that we can move on very quickly so that we won't look like we're doing nothing." *New AIDS Czar Gebbie Tackles Tough Position*, CHI. TRIB., June 27, 1993, § 3, at 23.

This statement is disturbing in its implication that public relations management may take precedence over well-considered public policy development, as politics supersede scientific considerations in the administration's treatment of the AIDS crisis.

23. *See infra* notes 121-22 and accompanying text; *see also* Laurie Garrett, *AIDS: The Search for a Cure*, N.Y. NEWSDAY, Nov. 17, 1991, City, at 7 (quoting AIDS activist Larry Kramer, "A general has to be put in charge of the army, and he or she has got to be given emergency powers to cut through all the red tape that prevents research from being entered into in this country. I'm talking about a Manhattan Project. It's as simple as that.").

24. The notion that centralization of research will reduce investigative redundancies, thereby enhancing research efficiency, may be a dangerous one. Sociologist Robert Merton has suggested that duplications occurring in competing laboratories may be beneficial in a number of ways. Overlapping research may expedite the ultimate accretion of knowledge by lending credibility and validation to overlapping findings, and by allowing pluralistic interpretations of similar data, improving the likelihood of accurate explanations of observed phenomena. Moreover, the existence of partial redundancies may in fact reflect the incremental alterations of experimentation typical of gradual scientific progress. ROBERT K. MERTON, *Multiple Discoveries as Strategic Research Site*, *in* THE SOCIOLOGY OF SCIENCE: THEORETICAL AND EMPIRICAL INVESTIGATIONS 371-82 (1973).

25. For the House version, see H.R. 4, 103d Cong., 1st Sess. (1993). For the Senate version, see S. REP. NO. 2, 103d Cong., 1st Sess. (1993).

26. Under current procedures, funds are distributed directly from the NIH to research institutes, without a centralized filtering process by the Office of AIDS Research. Whereas the House version of the bill proposes centralization of AIDS research funding through a facility independent of existing NIH authorities, the Senate version retains NIH distribution of funds.

decisions.[27] Whereas the NIH's sixteen institutes currently determine their own research agendas independently, the House and Senate bills shift decision-making about the content and nature of research programs to the centralized unit, either the NIH under the House bill, or the Office of AIDS Research under the Senate bill.[28] Heads of the NIH and other critics opposed the bills, suggesting that the delay in allocating funds may actually impede the progress of AIDS research.[29]

More recently, both the House and the Senate have approved a compromise bill.[30] The bill has characteristics of both the original Senate and House versions: The Director of the Office of AIDS Research is responsible for distributing funds in accordance with the terms of the original Senate proposal.[31] The final bill contains time limits, restricting the period during which the Office can retain funds prior to distribution. Funds for continuing and non-competing grants must be distributed within fifteen days of receipt by the Director of the Office of Management and Budget,[32] and funds for new and competing grants must be distributed within thirty days[33] of receipt. In addition, the bill establishes an emergency discretionary account, not to exceed $25 million per year, from which the Director will be able to fund projects that arise unforeseeably from ongoing developments.[34]

B. The Pharmaceutical Industry's Response to the Call for Increased Centralization of AIDS Research

As the House and Senate responded to critical demands for the centralization of publicly funded AIDS research through a national planning mechanism, private corporations have reacted to pressures on the pharmaceutical industry to expedite research efforts through centralization and collaboration. In April of 1993, in an effort to expedite drug development, fifteen pharmaceutical companies announced plans to increase collaboration and information sharing in regard to experimental AIDS treatments.[35] The collaborators, comprising a group called the Inter-Company Collaboration for AIDS Drug Development, were to begin meeting in the summer of 1993, and planned to

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27. *See supra* note 25.

28. *See* S. REP. NO. 2, *supra* note 25, at 9.

29. Stephen Burd, *Proposal to Centralize AIDS Research Draws Fire*, CHRON. HIGHER EDUC., Feb. 24, 1993, at A24 [hereinafter Burd, *Proposal*].

30. National Institutes of Health Revitalization Act of 1993, Title XVIII, 107 Stat. (amending Public Health Service Act), Pub. L. No. 103-43, 1993 H.R. 2518 (codified as amended at 42 U.S.C. §§ 300cc (1993)).

31. *Id.* § 2353(d)(3)(A), 107 Stat. 195.

32. *Id.*

33. *Id.* § 2353(d)(3)(B), 107 Stat. 195.

34. *Id.* § 2356(a)(2), 107 Stat. 197.

35. Michael Waldholz, *Top Firms Plan Joint Testing of AIDS Drugs*, WALL ST. J., Apr. 20, 1993, at B1.

convene approximately six times per year.[36] Members[37] will share clinical data and drug supplies, but will not share basic HIV research.[38] The Inter-Company Collaboration has been characterized as noncommercial, reflecting a decision to share information without joint ownership of medical discoveries, so that each company will have exclusive proprietary rights to any compound it discovers.[39]

The decision of pharmaceutical companies to collaborate was based partly on frustration over the sluggish pace of progress. Moreover, recent research findings suggest that individual drug treatments typically become subject to viral resistance, and therefore effective treatment is most likely to result from combination therapy [40] If our best hopes for a successful treatment or cure depend upon the simultaneous combination of numerous drug therapies, cooperation among pharmaceutical companies is likely to expedite the discovery of effective matches. By sharing information, companies may be able to experiment sooner with greater numbers of combinations of drugs, particularly unpatented drugs, which are ordinarily developed in secrecy

C. Legal and Public Policy Issues Regarding the Centralization of AIDS Research

While these efforts at centralization and collaboration have the potential to promote AIDS drug research, a number of questions regarding law and public policy remain. Should the Federal Government develop a centralized strategic plan to allocate its funds for AIDS research?[41] If so, how can this be accomplished without unnecessary bureaucratic delay? Would a federal strategic plan, developed to organize and coordinate funding decisions under the umbrella of one comprehensive program, suffice to optimize AIDS research effectiveness? Or are more Draconian measures warranted? Recommendations have included the creation of a "Manhattan Project for

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36. *15 Drug Firms Announce Alliance on AIDS*, L.A. TIMES, Apr. 20, 1993, at D2.

37. Founding members include Merck, Eli Lilly, Astra, Bristol-Myers Squibb, Boehringer Ingelheim, Burroughs Wellcome, DuPont Merck, Glaxo, Hoechst, Roche, Miles Laboratories, Pfizer, Sigma Tau, and SmithKline Beecham. At the time of the announcement, Abbot Laboratories and Upjohn were two major pharmaceutical companies absent from the list. Waldholz, *supra* note 35.

38. *Id.*

39. *Id.*

40. For discussion of this trend, see Liz Hunt, *Drug Firms Unite to Find AIDS Cure*, INDEPENDENT, Apr. 22, 1993, Home News, at 3; John Rennie, *Triple Whammy: Will an AIDS Therapy Live Up to its Advance Billing?*, SCI. AM., May 1993, at 18.

For scientific discussion of the utilization of combination therapy for the treatment of HIV, see Yung-Kang Chow et al., *Use of Evolutionary Limitations of HIV-1 Multidrug Resistance to Optimize Therapy*, 361 NATURE 650 (1993); Gail Skowron et al., *Alternating and Intermittent Regimens of Zidovudine and Dideoxycytidine in Patients with AIDS or AIDS-Related Complex*, 118 ANNALS INTERNAL MED. 321 (1993).

41. The question of federal strategic AIDS policy has been addressed frequently in the press, where treatment is naturally cursory, but infrequently in the academic literature. *See, e.g.*, Edward N. Brandt, Jr., *Government Involvement and the Development of Public Policy in AIDS Research and Reporting*, *in* AIDS AND PATIENT MANAGEMENT: LEGAL, ETHICAL AND SOCIAL ISSUES 36 (William D. Witt ed., 1986).

AIDS," potentially entailing governmental oversight of lab activity[42] and powers to appropriate federally funded lab equipment and staff utilization.[43]

In the area of corporate research and development, is information sharing enough, or should pharmaceutical companies go further, by sharing basic HIV-research findings, and perhaps even collaborating in joint testing and experimentation? Or is there a point at which collaborative efforts become anti-competitive, thereby reducing individual companies' initiatives and incentives to engage in constructive research? What role can joint ventures play in reconciling the tensions between competitive and coordinative benefits? And what policies should the government adopt in order to promote useful joint venture activity? These questions of public policy relate to the legal literature and theory of antitrust.

This Article examines these legal challenges in detail. Part I investigates the recommendation, increasingly mentioned but rarely examined by AIDS activists and politicians, that the Federal Government create a "Manhattan Project for AIDS."[44] The discussion concludes that proponents have failed to analyze the Manhattan Project model carefully, and have made cavalier and ill-considered recommendations that cannot be justified under careful scrutiny In particular, I suggest that potential differences between the original and proposed Manhattan Projects render the analogy suspect in its application to the AIDS crisis.

Part II explores the nature of competition and cooperation as they affect scientific research. The discussion focuses on the dysfunctional effects that may result from excessive government coordination and control over AIDS research, including impairment of adversarial pluralism and diversity of perspectives, exacerbation of bureaucratic impediments to research, and diminution of competitive incentives that drive scientific races.

Part III contains a proposal for the achievement of greater cohesiveness and better organization of AIDS research through limited or restrained government coordination. The proposal falls short of the extreme measure of establishing a "Manhattan Project for AIDS." The recommendation focuses on enhancing the use of government funding while retaining the characteristics of laboratory autonomy and decentralized decision-making. This focus thereby avoids some of the pitfalls inherent in excessive coordination, as discussed in Part I, while it increases the likelihood of discovering AIDS treatments more quickly and efficiently

Part IV examines in detail the ways in which joint ventures and strategic networks can provide the benefits of increased collaboration, as demanded by activists and politicians, without incurring the dysfunctional side-effects of a Manhattan Project.

Part V examines the current antitrust laws as they apply to joint ventures and other strategic alliances. I explain why ventures engaged in the present

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42. *See infra* text accompanying note 122.
43. *See infra* text accompanying note 122.
44. *See infra* note 46.

basic research stage of AIDS investigation entail little or no anti-competitive risk, while antitrust laws create a chilling effect on potentially valuable cooperative arrangements. Accordingly, Part V concludes by recommending that AIDS research be exempt from application of certain antitrust laws.

The Conclusion suggests that an overriding principle suffuses all the recommendations in this Article, a principle that should become a mainstay of any regulatory policies regarding AIDS research: While collaboration is vital to the advancement of science and the expedient eradication of AIDS, compulsory cooperation should exist only in restrained forms, and preferably as a natural by-product of competition within free and open scientific markets.

I. A CRITICAL EXAMINATION OF THE PROPOSAL TO ESTABLISH A MANHATTAN PROJECT FOR AIDS

In assessing the value of centralized AIDS policy, it is helpful to differentiate between forms of coordination. The form recently approved by Congress, which entails the development of a centralized strategic plan for the allocation of NIH resources, is a relatively moderate version of government coordination.[45] More extreme proposals include the development of a nationally managed research program, under which the government would facilitate and orchestrate collaborative efforts. Such a policy would surpass NIH strategic planning, as its scope and span of control would exceed the basic function of rationalizing the allocation of fiscal resources. I shall label the recently approved Congressional approach "restrained coordination," and I shall refer to more extremist calls for governmental intervention, such as proposals for a Manhattan Project for AIDS, as "unrestrained coordination." Proponents of unrestrained coordination cite the severity and intransigence of the AIDS crisis as justification for taking extraordinary measures. Most frequently, they call for a modern-day Manhattan Project to expedite the search for effective treatments.[46] Just as the crisis of World War II brought the world's top scientists together in an effort to develop an atomic bomb, so a cure for AIDS would ostensibly be hastened by a centralized, coordinated effort, uniting all the best minds in the field of viral research under one administrative

45. *See supra* notes 24-34 and accompanying text.

46. The idea of a Manhattan Project for AIDS arises with increasing frequency, predominantly in informal discussions or criticisms of AIDS research policy. *See, e.g.*, Pear, *supra* note 14, at 3 (quoting Peter Staley, of the AIDS Coalition to Unleash Power, "If we had a Manhattan Project Against AIDS, we might find one or more therapies that would halt the virus in its tracks."); *see also* Garrett, *supra* note 23, at 7 (quoting activist and author Larry Kramer's call for a Manhattan Project for AIDS); Philip J. Hilts, *Into the Maelstrom*, N.Y. TIMES, June 27, 1993, § 1, at 23 (citing President Clinton's reference to the need to establish a Manhattan Project for AIDS).

Some critics have warned against centralization of AIDS research in the form of a Manhattan Project-style collaboration effort. *See* Christopher B. Daly, *Generations Will Suffer AIDS, Scientist Asserts*, WASH. POST, Feb. 13, 1993, at A3 (referring to a statement by William Haseltine, of the Dana-Farber Cancer Institute, that "[t]oo many basic questions are unknown for an overall commander to begin assigning tasks.").

umbrella.[47] Suggested benefits of such an effort include the elimination of both research redundancy and research gaps.[48]

In this Part, I begin a critical examination of unrestrained coordination by asking whether the success of the Manhattan Project predicts, by analogy, the likely success of a Manhattan Project for AIDS. To proceed, we as a society must understand the nature and extent of collaboration under the original World War II prototype. The Manhattan Project was an extreme and radical departure from the usual norms of scientific project management in the United States. Previously autonomous investigators, accustomed under ordinary circumstances to having relatively unfettered control over the management of their laboratories, were placed under military administrative authority.[49] Scientists were directed in regard to the projects they were to pursue, the collaborators with whom they were to work, the flow of information pertinent to their research progress and findings, and the use of laboratory resources. By virtue of these extraordinary administrative powers, the Manhattan Project greatly exceeded the limited planning functions of restrained coordination. Recommendations favoring a Manhattan Project for AIDS are, therefore, recommendations for extreme and unrestrained government intervention, in which the usual academic freedoms of scientific investigators would be substantially curtailed.

Is highly centralized government authority over research on AIDS analogous to coordination of the Manhattan Project during World War II? The analogy is seductive, particularly given the ultimate success of the Manhattan Project in the achievement of its assigned task. However, the proponents of "Manhattan Project II"[50] have failed to examine the characteristics of the first effort to determine whether the metaphor is aptly applied to the war against AIDS. In the following subparts, I address some aspects of the Manhattan Project that were peculiar to the exigencies of World War II. These may affect the utility of unrestrained AIDS research coordination.

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47. On the surface, the purpose of the Manhattan Project appears to be compatible with the exigencies associated with AIDS research. Albert Einstein recommended coordination of research efforts to facilitate applied atomic research via gains in speed and scale. PETER WYDEN, DAY ONE 40 (1984).

48. Jon Cohen, *A Manhattan Project for AIDS?*, 259 SCI. 1112 (1993) [hereinafter Cohen, *A Manhattan Project*].

49. Robert P. Crease & Nicholas P. Samios, *Managing the Unmanageable*, ATLANTIC, Jan. 1991, at 80.

50. I shall refer at times to a "Manhattan Project for AIDS" as "Manhattan Project II." There have been several variants of the recommendation of a "Manhattan Project for AIDS." These include programs outside the NIH consolidating all government-funded AIDS research, programs outside the NIH with a budget for research contracts and a central facility leader, the creation of six research centers of excellence affiliated with academic institutions, and a centrally located facility to bring together "divergent approaches" of scientists with "extraordinary powers." *A Manhattan Project*, *supra* note 48, at 1113.

At this stage, people use the phrase "Manhattan Project for AIDS" indiscriminately and carelessly, so that it appears to have differing meanings in various discussions. *See Research Advances in AIDS War*, NATIONAL PUBLIC RADIO TRANSCRIPT, Weekend Edition, June 13, 1993 (quoting Robert Gallo, of the National Cancer Institute, discussing proceedings of the Ninth Annual Conference on AIDS in 1993: "Several people at the meeting and before this meeting have referred to [a] Manhattan Project but different people mean different things by that.").

A. The Success of the Manhattan Project May Be Attributable to Factors Other than Government Coordination of Research

Before concluding that unrestrained centralization of AIDS research is a good strategy, we must examine whether such coordination was the only distinctive characteristic of the Manhattan Project. The success of that historic effort may be attributable to unique characteristics other than centralization—characteristics that may not be shared by a similar program for AIDS.

For example, one plausible explanation of the success of the Manhattan Project is the remarkable level of public funding that it received compared to virtually all other scientific research projects, including health crisis initiatives like polio and AIDS research.[51] Manhattan Project physicist Raemer Schreiber describes the unique experience of doing scientific research with virtually unlimited funding: "Since many of us came from university labs where the research budget was very, very limited, it was a very heady thing to be able to order something that cost $50,000 and you got it in a few days."[52]

Consider this comparison: Whereas the Manhattan Project received two billion dollars of funding (in 1940 dollars) over a period of a few years,[53] the entire federal budget for health care R&D in 1956 was a mere $81 million (in 1988 dollars).[54] This latter figure represents all areas of federally supported medical research, including federal funding for the first field test of Salk's polio vaccination.[55] The juxtaposition of these figures suggests at least two hypothetical sources of the Manhattan Project's success: government orchestration of collaboration, or return on a supernormal investment, or a combination of both.

