RANDOM SAMPLES

edited by CONSTANCE HOLDEN

Clot kickers. Genzyme's goats' milk should yield anticoagulants.

Raising a Herd of Therapeutic Goats

Old McDonald had a farm, and now the U.S. biotech business has one, too. Last week, Genzyme Transgenics, a subsidiary of Genzyme of Cambridge, Massachusetts, announced it had bought a 166-acre farm in western Massachusetts to breed goats that have been genetically altered to produce human therapeutic and diagnostic proteins in their milk. At least two companies in Europe have recently established farms for the large-scale production of biotech proteins, but Genzyme Transgenic's spread, to hold up to 1000 goats, will be the first one in the United States.

The company's move is a big step for "gene pharming," a fledgling form of biotechnology in which genes that produce desired proteins, such as those to treat cystic fibrosis or cancer, are transferred into the embryos of dairy animals (*Science*, 4 October 1991, p. 35). If these new genes properly integrate into the host's DNA, the foreign proteins become part of the animal's milk.

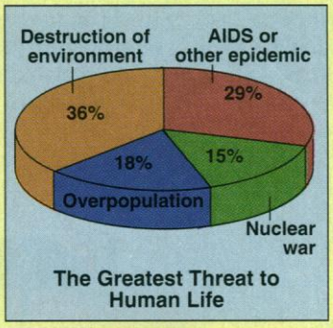
Gene pharming, which is being explored with pigs and sheep as well as goats, could prove to be a much cheaper production method than the traditional route, which is to use genetically altered tissue cultures that secrete small amounts of protein. "Everyone who has looked seriously at the technology believes it offers considerable cost savings," says Martyn Breeze of Scotland's Pharmaceutical Proteins Ltd., which runs a farm with 1500 sheep, many of which produce a protein in their milk that can help treat emphysema.

Nonetheless, gene-pharming companies have yet to demonstrate such savings. And biotech analysts worry that the time it takes a newborn animal to start lactating—sometimes more than 18 months—could actually make this approach prohibitively expensive. Nor have scientists established that proteins produced in milk are as safe and effective as those made in tissue cultures. The proteins can differ in subtle ways, and Genzyme Transgenics' research director Harry Meade acknowledges that "until someone takes a milk protein and carries it through the clinics, there's not really a track record you can feel comfortable with." The company is poised to provide that record: It plans to start the first human trials of a goat-produced protein, the anticoagulant antithrombin III, later this year.

Science: What the Public Thinks

So deep an impression has the AIDS epidemic made on public perceptions that almost 30% of the population now believes that the "greatest threat to human life" is AIDS or some other kind of plague. That was one of the results of a survey of public science knowledge sponsored by New York's American Museum of Natural History and conducted by the Louis Harris polling organization. The poll was done through telephone interviews with 1255 adults in a sample matched to the latest national census figures.

Museum director Ellen Futter noted in a press release that people "seem to have erratic, almost idiosyncratic, bits of scientific information." Most are aware of continental drift, for instance, but only half know that dinosaurs died out before humans showed up. And people's awareness of scientific issues is frequently dependent on the wording used. For example, while 82% were concerned about "mass extinctions of plant and animal life," only 49% were worried about the "biodiversity crisis"—suggesting "people don't know what this phrase means," says paleontologist Michael J. Novacek, the museum's dean of science. Novacek wasn't sure how to interpret another puzzler: 62% agreed that "scientists believe" humans are "most closely related to" apes (16% went for monkeys—close, but no banana). Yet only 44% agreed that humans evolved from "earlier species of animals."



