

# Bidding Bye-Bye to the Black Sheep?

Sheep already look so much alike that counting them helps people fall asleep. Now, they may become even more uniform. For the first time, researchers have demonstrated a technique that may lead to the mass production of livestock clones created from genetically altered cells.

Although scientists can create clones of genetically engineered mice, they are far less successful with livestock.

Researchers in Roslin, Scotland, report this week that they have succeeded in cloning sheep using a technique that they improved to produce potentially hundreds of animals. Moreover, the group expects to combine the method with genetic engineering to create animals with specific traits. Called nuclear transfer, the technique replaces the nucleus of an immature egg with a nucleus from another cell.

In the past, scientists obtained the replacement nuclei directly from cells in embryos. Now, Keith H.S. Campbell and his colleagues at the Roslin Institute are using nuclei from cells grown in a laboratory culture, they report in the March 7 NATURE. An embryo has no more than 30 or 40 usable cells, whereas a culture features an almost endless supply.

The new approach makes genetic engineering of these donor cells more feasible because a lab culture can supply so many of them to manipulate, says coauthor Ian Wilmut. A company could first select cells for cloning from prize animals, then improve them further with a gene that, for example, makes the animals produce milk rich in a therapeutic protein.

Many labs have tried for years to clone livestock using cell lines, "and now Campbell's group has done it," asserts George E. Seidel Jr. of the Animal Reproduction and Biotechnology Laboratory at Colorado State University in Fort Collins.

The success "is cause for celebration," exclaims Davor Solter of the Max Planck Institute for Immunobiology in Freiburg, Germany, who wrote a commentary accompanying the report. The finding opens the door to cloning mammals from adult cells, he adds.

In their study, the Scottish investigators grew embryo cells of Welsh mountain sheep in the laboratory. During a relatively stable stage of the cell cycle, they transferred 244 of the nuclei to the stripped-down eggs of Scottish blackface ewes.

They didn't have to fertilize the eggs, because the new nuclei had a full set of chromosomes. By giving the eggs an electric shock, they also took over the sperm's job of initiating development.

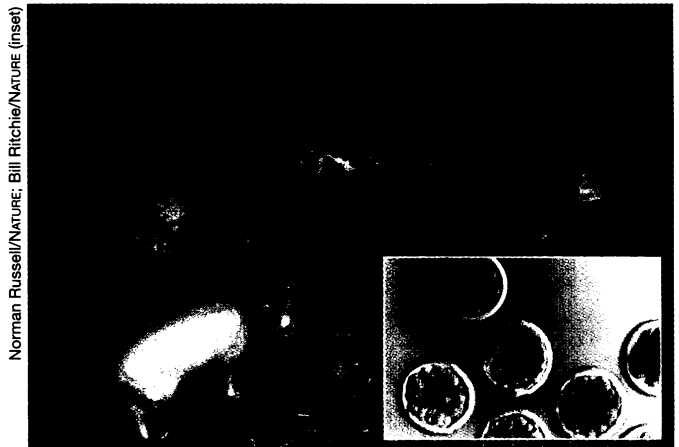
Thirty-four of the eggs developed sufficiently for the scientists to insert them into Scottish blackface ewes. After a week, they removed them from the ewes, discarded the failures, and returned the 19 healthy ones to their surrogate mothers.

Their efforts resulted in five genetically identical Welsh mountain lambs. Two of the lambs died within 10 days of birth, probably from kidney trouble. What caused the illness remains unclear. "The more you interfere with reproduction, the more danger there is of things going wrong," Wilmut acknowledges.

However, asking what failed with the procedure "is like asking what went wrong when [the Wright brothers] flew their plane and it went only 300 feet. . .

Things went remarkably well," Seidel observes. He expects the approach to be applicable to cattle and other livestock.

Might this approach work for cloning humans (SN: 2/5/94, p. 92)? Both Wilmut and Seidel agree it's theoretically possible but far from feasible. Besides, "we don't think it's something you'd want to do," says Wilmut. — T. Adler



Norman Russell/NATURE; Bill Ritchie/NATURE (inset)

Sheep clones with their foster mothers. Inset: sheep embryos.