In reality, government orchestration and supernormal investment are but two of many possible factors that may explain the efficacy of the Manhattan Project. In addition, successful government centralization of a research project may depend upon an interactive effect of numerous factors. Consider, for example, that the Manhattan Project was initiated after the requisite basic research findings were in place,[56] findings that indicated that the

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51. Secretary of War Henry L. Stimsom ordered General Leslie R. Groves, head of the Manhattan Project, to develop the atomic bomb without consideration to cost. DAN KURZMAN, DAY OF THE BOMB 75 (1986).

No unconditional government mandate has been given to find a cure for AIDS regardless of cost. The success of the Manhattan Project may have been a function of unbounded funding rather than centralization of research and development.

52. Sue M. Holmes, *Birth of a Bomb: 50 Years Ago, Manhattan Project Lighted Fuse on Atomic Weapon*, AUSTIN AMER.-STATESMAN, June 17, 1993, at A20.

53. GORDON THOMAS & MAX M. WITTS, ENOLA GAY 8 (1977).

54. SANDRA PANEM, THE AIDS BUREAUCRACY 54 (1988).

55. *Id.*

56. Most descriptions of the Manhattan Project attribute its viability to the relatively advanced stage of research, and to the opinion that sufficient knowledge had already been amassed to render imminent the production of an atomic bomb. *See, e.g.*, RICHARD RHODES, THE MAKING OF THE ATOMIC BOMB 357-93 (1986); MARTIN J. SHERWIN, A WORLD DESTROYED: THE ATOMIC BOMB AND THE GRAND ALLIANCE 13-39 (1975).

development of an atomic weapon was imminent.[57] Whereas the Manhattan Project entailed the application of an existing mathematical model to the development of the bomb, the basic models upon which a cure or vaccine for AIDS might be built do not presently exist.[58]

Perhaps government-orchestrated research can be effective, but only when interacting with a critical mass of capital and a mature state of pre-existing basic research findings.[59] If this hypothesis were accurate, centralized research would be ineffective and premature at the present stage of AIDS research because there is insufficient foundational progress for the effective exploitation of substantial government intervention.[60] Such observations certainly do not prove the inefficacy of federally coordinated research, nor do they necessarily impeach the theory that such efforts were the primary cause of the Manhattan Project's success. Rather, they suggest that we must be careful not to attribute causality where none has been proven. In particular, we must consider several important caveats before rushing precipitously into unrestrained federal coordination of AIDS research.

Alternative theories to the coordination theory, such as a hypernormal-levels-of-funding theory, may in fact explain the Manhattan Project's success. Because there are no comparison data, we cannot ascertain what factors account for the Manhattan Project's success. Without manipulation of variables and appropriate controls, we cannot determine which factor, or which combination of many factors, effected the successful completion of the Project's mission.[61]

Deducing the efficacy of government coordinated research from the efficacy of the Manhattan Project is statistically unsound. The Manhattan Project is a

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57. Because AIDS research is at an earlier stage with regard to basic scientific knowledge, critics suggest that "not enough is known about HIV at the level of basic science to stage a goal-oriented project like the one that led to the making of an atomic bomb, and that any attempt to do so could stifle the scientific creativity needed to provide a cure or a vaccine." Cohen, *A Manhattan Project*, *supra* note 48, at 1112.

58. *See id.* at 1114 (quoting Mark Harrington, an AIDS Activist of New York's Treatment Action Group, who admits that while predictions could be made on the mathematical models that existed prior to the Manhattan Project, such predictions cannot currently be made in the application of biology to AIDS); *see also After Such Knowledge*, ECONOMIST, Jan. 23, 1993, at 80 (stating that much of the pure science was already in place to support the Manhattan Project, a project which essentially entailed technological research applications).

59. This hypothesis is not an irrational or particularly controversial one, considering that scientists acknowledge the lack of basic scientific knowledge upon which effective applications for AIDS treatment are likely to be developed in the near future. *See supra* note 5; *see infra* notes 124-25.

60. While the hypothesis is stated here as an example, it is one which highlights a fundamental difference between the stages of advancement of the Manhattan Project and the proposed Manhattan Project II. Such differences may be crucial ones, and should be investigated before we prescribe drastic measures based on rash generalizations generated from one highly idiosyncratic historic event. What worked under very special circumstances may or may not work under the circumstances surrounding AIDS research.

61. Experimentation regarding the efficacy of centralized scientific projects is impracticable. A cruder approach, the examination of a few such projects from the past, yields inconsistent findings. For example, the work of the March of Dimes was effective in the fight against infantile paralysis in the 1930's, whereas Nixon's War on Cancer in the 1970's, which sought to evoke "the same kind of concentrated effort that split the atom," failed to find a cure. Jon Cohen, *History's Winners and Losers*, 259 SCI. 1114, 1114 (1993).

sample of one, not subject to observation within the norms of experimental research. It is also unreliable as a representative case study from which to glean anecdotal information. With any sample of one, it is impossible to determine whether the phenomenon studied is typical or atypical, because there are insufficient data from which to distinguish average cases from extreme ones. As a result, it is dangerous to make generalized inferences regarding centralized research from one arguably effective experience.[62]

Perhaps most crucially, the Project's efficiency and effectiveness in accomplishing the ends that were achieved are not susceptible to objective proof. Without comparison data, all we can conclude is that the goal of developing a bomb under time pressure was met. We cannot know, from the limited data available, whether a better method existed. For example, while unrestrained coordination did yield the necessary end product, it is possible that restrained coordination would have yielded similar or superior results, at the same or even lower costs.

B. Whereas the Manhattan Project Required Direct Government Restriction of Information Flows, AIDS Research Progress Depends upon Unrestrained Information Flows

Centralization was essential to the Manhattan Project goal of information containment, which was achieved by imposing severe security restrictions.[63] Because the search for an atomic bomb occurred within the context of a war, the usual norms of scientific exchange were obscured and warped.[64] The goal was not simply to invent an atomic bomb; rather, it was to invent an atomic bomb under extraordinary conditions of stealth and secrecy, conditions which were created by imposing severe limitations upon the usual scientific intellectual environment.[65] Collaborators formed an insulated world of their own. Combinations and synergies were fostered within that world, and all discoveries were carefully guarded and contained.

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62. *See* FREDERICK E. CROXTON ET AL., APPLIED GENERAL STATISTICS 9 (1967) (discussing the high probability that trends observed using small samples are attributable to chance).

63. Secretary of War Henry L. Stimson was obsessed with secrecy in regard to the operations of the Manhattan Project. KURZMAN, *supra* note 51, at 78. The Project was considered to be so confidential that an appropriations-related Senate investigation was blocked by Stimson and Groves, largely on the basis of the supreme importance of secrecy. When Secretary of State James F Byrnes suggested a review of the Project, Groves informed Stimson that he was willing to allow two senators and two representatives to view "those things outside the secret processing areas which have been under constant observation by the construction contractors and their persounel." THOMAS & WITTS, *supra* note 53, at 92-93.

64. The stealth of the Manhattan Project was such a high priority that many of the investigators involved were unaware of the real purposes behind the research. For discussion of the "need to know" policy of the Manhattan Project, see GREGG HERKEN, THE WINNING WEAPON: THE ATOMIC BOMB IN THE COLD WAR, 1945-1950 110-11 (1982).

65. Security concerns were such a high priority that middle and lower level investigators were not aware that a bomb was being developed. High level scientists referred during their work to "the gadget," in order to ensure the highest order of secrecy, even within the ranks of their own laboratories. *See* Holmes, *supra* note 52.

In essence, wartime conditions obstructed the operation of market dynamics that ordinarily and optimally apply to the development of science. Competition was disqualified from its usual role as an impetus to creativity because freely competitive laboratories are resistant to any realistic constraints on the flow of information.[66] As security was the highest priority, centralizing research into one artificial universe was sensible. Coordination effected a compromise between the need for stealth and the demand for teamwork and interaction among scientific researchers. Because the ordinary exchange of information in open research markets was of necessity curtailed, orchestration of research was a necessary expedient. Whereas the invisible hand ordinarily moderates the flow of information through freely chosen competitive and cooperative arrangements between and among laboratories, a more visible hand was required to arrange these flows under conditions of secrecy.[67]

It is plausible that the Manhattan Project resulted in the development of an atomic bomb despite, rather than because of, centralized government coordination. As Daniel S. Greenburg observes, Manhattan Project leader General Leslie R. Groves's desire to compartmentalize knowledge in the interests of security is an absurd and offensive incursion upon the traditions of science.[68] Greenberg notes that Groves's efforts to compartmentalize research were "inevitably stretched or pushed aside by the pressures of getting on with the job,"[69] so that military organization of the Manhattan Project was a nuisance, albeit one that fell short of being disabling.[70] If the Manhattan Project succeeded by overcoming centralized organizational obstacles rather than by exploiting centralized organizational benefits, it would be a grave error to adopt intrusive federal AIDS policies on the basis of that earlier example. As Part II explains, government coordination is an extraordinary process under extant norms of scientific research—so much that the invisible hand should be replaced by visible allocation of tasks and resources only under extraordinary conditions.

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66. The restriction of information flows is a severe departure from the ordinary norms of science. Whereas publication incentives in the academy encourage the sharing of information under ordinary conditions, and patent law encourages the dispersement of information in commercial laboratory settings, the Manhattan Project was restricted from participating in normal scientific research activity because of the need to protect information.

67. I borrow the idea of the visible hand freely here from business historian Alfred Chandler, who recognized development of economic and industry manipulation in tandem with the rise of the large and powerful corporation. ALFRED D. CHANDLER JR., THE VISIBLE HAND: THE MANAGERIAL REVOLUTION IN AMERICAN BUSINESS (1977).

68. DANIEL S. GREENBURG, THE POLITICS OF PURE SCIENCE 88 (1967).

69. *Id.*

70. *Id.* at 89.

C. While the Suspension of Laboratory Autonomy May Be Appropriate at Late, Goal-Implementation Stages of Research, It May Not Be Appropriate at the Stage of Basic Research

Activists demanding a Manhattan Project cite frustrations with the cumbersome, dilatory processes of science.[71] They have subjected the principles and procedures of normal science to unprecedented scrutiny, rendering the scientific community more accountable for a critical examination of processes and controls that may impede the search to cure AIDS.[72]

Still, there are compelling reasons to retain the protocols of normal, autonomous scientific research. In particular, it is vital that investigators maintain scientific autonomy during the early stages of exploration, when they seek the basic knowledge that forms the underpinnings of applied research.[73] The need for investigative autonomy in conducting basic research, discussed in detail in Part II, reflects the need to encourage pluralism rather than narrowness at this stage.

If successful AIDS treatments would likely result from simply applying proven scientific principles, efficiency would perhaps be optimized by focusing all efforts along one uncontroverted path. Under such circumstances, the development of the desired application would be essentially mechanical, and therefore amenable to external management.

Unfortunately, AIDS research is currently far from the verge of mechanistic applications. As a result, the scientific community must be allowed to entertain a wide variety of theoretical approaches, one or more of which may lead us to the basic scientific advances that will pave the way towards eventual applied ends. Until then, a Manhattan Project II would be overly confining. Rigidly classifying basic research projects would inhibit the creative and innovative models that arise in a free and pluralistic scientific community

D. If the Manhattan Project Analogy Is Suspect, Skepticism of a Manhattan Project II Is Appropriate

Given the observations in the preceding three subparts, we should be reluctant to embrace a Manhattan Project II as the best R&D response to AIDS. Before we decide that governmentally centralized research is optimal under crisis conditions, we should be reasonably convinced that the Manhattan

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71. Cohen, *A Manhattan Project*, *supra* note 48, at 1112.

72. *See* Epstein, *supra* note 8, at 49-51 (discussing the ability of AIDS activists to reduce the insulation of the scientific community, and critically examining scientific protocols as social constructions created in the context of political power dynamics).

73. Indeed, regulation of applied scientific research tends to be far more prevalent than regulation of basic scientific research. For a discussion of the relative degrees of regulation of basic and applied research, see Steven Goldberg, *The Reluctant Embrace: Law and Science in America*, 75 GEO. L.J. 1341 (1987).

Project benefitted from government coordination, rather than mega-funding or other alternative causes. We should also consider the possibility that the Project would have been even more effective and efficient without coordination had the need for confidentiality not usurped that choice.

Ordinarily, we view government coordination of research as ineffective and inefficient. Compare AIDS research with cancer research and heart research, for example. Cancer and heart disease certainly can be considered health care crises similar to the AIDS crisis,[74] and therefore equally analogous to the crisis of World War II. Yet there has been no serious consideration of a Manhattan Project III to expedite the fight against cancer, or of a Manhattan Project IV to speed the discovery of a cure for heart disease.[75]

Why has there been a clamor for government coordination of AIDS research but not for cancer or heart research? In all likelihood, the distinction is a political one. Cancer patients and heart patients face their diseases in isolated pockets. In contrast, many AIDS patients are politically well organized.[76] Moreover, the gay community at large has embraced the fight against AIDS as a crucial concern.[77] There is no demographic equivalent among cancer or heart patients to flex its muscle in the form of demands on the government for change in R&D policy Because cancer patients and heart patients are not organized, they have not placed comparable political pressure on governmental officials and entities.

The substance of political demands, particularly the demand for increased organization of the fight against AIDS, is the product of a sense of helplessness and chaos. Because the disease has remained inscrutable and untamed,

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74. Heart disease is presently the number one cause of premature deaths in the United States. Alexander Leaf, *Preventive Medicine for Our Ailing Health Care System*, 269 JAMA 616 (1993). In 1989, 497,850 persons died of heart disease in the United States. *1992 Heart and Stroke Facts*, AMER. HEART ASS'N PAMPHLET, 1991.

In contrast, 100,777 deaths from AIDS were reported to the Centers for Disease Control from 1981 through 1990. *Mortality Attributable to HIV Infections/AIDS—United States, 1981-1990*, 265 JAMA 848 (1991).

Because AIDS-related and cancer-related deaths overlap, it is difficult to compare these two causes of mortality. For discussion of AIDS-related deaths associated with cancer, see Andrew A. Skolnick & Margaret A. Winker, *Eleventh Annual Science Reporters Conference Offers Cornucopia of Medical Research Stories*, 268 JAMA 2620 (1992).

Statistics comparing heart disease-related and AIDS-related mortality are not intended to trivialize the severity of the AIDS epidemic, but rather to suggest that while research challenges concerning heart disease and AIDS are both compelling, there has been no call for government coordination of research concerning heart disease. My hypothesis here is that the call for a Manhattan Project II for AIDS research is a function of political clout and organization in the gay community.

75. If AIDS activists who demand government coordination of research are correct in the belief that a more concerted effort will expedite the discovery of a cure, then such coordination would also be likely to expedite discoveries of cures for cancer and heart disease. Either the entire competitive capitalist system of research autonomy is faulty, or there are compelling reasons to avoid coercive research programs—reasons which have been recognized through past experience, and incorporated into the existing model.

76. Jeremy Pripstein, *When Science and Passion Meet: The Impact of AIDS on Research*, CAN. MED. ASS'N J., Feb. 15, 1993, at 638.

77. Robert M. Wachter, *Aids, Activism, and the Politics of Health*, 326 NEW ENG. J. MED. 128 (1992).

those most immediately affected want to exert more control over it.[78] Unfortunately, the natural desire to seek control through expanded organization is revealed as dysfunctional when examined beyond its appealing surface.[79]

The nexus between centralization and effectiveness has not been proven. To the contrary, evidence from organizational theory suggests that centralization may be ineffective for high-innovation projects. Robert E. Quinn and John Rohrbaugh, for example, have observed that cultures of flexibility are associated with decentralization and differentiation, whereas cultures of control are associated with centralization and integration.[80] In accordance with this model, decentralized authority over AIDS research may be associated with flexibility and differentiation, typically sources of innovation, whereas centralized government authority over AIDS research may be associated with control and integration, potential inhibitors of creativity

A dysfunctional relationship between innovation and centralized authority may explain why privatized, uncoordinated research is the received scientific and commercial model in the United States. Proponents of the private system contend that it is the most expedient method of ensuring scientific and medical progress.[81] If they are correct, then a political decision to adopt a Manhattan Project II in response to the AIDS crisis would appease critics, but at a possible cost of human suffering and lives. In the following Part, I address the nature of science and the roles of competition, coordination, and collaboration in scientific processes. By examining these dynamics, we can try to understand the potential benefits and disadvantages of government centralization in order to choose an AIDS policy based on rational expectations rather than political pressures.