The Greatest Threat to Human Life

Science From the Magic Kingdom

The name of Bill Nye will soon be on the lips of all the nation's fourth-graders if the creators of a new TV science series have gauged their market right. Last week, Walt Disney's Buena Vista Television company and the Public Broadcasting Service announced that they have teamed up to put on a daily science show, starting in the fall, called "Disney Presents Bill Nye the Science Guy." Science will be served up to kids via the high-jinks of Nye, a mechanical engineer–turned–"standup scientist" who has been doing his Science Guy routines on a Seattle comedy show and on network TV guest appearances. Each show will have its own theme—such as "Earth's crust," in which a helicopter lowers Nye into the mouth of Mount St. Helens—as well as demonstrations of experiments that can be done at home. All the scripts are being vetted by scientists. The National Science Foundation (NSF) is putting $4.5 million into the project, which will run and re-run shows for 3 years—with a show airing at 4 p.m. weekdays on public TV, and networks sending it out on weekends.

Teaming Up Cleanup Bugs

Most coaches know that one outstanding player can't produce a championship title. It takes a well-organized team. By the same token, environmental biologists are finding that it may take teams to do the dirty work of bioremediation. Now microbial talent scouts at Purdue University have put together a team whose combined talents may break down spilled herbicides into harmless components.

The offending substance in question is atrazine, a chlorinated herbicide widely used on corn fields. In addition to killing weeds, it can wreak havoc on the livers, kidneys, and cardiovascular systems of laboratory animals—which means the Environmental Protection Agency (EPA) doesn't want humans ingesting it. Researchers have been especially interested in finding ways to clean up atrazine spills since January of last year, when EPA placed a limit on the amount permitted in water supplies.

Environmental microbiologists Ronald Turco and Nasser Assaf (who is now with the EPA) recruited some atrazine-digesting microbes from polluted soil samples. By applying more herbicide, they were able to pick out the high performers. Such microbes have been identified in the past, but "single strains were inefficient and produced a lot of [toxic] metabolites," says Turco. So the researchers looked for organisms that would produce no metabolites. They have now put together a "consortium" containing at least three different—and as yet unidentified—microbes that will transform 86% of the

atrazine in a soil sample into carbon dioxide and degraded cells in 150 days. (With no help, just 40% would degrade in a year.) And, there are no toxic metabolites. Turco suspects that some of the microbes produce toxic metabolites while others degrade them.

Environmental microbiologist Raina Miller from the University of Arizona says the Purdue researchers' success reflects one direction that pollution cleanup is taking—bioremediation by consortium. "Nature is not a pure culture, so why shouldn't we harness all the microbial systems we can?" she says.

Grantsmanship in the Fast Lane

You've got a grant proposal due in 3 days and you're short two foreign collaborators. What do you do? Biologist Leonid Gavrilov of Moscow State University went to the Internet for help—and found that even the information superhighway has its speed limits.

Gavrilov, who works at the A.N. Belozersky Institute for Physico-Chemical Biology, was seeking a European Union grant to study the relationship between offspring longevity and parental age at conception. He wanted to test his hypothesis that age-related accumulation of DNA damage in a parent can affect children's lifespans. The grant was designed to foster multinational collaborations, and though Gavrilov had Belgian and French collaborators, the rules called for additional partners from two eastern European countries. So on 28 April, Gavrilov sent a plea out into cyberspace.

Within 2 days, he reports, he collected several more European partners, but got only silence from Eastern Europe, where, he says, very few scientists have e-mail. After he "saturated all the networks with announcements" he hooked a Hungarian and a Slovenian—but, alas, they materialized several hours after the 2 May deadline. Nonetheless, he is optimistic—he has a small grant from the International Science Foundation (set up by Hungarian-born financier George Soros) which he hopes to supplement from other sources. As for rounding up collaborators via the Internet, Gavrilov says "I am sure this way of action will be a common practice soon." Indeed, he says that with limits on travel and communications imposed by Russia's current state of penury, "this is the only way to solve such problems for Russian scientists who were isolated by Iron Curtain in the past and are even stronger isolated now by Golden Curtain."