## One-man band: X-ray source plays two tunes

It pulses, it flickers, and some 20 times a day it emits a torrent of X rays more intense than the combined radiation of a million suns. Since bursting on the scene in early December, this bizarre astronomical object, a Milky Way resident that lies toward our galaxy's center, has ranked as the brightest known X-ray source in the heavens.

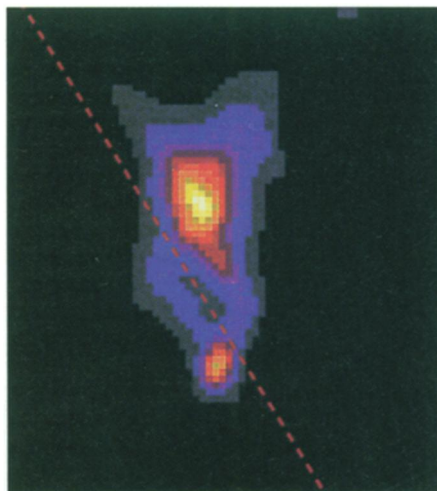
Though it's still the champ at X-ray wavelengths, the source's intensity has halved, and in a month or two the fireworks will probably fizzle altogether. That's why researchers are scrambling

to study this enigmatic system, which exhibits two types of X-ray activity—regular pulsing and sporadic bursting—never before seen in the same object.

Astronomers believe the object is a neutron star—a remnant of a collapsed star that packs the mass of the sun into a sphere no more than 16 kilometers in diameter. Some, perhaps even all, of the dazzling X-ray emissions stem from the violent interactions that ensue when the star steals mass from an orbiting companion.

Discovered Dec. 2, 1995, by NASA's Compton Gamma Ray Observatory (GRO), a spacecraft carrying X-ray and gamma-ray telescopes, this celestial source emits pulses of X rays every 2 seconds. At erratic intervals averaging about once an hour, it also emits an outburst of high-energy X rays.

Rapidly rotating neutron stars that act as X-ray pulsars, beaming radiation at regular intervals, are familiar to astronomers. And the GRO has recorded thousands of so-called gamma-ray bursters—objects that explode like flashbulbs, emitting high-energy radiation and then vanishing without a trace. But the new object, for-



Compton Gamma Ray Observatory/NASA

Image of the sky taken by GRO after Dec. 2, 1995 shows a new object (top), the bursting pulsar. Dashed line indicates the galactic plane of the Milky Way.

mally dubbed GRO J1744-28, manages to combine both behaviors.

"We've seen pulsars and we've seen bursters, but never together in the same source," says codiscoverer Chryssa Kouveliotou of the Universities Space Research Association (USRA) and NASA's Marshall Space Flight Center in Huntsville, Ala.

"We have some objects that play the drums, some that crash the cymbals. . . but this is a one-man band," declares Frederick K. Lamb of the University of Illinois at Urbana-Champaign, who has studied the system, informally known as the bursting pulsar, with the recently launched X-ray Timing Explorer Satellite.

Kouveliotou and her colleagues report their work in the Feb. 29 NATURE. She and Lamb presented further details last week at a press briefing in Washington, D.C.

When the GRO first spied the bursting pulsar, it detected 140 powerful bursts of high-energy X rays in a single day. In mid-December, the craft discovered that the object also emits X rays of a lower intensity at a steady rate. Mark H. Finger of USRA found evidence that the bursting pulsar consists of a neutron star and a lower-mass, ordinary star that orbit each other every 12 days.

Lamb notes that most researchers agree on the origin of the pulsed X rays. Rapidly rotating neutron stars have strong magnetic fields. When such a star steals mass from a companion, the magnetic field funnels the material onto two tiny spots, the magnetic poles, at opposite sides of the star's surface. Crashing into the poles at half the speed of light, the stolen matter emits X rays, which sweep across the sky like a lighthouse beam as the star rotates.

Astronomers speculate that the intermittent outbursts may stem from a variation on this theme. If material torn from the companion star is sometimes delayed from immediately crashing into the neutron star, enough matter could accumulate near the star to produce a huge outburst of X rays when it finally strikes. Such a delay might come about if the outward pressure exerted by the radiation streaming from the neutron star temporarily holds its own against gravity, keeping material away from the star's surface.

