tutes of Health (NIH) grants. My client was a Cornell University researcher who used the University of Alabama's data and from that developed her own data set and epidemiological study and drew her own conclusions, to which the Alabama researchers were privy.

Second, scientific collaborations fall under the general rules of partnership. In life and the law, partnerships often are not in writing. They require the utmost good faith on the part of their participants. There is no code of ethics that improves on the human capacity for honesty and decency in science and other endeavors.

Edward T. Dangel III
Dangel, Donlan and Fine, 31st Floor, One International Place, Boston, MA 02110, USA

Response: Dangel's comments illustrate the importance of how one characterizes the issues in a case. Dangel describes Berge's complaint against the University of Alabama, Birmingham, as arising from alleged misuse of *her* intellectual property. The threshold question in my view is whether—and if so, under what circumstances—primary data collected by one group of scientists ever become the *exclusive* property of a visitor who is permitted to use their data for further analysis. Berge spent 7 months in Alabama reviewing a unique collection of data amassed over two decades, and extracting portions for her own research. Alabama provided an NIH-funded biostatistician for computer entry and initial organization of the derived data set, and Alabama personnel were co-authors on the resulting paper. Nevertheless, Berge now claims *exclusive* rights to the results of her analyses. She also claims that no one else should have access to Alabama's massive collection of primary data (even to study different questions) so long as she continues to analyze her derived data set.

Good faith, honesty, and decency are essential, but not always sufficient, for avoiding conflicts in human relations. People can enter into partnerships with good faith but different expectations, and disputes arise when those expectations collide. Established bodies of law resolve disputes over rights and responsibilities when marriages or business partnerships dissolve, just as prenuptial and partnership agreements attempt to anticipate problems and resolve them in advance. My hope is that general principles can be established for scientific collaborations to avoid—or resolve—disputes arising from incompatible expectations.

Barbara Mishkin
Hogan & Hartson, Columbia Square, 555 Thirteenth Street, NW, Washington, DC 20004, USA

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Megajoules and Other Missions

The letter "Megabucks for megajoules?" by William E. Parkins (24 Nov., p. 1281), in which he opposes the National Ignition Facility (NIF) and the Accelerator Production of Tritium (APT) projects, does not account for recent technological progress or for multiple missions.

The premise that ideas that are difficult or take a long time to realize should be abandoned would deny society many technological benefits. Following this premise, we would not today have manned air or space flight or even the laser.

The fact that fusion is difficult to achieve means that enhanced safety with entirely passive systems is possible; that is, if anything were to go wrong, the reactions would stop and the plant would shut down. Furthermore, a fusion plant would produce little residual radioactivity (1000 times less than a fission plant) which would decay in

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tens of years instead of tens of thousands. In some designs, no high-level waste storage would be required (*1*).

Although fusion energy research is almost 50 years old, inertial confinement fusion (ICF) is much younger. The demonstration of the laser in 1960 led to the idea of compressing and heating a target of fuel a few millimeters in diameter until fusion occurs. Formal programs to attempt this approach began in the early 1970s, and significant target experiments were only begun in the late 1970s. We are now ready to build a machine to establish feasibility, that is, net energy gain (gain being the ratio of fusion energy produced to laser energy consumed).

This progress has been closely monitored by independent advisory groups such as the National Academy of Sciences and the JASON group. Reviews have resulted in positive recommendations to the U.S. Department of Energy (DOE) to proceed with the NIF (*2*).

Parkins references a 1978 article (*3*) that discusses "engineering realities" that he argues would prevent fusion from becoming practical, but the principles of ICF readily lead to designs that negate his stated objections (*1*).

Parkins mentions only the NIF's energy mission. However, the NIF's national security mission is its principal justification, as it is a cornerstone of the DOE's science-based Stockpile Stewardship and Management Program. At the request of the president and Congress, the DOE developed this program to maintain a core scientific and engineering competency to allow the United States to retain confidence in the safety and reliability of the remaining nuclear weapons in the absence of nuclear testing. This expertise is also needed to further nonproliferation and to support negotiation and monitoring of further arms control. Even if the NIF does not achieve the net energy gain needed for producing power commercially, it could access the high energy densities required for weapon physics and weapon effects experiments.