78. Political pressure appears to be a driving force in increasing amounts of funding spent on AIDS research. Julie Johnsson, *CEOs: Politics Hurts Long-Term Medical Research*, HOSPITALS, Aug. 20, 1990, at 22. Yet, while political pressure may increase AIDS funding and thereby speed the process of finding a cure, misguided political pressures favoring extreme centralization and coordination of research may in fact have a negative impact on the search for a cure. Policy makers should avoid yielding to knee-jerk political pressures and favoring policies the impact of which has not been fully considered.

79. In response to proposed legislation for the centralization of AIDS policy within the NIH, one representative has observed, "I am concerned that enactment of this legislation we are debating today will impede, and not enhance, the very fine work that is conducted by NIH. The NIH must be above both politics and political correctness." Stephen Burd, *Key Legislation for NIH Approaches Enactment in Congress; Scientists Relieved, but Controversy over AIDS Goes On*, CHRON. HIGHER ED., June 2, 1993, at A19, A20 (quoting Thomas J. Bliley, Jr., R-Va.).

For further critical discussion of the effects of political pressures on AIDS research, see Marcia Angell, *A Dual Approach to the AIDS Epidemic*, 324 NEW ENG. J. MED. 1498 (1991); Ronald Bayer, *Public Health Policy and the AIDS Epidemic: An End to HIV Exceptionalism?*, 324 NEW ENG. J. MED. 1500 (1991).

80. *See* Robert E. Quinn & John Rohrbaugh, *A Spatial Model of Effectiveness Criteria: Towards a Competing Values Approach to Organizational Analysis*, 29 MGMT. SCI. 363 (1983).

81. *See infra* note 95 and accompanying text.

II. THE IMPACT OF COMPETITION, COORDINATION, AND COLLABORATION ON SCIENTIFIC RESEARCH

We cannot deduce from the achievements of the Manhattan Project that the creation of a similar project is the ideal policy approach to AIDS research. Because the Manhattan Project was a single and distinctive nonexperimental phenomenon, the ability to make inferences from its experience is severely constrained. The hypothesis that governmentally centralized research is the most effective policy is an important one, yet we must be careful not to embrace a Manhattan Project II approach without giving serious consideration to the likely effects of such an endeavor on the competitive and cooperative forces that shape innovation.

This Part examines the possible impact of unrestrained research coordination on scientific innovation, focusing on the adversarial nature of scientific breakthroughs, the effects of bureaucratization on research, and the role of competitive forces in the advancement of science.

A. The Adversarial Nature of Scientific Breakthroughs

The creation of new knowledge is a product of contentiousness within scientific communities.[82] As a result, short-term research efficiency, particularly when gained as a product of coordinated programming, may conflict with long-term research effectiveness.

In his classic examination of the nature of scientific progress, Thomas Kuhn explains the development of revolutionary models that supplant and improve upon prior research paradigms.[83] Kuhn observes the tendency in scientific communities to suppress novel approaches that are subversive to received models.[84] Scientific progress is therefore an inherently revolutionary process, in which the forces of scientific inertia are transcended, and the paradigms for understanding a particular research problem are transformed.[85]

The existence of received paradigms is vital to the advancement of science. The acceptance of given models and assumptions allows scientists to build on another's existing findings without repeating accepted foundational research.[86] Yet, paradigmatic science can also breed myopia, as investigators schooled in a specific approach view their research questions with "drastically restricted vision," evincing intolerance for new theories and paradigms that diverge from the traditional models in which they have been trained.[87]

While some constraint upon vision, consistent with the findings and widely held beliefs of others, encourages the efficient progress of stepwise research, it may be harmful to long-term research effectiveness. Because "[d]iscovery

82. *See infra* notes 89-90 and accompanying text.
83. THOMAS S. KUHN, THE STRUCTURE OF SCIENTIFIC REVOLUTIONS (2d ed. 1970).
84. *Id.* at 5.
85. *Id.* at 6-7.
86. *Id.* at 19.
87. *Id.* at 24.

commences with the awareness of anomaly,"[88] the quest to find more effective treatments for AIDS may depend upon the degree to which the research community remains receptive to innovative but unpopular investigative streams.[89]

For example, Dr. Jonas Salk currently is engaged in controversial AIDS research[90] that bears remarkable similarity to the research that resulted in the polio vaccine decades ago: once again, he is pursuing an investigative vein largely ignored or discredited by others.[91] As Salk's iconoclastic theories led to the end of the polio epidemic, so the vaccination or cure for AIDS will come from the vision of someone who sees the problem somewhat differently from the masses of investigators. The end of AIDS will likely accompany a demonstration that the scientists who came before missed something essential, or modeled the disease inaccurately, due to some largely accepted but false paradigm.

Salk's controversial approach to AIDS research is not the only unpopular model that probably would be harmed by highly centralized orchestration. A minority of controversial scientists contend that HIV is not the sole cause of the onset of AIDS, suggesting the existence of some co-factor to explain disparities in the experiences of persons diagnosed as HIV positive.[92] Because they are outside the mainstream of received AIDS research, proponents of co-factor theories have experienced difficulty in receiving funding to examine their hypotheses—even under our currently restrained form of government coordination.[93] While co-factor theorists face impediments to doing contrarian research in a relatively unfettered marketplace of ideas, their work remains feasible in part because such alternative perspectives have not been marginalized out of existence by rigid centralization.

Like Salk's current work, the co-factor theory of AIDS may eventually win more converts, or it may prove to be as fruitless as the majority of investigators currently contend. The ultimate fate of these particular approaches, or of any other controversial approach, is not the issue here. Rather, the critical

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88. *Id.* at 52.

89. In this vein, Dr. Anthony Fauci has observed, "To completely Manhattanize [AIDS research] would take away from the creativity." Garrett, *supra* note 23, at 4.

90. Salk's work on an AIDS vaccine met with much skepticism at the most recent international meeting on AIDS. Sheryl Stolberg, *Salk Report on AIDS Vaccine Meets Skepticism at Convention*, L.A. TIMES, June 10, 1993, at A7.

91. For discussion of the Salk AIDS vaccine, "Salk Immunogen," and the similarity between his discredited approaches to polio and AIDS, see Sheryl Stolberg, *Hero with Something to Prove*, L.A. TIMES, Mar. 7, 1993, at A1.

92. For discussion of this theory, see ROBERT S. ROOT-BERNSTEIN, RETHINKING AIDS: THE TRAGIC COST OF PREMATURE CONSENSUS 327-49 (1993).

Some have gone beyond the co-factor theory to suggest that HIV does not cause AIDS at all. *See, e.g.*, William Booth, *A Rebel Without a Cause of AIDS*, 239 SCI. 1485 (1988) (discussing the iconoclastic viewpoints of U.C. Berkeley biologist Peter Duesberg, who contests the HIV theory of AIDS) [hereinafter Booth, *A Rebel*]. Duesberg has posited that AIDS is caused by recreational and anti-HIV drugs. Peter H. Duesberg, *The Role of Drugs in the Origin of AIDS*, 46 BIOMED & PHARMACOTHERAPIE 3 (1992).

93. Barbara O'Brien, *Scientist Points to Alternative in AIDS Research*, BUFFALO NEWS, Apr. 28, 1993, at 6.

point is to ensure a diversity of scientific approaches, including acceptance of unpopular models espoused by otherwise highly qualified and esteemed scholars.

Specifically, we must eschew regulatory policies that may inadvertently result in administrative imperialism. If pluralism and tolerance are essential elements of scientific advancement, the government faces a difficult challenge in developing an optimal AIDS research policy. It must maintain standards to ensure that the research being funded is not spurious while remaining receptive to novel approaches that are unpopular or threatening to a community of scientists who have vested interests in their own potentially flawed paradigms.

The granting of extraordinary government powers, such as the implementation of a unified research program directed by an AIDS Czar, would be a policy dangerous in its extremity Potential harm lies in the centralization of decision-making power and the damage to science associated with limitations of vision, diversity of perspectives, and objectivity [94]

The vesting of extreme powers in an AIDS Czar may eliminate some replication and disqualify ostensibly ill-conceived projects. It may also have an intolerable chilling effect on eccentricity, the twisted vision essential to the shifting of paradigms in the scientific and medical communities. We currently lack effective treatments for AIDS because of false assumptions and blind spots in the received scientific models. The discovery of better treatments will depend upon activities that are subversive to the limits of extant understandings. Subversive research activity can thrive, but only if the mechanisms for funding and resource allocation remain reasonably open to a diversity of perspectives. This essential element of diversity would be discouraged by highly centralized coordination of AIDS research through federal administrative control over laboratory activities.[95]

B. The Impact of Centralized Policy on Bureaucratization of Research, and Concomitant Losses in Efficiency and Effectiveness

Government regulation of private enterprise, and government management of public and quasi-public organizations, have long been associated with

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94. The potentially negative impact of centralized research policy on scientific advances is a function of the relationship between innovation and autonomy. For discussion of the superiority of autonomous behavior over induced behavior in high value-added, high innovation activities, see Steven R. Salbu & Richard A. Brahm, *Planning Versus Contracting for International Joint Venture Success: The Case for Replacing Contract with Strategy*, 31 COLUM. J. TRANSNAT'L L. 283 (1993).

95. The free market approach to science, in contrast to extreme centralized regulatory control, is relatively open-textured, providing for the free flow of information, as well as the freedom to pursue alien or unpopular avenues of thought. For discussion of the value of "free access" to information and data developed among competing labs, and its role in facilitating challenges to extant paradigms, see Rebecca S. Eisenberg, *Patents and the Progress of Science: Exclusive Rights and Experimental Use*, 56 U. CHI. L. REV. 1017, 1053-55 (1989) [hereinafter Eisenberg, *Patents*].

inefficiencies and costs related to the cumbersome nature of bureaucracy [96] Some scientists believe that centralized planning of AIDS research may result in bureaucratic delays.[97] Both relatively unintrusive centralization, such as strategic planning of resource allocation, and relatively intrusive centralization, such as a Manhattan Project II, could subject projects to bureaucratic inefficiency and delay

Moreover, bureaucracy is likely to subvert organizational adaptation by emphasizing control over autonomy of personnel.[98] Bureaucracy demands compliance with rules and regulations, behavior that is predictable and dependable, and internalization of organizational values.[99] These bureaucratic characteristics are incompatible with the processes of intellectual exploration and scientific discovery

Unnecessary layers of bureaucracy, imposed on the decision-making processes of ordinarily independent labs, may also impede institutional learning. Argyris and Schon have distinguished "single-loop" and "double-loop" learning in organizations: single-loop learning consists of adjusting results of activity to pre-established standards, while double-loop learning entails periodical or ongoing reassessment of, and modification of, the standards themselves.[100]

Double-loop learning is a desirable attribute of laboratory research because it allows investigation to build on itself, incorporating information and adjusting goals and programs accordingly [101] These adjustments, which steer the direetion of work in progress, are incompatible with bureaucratie control. While double-loop learning pervades the entire life of the institution or organization as it unfolds from one moment to the next, bureaucratic standards and instructions are hierarchical and detached from daily operations. As a

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96. For discussion of the inefficiencies associated with regulatory bureaucracy, see generally CHARLES L. SCHULTZE, THE PUBLIC USE OF PRIVATE INTEREST (1977). For discussion of the negative effects of NIH bureaucracy on laboratory research, see Larry Thompson, *NIH at 100: Where Big Government Meets Big Science*, WASH. POST, Jan. 13, 1987, at Z12.

97. *See supra* note 50.

98. *See* JEFFREY PFEFFER, ORGANIZATIONS AND ORGANIZATIONAL THEORY 166 (1982) (discussing the tendency of bureaucratic structures to increase organizational control).

99. Richard C. Edwards, *Worker Traits and Organizational Incentives: What Makes a "Good" Worker?*, 11 J. HUM. RES. 51 (1976).

100. CHRIS ARGYRIS & DONALD A. SCHON, ORGANIZATIONAL LEARNING: A THEORY OF ACTION PERSPECTIVE (1978).

101. *See* Michael Polanyi, *The Republic of Science: Its Political and Economic Theory*, 1 MINERVA 55 (1962). In his principle of "spontaneous coordination of independent initiatives," Polanyi expresses the particular role of feedback loops in the learning process of research labs. He suggests that unfettered, unmanaged scientific research will be naturally coordinated by an invisible hand, which consists in part of the continual flow of information and a resulting refinement of research topics and experimental design. Accordingly, "a series of independent initiatives are organised to a joint achievement by mutually adjusting themselves at every successive stage to the situation created by all the others who are acting likewise." *Id.*

Performance is optimized through stepwise advancement of cooperation, decentralized so that the most competent decision-maker can incorporate the latest, most relevant information with maximum efficieney and effectiveness. Because double-loop learning relies on constant and immediate incorporation of feedback in an ongoing process of investigation, it is naturally best suited to decentralized environments, allowing those working most intimately with the knowledge and information to make expedient, well-informed adjustments.

result, bureaucratic authority over R&D is likely to be unresponsive and rigid—resistant to frequent and rational adjustment of goals and standards.[102]

The bill recently approved by the House and Senate, requiring resource allocation to be approved by the Director of the Office of AIDS Research,[103] adds a layer of potential bureaucratic delay in funds allocation. A Manhattan Project II would be subject to innumerable other sources of delay, as previously autonomous lab decisions would fall under the fiat of governmental authority and approval procedures. As Manhattan Project scientists became frustrated with the red tape accompanying military control,[104] so AIDS researchers would face potential areas of conflict with administrators, the resolution of which would require time-consuming negotiation activity that simply does not exist in regard to unilateral decision-making.[105]

While both moderate and extreme proposals for government coordination of AIDS research would be subject to potential bureaucratic inefficiencies,[106] less extreme recommendations such as centralized strategic planning of resource allocation have countervailing benefits that would probably more than compensate for bureaucratic impediments.[107] Moreover, my forthcoming proposals for limited centralization are tempered by provisions aimed at reducing prospective inefficiencies.[108]

C. *The Role of Competitive Forces in the Advancement of Science*

Unfortunately, the more extreme proposals favoring administrative usurpation of public and private research activity would have side effects apart from bureaucratic sluggishness. They would also undermine the basic incentives and values that form the foundation of normal science. Although cooperation is obviously a source of information dispersion as well as production synergies, the optimal role of cooperation in scientific research is as a competitive tool.[109] While cooperation is important to the rapid

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102. Scholars have observed that double-loop learning is difficult to sustain, and requires substantial institutional support. *See, e.g.*, James G. March, *Exploration and Exploitation in Organizational Learning*, 2 ORG. SCI. 71 (1991); Danny Miller & Peter H. Friesen, *Momentum and Revolution in Organizational Adaptation*, 23 ACAD. MGMT. J. 591 (1980). As a result, centralization of AIDS research policy that is overly intrusive and overly bureaucratic may impede laboratory learning by rendering feedback and reassessment processes overly cumbersome, or even impossible, given regulatory requirements such as top-down approval or authorization of change.

103. *See supra* note 30.

104. *See supra* notes 69-70 and accompanying text.

105. Eisenberg, *Patents*, *supra* note 95.

106. *See* Philip H. Abelson, *Federal Impediments to Scientific Research*, 251 SCI. 605 (1991) (describing how laws and regulations monitoring use of public funds have diverted scientific talent from research to bureaucratic and regulatory compliance work, essentially turning scientists into administrators).

107. *See infra* notes 129-36 and accompanying text.

108. *See infra* notes 136-52 and accompanying text.

109. *See* ROBERT K. MERTON, *Behavior Patterns of Scientists*, *in* THE SOCIOLOGY OF SCIENCE: THEORETICAL AND EMPIRICAL INVESTIGATIONS 325, 339 (1973) (referring to science as "institutionalized vigilance, involving competitive cooperation.").

development of scientific theory, it should be subsumed within, and subverted to, the dominant and driving force of competition.

Competition is vital to scientific advancement because of the role it plays in inducing effort, innovation, investment, and creativity, both in the public and the private research sectors. In NIH and university facilities, highly motivated scholars are driven to compete against one another for a sense of accomplishment, academic prestige, and potentially lucrative private consulting opportunities that come with academic achievement.[110] The famous DNA race between James Watson and Linus Pauling exemplifies the relationship between scientific advances and high stakes, ambition, drive, and competition.[111] In the private sector, more purely commercial incentives, too often disparaged by activists, account for the rapid rate of innovation in biotechnological applications today [112]

Competition should be valued more highly than cooperation in research policy because, while competitive dynamics will ensure the occurrence of cooperative behaviors, mandatory cooperation will not in itself induce competition or the incentives inherent therein.[113] Competition naturally begets cooperation, to the extent that alliance activity confers competitive advantage over those who attempt to work in isolation.[114] As long as collaboration provides value to those who engage in it, competitors will recognize the need to collaborate and arrange strategic alliances accordingly The market, driven by the competitive activity of self-seeking investigators, will monitor itself in regard to optimal collaborative opportunities. For these reasons, we should restrict government compulsion of R&D collaboration.[115]

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110. For discussion of the incentives that drive scientific research, see MARLAN GLISSET, POLITICS IN SCIENCE (1972); JAMES D. WATSON, THE DOUBLE HELIX (1981).

