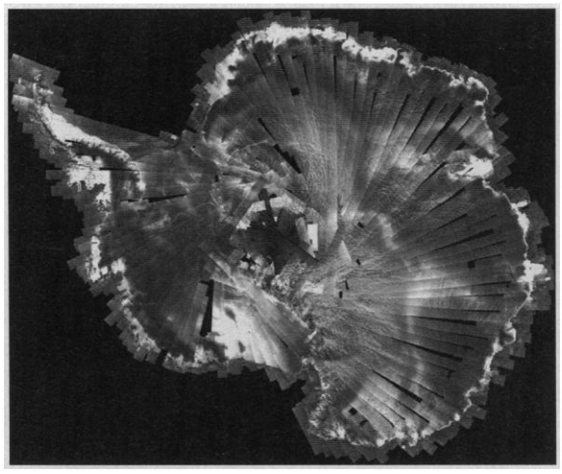
POLAR RESEARCH

Spacecraft Offers Details of Antarctica

A new Canadian radar satellite is giving polar researchers the first highly detailed map of Antarctica and its ice sheet, revealing unexpected ice flows and a heavily textured surface in areas that were thought to be largely featureless. Researchers say the data offer clues to the topography of the continent hidden under the ice. Comparisons with earlier images could also trace the retreat of ice shelves and glaciers, a possible sign of global warming.

Antarctica's expanse of ice shelves, mountains, and ice-covered plains is largely unexplored. But because the region contains nearly three-quarters of Earth's fresh water, changes there can have a major influence on world sea levels and climate. This fall, the Radarsat spacecraft, which has been mapping the Earth's surface for 2 years, turned its attention to Antarctica. Over 18 days as it crisscrossed the continent, Radarsat gathered 8000 separate images with its synthetic aperture radar, which peers through clouds and darkness to pick up detailed surface relief.



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Cold, hard data. New radar images provide the first comprehensive high-resolution map of Antarctica.

"It's been a resounding success," says Robert Thomas, chief of NASA's polar research program, which is overseeing the work.

The initial results were a surprise, adds Ken Jezek, a geologist at Ohio State University in Columbus, who has a $2.8 million, 3-year NASA grant to conduct the study. "We expected to see a flat and featureless Antarctic ice sheet—particularly in the east—but we're seeing great detail and exotic features." For example, oddly shaped flows of ice that extend for hundreds of kilometers upstream of the massive Recovery Glacier hint at the complex shape of the bedrock below. And by contrasting the data with those obtained by U.S. spy satellites in the 1960s, he says, scientists can also study the retreat of the ice shelves that fringe the coast.

The Canadian government paid for the construction of Radarsat, and NASA launched it in November 1995 in exchange for a 15% share of the satellite's use. A private company—Radarsat International Inc.—sells the data to users ranging from oil and gas companies to disaster relief organizations. As a result, data gathered during NASA's projects—such as the Antarctica images—are supplied to researchers who win peer-reviewed grants, but further dissemination is restricted because of the data's potential commercial value. Jezek says it will take more than a year to process the Antarctica data fully so all the images mesh. A follow-up mission is planned before the century is out.

–Andrew Lawler

EVOLUTION

Sex Frees Viruses From Genetic 'Ratchet'

ARNHEM, THE NETHERLANDS—It's probably the only question that the celebrated sexologists Masters and Johnson didn't ask: How did sex originate? Evolutionary biologists, however, have puzzled for much of this century over why so much of life has evolved the ability to shuffle genetic material between individuals—the essence of sexual reproduction. "It must confer some benefit," Lin Chao, an evolutionary biologist at the University of Maryland, College Park, said at a meeting of the European Society for Evolutionary Biology here in August. He then went on to report some of the first experimental evidence supporting one explanation, proposed 3 decades ago: that sex enables a population to free itself of harmful genetic mutations.

Chao gathered his evidence in one of the simplest of all sexual organisms, an RNA virus whose rapid mutations and short generation time put evolution on fast forward. "He's developed a clever experimental system to test a classic question in evolution," says Peg Riley, an evolutionary biologist at Yale University. "And he's got strong results" that support the hypothesis.

In the early 1960s, evolutionary theorist Hermann J. Muller argued that small, asexual populations would necessarily decline in fitness (or reproductive success) over time if their mutation rate was high, because they would accumulate harmful mutations. Muller proposed that this process would work like a ratchet, with each new mutation irreversibly eroding the population's fitness. Sex could provide an escape from the ratchet, he said, because recombination lets an organism reconstruct a mutation-free genome from two genomes that contain different mutations.

But devising a method to test the idea requires more than your garden-variety lab animal. Besides short generations and rapid mutations, the organism needs to be able to reproduce sexually as well as asexually. "You can't see the advantage of sex, unless you can withdraw that advantage," says Chao. Certain RNA viruses, he notes, fit the bill on all counts.

Chao chose to work with the ϕ6 virus, which infects bacteria. The ϕ6 genome is made up of three RNA segments, and virus "sex" consists simply of reshuffling these seg-

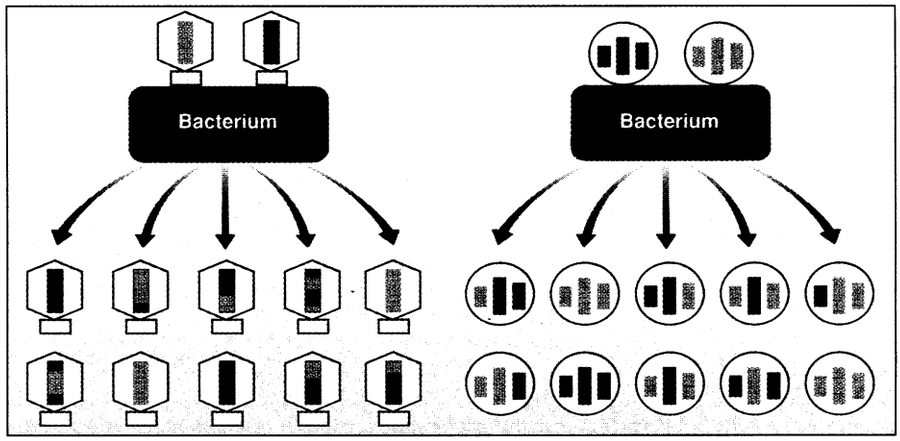

ILLUSTRATION: LIZ CARROLL SOURCE: LIN CHAO

Even viruses do it. Viruses from two strains infecting the same cell can recombine whole chromosomes (right) or swap chromosome segments (left) in their offspring.