With respect to Parkins's remarks about the APT, he appears to assume no changes in technology have occurred since the 1949 materials testing accelerator. Radio-frequency linear accelerators have been successfully operated world-wide over the past 30 years with continuing improvements in efficiency, reliability, and cost. Many independent expert groups have reviewed APT and concluded that the design is conservative and a viable option (*4*). The facts are (i) the United States has no reactors producing tritium for the weapons stockpile today, (ii) no new reactor projects have been started in this country since the late 1970s, and (iii) we will need an assured supply of tritium for the nuclear weapons stockpile. Thus, DOE has announced a dual-track approach to tritium production—developing APT and securing tritium from an existing commercial light water reactor.

This approach recognizes certain realities. Although buying or leasing irradiation services at a commercial reactor is the cheapest solution "on paper," it has several risks. The "real" costs, after the reactor goes through relicensing, are uncertain. Can commercial and military uses of a reactor be successfully mixed? Would the possibility of tritium releases to the environment be acceptable at a commercial reactor?

The APT approach offers several advantages as compared with a reactor. Because APT would not use fissile fuel, it would not add to the nation's nuclear waste problem. APT would be inherently safe, as there would be no criticality issues or significant loss-of-coolant accident scenarios. The inventory of tritium would be low, as it would be continuously extracted. Thus, there is much less risk that radioactivity would be released into the environment.

APT would have another major advantage: Its output could scale easily with the size of the future nuclear weapons stockpile.

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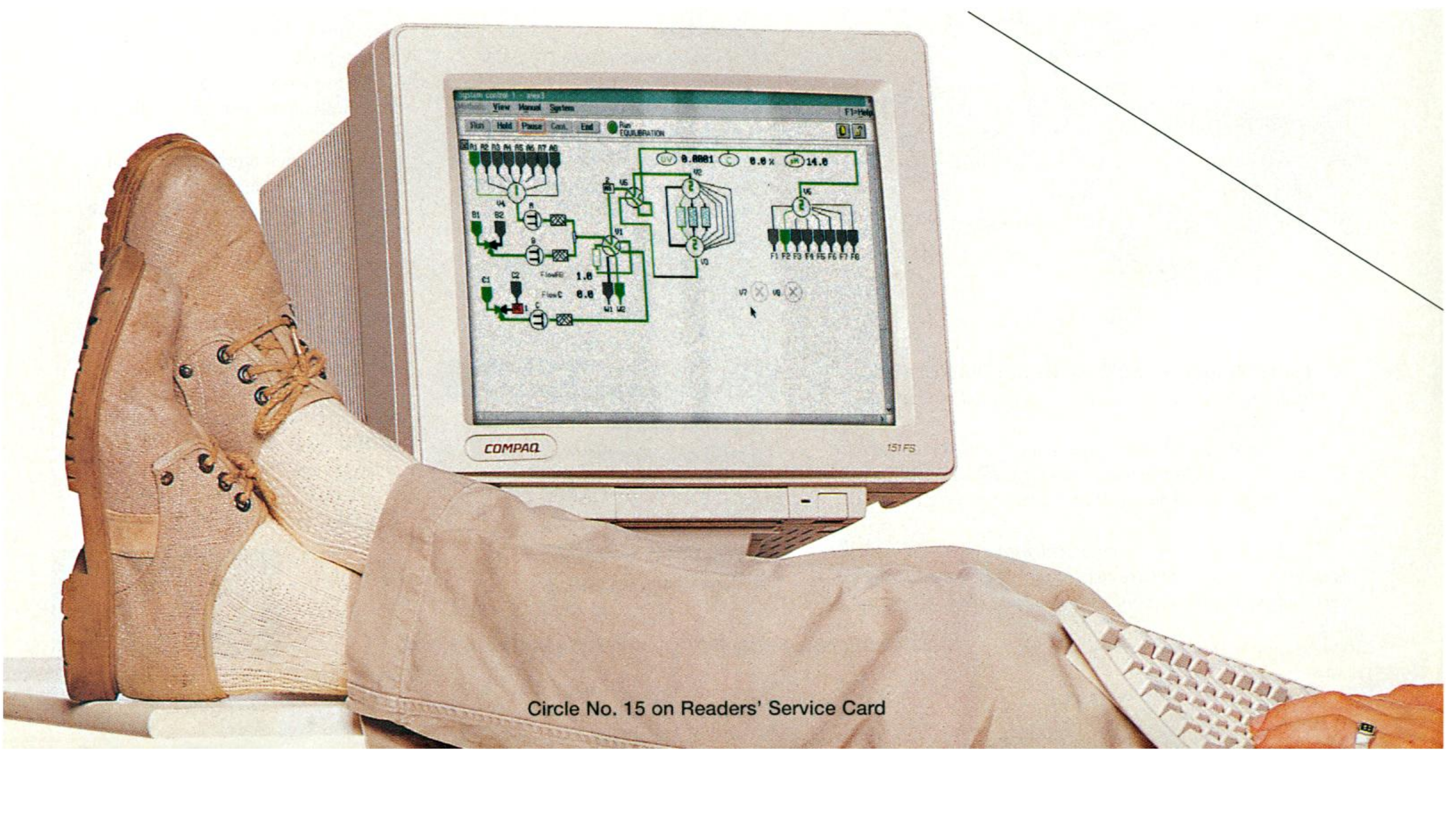