The incentives that drive scientists are controversial, however, and critics have suggested that the commercialization of research is creating conflicts of interests that may jeopardize the purity of research. *See, e.g.*, Warren E. Leary, *Business and Scholarship: A New Ethical Quandary*, N.Y. TIMES, June 12, 1989, at A1.

111. W. Henry Lambright & Albert H. Teich, *The Organizational Context of Scientific Research*, *in* 2 HANDBOOK OF ORGANIZATIONAL DESIGN 305, 307 (Paul C. Nystrom & William H. Starbuck eds., 1981).

112. *See* Rebecca S. Eisenberg, *Proprietary Rights and the Norms of Science in Biotechnology Research*, 97 YALE L.J. 177, 178 (1987) ("The commercial potential of recent advances in biotechnology has substantially increased private investment in basic research in the biomedical sciences.").

113. For an excellent discussion of the manner in which open competition will naturally and optimally allocate cooperative efforts among competitors, see Polanyi, *supra* note 101.

114. *See* James R. Golden, *Economies and National Strategy: Convergence, Global Networks, and Cooperative Competition*, 16 WASH. Q., Summer 1993, at 88, 91 ("Corporate strategy now requires cooperative competition, a framework that simultaneously enhances mutual performance and shapes the form of competition. In this sense, cooperation and competition are not alternative approaches to relationships. The cooperative component enhances the competition by making both parties more effective, and at the same time the structure of cooperation limits the scope of acceptable competition.").

115. A counter-argument might be made as follows: while competition begets some cooperation, for example, self-serving forms of cooperation, it also begets secrecy and furtiveness, qualities that impede the progress of scientific research.

There is no doubt that competition can yield some dysfunctional side effects. The well-publicized battle between Robert Gallo and Luc Montagnier over credit for identifying the AIDS virus is an example, wherein two scientists with a history of data sharing became secretive and adversarial. David Remick, *Robert Gallo Goes to War*, WASH. POST, Aug. 9, 1987, (Magazine), at W10.

III. STRATEGIC PLANNING: A PROPOSAL FOR RESTRAINED GOVERNMENT COORDINATION OF AIDS RESEARCH

A. The Value of Restrained Government Coordination

Although oversimplified, the ideals of centrally managed AIDS research are not entirely invalid. They reflect a legitimate perception of the need for public policy to promote the quick dispersion of information, the sharing of research findings, and the effective choice of research questions so as to avoid unnecessary redundancy

My criticism of a centralized research policy has focused on the loss of adversarialism and private research incentives,[116] as well as the financial and temporal costs associated with bureaucratization.[117] Perhaps most importantly, the bureaucratization of research into a centralized approach to AIDS investigations is likely to lead to institutionalized myopia: the very notion of a single, *approved* research policy forecloses the possibility of innovative, paradigm-breaking research.[118] While there are undeniable benefits to be gained from encouraging collaboration, the policy should gain such benefits in a manner that preserves the stimuli and the fluidity of private enterprise.

Various proposals for the centralization of AIDS research would be accompanied by different levels of intrusiveness into laboratory autonomy Martin Delaney, of Project Inform in San Francisco, has recommended creating a blue-ribbon panel to assess proposed research programs quickly [119] Delaney's proposal also includes a well-funded Manhattan Project, tax and patent benefits for commercial collaborators, and streamlined Food and Drug Administration review through a review team dedicated to the project.[120] A more intrusive set of recommendations, entitled the "Barbara McClintock Project to Cure AIDS," comes from ACT UP/New York.[121] The McClintock Project entails the granting of "extraordinary powers," such as the right to use all facilities or staff that have been funded by the government, the right to test possible cures when companies are dilatory in doing so, and the right to access all relevant data from public or private companies engaged in

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Projects rendered competitive by virtue of high stakes, whether in science or in industry, will inevitably result in both normal and excessive furtiveness and combativeness. Yet, I stand by my assertion that cooperation should be subsumed within competition. A lack of competitive incentives would do worse than create isolated pockets of dysfunction—it would drive research to a halt, removing the excitement and undermining the entire game. Inevitably, competitive dynamics have allowed capitalist economies to dominate technological innovation across the world, while planned, communist economies lagged decades behind. The competitive impetus to innovation, albeit somewhat marred by overzealous rivalry, is still the preeminent path to high-technology breakthroughs.

116. *See supra* notes 82-95, 109-18 and accompanying text.

117. *See supra* notes 96-108 and accompanying text.

118. *Id.*

119. Cohen, *A Manhattan Project*, *supra* note 48, at 1113.

120. *Id.*

121. *Id.*

AIDS research.[122] While the McClintock Project might expedite a limited number of short-term research transactions, it would also reduce private incentives to pursue AIDS projects. Moreover, the public usurpation and unification of research activities would tend to impair the full force of the "patent race" that is encouraged by atomistic and natural competition among numerous decentralized and autonomous labs.[123]

The exigency of AIDS might justify the sacrifice of private interests for the benefit of an immediate cure, if such a cure were imminent. Most experts concede, however, that no immediate cure is in sight.[124] The search for an effective AIDS treatment is probably a long-term project, which will rely on building a foundation of basic research—a foundation that is likely to take years to achieve.[125] Consequently, the preservation of private rights in AIDS research is not simply a greedy exchange of lives for money Rather, it reflects a continued faith in private incentives as the most effective and efficient medium for long-term technological progress.

For these reasons, as well as those discussed in the previous Part, a Manhattan Project for AIDS cannot be justified. The bureaucratic collection of star scholars, management of their research, and control over the flow of information are all ultimately inefficient. Because the efficacy of managed research under the Manhattan Project is speculative,[126] and because a Manhattan Project II would take a heavy toll on research autonomy and incentives,[127] the proposal in this Part is less drastic. It reflects an effort to balance the virtues of competition and cooperation with an eye towards encouraging voluntary collaboration in lieu of exacting mandatory cooperation.

B. Improved Government Coordination Through Enhanced Strategic Planning and Organization of Grant Review and Approval Processes

This proposal recognizes that the existing system of government funding is a potentially potent tool for improving the cohesiveness of otherwise insular AIDS research projects. My recommendation supports the development of a strategic plan for AIDS research. Consistency and fit with the plan are

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122. *Id.*

123. For discussion of patent race effects, see Alden F. Abbott, *Joint Production Ventures: The Case for Antitrust Reform*, 58 ANTITRUST L.J. 715, 719-22 (1989).

124. Lawrence K. Altman, *The Doctor's World: Conference Ends with Little Hope for AIDS Cure*, N.Y. TIMES, June 15, 1993, at C1 ("Only an eternal optimist would have left the ninth international AIDS meeting last week believing that new drugs will be available anytime soon to save the lives of the 14 million people now infected with the virus that causes AIDS.").

125. Virologists Lawrence Corey and William Haseltine suggest that, at the present stage of understanding, it is crucial to attract more investigators to basic research. A cure and a vaccine for AIDS will require a better knowledge base than currently exists. Cohen, *A Manhattan Project*, *supra* note 48, at 1113.

126. *See supra* notes 51-81 and accompanying text.

127. *See supra* notes 109-15 and accompanying text.

legitimate factors in determining which grant proposals should be funded.[128] The proposition is controversial to the extent that a preordained strategic plan may be viewed as having the potential to chill academic freedom and to inhibit projects that are counterintuitive, contrarian, or paradigm shifters.[129] These potentially negative effects of strategic planning are significant, given the essentially revolutionary nature of scientific advancement.

At the extreme, some purists suggest that science should be motivated solely by the search for truth.[130] According to this philosophy, social ends should never be the criteria that drive science, because the influence of social problems on a scientist's framing of her research undermines "the purity of the developing body of knowledge."[131]

Notwithstanding the real possibility that a strategic plan may stifle some innovative research proposals and influence the otherwise naturally unfolding direction of scientific investigation, planning is a viable means of improving the efficiency and comprehensiveness of AIDS research. With or without a strategic plan, funding decisions must ultimately be made based on assessments of relative merit,[132] and such decisions will always be subject to the biases and beliefs of decision-makers. Given that allocation of scarce resources requires some form of evaluation,[133] it is appropriate as well as inevitable that grant committees try to estimate the chances that AIDS

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128. The use of strategic planning to balance the goals of scientific cohesiveness and autonomy dates to the Atomic Energy Act of 1946, under which the system of "administrative contracts" was developed. 42 U.S.C. §§ 1801-1819 (1992).

The system essentially uses contract granting standards as a front-end mechanism for quality control, but then allows for scientific autonomy and flexibility by decentralizing project management and limiting administrative review procedures.

For discussion of the reasons that this limited method of governmental control is preferable to more pervasive and centralized governmental authority over laboratory work, see Crease & Samios, *supra* note 49, at 86-88.

129. *See* Eisenberg, *Patents*, *supra* note 95, at 1060.

> The independence of scientists in the day to day conduct of research promotes progress by enabling scientists to exploit their expertise fully and to make use of new information as they acquire it in the course of their investigations, without needing to comply with instructions or justify their activities to supervisors. Coordination or central planning of research substitutes the judgment of the research coordinator for that of the individuals who are actually immersed in the details of the research.

Id. (citation omitted).

130. For a good explication of this purist view, see GEORGE H. DANIELS, SCIENCE IN SOCIETY: A SOCIAL HISTORY 288-95 (1971).

131. *Id.* at 288.

132. The Division of Research Grants of the NIH is guided by an elaborate set of acts and regulations regarding grants policy and grant applications review. For an historical summary, see NIH ALMANAC 1992, NIH Pub. No. 92-5, Nov. 1992, at 102-04.

133. For NIH evaluation criteria, see APPLICATION KIT, NATIONAL INSTITUTES OF HEALTH RESEARCH GRANTS, PHS 398.

Much has been written on the process of grant application evaluation by the NIH. *See, e.g.*, Janet M. Cuca, *NIH Grant Applications for Clinical Research: Reasons for Poor Ratings or Disapproval*, 31 CLIN. RES. 453 (1983); Janet M. Cuca, *Why Clinical Research Grant Applications Fare Poorly in Review and How to Recover*, 5 CANCER INVESTIGATION 55 (1987); George N. Eaves, *The Project-Grant Application of the National Institutes of Health*, 32 FED. PROCEEDINGS 1541 (1973); Doris H. Merritt & George N. Eaves, *Site Visits for the Review of Grant Applications to the National Institutes of Health*, 34 FED. PROC. 131 (1975); Antonia C. Novello, *The Peer Review Process: How to Prepare Research Grant Applications to the NIH*, 11 J. MINERAL ELECTROLYTE METABOLISM 282 (1985).

research will add to the knowledge base.[134] A carefully considered plan, with guidelines requiring decision-makers to abide by its terms in allocating resources, has the potential to curb the influence of capriciousness or political bias and to reinforce the rationality of decision factors. While the possibility of imperfect decision-making is an inevitable component of selective and competitive funding, a planning structure is likely to act as a check on, rather than as a source of, poor decisions.[135]

Moreover, the dangers of chilling creativity and innovation by funding only projects that fit the strategy can be minimized by buffering policies. Accordingly, my proposal for centralized strategic planning of AIDS research includes the following safeguards, designed to reduce unnecessary redundancies, increase symbiotic interaction, and ameliorate the propensity of a plan to chill innovation:

(1) Both the strategic plan and funding decisions in compliance with the strategic plan should be made by a pluralistic committee representing various perspectives and schools of theory Under both current governmental funding processes and my proposed plan for enhanced strategic coordination, judgments regarding the comparative value of proposed projects are unavoidable, and indeed desirable. Given limited resources to be distributed among competing proposals, it is appropriate and necessary to engage in relative evaluation processes.[136]

If limited government funds are to be used wisely, it is essential that the group or committee passing judgment on proposals be impeccably qualified to compare their relative merits.[137] The necessity of maintaining a top quality administrative board will tend to become subject, unfortunately, to a variety of political dynamics.[138] Power bases, among whom the responsibility of choosing board representation is lodged, may be inclined to favor either liberally or conservatively oriented committee members, or to give preference

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134. President Kennedy aptly summarized the balance between academic freedom and public needs in the funding of scientific research, observing, that "[s]cientists alone can establish the objectives of their research, but society, in extending support to science, must take account of its own needs." GREENBERG, *supra* note 68, at 288 (quoting President John F. Kennedy's address to the National Academy of Science).

135. Although the tendency of scholars to favor conventional research may chill creativity, it will also serve to weed out projects that are poorly conceived or designed, as well as projects that are clearly unworkable, according to well-documented scientific tenets. If standards must and should be applied in evaluating prospective AIDS research projects, it is better to have intelligently organized and evaluated standards established under a strategic plan than haphazard and ill-considered standards.

136. As Professor Harold P. Green aptly observes, "[N]o scientist is entitled to a research grant except in the nonarbitrary, noncapricious, nondiscriminatory discretion of the granting agency." Harold P. Green, *The Law-Science Interface in Public Policy Decisionmaking*, 51 OHIO ST. L.J. 375, 378 (1990).

137. Qualification to engage in political planning regarding scientific policy should, but too often does not, require a high degree of scientific literacy. For a discussion of dangers related to scientific policies created by those who are scientifically ignorant, see Maxine F. Singer, *Genetics and the Law: A Scientist's View*, 3 YALE L. & POL'Y REV. 315 (1985).

138. *See* Pear, *supra* note 14, at 3 ("In practice, the allocation of money [in the course of the federal process of peer review of grants applications] reflects the political strengths of various lobbies including women's groups and gay rights advocates.").

to members with either traditional or nontraditional approaches to science.[139] These tendencies will occur naturally, as part of a general inclination among power coalitions to enhance their control by stacking decision-making units with sympathetic representatives.[140]

If government authority over funding allocation is to be strengthened in order to improve the use of resources, it is imperative to establish safeguards to mitigate the likelihood that strategic consistency will deteriorate into scientific or ideological parochialism. The best defense in this regard rests in the composition of the body charged with establishing the strategic plan and distributing funds thereunder. The political dynamic that favors committee stacking by existing power bases must be countered, so that the decision-making board is comprised of members with both uniformly impeccable qualifications and ideological diversity.[141]

By couching funding decisions within a board comprised of expert members of heterogeneous perspectives, the balance can be maintained between ensuring quality research and protecting against prohibitively restrictive research models. A board comprised of widely varying perspectives is most likely to include vocal advocates of controversial but promising research efforts, assuring that potentially ground-breaking or paradigm-shifting research proposals will receive a fair hearing.[142]

(2) The strategic plan should include a baseline percentage of projects designated as controversial. These projects would be considered in a separate category into which they would be submitted by their sponsors. In other words, if the plan required that ten percent of total funding go to projects labeled controversial, these dollars would be awarded to projects chosen from a separate pool of entries. Scientists would channel controversial entries into the pool by their own choice, and the committee evaluating grant proposals would be charged with the duty to award ten percent of total funding to the projects from the controversial pool deemed most meritorious.[143]

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139. For a good discussion of the political dynamics that affect decision-making within federal agencies, see James E. Katz, *Science, Technology, and Congress*, SOCIETY, May-June 1993, at 41, 43-48.

140. For a classic discussion of the dynamics of power coalitions in organizational processes, see Gerald R. Salancik & Jeffrey Pfeffer, *The Bases and Use of Power in Organizational Decision Making: The Case of a University*, 19 ADMIN. SCI. Q. 453 (1974).

141. There are several ways to achieve heterogeneity of committee membership, all of which ultimately rest on our ability to remove personnel decisions, and thereby remove funding decisions, from the political process. The most obvious classification of these mechanisms distinguishes voluntary and regulatory impetuses to diversity. Either executive appointments to the committee charged with oversight of AIDS grant applications must exhibit political restraint and sensitivity to the need to de-politicize membership, or else regulatory edict must mandate bi-partisan or other heterogeneous division of appointment power.

142. Group diversity has been shown to encourage creative outcomes. *See, e.g.*, Nigel King & Neil Anderson, *Innovation in Working Groups*, *in* INNOVATION AND CREATIVITY AT WORK 81 (Michael A. West & James L. Farr eds., 1990); T.H. Thornburg, *Group Size and Member Diversity Influence on Creative Performance*, 25 J. CREATIVE BEHAV. 324 (1991). Diversity among decision-makers who control allocation of grant funds can therefore be expected to enhance the likelihood of creativity and openness to creativity in the distribution of research moneys.

