Letters

Ownership of the Human Genome

In "Who owns the human genome?" (Research News, 24 July, p. 358) Leslie Roberts quotes Walter Gilbert as making the astonishing assertion that scientists can map and sequence human DNA, place their findings in a manual, obtain a copyright on that knowledge, and charge their colleagues users' fees for the data contained therein. In my book *Cloning and the Constitution* (*1*), I specifically address the question of whether researchers can acquire proprietary control over such information, concluding that the Constitution forbids the result. Congress, of course, does not own the human genome; nor is there any way under American law for Congress to stake out hegemony over our double helix and transfer a portion of this hegemony to others. The key lies in appreciating the play of the First Amendment. My notion is that the biological universe and our preceptions of that universe comprise an idea marketplace. Debate over competing theories of this biological reality lies at the core of free expression and presupposes universal access to the reality under investigation. As Congress lacks power to punish dissemination of these theories, so Congress lacks power to carve out segments of that idea marketplace and put them in the hands of any person or group to be allocated as these persons see fit. Gilbert can prepare his manual and sell it to willing buyers, but he cannot rely on a franchise from the Congress to protect the sanctity of his product against the discoveries of other scientists and the manuals they publish containing those discoveries. Shakespeare would be entitled to clothe Hamlet's speeches in copyright dress, but Congress could not hand Einstein $E = mc^2$ on a patent platter and similarly cannot (even if it wanted to) hand the human genome to Gilbert. Our genetic constitution belongs to us.

IRA H. CARMEN
Department of Political Science, University of Illinois at Urbana, Champaign, Urbana, IL 61801-3696

REFERENCES

1. I. H. Carmen, *Cloning and the Constitution* (Univ. of Wisconsin Press, Madison, WI, 1985).

The article "Who owns the human genome?" raises issues about the conduct of research and the dissemination of information that must be clearly formulated if they are to be resolved sensibly. I am concerned that some comments reflecting fears of or distaste with patent and other proprietary rights may stem from a misunderstanding of the role these rights play in furthering public policy goals. Much of the confusion arises because we actually have two separate systems for promoting research and stimulating innovation in this country, both very successful.

One, the private investment system, involves a grant of limited monopoly, usually a patent, for usable research results, which gives the owner a chance to recoup a return on research investment and provides an incentive to make such an investment. The public benefits from the products developed and marketed and from the information that is disseminated when the patent is published. Although publication is slower than in academic channels, it provides a substantial public benefit when compared with the alternative of maintaining secrecy.

The academic system is used primarily when research is funded from philanthropic or public sources. Rapid publication, free exchange of ideas, and extensive collaborative networks are characteristic of this system, which does not directly foster the development and testing of products.

Both systems have been extremely effective at generating creative, innovative research. In my view, it is a mistake to regard either system as superior on moral, ethical, or scientific grounds. On practical grounds, each serves the public effectively for its intended purpose. Furthermore, the two systems complement and extend one another. Research conducted in one system does not damage or limit research conducted in the same general area in the other.

Over the past decade and a half, the level of public support for the academic research system has decreased, and many researchers have turned to the private investment system as a way of maintaining an active lab momentum (research activity). At the same time, the industrial sector has become more attuned to the value of basic research for opening up new product opportunities.

Most of those who conduct academic research would agree that the public interest in a robust, effective academic research system would be severely damaged if the system were to be allowed to atrophy or if too many of its practitioners opted for the private investment system. By the same token, the public interest would be severely damaged if the private investment system were rendered less effective by restrictions designed to limit its scope. I see nothing inherently wrong with commercial activity regarding the human genome, if such activity can lead to alleviation of disease and suffering, as it surely must if the activity is to persist. However, as a matter of public policy, we might conclude that human genomic data are best developed, analyzed, or disseminated by the academic system.

If we want to make a policy decision that the public is better served by conducting human genome research in the academic system, then the solution is to support that system by allocating the necessary resources to it, not to damage the private investment system by restrictive legislation.

LORANCE L. GREENLEE
Greenlee and Associates 5370 Manhattan Circle, Boulder, CO 80303

World Population: Still Ahead of Schedule

Twenty-seven years ago *Science* published a remarkable article, "Doomsday: Friday, 13 November, A.D. 2026," in which it was predicted that world population in the year 2026 would go to infinity (*1*). This startling conclusion was the result of careful analysis of population data going back thousands of years. The article presented an equation that permits computing the population for any given time or the time corresponding to any given population. The equation is

$$\text{Population} = \frac{1.79 * 10^{11}}{(2026.87 - \text{time})^{0.99}}$$

The article attracted wide attention. Not only was it mentioned in *Time* (*2*) and the *New York Times* (*3*), it became probably the only article from *Science* ever to be the subject of three Pogo cartoon strips (*4*).

The article was subjected to severe criticism, but the authors held their ground and with sprightly and entertaining argumentation demonstrated the flaws in the logic of their critics (*5*).

Although the "doomsday equation" fit surprisingly well estimates of human population in the past, there were doubts about how well the equation would fare in predicting human population in the future. A small group of scholars have followed the doomsday equation over the years.

In 1975 Serrin noted that most predictions made at the same time as that of von Foerster *et al.* had ranged from 3 billion to 3.5 billion (*6*). But the doomsday equation, which had predicted a human population of 3.65 billion people in 1975, was closer to the number being reported by the Population Reference Bureau—3.97 billion. The human reproductive capacity had outperformed all estimates and had jumped to a lead of 320 million.

By 1980 the climate of public opinion regarding population had changed dramati-