step was to make "equivalent human monoclonal antibodies with those same marching orders," Lostrom says. The technique they used, called cell-driven viral transformation, is the "newest advance" in antibody production, according to Lostrom.

This surprising technique avoids the cell fusion step of most other methods to create antibody-producing cells that survive indefinitely in the laboratory. Instead of merging a cell making the appropriate antibody and a cancer cell to create a cell called a hybridoma, the new technique mixes normal blood cells, called B lymphocytes, from patients likely to have hospital-acquired bacterial infections, with other cells infected with the cancer-causing Epstein-Barr virus. The virus moves into the blood cells, and with some biochemical sleight-of-hand the scientists destroy the cells originally infected with Epstein-Barr virus. The scientists then choose from among the transformed cells the ones producing an antibody of interest.

The number of "immortal" cells that result from this procedure is far greater than those from other methods. Lostrom estimates that 1 in 50 of the B lymphocytes present is transformed, whereas with the cell-merging technique only 1 human cell in 10 million is transformed.

"Cell-driven viral transformation gives us the broadest view of the antibody repertoire," Lostrom says.

Animal trials examining the protective effect of the human monoclonal antibodies gave results so clear-cut that Lostrom admits being self-conscious about showing the graphs. All 10 mice given the human monoclonal antibody survived a high dose of bacterium. But the unprotected mice all died the first day.

The research at Genetic Systems was performed under contract to Cutter Laboratories of Emeryville, Calif. Cutter is now moving toward the product development stage, Lostrom says.

Lostrom suggests that the strategy used to develop the antibodies against *P. aeruginosa* can be used for fighting other bacteria. But other cases may be more complicated. For example, *Escherichia coli,* another major cause of hospital-acquired infections, has more than 150 serotypes, among which 14 are responsible for about 80 percent o′ human *E. coli* disease.

Hospital-acquired infections are an increasing problem, Lostrom says. He estimates that they strike about 5 percent of U.S. hospital patients, adding more than $1 billion annually to medical costs. As bacterial resistance to antibiotics increases, the fatality rates for the infections also are increasing.

"The best hope [against hospital-acquired infections] is prophylaxis," Lostrom says. "It is a very viable alternative to antibiotic therapy." — *J.A. Miller*

Spots in the air: A comet controversy

For nearly half a decade, Louis Frank has been seeing spots. And if their cause is what Frank and his colleagues at the University of Iowa in Iowa City think it is, says the editor of the journal that is about to publish the observations and their interpretation for the first time, "its influence in several fields of science will be profound."

In fact, says GEOPHYSICAL RESEARCH LETTERS (GRL) Editor Alexander Dessler, head of the Space Science Laboratory at NASA's Marshall Space Flight Center in Huntsville, Ala., "I think it is one of the more interesting papers GRL has ever published."

It is also controversial. "Both referees firmly disagree with the interpretation," says Dessler, referring to scientific journals' custom of asking researchers in related fields to evaluate, or referee, articles submitted for publication. More than one scientist has even urged Frank to withdraw the "interpretation" section altogether, arguing that his credibility could suffer, while a similar concern about GRL has been expressed to Dessler.

At the heart of the matter is a series of dark spots that have been appearing in ultraviolet images of earth's atmosphere taken by the Dynamics Explorer 1 satellite (DE-1) ever since the craft was launched in 1981. Several of the spots show up in virtually every one of the more than 10,000 images so far amassed by Frank and colleagues John Sigwarth and John Craven. Each lasts about two to three minutes and covers an area that the authors estimate to be about 2,000 to 3,000 square kilometers.

The furor arises from Frank *et al.*'s proffered explanation: that the spots represent reductions in the atmosphere's ultraviolet brightness, triggered by the water from vast numbers of small, previously unsuspected comets (SN: 12/21&28/85, p. 391) — so many that their mass would add up to the equivalent, in water, of earth's entire atmosphere every 5 million years.

The implications of so many infalling comets' worth of water — about 20 per minute, globally, each averaging about 40 feet in diameter according to the authors' calculations — would be far-reaching. Or, as the authors put it in a term seldom found in scientific journals, "startling."

Researchers have long wondered, for example, if Venus once had an earthlike ocean that has since disappeared, a hypothesis bolstered in recent years by spacecraft measurements of the Venusian atmosphere's deuterium-to-hydrogen ratio (SN: 12/12/81, p. 372). But if the tiny amount of water now detected in the atmosphere has been arriving over billions of years as a succession of comet nuclei, says Frank, "probably there never was an ocean on Venus."

Closer to home is the question of whether numerous prehistoric species on earth were wiped out by the impact of a large asteroid or comet whose debris cut down the incoming sunlight until it triggered an ice age. If the myriad mini-comets are periodically brought in from the solar system's outer reaches by the system's passage through the spiral arms of the Milky Way, writes Frank's group, "fluctuations in the rate of mass accretion may be large enough for rapid climatic fluctuations sufficiently severe to account for the massive extinction of species in lieu of a catastrophic infall of a single large object."

In a more subtle example, "the occasional bursts of gases observed on the moon may be the direct signature of the impact of these small comets rather than impulsive ejection of gases from the moon's interior."

Yet another case, notes Frank, could be the numerous apparently water-formed channels on the surface of Mars (though many researchers are actively studying the view that water in the Martian past came the "conventional" way — from the planet's interior). Other possibilities posed by the group range from the relatively smooth-looking icy surfaces on some of the moons of the outer planets to the strange "spokes" on the widest of Saturn's rings.

The main problem raised by a number of researchers is that of all the water that so many comets would be bringing to earth. Much of it is broken down into hydrogen and oxygen by ultraviolet radiation from the sun, with the hydrogen atoms escaping into space from the top of the atmosphere, or exosphere. But the exospheric "escape rate," notes Thomas Donahue of the University of Michigan in Ann Arbor, would account for about 1,000 times less water than the proposed comet flux is said to be bringing in. Donahue, who has revealed that he was one of the GRL article's referees (their identities are usually kept secret), finds the idea "absurd."

He also admits, however, like most of the other scientists who find Frank's hypothesis uncomfortably exotic, that Frank has "really been careful" to examine the DE-1 data for instrumental problems, statistical errors and other misleading possibilities. Says Edward Smith of Jet Propulsion Laboratory in Pasadena, Calif., "I'd be very, very, very surprised if [the spots] are artifacts in the data."

So what are they? — *J. Eberhart*

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