143. The ten percent figure chosen here is arbitrary, reflecting the importance of balancing the efficiency of intelligent prejudices against their chilling effect upon innovation. The figure is kept as a

Of course, the creation of a designated pool of controversial projects cannot ensure that any funding committee will review the applications objectively—without undue prejudice associated with received models and schools of belief. The creation of a controversial pool can, however, charge the committee with a good faith responsibility to assess at least a portion of the proposed projects with open minds. It would also force the committee to fund a minimum number of maverick studies, regardless of their beliefs and prejudices, thereby protecting the viability of the most meritorious controversial projects.

(3) The strategic plan should be developed and implemented under both top-down and bottom-up influences. The planning literature recognizes two prototypical approaches to strategy formulation and implementation: top-down and bottom-up. Top-down strategies are relatively centralized and authoritarian.[144] Ideas tend to be generated from the highest level of the institution or organization, reflecting a purported need to incorporate a broad, inclusive perspective into the planning process. Bottom-up planning attempts to de-emphasize formal organizational and hierarchical boundaries while encouraging the bubbling up of proposals and ideas from the lower and middle ranks of the institution.[145]

While maximizing resource allocation efficiency requires the application of the wide, inclusive vision of top-level decision-makers, the norms of science demand that strategic planning of AIDS research funding incorporate a high degree of openness and receptivity to proposals from all levels of the scientific community.[146] High level administrators are advantaged by the scope of their purview, but they are also disadvantaged by the distance at which they are separated from the ongoing work of AIDS research. The

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relatively small percentage, in deference to the high level of expertise among American scientists and the likelihood that respect for strongly held beliefs and conventions will therefore reduce wasteful resource allocation.

I also suggest that free market dynamics will control the percentage of submissions that scientists self-select for consideration as "controversial," provided that feedback regarding submission levels and acceptance rates is made public information. This assertion is based on an assumption that a history of over-submission will reduce future submissions in the category, while a history of under-submission will increase future submissions in the category.

144. Entirely top-down strategy formulation has been largely discredited for being unresponsive, unadaptive, and detached from nuts-and-bolts inputs of those who will ultimately be responsible for implementing the strategy. Accordingly, while formal strategic planning models tend to emphasize top-down planning direction, they virtually always include feedback and control mechanisms for the incorporation of information that can "bubble up" from all ranks. *See, e.g.*, BALAJI S. CHAKRAVARTHY & PETER LORANGE, MANAGING THE STRATEGY PROCESS 7 (1991) (proposing an essentially top-down planning process that allows for formal and informal interaction across all levels that will eventually be involved in strategic implementation).

145. Bottom-up strategies are often associated with McGregor's "Theory Y" philosophy of human nature, which emphasizes self-direction and self-control, and the dispersion of responsibility and creativity across all levels of bureaucracy, resulting in greater commitment to institutional objectives and enterprises. For a discussion of Theory Y, see DOUGLAS MCGREGOR, THE HUMAN SIDE OF ENTERPRISE (1960). For a discussion of the compatibility between Theory Y and bottom-up strategic formulation, see JAMES B. QUINN, STRATEGIES FOR CHANGE: LOGICAL INCREMENTALISM 86 (1980).

146. For a discussion of the relationship between organic organizational structures and innovation, see TOM BURNS & GEORGE M. STALKER, THE MANAGEMENT OF INNOVATION (1966).

insights that are gained daily by lab workers at every level will not naturally reveal themselves in the midst of government bureaucracy Because organizational dynamics, such as hierarchical norms of authority and complexity of communications channels, reduce the likelihood that important information will move upward and reach strategic decision-makers,[147] the planning process must be built to fight inertia and encourage the surfacing of ideas.[148]

The facilitation of bottom-up communication and generation of ideas is particularly crucial whenever any recommendation to increase governmental decision-making roles is adopted. The most radical cost of centralized decision-making, even at the limited level of project funding, consists of the loss of open-market information flows and resulting heterogeneous inputs.[149] To offset this loss, the planning process should be built with an eye towards opening communications and increasing fluidity of information.[150]

Specifically, the process should vest ultimate decision-making authority in the control of top-level administrators, but should delegate to middle-level administrators responsibility for generating proposals regarding funding priority guidelines. By shifting strategic planning proposal development from the top to the middle levels of the NIH or other appropriate governmental body, two crucial benefits are likely to result: (1) Decentralization will allow greater numbers of middle-level administrators to sift through a large amount of information; and (2) Decentralization will facilitate the effective movement of information from the labs themselves into the strategy formulation and implementation processes.

The middle-level administrators responsible for generating ideas should be expected to maintain open communications with the scientific AIDS community They should be sufficiently knowledgeable to understand the nature of the research. Most importantly, administrators responsible for generating strategic funding priorities should be expected to begin the conversation with the scientific community They must communicate their receptiveness to, and establish channels for, informational inputs.[151] This

147. Goal announcement from loci of authority results in centralization of organization. Centralization creates an implicit understanding that (i) tangential or outside issues remain closed for consideration, and (ii) the ideas of subordinates regarding decision-making alternatives are irrelevant. The benefit of various perspectives, culled from widespread inputs by those having intimate knowledge in relevant areas, is therefore lost in overly authoritarian processes. QUINN, *supra* note 145, at 67.

148. *See* Henry Mintzberg, *The Innovative Organization*, *in* HENRY MINTZBERG & JAMES B. QUINN, THE STRATEGY PROCESS 731, 742-43 (1991) (observing that strategies "grow initially like weeds in a garden," and that "to manage this process is not to preconceive strategies but to recognize their emergence and intervene when appropriate").

149. *See* HENRY MINTZBERG, THE STRUCTURING OF ORGANIZATIONS: A SYNTHESIS OF THE RESEARCH 432-33 (1979) ("To innovate means to break away from established patterns. So the innovative organization cannot rely on any form of standardization for coordination. In other words, it must avoid all the trappings of bureaucratic structure.").

150. For an excellent discussion of some dysfunctions of formal communications processes and the value of encouraging informal channels of commnnication, see EDWIN A. GERLOFF, ORGANIZATION THEORY AND DESIGN 281-300 (1985).

151. For discussion of the importance of including inputs from the scientific community into the establishment of AIDS and other research priorities, see Daniel E. Koshland, Jr., *Basic Research (III): Priorities*, 259 SCI. 1379 (1993).

middle administrative level is an essential mediator between the information held by the working ranks and the coordinating perspective that ultimately must be applied by upper level administrators if funding allocations are to be optimally effective and efficient.

IV THE SUPERIORITY OF VOLUNTARY ALLIANCES OVER MANDATED ALLIANCES IN ACHIEVING COOPERATIVE ADVANTAGE

In the proposal just examined, government authority over research is limited to strategic planning of publicly funded science. More intrusive regulatory efforts have been rejected as antithetical to the norms and dynamics of scientific progress. While I have dismissed the prudence of compulsory collaboration under a Manhattan Project II, we need not therefore lose the benefits of substantially increased levels of cooperation. The following analysis suggests that these advantages may be achieved by encouraging voluntary strategic alliances.

Organizational scholarship over the past decade has recognized the value of strategic alliance activity in facilitating technological innovation.[152] My recommendations are intended to capitalize on the innovative potential of alliances by encouraging free and open collaboration through the use of innovative organizational systems. Specifically, I emphasize the potential efficiency and effectiveness benefits to be derived from joint venture[153] and network forms[154] of voluntary collaboration in AIDS research.[155] Joint ventures and strategic networks can provide many of the advantages sought by AIDS activists who are currently demanding a federally coordinated AIDS research program while avoiding many of the shortcomings of government centralization. Taken together, the benefits discussed in the following categories have the potential to increase return per dollar spent on AIDS research and to improve the effectiveness of that research by enhancing the use of both knowledge and resources.

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152. *See, e.g.*, Herminia Ibarra, *Network Centrality, Power, and Innovation Involvement: Determinants of Technical and Administrative Roles*, 36 ACAD. MGMT. J. 471 (1993); Michael L. Tushman, *Special Boundary Roles in the Innovation Process*, 22 ADMIN. SCI. Q. 587 (1977).

153. For the purposes of this discussion, I shall define a "joint venture" as a cooperative association, between two or more parent firms, in the form of a new jointly owned or jointly managed entity. While joint ventures can serve many potential functions, the emphasis in this Article will be placed on ventures for R&D collaboration.

154. For purposes of this discussion, I shall define a "strategic network" as a collection or an organized set of collaborative arrangements, such as joint ventures, co-marketing agreements, consortia, licensing and cross-licensing arrangements, and minority equity investments.

155. Organizational collaboration can occur at other levels as well, and my focus here on joint ventures and strategic networks is not meant to foreclose consideration of other options. Bryan Borys and David B. Jemison have identified five hybrid forms of organization that reflect varying levels of mutual commitment. From greatest to least commitment, these five forms are mergers, acquisitions, joint ventures, license agreements, and supplier arrangements. Bryan Borys & David B. Jemison, *Hybrid Arrangements as Strategic Alliances: Theoretical Issues in Organizational Combinations*, 14 ACAD. MGMT. REV. 234, 235 (1989).

A. Technological Synergy and Technology Diffusion

The pharmaceutical industry already engages in joint ventures to exchange complementary technologies and patents.[156] Parent firms identify promising partners and negotiate relations with those most likely to provide them with the missing pieces of the research puzzles they are solving.[157] Typically, this entails choosing partners with similar research and development commitments or with complementary strengths, so the alliance creates a symbiotic relationship through which each collaborator builds upon the capabilities of the other.[158] According to Contractor and Lorange, firms engaged in technology exchange ventures seek superior products or processes through the pooling of patents, knowledge, and skills.[159]

Throughout private industry, high technology firms are engaging successfully in strategic alliances in order to share a scarce and expensive resource: expertise. Companies in high value-added industries recognize the importance of knowledge linkages in maintaining competitiveness in markets characterized by speedy innovation.[160] The ultimate goal of these strategic alliances is remarkably similar to a fundamental goal of proposed government centralization and planning of research—to get investigators in labs to talk to one another and to share important findings and information.

While the conversation among otherwise scattered scientists can be encouraged either by regulatory compulsion or by voluntary and privately chosen association, the latter is more likely to result in effective collaboration. Partners who choose to collaborate consider compatibility factors important in determining whether to pursue the alliance, including partner rapport, basic values, belief systems, norms, and trust.[161] These sources of rapport are the underpinnings of group cohesiveness, which has a curvilinear correlation with group creativity [162]

Moreover, assessment of organizational capabilities, a task best accomplished by those within the relevant firms who have intimate knowledge of corporate resources, is a crucial component in the development of successful alliances.[163] Like interpersonal relations, corporate capabilities are

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156. Farok J. Contractor & Peter Lorange, *Why Should Firms Cooperate? The Strategy and Economics Basis for Cooperative Ventures*, *in* COOPERATIVE STRATEGIES IN INTERNATIONAL BUSINESS 3, 13 (Farok J. Contractor & Peter Lorange eds., 1988).

157. *Id.*

158. Steven R. Salbu & Richard A. Brahm, *Strategic Considerations in Designing Joint Venture Contracts*, 1992 COLUM. BUS. L. REV. 253, 271 [hereinafter Salbu & Brahm, *Strategic Considerations*].

159. Contractor & Lorange, *supra* note 156, at 13.

160. For discussion of the role of knowledge linkage in the formation of many high-technology strategic alliances, see JOSEPH BADARACCO, JR., THE KNOWLEDGE LINK: HOW FIRMS COMPETE THROUGH STRATEGIC ALLIANCES (1991). For discussion of joint venture activity as a tool for organizational learning, see Bruce Kogut, *Joint Ventures: Theoretical and Empirical Perspectives*, 9 STRATEGIC MGMT. J. 319 (1988).

161. For discussion of these characteristics of successful joint ventures, see Marjorie A. Lyles, *Learning Among Joint Venture Sophisticated Firms*, MGMT. INT'L REV. Special Issue 85, 94-95 (1988).

162. HARRY NYSTRÖM, CREATIVITY AND INNOVATION (1979).

163. BADARACCO, *supra* note 160, at 131.

idiosyncratic variables likely to be ignored, or managed poorly, by impersonal and distant government bureaucracy

In other words, while mandatory research associations based on subject areas and competencies alone may seem rational at first glance, organizational dynamics will also be an important factor in determining the ultimate success of any joint endeavor.[164] Centralized regulatory agencies are neither qualified nor equipped to assess the organizational fit of a proposed arrangement. Conversely, scientists in independent labs are experienced in assessing the potential for fruitful technological synergy via voluntary project collaboration. Because independent contracting parties have experience in assessing relational dynamics,[165] their natural efforts to exploit interactive research efficiencies are likely to be more successful; on average, than compulsory relations. Moreover, qualities like enthusiasm, goodwill, and mutual good faith are more likely to characterize voluntary associations than compulsory ones.[166]

In addition, the optimal conditions for breeding creativity are more characteristic of voluntary, naturally developed arrangements than of the mandatory, imposed relationships of a Manhattan Project. These conditions include democratic and collaborative rather than authoritarian leadership, and an organizational structure that is organic rather than mechanistic.[167] That innovation is more likely to arise from spontaneous relations than forced relations is not surprising, given that the very nature of creativity entails a departure from, rather than an adherence to, tradition, authority, and order. As creativity cannot be managed and must be nurtured, so organic and uncoerced relations are a more propitious source of research innovation than constrained, obligational organization.[168]

The crossbreeding that occurs among competitors who form cooperative alliances for mutual gain also facilitates the general movement of knowledge and the diffusion of technology [169] From a micro-organizational perspective, firms sometimes use joint venture and network arrangements to obtain skills

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164. *See* Steven R. Salbu, *Joint Venture Contracts as Strategic Tools*, 25 IND. L. REV. 397, 424-27 (1991) [hereinafter Salbu, *Joint Venture*].

165. STEVEN R. SALBU, STRATEGIC IMPACT OF THE JOINT VENTURE CONTRACTING PROCESS (1990) [hereinafter SALBU, STRATEGIC IMPACT].

166. Satisfaction levels are higher in democratic organizations than in autocratic organizations. RALPH M. STOGDILL, HANDBOOK OF LEADERSHIP: A SURVEY OF THEORY AND RESEARCH 370 (1974).

167. Richard W. Woodman et al., *Toward a Theory of Organizational Creativity*, 18 ACAD. MGMT. REV. 293, 302 (1993).

168. In this discussion, I mention free and voluntary contracting in comparison with coercion, suggesting that the former is a more fruitful source of innovation than the latter. In essence, the argument for minimizing compulsory collaboration and optimizing opportunities for voluntary collaboration is simply a reassertion of our basic faith in freedom of contract as the optimal vehicle for providing markets with their needs. For a more elaborate discussion of contract versus coercion, see Steven R. Salbu, *Law and Conformity, Ethics and Conflict: The Trouble with Law-Based Conceptions of Ethics*, 68 IND. L.J. 101 (1992).

169. Joint venture literature often refers to this phenomenon, from the perspective of the firm, as the risk of technology transfer, or the risk of arming competitors with skills and technologies gained through the collaborative arrangement. *See, e.g.*, Contractor & Lorange, *supra* note 156, at 8-9.

and information.[170] As profit-seeking firms establish voluntary interorganizational linkages in order to receive the technologies necessary to position themselves in strategically selected industries, there is an inadvertent effect—the macro-organizational dispersion of technology throughout the entire industry.[171] The strategic alliance, used by self-seeking companies to augment their technological positions, is currently an effective tool that encourages the rapid diffusion of knowledge within the industries in which they operate. Moreover, even network activity motivated by goals other than technology transfer will inadvertently facilitate the diffusion of innovation, as interorganizational channels expedite the flow of information.[172]

B. Transnational Cooperation

A nationally centralized program of AIDS research would be constrained by artificial boundaries that are irrelevant to scientific inquiry—the boundaries of national sovereignty If the Federal Government tries to organize American laboratory activity, it will be restricted by the limitations of its jurisdiction. For example, the United States Government cannot compel the best or the most efficient collaboration if the optimal partnership is between American and French laboratories. Government's sovereign limitations restrict its efforts to modulate research activity

The limits of sovereignty do not circumscribe joint venture activity as constrictively [173] Voluntary transnational alliances can therefore be developed from the widest possible range of potential research partnerships. The Federal Government should be reluctant to force a research policy upon laboratories within its legal reach when the alliances these labs would form internationally, and of their own accord, might in fact be superior ones.[174]

Compulsory collaboration across borders will be inhibited by more than jurisdictional constraints. Limitations of the U.S. Government's authority to compel transnational joint ventures exist in two forms: the obvious formal, legal-jurisdictional limits, and the less obvious informal organizational limits. Multinational enterprises ("MNE's") are distinctive in their subjection to both

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170. C. Christopher Baughn & Richard N. Osborn, *The Role of Technology in the Formation and Form of Multinational Cooperative Arrangements*, 1 J. HIGH TECH. MGMT. RES. 181, 182-83 (1990).