The current APT design could handle the stockpile allowed by the Strategic Arms Reduction Talks–1 (START-1). If the United States and Russia reduce the number of warheads to the START-2 level or below, APT could scale its tritium production downward. Production would be directly proportional to accelerator power, which would be the major operating cost. Thus, as tritium needs decreased, operating costs would also decrease significantly.

E. Michael Campbell
Associate Director, Laser Programs, Lawrence Livermore National Laboratory, Livermore, CA 94550, USA
John C. Browne
Program Director, Los Alamos Neutron Science Center, and Energy Research Programs, Los Alamos National Laboratory, H-845, Los Alamos, NM 87545, USA

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Corridors for Wildlife

The article "Are wildlife corridors the right path?" by Charles C. Mann and Mark L. Plummer (News and Comment, 1 Dec. 95, p. 1428) covered a number of perspectives. Any debate about the effectiveness of corridors needs to address the wide variability of species responses. For example, empirical research on deer (*1*) would be expected to produce results at variance with studies of smaller mammals, let alone with an array of other species. Thus, "each potential corridor must be considered on its own merits" (*2*). The problem is that if we wait until there is "adequate" research on the effectiveness of corridors, many more habitats and habitat patches will be irrevocably lost.

I suspect that the project of underpasses for the Florida panther is a success (*3*). Monies used for such projects do not necessarily come from funds that would be used for other conservation efforts. Another aspect of corridors or connectivity is that the constraints of minimum viable population sizes (*4*) may be relaxed if even some genetic dispersal occurs (*5*). For the area between the Torrey Pines and Los Peñasquitos Reserves, a larger corridor will likely increase the probability of success.

As a case in point, deer west of Vail, Colorado, have been restricted to a narrow corridor (the underpass under I-70) (*1*) for about 25 years and, although deer continue to use the structure, they also exhibit reluctance and often challenge the 2.44-meter fence for alternative routes. In retrospect, should the structure have been larger? Without doubt—probably twice as large. When considering corridors for the long term, bigger is probably better.

Dale F. Reed
Colorado Division of Wildlife, Wildlife Research, 317 West Prospect, Fort Collins, CO 80526, USA

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My colleagues and I have shown (*1*) that implementation of the Conservation Reserve Program in a portion of southern Wisconsin would effectively reconnect many isolated patches of oak forest, permitting ready bird-dispersal of acorns across the landscape. Because other dominant tree

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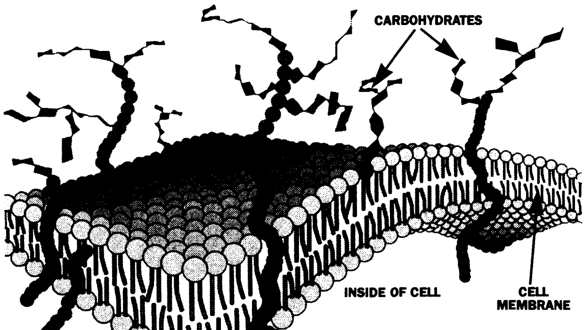

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