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EDITORIAL

Breakthroughs of the Year, 1996

Sir Walter Scott, 1771–1832: ". . . And hope is brightest when it dawns from fears."

The opportunity to make scientific discoveries is openly acknowledged to emerge from a foundation of prior discoveries and methods. When the discovery process leads not only to major new facts but serves to tie together seemingly disparate, but mysteriously related, findings and also opens the door for new ways to defeat a worldwide plague, both science and society stand in awe. This year, as we looked back at the numerous extraordinary results reported in our pages and others', a series of advances providing just such critical gateways between mystery and medication led us to designate them as our breakthroughs of the year. Topping the list are those that promise hope for people infected with the human immunodeficiency virus (HIV).

The year-end recognition by *Science* of the most significant developments in scientific research, in terms of their consequences for the advancement of science and for society, was originally termed the Molecule of the Year [*Science* **246**, 1541 (1989)]. However, although the foundation of this year's selected advances in the understanding of HIV disease is unquestionably molecular, it encompasses much more than a single molecular signal or process. *Science* holds the view that it is important to recognize those groups of discoveries that on rare occasions can provide sufficient change in the practice or interpretation of science or in its implications for society that they deserve to be viewed as breakthroughs.

Coming on the heels of a series of widely acclaimed new drug-combination regimens for treatment of HIV infection, the several new advances in the understanding of the biology of HIV infectivity and of the chemoattractant cytokines known as chemokines are breakthroughs of the highest order. Chemokine receptors are critical co-receptors required for HIV infection of CD4-bearing cells. The functions of chemokines and their receptors provide new ways to devise animal models for HIV pathogenesis and to evaluate new medications and vaccines. The currently available therapies, based on inhibitors of enzymes essential for viral replication, have dramatically improved the outlook for many patients. But no large-scale clinical trials have yet been completed with the costly new drug combinations, and they are far from generally available. Still unknown is whether any of these drugs can eradicate the virus from infected cells, especially those in the brain. Future medications based on knowledge of the role played by chemokine receptors in assisting HIV's CD4-based entry into host cells may be powerful enough to succeed in these objectives; vaccine developers have been alerted that individuals with mutations in their chemokine receptors may have natural resistance to HIV infection.

In this issue, the article on page 1988 by Michael Balter and the special section coordinated by Deputy News Editor Elizabeth Culotta (with the help of the News and Editorial staffs) highlight not only the advances that provide hope to current and future casualties of HIV disease, but a series of other scientific breakthroughs as well. We consider several threads of new information concerning the origins of life itself, on our planet and elsewhere in the universe, including updates on the possibility of ancient life on Mars. Other runner-up breakthroughs range from the Earth's inner core to the subtle signals that shape a developing embryo or determine whether a cell lives or dies. Exemplifying the nature of such breakthrough research is a consistent pattern in which multiple individual efforts merge into a more comprehensive body of information from which may be spun new insights, better experiments, and, eventually, useful advances for science and society.

No matter how inspired scientists are, their ability to contribute to the pool of knowledge requires funding, and in this year-end survey we examine how the picture varies worldwide. We conclude by gazing into our crystal ball to see what will be hot in 1997 and give ourselves a scorecard on how well we did last year in predicting the important discoveries of 1996.

Because of continued refinements of *Science* Online (at http://www.sciencemag.org/), the full-length online presentation of the Breakthrough of the Year section can serve as a direct electronic link to our coverage of these very important research items, as well as to other *Science* papers and news stories and selected online resources. *Science* looks forward to greeting all of its continuing readers in print and online in the New Year. Have you signed up yet?

Floyd E. Bloom