171. *Id.*

172. Howard Aldrich & David A. Whetten, *Organization-Sets, Action-Sets, and Networks: Making the Most of Simplicity*, *in* 1 HANDBOOK OF ORGANIZATIONAL DESIGN: VOLUME 1 ADAPTING ORGANIZATIONS TO THEIR ENVIRONMENTS 385, 394 (Paul C. Nystrom & William H. Starbuck eds., 1981).

173. Of course, transnational joint venture activity is subject to sovereign limitations of foreign policy and contract law. These limitations are nowhere near as restrictive as the limits of U.S. Government jurisdiction, which can only compel research alliances within the United States borders and within Constitutional bounds. Foreign restrictions on international joint ventures also appear to be declining as economies are becoming more open. *See* Salbu, *Joint Venture*, *supra* note 164.

174. Implicit here are the notions that optimal research collaboration knows no boundaries and that scientific investigation is a global enterprise. The idea that the United States Government can organize a superior research agenda domestically fails to recognize the transnational nature of AIDS research efforts. A policy of nationalized research may reflect an ethnocentric and false presumption that the United States is the exclusive sphere of biotechnological advancement.

"multiple sources of external authority" and "multiple denominations of value,"[175] the latter of which confine the receptiveness of MNE's to centralized forms of control. Even if American regulatory fiat could completely preside over both parties to transnational alliances, it would have difficulty doing so due to the complexity of managing cultural and normative diversity.[176] Boilerplate regulatory edict cannot conceivably serve the wide variety of distinctive challenges that will be created by many different but potentially valuable international matches.[177]

Encouragement of the voluntary joint venture has greater potential than American regulatory fiat for facilitating optimal cooperative behavior. The joint venture has become a common and popular vehicle for facilitating transnational initiatives between private companies.[178] International joint ventures provide a means by which companies can create alliances more substantial than contractual, arm's length deals,[179] without being deterred by the excessive risks and commitments inherent in merger or acquisition.[180] In the area of AIDS research, neither market contract nor unity of organizational hierarchy may provide an adequate mechanism for some companies considering significant laboratory cooperation. When companies seek to maintain their distinctive organizational boundaries for most purposes while attempting to establish high-level commitment to particular team projects because of potential collaborative synergies or efficiencies, the joint venture provides opportunities that cannot be achieved by either contracting or merging. A movement in the law to encourage or even facilitate such voluntary venture activity should logically increase the incidence of R&D

175. Anant K. Sundaram & J. Stewart Black, *The Environment and Internal Organization of Multinational Enterprises*, 17 ACAD. MGMT. REV. 729, 734-39 (1992).

176. For discussion of the cultural constraints on technology transfer across international borders, see Ben L. Kedia & Rabi S. Bhagat, *Cultural Constraints on Transfer of Technology Across Nations: Implications for Research in International and Comparative Management*, 13 ACAD. MGMT. REV. 559 (1988).

177. Steven R. Salbu, *Parental Coordination and Conflict in International Joint Ventures: The Use of Contract to Address Legal, Linguistic, and Cultural Concerns*, 43 CASE W. RES. L. REV. (forthcoming 1994).

178. For a general discussion of transnational venturing, see KAREN J. HLADIK, INTERNATIONAL JOINT VENTURES (1985); Farok J. Contractor, *Strategies for Structuring Joint Ventures: A Negotiations Planning Paradigm*, COLUM. J. WORLD BUS., Summer 1984, at 30; Kenichi Ohmae, *The Global Logic of Strategic Alliances*, HARV. BUS. REV., Mar.-Apr. 1989, at 143; Robert J. Radway, *Overview of Foreign Joint Ventures*, 38 BUS. LAW. 1040 (1983).

179. While joint ventures depart from open market contractual relations between independent firms, they are nonetheless voluntary and therefore essentially contractual in nature. Whether the coordination of the relationship between venturing firms takes the form of formal contracting or strategic planning, the voluntary alliance will be characterized by some governance structure that a bureaucratic entity will have difficulty reproducing. As a result, control of voluntary joint ventures will tend to be superior to control of mandatory collaboration. For a detailed discussion of the role of contract and strategy in coordinating and controlling international ventures, see Salbu & Brahm, *Strategic Considerations*, *supra* note 158.

180. This observation reflects the theory that joint venture activity is a compromise between loose linkage of firms via market contracting and tight linkage via unification of hierarchical control into one organizational structure. For discussion of the nature of organizational relationships as a function of market and hierarchy choices, see OLIVER E. WILLIAMSON, MARKETS AND HIERARCHIES: ANALYSIS AND ANTITRUST IMPLICATIONS (1975).

cooperation among firms that would otherwise be unable to engage in such projects. The preference for voluntary alliances,[181] including international ones, is likely to result in the abbreviation of technological development timeframes. As innovations have been introduced more frequently by firms outside the United States, product cycles have shrunk because of "global scanning capabilities" of multinational businesses.[182] By encouraging privately formed, international alliances rather than requiring alliances that are restricted by jurisdiction to the domestic realm, we accomplish more than simply increasing the number of possible collaborative combinations; we also supports the enlargement of the biotechnological network within which knowledge scans are likely to occur. By increasing the scope of network interaction from domestic to international proportions, we facilitate the worldwide diffusion of technology and increase correspondingly the chances that the product cycles in AIDS treatments will be shortened. An open market approach to AIDS R&D allows both public and private facilities to exploit the development of international networks as a means of expediting technological innovation.

Joint venture activity has also helped companies to interact with foreign firms in countries otherwise reluctant to allow American businesses to operate within their borders.[183] Moreover, the reduced entry costs characteristic of joint venture and network alliances, compared with foreign direct investment, can encourage international collaboration deemed too politically risky to justify international merger or acquisition activities.[184]

C. Economies of Scale, Rationalization of Research, and Dilution of Cost and Risk

Both federally mandated collaborative research projects and voluntary strategic alliances attempt to rationalize research efforts by avoiding unnecessary duplication of studies and facilities and by achieving potential scale economies related, for example, to expensive equipment that cannot be efficiently amortized over the experimentation of a single laboratory. Joint ventures have long been utilized in a number of industries to exploit the distinctive cost advantages of each collaborator and to exploit economies associated with a larger scale than either parent company could achieve

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181. This preference is a function, inter alia, of the strategic and financial complexities attendant to innovation management. For a detailed examination of these complexities, see BRIAN TWISS, MANAGING TECHNOLOGICAL INNOVATION (1974).

182. Weijian Shan, *An Empirical Analysis of Organizational Strategies by Entrepreneurial High-Technology Firms*, 11 STRATEGIC MGMT. J. 129, 133 (1990); Raymond Vernon, *The Product Cycle Hypothesis in a New International Environment*, in STRATEGIC MANAGEMENT OF MULTINATIONAL CORPORATIONS: THE ESSENTIALS 16 (Heidi V Wortzel & Lawrence H. Wortzel eds., 1985).

183. For discussion of joint venture activity as a facilitator of foreign market entry and presence, see James C. Abegglen, *U.S. Japan Technological Exchange in Retrospect, 1946-1981*, in U.S.-JAPAN TECHNOLOGICAL EXCHANGE SYMPOSIUM 1 (Cecil H. Uyehara ed., 1982).

184. For discussion of the relationship between political risk of entry and the use of alternatives to foreign direct investment to mitigate costs associated with such risk, see Ming-Je Tang & Chwo-Ming Joseph Yu, *Foreign Market Entry: Production-Related Strategies*, 36 MGMT. SCI. 476, 484-85 (1990).

individually [185] While either mandatory or optional collaboration has the potential to achieve these important ends, the latter choice will achieve them more effectively and with fewer unforeseen costs. The form of any high-technology linkage should depend in part upon "the conflicting tensions involved in establishing transactions that are efficient and flexible and are able to withstand or overcome technological uncertainties."[186] As technological intensity increases, rational firms will seek to maintain relatively flexible commitments in order to respond quickly to unpredictable changes in assumptions.[187] Whereas firms permitted to choose the degree of mutual commitment ranging from market to hierarchy will maintain control over the level of resource dedication, firms compelled to engage in particular projects lose the flexibility and responsiveness that are so valuable in permitting quick reaction to and assimilation of new information as it emerges continually during the R&D process.[188] Uncoerced collaboration will tend, therefore, to maintain a relatively high degree of adaptability, while federally mandated research interactions will tend to become bureaucratically rigid and entrenched. Adaptability allows autonomous entities to modulate idiosyncratically crafted commitments in order to exploit shifting cost-containment opportunities. Bureaucratically imbedded mandates to collaborate are simply too unwieldy and too highly centralized to be adequately responsive or adaptive to changing conditions.

Voluntary joint venture activity also has the potential to reduce the costs and risks of any project, thereby increasing the possibility that laboratories will be willing to take chances on innovative experimentation. Herbert I. Fusfeld and Carmela S. Haklisch have observed that cooperative groups generate extraordinarily large research budgets, facilitating projects that may have been impossible using internally generated financing.[189] Collective industrial research at the "precompetitive" stage thus serves some of the functions advocated by supporters of governmental R&D coordination—most notably, the provision of a technological base to be shared within the research

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185. Farok J. Contractor, *Dispersion of Risk Through Multinational Teamwork*, MERGERS & ACQUISITIONS, July-Aug. 1987, at 73, 73 [hereinafter Contractor, *Dispersion*].

186. Baughn & Osborn, *supra* note 170, at 185.

187. *Id.* "As the technological intensity of the product of the arrangement increases, firms may be more likely to opt for market mediated mechanisms (agreements versus joint ventures). When intending to conduct joint R&D however, firms may opt for the quasi-hierarchy provided by the joint venture." *Id.*

An implication is that firms seek the least restrictive viable organizational arrangement under conditions of uncertainty. This suggests that the bureaucratic intransigence of governmental coordination of research would be highly ineffective in responding to changes in research assumptions or goals.

188. This assertion is consistent with the recommendation that firms operating under conditions of uncertainty engage in relatively decentralized governance structures in order to retain strategic flexibility. Governmentally coordinated programs, being centralized in the extreme, are unlikely to provide necessary flexibility. For discussion of the value of decentralized governance under conditions of uncertainty, see Alan D. Meyer, *Adapting to Environmental Jolts*, 27 ADMIN. SCI. Q. 515 (1982).

189. Herbert I. Fnsfeld & Carmela S. Haklisch, *Cooperative R&D for Competitors: Joint Activities Are Transforming How and Why Companies Undertake Research*, HARV. BUS. REV., Nov.-Dec. 1985, at 60. The authors cite collaborative research budgets approaching one billion dollars in the mid-1980's.

community, and cost-sharing and risk-sharing when the resources of individual companies prove inadequate.[190]

While one should not underestimate the value of pooling resources to achieve otherwise prohibitively expensive, large scale projects, cost-saving joint venture activity bears another, more indirect advantage—the reduction of per-project risk to any given firm and the concomitant encouragement of a wider variety of R&D projects that might otherwise be considered too marginal to merit investment.[191] Accordingly, one group of scholars has observed that "risk reduction or pooling can bring about more innovative activity than would otherwise be the case."[192]

Encouraging joint venture activity is likely to reduce another form of risk—the risk of free ridership by competitors who are able to appropriate nonproprietary, unpatentable research findings. Scholars have observed that the prospect of free ridership will tend to inhibit overall levels of R&D investment, but that collaboration that includes otherwise potential free riders reduces the problem and encourages private investment.[193] Because AIDS research is presently stalled at the basic rather than applied stage, both public and private investigation are more likely to result in unpatentable rather than patentable findings.[194] As a result, the potential for voluntary alliances to reduce free ridership and encourage private investment in AIDS research is likely to be substantial.

While joint venture collaboration aimed at risk reduction and enhanced creativity and innovation is common among firms engaging in voluntary alliances,[195] compulsory collaboration is unlikely to have the same effect. Two dynamics combine to ameliorate potential risk reduction effects within mandatory alliances.

First, because risk assessment is a partially subjective activity, dependent, for example, upon organizational levels of risk aversion,[196] a centralized agency is not qualified to engage in this behavior. Strategies created to manage risk effectively are best handled at the organizational level because

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190. *Id.* at 65.

191. Diminution of cost, associated with both scale economies and the sharing of expenditures that are spread among firms, is associated with reduction of institutional risk. Joint venture activity directed at cost reduction will also reduce each firm's per-project risk, yielding greater willingness to engage in a wider portfolio of otherwise unacceptably risky endeavors. For a discussion of risk reduction through joint venture activity, see Contractor, *Dispersion*, *supra* note 185, at 73.

192. Philip Friedman et al., *External vs. Internal Knowledge Acquisition: Joint Venture Activity and R&D Intensity*, 31 J. ECON. & BUS. 103, 109 (1979).

193. Kenneth J. Arrow, *Economic Welfare and the Allocation of Resources for Invention*, in THE RATE AND DIRECTION OF INVENTIVE ACTIVITY 609 (R. Nelson ed., 1962); Robert Pitofsky, *Proposals for Revised United States Merger Enforcement in a Global Economy*, 81 GEO. L.J. 195, 240 (1992).

194. This is because basic research will tend to yield unpatentable knowledge or information rather than patentable products or processes.

195. Sanford V Berg & Philip Friedman, *Joint Ventures, Competition, and Technological Complementarities: Evidence from Chemicals*, 43 S. ECON. J. 1330, 1331 (1977).

196. For a discussion of variations in organizational risk profiles, see MAX H. BAZERMAN, JUDGEMENT IN MANAGERIAL DECISION MAKING 66-67 (2d ed. 1990).

desirable risk postures are an organizational artifact, idiosyncratic to the particular firm.[197]

Second, compulsory collaboration will tend to increase rather than reduce systematic risk. Organizational receptiveness to externally imposed collaboration will range from highly desirable to highly undesirable, and we can assume that compelled alliances will be distributed in some manner across the continuum. Whereas voluntary alliances are entered because they are viewed by the firms as yielding a net benefit and therefore as being essentially desirable, some compulsory alliances will be resisted, and viewed as undesirable.

Companies engaged in unwanted collaboration will view the mandate as creating rather than ameliorating risk. This means that while voluntary collaboration may be motivated by its potential to reduce risk, forced collaboration will tend to increase systematic risk. As net risk reduction encourages an organization to engage in creative and innovative behaviors, compulsory collaboration that increases perceived risk will also tend to dampen creative and innovative activities. While encouragement of voluntary cooperation has the potential to act as a spur to innovation, cooperation under regulatory compulsion can be expected to reduce innovation.

D. Maximizing Competitive Incentives and Accelerating Technological Advances

While charges of excessive profiteering on the part of pharmaceutical companies[198] reflect real problems in current patent policy,[199] the connection between potential profits and investment incentives remains a compelling force. This relationship is examined through the following propositions:

(1) Maintaining an essentially competitive market environment is vital to technological innovation, as firms are encouraged to develop innovative technologies as a means of surmounting entry barriers. In a competitive industry,[200] an equilibrium develops between companies seeking to inhibit competition by erecting barriers to entry and others seeking to overcome those barriers by developing innovative competencies or products that will yield sufficient advantage to carve a niche in otherwise tenaciously guarded

197. *Id.*

198. *See* Marc Pitzke, *AIDS Activists Target Big Business at Conference*, REUTER LIBR. REP., June 11, 1993, *available in* LEXIS, Nexis Library, LBYRPT File (describing the protest activities of ACT UP at the 1993 International Conference on AIDS, in response to allegedly excessive profiteering by pharmaceutical companies).

199. *See* Salbu, *AIDS and Drug Pricing*, *supra* note 1 (arguing that unfettered monopoly power conferred upon private corporations may not be justified when substantial governmental research subsidies have supported the R&D efforts that resulted in the patented product).

200. I refer here to an industry that operates in an open, unfettered market, such that natural competitive forces operate, rather than centralized governmental planning.

markets.[201] Competitive industries, in which companies can adopt uncoerced, individualized strategies, are essential to both the incentive of entrenched firms to erect entry barriers and the incentive of newcomers to transcend those barriers through competitive advantage based on technological innovation.[202]

Proponents of federally centralized research overlook the impetus to innovation that results from industry competition. They presume that there is a finite pool of AIDS researchers, and that government organization of this pool will yield greater efficiency and effectiveness. Yet the pool is not finite, as some firms decide to develop high technology R&D projects as a response to competitive dynamics within their industry.[203]

(2) Maintaining an essentially competitive market environment is vital to technological innovation, as firms are encouraged to engage in biotechnology research as a means of seeking economic growth and managerial stability. Advances in biotechnology, including pharmaceutical applications, will provide one of the potentially fruitful, profitable industries for economic growth in the twenty-first century.[204] According to one study, leadership in biotechnology will be a significant source of competitive advantage in the foreseeable future.[205]

Hamilton observes that firms in competitive markets engage in substantial strategic alliance activity during the early stages of biotechnology R&D.[206] They become more independent and engage in fewer alliances during the later commercialization stages.[207] These findings are consistent with the balance between cooperative and competitive dynamics and incentives; left to their own devices, firms appear to recognize the advantages of early collaboration

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201. For detailed discussion of competitive industry analysis and the nature of entry barriers in developing competitive advantage, see MICHAEL E. PORTER, COMPETITIVE STRATEGY: TECHNIQUES FOR ANALYZING INDUSTRIES AND COMPETITORS (1980) [hereinafter PORTER, COMPETITIVE STRATEGY].