Racing against time, observers on the ground are striving to detect the bursting pulsar at other wavelengths. Using the Very Large Array Radio Telescope at the National Radio Astronomy Observatory near Socorro, N.M., Dale A. Frail has found an intriguing radio-emitting source in the same general part of the sky.

But Frail says he'll require the finer eye of another X-ray satellite, ROSAT, scheduled to observe the bursting pulsar on March 12, before he can determine whether the radio source coincides with the X-ray-emitting object.

— R. Cowen

## Pesticides may challenge human immunity

Many popular pesticides appear capable of compromising the body's ability to fight infection, an extensive study finds. If true, pesticide use "could be a hidden killer"—especially in developing countries, "where infections are a leading cause of death," says Robert Repetto, vice president of the Washington, D.C.-based World Resources Institute (WRI) and a coauthor of the new report.

Poor nutrition, bad sanitation, and inadequate instruction on how to use pesticides safely add to the vulnerability of farmworkers in these developing nations, he charges.

With colleague Sanjay S. Baliga, Repetto surveyed a broad range of scientific studies on the immunotoxicity of widely used pesticides—including organochlorines such as DDT, organophosphates such as malathion, and carbamates such as aldicarb. Though most of the studies tested laboratory animals, a few looked at the suppression of immunity in wildlife—such as harbor seals that had eaten Baltic herring tainted with high concentrations of organochlorines (SN: 7/2/94, p. 8).

The report also cites a host of studies from the former Soviet Union—one of the few regions where investigations have focused on pesticide-induced changes in human immunity. The WRI commissioned local scientists, such as Lyudmila Kovtyukh of the Academy of Sciences in Kishiněv, Moldova (a republic between Romania and Ukraine), to track down and translate studies for English-speaking researchers.

One of Kovtyukh's reports found that water, soil, and many of the local crops around Kishiněv carry pesticide residues exceeding what she calls "accepted standards." Children living in areas where pesticides had been most heavily applied experienced elevated rates of acute respiratory diseases (including pneumonia), skin disease, ear infections, tuberculosis, and dental caries. Adults also suffered from unusually high rates of infection.

Scientists there documented suppressed T cells, white blood cells that help orchestrate or participate in immune defenses. The extent of T cell suppres-

sion corresponded to an individual's degree of pesticide exposure.

The report also cites data from ongoing studies among Inuit children in the northern Hudson Bay area of Canada. Nursed on human milk laced with organochlorines, these children not only face a highly elevated risk of infection (SN: 2/12/94, p. 111), Repetto notes, but in some cases are so immunocompromised that they "can't be vaccinated, because they don't produce any antibodies."

Michael Luster, chief of toxicology at the National Institute for Occupational Safety

and Health in Morgantown, W. Va., served as an adviser to the WRI team. Although many of the cited studies were "weak," he says, the body of work overall certainly "raises a flag of concern."

Former Food and Drug Commissioner Donald Kennedy, now at Stanford University, believes the new study's major contribution is its weaving together of a host of disparate immunotoxicological studies with data on pesticide use "and the lack of care or instruction about that use that prevails in many developing countries." He told SCIENCE NEWS, "I don't think the extent of this problem had been realized before—by anybody."

Other reports have linked pesticides to immune system problems, notes Albert

Munson of the Medical College of Virginia in Richmond, but "this certainly is the most comprehensive one." It also highlights the social and educational factors that contribute to making this largely "a Third World problem," the immunotoxicologist says.

Munson contends that current U.S. requirements for testing the immunotoxicity of pesticides are essentially worthless. Repetto concludes that industrialized countries should require a stronger battery of such tests before they allow pesticides to be registered for use.

In fact, notes Sheryl Reilly of the Environmental Protection Agency in Arlington, Va., recommendations by Munson and other EPA advisors have already prompted the agency to begin drawing up new rules to do just that. She expects a proposal to be released this summer. — J. Raloff



Ann Thirup/WRI

With only a bandanna for protection (above), a farmworker treats plants—and himself—with a pesticide. Barefoot and ungloved, these Costa Rican farmers (below) risk hefty chemical exposures as they mix pesticides.