202. For discussion of the use of technological innovation as a competitive tool, see EDWIN MANSFIELD ET AL., THE PRODUCTION AND APPLICATION OF NEW INDUSTRIAL TECHNOLOGY (1977); Michael E. Porter, *Technology and Competitive Advantage*, 60 J. BUS. STRATEGY 60 (1985); Michael E. Porter, *The Technological Dimension of Competitive Strategy*, *in* 1 RESEARCH ON TECHNOLOGICAL INNOVATION MANAGEMENT AND POLICY (Richard S. Rosenbloom ed., 1983); Alan M. Kantrow, *The Strategy-Technology Connection*, HARV. BUS. REV., July-Aug. 1980, at 6.

203. If some decisions to engage in AIDS research function predominantly as a competitive strategy aimed at overcoming entry barriers, then the assumption that there is a finite amount of AIDS research to be apportioned by the government is erroneous. To the extent that the government replaces the invisible hand of industry competition with its visible hand of federal policy, it is likely to disrupt the competitive equilibrium between entry barrier erection and offensive technological innovation strategies in response to these barriers. In the process, the dilution of competitive dynamics will tend to diminish the pool of companies engaged in cutting-edge AIDS research as the group of "entry barrier reactors" lose their incentives. Simply stated, the loss of free competition will eliminate the defensive strategy of building entry barriers, which will then eliminate the need for offensive innovation reactions directed towards defeating entry barriers. In effect, the reduction or elimination of the competitive environment also reduces or eliminates an important incentive to engage in technological innovation.

204. William F. Hamilton, *Corporate Strategies for Managing Emerging Technologies*, 7 TECH. SOC'Y 197, 199 (1985).

205. Emily A. Arakaki, *A Study of the U.S. Competitive Position in Biotechnology*, *in* HIGH-TECHNOLOGY INDUSTRIES: PROFILES AND OUTLOOKS: BIOTECHNOLOGY 39 (International Trade Administration, U.S. Department of Commerce, July 1984).

206. Hamilton, *supra* note 204, at 209.

207. *Id.*

and subsequent independent, competitive positions. In other words, the market successfully moderates the simultaneous but somewhat conflicting roles of collaborative and competitive positioning.

Naturally occurring, voluntary network activity may have economic properties that serve relational governance functions. Kogut has noted that individual transactions among collaborators may not be as important moderators of behavior as bundles of contractual commitments and ties among members of a strategic network, suggesting that relational stability may be more a function of economic relationships than of particular transactions.[208] If collaborative activity is in fact governed and managed by a web of market incentives rather than by specific contractual arrangements, then policy that promotes unbridled freedom of choice should create more stable alliances than policy that essentially eliminates economic functions by centralizing the processes of resource commitment and allocation.

While interfirm dynamics produce a naturally self-sustaining balance of relations, the cruder centralized cooperation of a Manhattan Project lacks the self-adjustment mechanism derived from competitive forces. If a designated AIDS Czar were to develop a plan for mandatory collaborative research activity over an extended time frame, companies directed to do designated research and development would lose the autonomy to determine for themselves the nature and limits of the cooperative efforts. Unfortunately, an AIDS Czar overseeing hundreds of interlocked research efforts would lack both the intimate understanding of each project and the private incentives to determine the optimal moment for shifting from a cooperative to a competitive stance. The official who has been deputized to enhance cooperative efforts in AIDS research is also unlikely to view competition and its resulting incentives as the mission of a Manhattan Project II. Both by its design and by virtue of the inefficient dynamics of centralized government management, even a good-faith effort to coordinate AIDS research would inevitably reduce the effectiveness of private incentives that are crucial to rapid technological advancement.

Because efficient technological advancement is the product of fundamentally competitive environments,[209] the benefits of collaboration should be subsumed within, and limited by, the fundamental tenets of capitalist competition. Cooperation, in this context, is best viewed as a competitive tool or strategy Cooperation is vital to the expedience of AIDS research, and can provide the companies that engage in astute cooperative efforts with economies and knowledge linkages.[210] Yet, if we recognize the fundamental virtue of competitive markets in facilitating the quick development and

208. Bruce Kogut, *The Stability of Joint Ventures: Reciprocity and Competitive Rivalry*, 38 J. INDUS. ECON. 183, 195 (1989) [hereinafter Kogut, *Stability*].

209. For discussions of the allocational and operating efficiencies provided by competition, see William S. Comanor & Harvey Leibenstein, *Allocative Efficiency, X-Efficiency and the Measurement of Welfare Losses*, 36 ECONOMICA 304 (1969); Richard M. Cyert & Morris H. DeGroot, *An Analysis of Cooperation and Learning in a Duopoly Context*, 63 AM. ECON. REV. 24 (1973).

210. *See supra* notes 160-72, 189-94 and accompanying text.

dispersion of new technologies,[211] we must also circumscribe the role of cooperation within a competitive context. Cooperation thus becomes one of numerous elective strategies to be employed within a basically efficient market.

This means that the value which we must hold sacrosanct is the value of free, uncoerced competition. Companies seeking to maximize value in the free market will engage in mutually beneficial, voluntary collaborative efforts in order to gain the benefits of shared R&D.[212] The capitalist market is not hostile or unreceptive to cooperation, as witnessed by the ever-increasing incidence of high-technology joint ventures. A public policy decision to support voluntary, private collaboration is a decision to retain intact the compelling force of capitalist incentives on cooperative technological innovation. A national research agenda is not needed to provide collaborative incentives. Instead, market freedoms are necessary to maintain the industry incentives which drive companies to seek competitive advantage through technological superiority

(3) Maintaining an essentially competitive environment will improve the quality of cooperative endeavors by fostering institutionalized incentives to refrain from opportunistic behavior and cheating.[213] Assuming that some degree of collaboration has the potential to promote rather than hinder progress towards a cure for AIDS, companies involved in any alliance must constantly assess the extent to which they are willing to share information and the point at which individual self-interest takes precedence over cooperative behavior. Stated differently, R&D collaboration in pharmaceutical research is consensual, and it is subject to temptations for individuals to act opportunistically, to exploit free rider opportunities, and even to cheat. Like any other network of organizations engaged in a hybrid of collaboration and competition, a consortium created to accelerate research findings through any sharing of information needs to coordinate and control the activities of its members through some contractual or institutional control mechanism.

A potential cost of any collaborative transaction may be charged in the form of aggressive behavior that is damaging to the interests of co-collaborators.[214] Transaction theory of institutional economics suggests that collaborative efficiency is increased when any partnership reduces aggressive behavior or encourages parties to forbear from engaging in opportunistic behavior which diminishes the overall effectiveness of the venture.[215] Voluntary

211. *See supra* notes 160-72 and accompanying text.

212. *See supra* notes 160-72 and accompanying text.

213. Costs associated with opportunism, cheating, and aggression are considered predominantly by companies entering strategic alliances. However, these costs affect collaboration among government and university laboratories as well. The rewards and perquisites that exist in the scientific community, including monetary rewards, recognition, consulting opportunities in private industry, and prospects of receiving larger grants in the future, act as incentives for all scientists to act self-seekingly. These dynamics are magnified as the stakes grow and the limelight focuses on particular areas of research that are viewed as socially critical, such as AIDS research.

214. *See* WILLIAMSON, *supra* note 180, at 25-26.

215. *Id.*

strategic alliances have greater potential to mitigate the costs of aggressive behavior than do compulsory alliances, for three reasons:

(a) Aggressive behavior is more likely to occur among those who have been forced together than among those who have chosen to engage in a research partnership. Not all voluntary alliances are made in heaven. An organization may enter an alliance on the strength of one factor, such as complementary R&D capabilities, despite weaknesses among other factors, such as organizational or interpersonal compatibility Still, on average, aggressive behavior should occur less frequently among voluntary collaborators in a free market than among coerced collaborators under governmental fiat. Some voluntary alliances are made in heaven, and the quality of fit at every level is the product of a significant investment in courtship and negotiation.[216] Because some superior voluntary alliances owe their superiority to careful planning rather than accident, and because the companies themselves are in the best position to understand all the peculiar factors relevant to the success of their own alliances, overall organizational compatibility should be higher among voluntary collaborators than among coerced collaborators. Collaborative compatibility will act as a natural inducement to good will rather than suspicion, cooperation rather than tension.

(b) Assuming arguendo that a voluntary alliance and a coerced alliance are characterized by identical levels of compatibility along every important dimension, the very processes themselves will result in differentiated levels of good will. I refer specifically here to the idea that, *ceteris paribus*, levels of resentment associated with any relationship or transaction will be greater under circumstances of compulsion and constraint than under conditions of free choice. As a result, even when all indicia of compatibility are identical, we should expect higher levels of genuine cooperative spirit among freely chosen alliances than among forced alliances.

(c) Voluntary ventures provide both contractual and organizational sources of control over opportunistic behavior.

Corporate management, accustomed to increasing levels of joint venture activity, has developed contractual means to reduce the potential for opportunistic behavior. The creation of reciprocal penalties, rewards for altruistic behavior within the collaborative dyad, bundling of commitments, and residual risk sharing provides a means for management to curb anti-competitive activity [217]

Government entities could certainly attempt to mimic the use of these tools. Nevertheless, administrative and bureaucratic unwieldiness may impede the efforts of government agencies to reproduce the contractual protections which private organizations can tailor to their idiosyncratic needs.

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216. SALBU, STRATEGIC IMPACT, *supra* note 165.

217. For a detailed discussion of these incentives, see ROBERT AXELROD, THE EVOLUTION OF COOPERATION (1984); THOMAS C. SCHELLING, THE STRATEGY OF CONFLICT (1960); Peter J. Buckley & Mark Casson, *A Theory of Co-operation in International Business*, MGMT. INT'L REV., Special Issue, 19, 22-23 (1988); Kogut, *Stability*, *supra* note 208; and Salbu & Brahm, *Strategic Considerations*, *supra* note 158, at 296-302.

Voluntary ventures provide natural organizational incentives to avoid aggressive and opportunistic behavior which are missing from compulsory collaborative arrangements. Scholars have recognized the importance of reputational effects as natural monitors of behavior within open collaborative markets.[218] Specifically, the prospective need to bargain in an open market for advantageous relationships and transactions acts as an incentive to maintain a good reputation in order to be viewed by potential future collaborators as an attractive partner.[219] Forced collaboration would eliminate or reduce the choice of future partners, and thus the incentive to invest in reputation by dealing openly, fairly, and with forbearance to opportunism.[220] As more future alignments are orchestrated by a government agency on the basis of topical synergies and efficiencies, organizations lose the ability to exploit reputation as an asset in future negotiations. All laboratory facilities looking ahead to a system of nonvoluntary cooperation will foresee less future return on an investment in reputation, and will be less likely to protect that reputation by placing cooperative values above competitive values.

V. THE NATURE OF ANTITRUST LAW AS APPLIED TO JOINT VENTURES, AND THE NEED FOR MODIFICATION OF ANTITRUST RESTRICTIONS IN ORDER TO FACILITATE AND ENCOURAGE PRIVATE, VOLUNTARY COLLABORATION

While voluntary strategic alliances are potentially powerful tools to facilitate and expedite AIDS research, our antitrust laws encourage competition and limit cooperation to an extent that valuable cooperative efforts may be impeded. To explain this effect, I shall examine first the balance between cooperation and competition, and then the deficiencies of our antitrust laws as they limit the attractiveness of voluntary alliances.

The cooperative element of technological transfer ventures is limited by the competitive dynamic of firms operating within the same industry.[221] Reich and Mankin have observed that technology transfer activity within joint ventures is often furtive and tacit rather than express and condoned.[222] This phenomenon should not surprise us, given that cooperation is primarily viewed as a competitive tool in capitalist markets. Arms-length relations will naturally

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218. Buckley & Casson, *supra* note 217, at 23-24.

219. *Id.*

220. For a discussion of the impact of the free market in restraining opportunism, see Charles W.L. Hill, *Cooperation, Opportunism, and the Invisible Hand: Implications for Transaction Cost Theory*, 15 ACAD. MGMT. REV. 500 (1990).

221. *See* PORTER, COMPETITIVE STRATEGY, *supra* note 201.

222. Robert B. Reich & Eric D. Mankin, *Joint Ventures with Japan Give Away Our Future*, HARV. BUS. REV., Mar.-Apr. 1986, at 78, 84. The authors refer to the trading of technology within American-Japanese joint ventures in terms of a Trojan horse, suggesting that technology sharing in competitive markets tends to be an activity of stealth rather than open and encouraged behavior.

encourage self-protective and opportunistic behaviors antithetic to good-faith sharing, whereas increasingly hierarchical collaborative arrangements will reduce adversarial behavior as the increase in organizational alignment augments the sphere of overlapping organizational interest. Companies engaged in market-centered collaboration, such as contracting or licensing, have few shared interests and can be expected to collaborate reluctantly, with one eye always monitoring competitive position relative to the collaborator. As cooperation becomes more hierarchical, from market contract to joint venture to merger, common interests expand and competitive postures diminish, encouraging wholehearted, good-faith sharing of information.

While the movement of firms away from market competition and towards hierarchical, collaborative identity reduces interfirm rivalry and increases interfirm cooperation, it also has the potential to diminish intra-industry competition. Although the former dynamic should logically expedite the industry-wide progress of AIDS research, antitrust legislation has arisen from concern that the latter dynamic may impede that progress. In determining a reasonable public policy to facilitate AIDS research, we must examine the nature of these two dynamics. In the discussion that follows, I suggest that collaborative efficiencies of R&D venturing are significant, while impediments to meaningful competition resulting from R&D venturing are insignificant. Unfortunately, although hierarchies establish potentially closer relations than market transactions, federal public policy discourages joint ventures for consolidating R&D.

A. Market Efficiency Versus Market Power Hypotheses to Explain the Incidence of Technology Ventures

Scholars have posited two potentially driving forces behind the development of knowledge-acquisition ventures among high technology firms. I shall label these forces in terms of two hypotheses: the market efficiency hypothesis and the market power hypothesis. Under the market efficiency hypothesis, knowledge acquisition ventures are established primarily to achieve efficiencies in the development of technological skills and knowledge.[223] Such efficiencies, discussed in the various subparts above, include cost-sharing, data-sharing, and risk-sharing. If firms enter strategic alliances to gain such efficiencies, the marketplace logically stands to benefit from the activity, as efficiencies are passed on to consumers in such forms as reduced costs and expedited product-to-market processes.

Under the market power hypothesis, knowledge-acquisition joint venture activity is motivated primarily by the desire and ability to consolidate resources into power bases substantial enough to affect or even control market

223. For a discussion of market efficiency explanations of joint venture activity, see DAVID C. MOWERY, INTERNATIONAL COLLABORATIVE VENTURES IN U.S. MANUFACTURING (1988); and Gary Hamel et al., *Collaborate with Your Competitors—and Win*, HARV. BUS. REV., Jan.-Feb. 1989, at 133.

mechanisms, such as supply costs, labor costs, and product pricing.[224] Ventures achieve profitability not by creating and exploiting efficiencies that are ultimately valuable to consumers, but rather by reducing competition to the extent that normal market control of supply and price becomes subverted. If the market power hypothesis of knowledge-acquisition ventures is correct, the loss of competitive incentives and controls can be expected to harm consumers. Immunity from competitive pressures could effectively eliminate the race to invent increasingly effective products.

The market efficiency and the market power hypotheses are not mutually exclusive. Undoubtedly, size relative to suppliers, buyers, and competitors will tend to result in a concomitant increase in power.[225] Likewise, efficiencies cannot be discounted as incentives to cooperate in high technology industries.[226] While some degree of market power will be established in tandem with many mergers and alliances, the threat of market control or market domination is less than the cost of discouraging valuable efficiencies and synergies associated with cooperative efforts in the area of AIDS research.

In the following subpart, I discuss the present status of American antitrust laws as they relate to voluntary alliances such as joint ventures and strategic networks. I examine the degree to which such alliances threaten the public welfare, as well as the benefits to be gained by encouraging such alliances. Specifically, I contend that the danger of market power alliances is insignificant in the context of AIDS research. For this reason, and because of the potential market efficiency benefits of AIDS research ventures, I recommend modification of the present laws in order to eliminate the chilling effect of current policies.

B. American Antitrust Law as It Relates to Voluntary Alliances

Joint venture activity focusing on AIDS R&D is unlikely to trigger most of the antitrust provisions that may apply to other strategic alliances. While joint ventures are subject to federal restrictions prohibiting price fixing and market division, these specific distribution-end activities do not ordinarily occur during the upstream stages of research that currently characterize the scientific investigation of AIDS.[227]

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224. For a discussion of market power hypotheses explaining joint venture activity in high value-added industries, see Richard Brahm & Steven R. Salbu, *Beyond Strategic Alliances: Reconstructing Market Power in International Business*, in INTERNATIONAL ASSOCIATION FOR BUSINESS AND SOCIETY: 1993 PROCEEDINGS 193, 194-96 (Jean Pasquero & Denis Collins eds., 1993).

225. Indeed, the competitive strategy literature derived from industrial economics recommends the establishment of power over suppliers and buyers in the process of jockeying for competitive position with industry rivals. PORTER, COMPETITIVE STRATEGY, *supra* note 201.

226. *See supra* note 213.

227. *See infra* notes 254-60 and accompanying text.

A more likely source of potential antitrust scrutiny is section one of the Sherman Act ("Section One").[228] Section One prohibits contracts, combinations, and conspiracies in restraint of trade.[229] Currently, joint venture activity is assessed using the "rule of reason," and violates Section One if it results in significant and unjustified reduction of competition.[230] In *Broadcast Music, Inc. v. Columbia Broadcasting System, Inc.*,[231] the Supreme Court stated that violation of Section One arises from the concern that certain concentrative behavior has a tendency "to restrict competition and decrease output."[232] Collaborative behavior is prohibited under the rule of reason if it is "'unreasonably restrictive of competitive conditions.'"[233]

Unfortunately, firms may have difficulty determining, in anticipation, whether an alliance they are considering is permissible under such vague standards. Because application of the rule of reason entails case-by-case assessment of the competitive impact of each collaborative effort, prospective collaborators lack clear precepts by which to determine whether a proposed alliance is in compliance with Section One.[234] In this vein, Jorde and Teece observe, "the parameters of the rule of reason analysis are ambiguous and unstructured, resulting in uncertainty and unpredictability."[235] While the Justice Department has provided guidelines for merger activity compliance with Section One,[236] the lack of parallel guidelines for strategic alliances renders this less collaborative organizational form ironically more risky than full-blown merger activity.[237] As a result, private firms may be dissuaded from engaging in effective voluntary alliances.

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228. 15 U.S.C. § 1 (1988 & Supp. III 1991) ("Every contract, combination in the form of trust or otherwise, or conspiracy, in restraint of trade or commerce among the several States, or with foreign nations, is declared to be illegal.").

229. *Id.*

230. In other words, the rule of reason engages in a case-by-case evaluation of the overall competitive impact of a joint venture. For a detailed discussion of the rule of reason, see Robert H. Bork, *The Rule of Reason and the Per Se Concept: Price Fixing and Market Division*, 75 YALE L.J. 373 (1966).

231. *Broadcast Music*, 441 U.S. 1 (1979).

232. *Id.* at 19-20.

233. Nat'l Soc'y of Prof. Eng'rs v. United States, 435 U.S. 679, 690 (1978) (quoting Standard Oil Co. v. United States, 221 U.S. 1, 58 (1911)).

234. *See* James Ball, Note, *Rule of Reason Analysis in Intellectual Property Joint Ventures*, 68 DENV. U. L. REV. 315, 317 (1991) ("[T]he guarantee of rule of reason analysis may be of little solace to potential joint venturers so long as the courts, with their limited business savvy, are given free reign to determine what is 'reasonable.'").

235. Thomas M. Jorde & David J. Teece, *Competition and Cooperation: Striking the Right Balance*, 31 CAL. MGMT. REV. 25, 34 (1989).

236. U.S. DEPARTMENT OF JUSTICE AND THE FEDERAL TRADE COMMISSION, HORIZONTAL MERGER GUIDELINES (1992), *reprinted in* 4 Trade Reg. Rep. (CCH) ¶ 13,104 (1992). The guidelines explain the Justice Department and Federal Trade Commission's utilization of the Herfindahl-Hirschman Index ("HHI"), which measures industry concentration. The Justice Department provides guidance regarding the degree of HHI concentration likely to trigger challenges to merger activity. Reduced ambiguity leads to reduction in risk for mergers below the guidelines margin, and concomitant reduction of chilling effect upon lawful merger activity. Since joint venture activity operates without such guidelines, there is no administrative effort to mitigate the chilling effect on prospective strategic alliances.

237. Jorde & Teece, *supra* note 235, at 35.

Another potential source of joint venture liability is section two of the Sherman Act ("Section Two"),[238] which prohibits the monopolization of trade or commerce.[239] Liability under Section Two ordinarily requires intent to monopolize[240] and a finding that the combination in question results in sufficient market power to control prices or exclude competition.[241] Section Two liability is not limited to mergers, but applies as well to joint ventures involving "all or most of the firms in an industry."[242]

Like Section One, Section Two is likely to curtail the voluntary collaborative activities of private groups such as the fifteen large drug companies that comprise the Inter-Company Collaboration for AIDS Drug Development.[243] Even at the early stages of cooperation, as the members of the Inter-Company Collaboration limit their activities to the sharing of clinical data and drug supplies, the group is concerned about potential antitrust liability.[244] If an important goal of AIDS research is to encourage rather than discourage both public and private collaboration, then there is a tension between the market protection function of Section Two and the desire to increase laboratory cooperation. Unless the application of Section Two serves a real market protection function as applied to AIDS research alliances, it should be eliminated in order to reduce the fear that accompanies intra-industry teamwork.

Joint venture activity is also covered under section seven of the Clayton Act ("Section Seven"),[245] as illustrated in *United States v. Penn-Olin Chemical Co.*[246] Section Seven forbids the direct or indirect acquisition of the assets of another corporation if the effect "may be substantially to lessen competition, or to tend to create a monopoly."[247] Potential liability under Section Seven may have effects analogous to the effects of Sections One and Two. Because collaborative ventures may later be found to have reduced competition, the risk of any venture is increased, and companies are discouraged from joining research forces.

As demonstrated in the following discussion, Section One, Section Two, and Section Seven do little to protect competitive markets when applied to AIDS

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238. 15 U.S.C. § 2 (1988 & Supp. III 1991).

239. *Id.* ("Every person who shall monopolize, or attempt to monopolize, or combine or conspire with any other person or persons, to monopolize any part of the trade or commerce among the several States, or with foreign nations, shall be deemed guilty of a felony.").

240. HERBERT HOVENKAMP, ECONOMICS AND FEDERAL ANTITRUST LAW 145-46 (1985).

241. *Id.* at 56.

242. Joseph F. Brodley, *The Legal Status of Joint Ventures Under the Antitrust Laws: A Summary Assessment*, 21 ANTITRUST BULL. 453, 455 (1976).

243. For a discussion of this alliance, see *supra* notes 36-39 and accompanying text.

244. *See* Waldholz, *supra* note 35, at B6 ("Several researchers said they hoped the [Inter-Company] drug companies might also share details of drug discoveries prior to human testing. But the companies said such a collaboration might violate antitrust laws.").

245. Clayton Act ch. 323, § 7, 38 Stat. 730 (1914) (current version at 15 U.S.C. § 18 (1988)) [hereinafter Clayton Act].

246. *Penn-Olin*, 246 F. Supp. 917 (D. Del. 1965), *aff'd per curiam by an equally divided court*, 389 U.S. 308 (1967).

247. Clayton Act, *supra* note 245, at § 7.

research combinations, but they are likely to have a detrimental impact by discouraging vital collaborative activity

C. Why AIDS Research Ventures Should Be Exempt from Antitrust Regulations

As ambiguous standards exacerbate the risk faced by potential allies, the threat of antitrust prosecution under both the Sherman Act and the Clayton Act may have a chilling effect on collaborative activity [248] While the Acts have a net effect of discouraging cooperative arrangements[249] and hence hinder AIDS research, R&D ventures in fact pose little or no threat to competition for two reasons:

(1) Upstream behavior, such as R&D activity, poses less threat to competition than downstream behavior. Thomas Piraino has observed that alliances affecting competition, pricing, market-domination, and output occur downstream, at the production stage.[250] During the R&D stage, collaboration is so attenuated from market activity as to pose little serious anti-competitive threat.[251]

In particular, when a potential technology requires the achievement of substantial basic research, as is currently the case in regard to AIDS treatments, cooperation is "precompetitive,"[252] and therefore far removed from the concerns of antitrust laws.[253] The potential for R&D venturing to become production venturing is diluted by the need for basic research advancement[254] separating upstream from downstream behaviors.[255] In this

248. For a discussion of this effect, see Andrew C. Hruska, *A Broad Market Approach to Antitrust Product Market Definition in Innovative Industries*, 102 YALE L.J. 305 (1992).

249. *See* William J. Murphy, *Interfirm Cooperation in a Competitive Economic System*, 26 AM. BUS. L.J. 29, 47 (1988) ("[T]he perception of potential antitrust exposure has hung over the heads of cooperative R&D participants like the sword of Damocles. [B]usiness executives and their legal advisors can hardly be faulted for their caution with regard to cooperative research and development activities.").

250. Thomas A. Piraino, Jr., *Beyond Per Se, Rule of Reason or Merger Analysis: A New Antitrust Standard for Joint Ventures*, 76 MINN. L. REV. 1, 37 (1991).

251. *Id.*

252. Jeremy Main, *Making Global Alliances Work*, FORTUNE, Dec. 17, 1990, at 121, 126.

253. *See* Timothy K. Armstrong, Note, *Transnational Production Joint Ventures and United States Antitrust Law: Evaluating the Proposed National Cooperative Production Amendments*, 28 TEX. INT'L L.J. 119, 127 (1993) ("It is fairly well settled that cooperative research poses minimal threats to competition.").

254. After the basic research that most scientists believe must still be done to investigate AIDS, marketing of products will be delayed by the stages of applied research, invention, development, and commercial application. For a discussion of these stages of product development as they relate to antitrust considerations, see W. KIP VISCUSI ET AL., ECONOMICS OF REGULATION AND ANTITRUST 83 (1992).

255. Technically, it is difficult to categorize research performed by pharmaceutical companies as basic or applied. Under the National Science Foundation ("NSF") definitions, basic research is done "for the advancement of scientific knowledge not having specific immediate commercial objectives, although such investigations may be in fields of present or potential interest [to the firm]." The NSF defines applied research as "[i]nvestigations directed to the discovery of new scientific knowledge having specific commercial objectives with respect to products or processes." NAT'L SCI. FOUNDATION, RESEARCH AND DEVELOPMENT IN INDUSTRY: 1987, 2 (1989).

vein, Stockdale has noted that "an RJV [research joint venture] directed at basic or precommercial research is likely to generate significant benefits without imposing substantial social costs. . [B]ecause basic research and precommercial R&D are distanced from the competitive concerns of the market, the RJV will not likely spur collusion."[256]

(2) International R&D activity in high-technology areas such as AIDS research diminishes the possibility that firms can unilaterally control markets. The Antitrust Division of the Justice Department recognizes that the market for scientific research today is global rather than domestic.[257] As a result, alliances between American firms cannot realistically confer market domination. Moreover, ordinary international alliances are also unlikely to inhibit competition as increasingly scattered markets become resistant to unilateral control.

Legislators have recognized, to a limited degree, that while the threat posed by collaborative R&D activity is small, the potential chilling effect of antitrust law upon valuable R&D cooperation may be substantial. In 1984, Congress passed the National Cooperative Research Act ("NCRA"),[258] purportedly to encourage collaborative research by reducing the risk generated by threat of antitrust prosecution. Unfortunately, the NCRA is a weak mechanism for the achievement of these laudable ends. The NCRA stipulates that R&D ventures will be evaluated under the rule of reason and not be deemed illegal per se.[259] As one commentator has observed, this provision adds no new incentives to engage in R&D collaboration since it simply mimics existing law.[260] The NCRA also permits R&D ventures to register so that any antitrust damages arising from the venture will be limited to single damages, interest, and legal costs.[261] In other words, the NCRA merely exempts properly registered ventures from treble damages liability.

The NCRA may be more important for its symbolic value than for its actual economic impact. While the NCRA manifests Congress' desire to encourage R&D ventures by reducing unwarranted regulatory incursion,[262] the mere

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Whether we classify current AIDS research as basic, by virtue of the poor prognosis for immediate commercial applications, or as precommercial applied research, in recognition of the ultimate market goals, the development of a cure for AIDS will likely be stalled until more advances in basic research provide an adequate foundation for realistic applications. *See supra* notes 128-29.

In terms of antitrust law, the important point, regardless of classification or terminology, is that the dangers of anticompetitive behavior in the marketing of relevant products are several steps away.

256. Donald K. Stockdale, Jr., *Antitrust and International Competitiveness: Is Encouraging Production Joint Ventures Worth the Cost?*, 7 HIGH TECH. L.J. 269, 279-80 (1992).

257. *See Antitrust Enforcement Guidelines for International Operations—1988*, 4 Trade Reg. Rep. (CCH) ¶ 13,109.10, at 20589-3 (Nov. 10, 1988).

258. 15 U.S.C. §§ 4301, 4302 (1988).

259. *Id.*

260. Christopher O.B. Wright, *The National Cooperative Research Act of 1984: A New Antitrust Regime for Joint Research and Development Ventures*, 1 HIGH TECH. L.J. 133, 178 (1986).

261. Jorde & Teece, *supra* note 235.

262. *See id.* at 31 ("The NCRA is a significant piece of legislation, as it demonstrates that Congress has recognized the importance of innovation to the American economy and to America's competitiveness in a world marketplace. Congress also grasped that traditional antitrust treatment of innovation and cooperative innovative arrangements was inhibiting desirable activities.").

elimination of the threat of treble damages is unlikely to increase significantly the incidence of such ventures. The small number of R&D ventures registered under the NCRA during its first three years of operation[263] may reflect the industry's belief that the incentives provided by the act are inadequate.

AIDS research facilities should be exempted by statute from prosecution under the Sherman and Clayton Acts. The benefits of voluntary collaboration, compared with governmentally coerced collaboration, are documented in Part IV These include the creation of technological synergies, the rapid dispersion of technological information, the promotion of transnational cooperation, the exploitation of economies of scale, the rationalization of research efforts, the dilution of cost and risk, and the maintenance of essential competitive incentives relative to compulsory cooperation.

Cooperative ventures may be encouraged in AIDS R&D with little risk of downstream market concentration that stifles competition or drives price escalation. If there are substantial benefits to be gained from encouraging voluntary R&D alliances, and none to be gained from discouraging them, then the disincentive that currently exists in the form of antitrust scrutiny should be eliminated. A statutory exemption of AIDS research facilities from antitrust liability costs nothing, and eliminates a source of risk that is likely to deter some facilities from joining forces.

CONCLUSION

The policy recommendations in these pages are derived from an attempt to reconcile the sometimes conflicting values of competition and cooperation. I have argued that cooperation, while indisputably an essential element of AIDS R&D progress, is best viewed as subordinate to the value of competition, because while competition begets cooperation, cooperation does not in itself create competitive incentives.

Notwithstanding a proclivity toward competitive values, I have suggested that the NIH engage in restrained coordination of AIDS research by rationalizing strategic planning, to improve the manner in which grant funds are allocated. I have posited a method for improving governmental control over federally subsidized research activity, emphasizing a need to limit that control in order to avoid bureaucratic impediments to scientific progress, and to maximize respect for scientific autonomy and competitive incentives.

My proposals include, as well, a recommendation that joint ventures for AIDS R&D be exempted from antitrust scrutiny under Sections One and Two of the Sherman Act, and Section Seven of the Clayton Act. This suggestion is derived from a detailed examination of the benefits to be gained from voluntary AIDS research collaboration as well as an analysis of the reasons why such activity poses little or no anticompetitive threat. Consistent with my

263. *Id.* at 33 (summarizing Federal Register data on NCRA registration from January 1985-June 1988 inclusive, and indicating that only 2.7% of biotechnology ventures had registered during that initial period).

earlier observation that competitive forces should be viewed as a viable and superior broker of collaborative possibilities, the recommendation to remove AIDS research from antitrust scrutiny reflects a broad regulatory orientation toward eliminating useless impediments to freely chosen strategic alliances.

Undoubtedly, expediting the progress of AIDS research is a global priority Because the stakes are so high, we can expect that activists will continue to clamor for better results, achieved more quickly As we strive to meet these ends, it behooves us to remember that the competitive dynamics of capitalist markets are the best source of rapid technological breakthrough. In developing the policies needed to expedite the search for a cure, we must restrain the desire to achieve progress through excessive coercion. Under this reasoning, I recommend restrained regulatory coordination that encourages effective free market responses to the AIDS crisis.