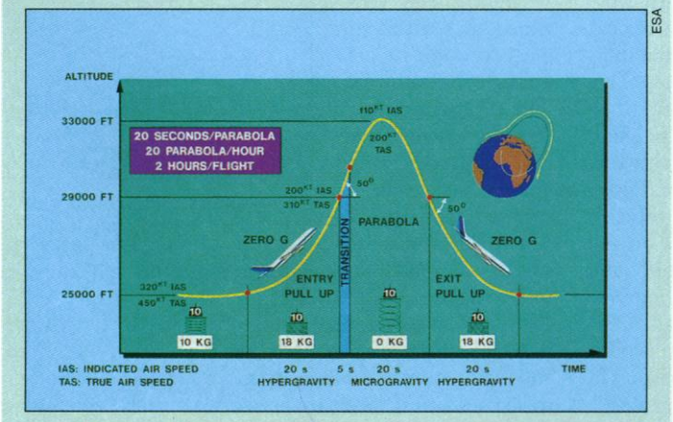
Experiments for Lightweights

Ever get that "floating on air" sensation from your scientific work? Thirty European university students will get it soon, when they win a chance to perform experiments while experiencing weightlessness aboard a special airplane flight run by the European Space Agency (ESA). The winners will be chosen from entrants in a contest to propose original experiments to be carried out during parabolic flights.

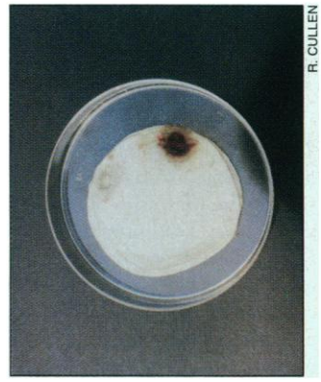
Arranged as part of the 2nd annual European Week of Scientific Culture, the flight will take off next November from a test flight center in Brétigny, France. When a plane is flown in a parabolic trajectory, it can achieve a state of microgravity—similar to that experienced rounding the top of a curve in a roller coaster—for about 20 seconds. The ESA has been operating such flights, which go on up to 30 parabolas per trip, for astronaut training and research since 1989, using a twin-engined Caravelle jet.

The contest was conceived by the students of Dutch astronaut Wubbo Ockels, visiting professor at Delft University of Technology and a former space shuttle crew member. The students were intrigued with his adventures in weightlessness, so in collaboration with ESA, the university's space students' society launched the Europe-wide challenge. Aerospace engineering student Marc Bouwmeester says proposals for experiments, which can only be conducted in 20-second spells, "should be very, very simple—for example, how a fly flies when he won't know up from down." Ockels thinks the flight could also include some parabolas designed to produce a force of one-sixth *g*, the same as on the moon, so the students can feel what it would be like on a lunar trip.

Winners of the competition will have to pass medical and mental fitness tests. The deadline for entries is 13 June. For details, phone the Delft students' society at 31 15 785371.



Roller coaster. Graph of airplane flight shows *g* forces experienced by the craft as it makes the parabola.



Cultured host. Spot on communion wafer mimics blood.

Miracle or Microbe?

That provocative question continues to surround the Miracle of Bolsena in spite of recent evidence pointing to a microbe. In 1263, a German priest on a pilgrimage to Rome was experiencing a crisis of faith, wondering if the sacramental wafer was really the body of Christ. But when he stopped in the Italian city of Bolsena to celebrate mass, his doubts were erased when "blood" oozed from the host onto the altar. The phenomenon was promptly hailed as a miracle by Pope Urban IV. Scientists have long been curious about such sanguineous food, says Ron Doyle, a microbiologist at the University of Louisville, Kentucky. And from time to time over the past century they have proffered a more mundane explanation: the common bacterium *Serratia marcenses*, which produces a red pigment. In the April issue of *American Society of Microbiology News*, Johanna Cullen, a nursing and premed student at George Mason University, added more evidence when she induced the microbe to grow in a communion wafer (see above). She and Doyle suggest a further test would be to search for microbial DNA on the wafer and linens from Bolsena, now enshrined in Orvieto.

Despite her apparent success, Cullen says "I don't think it totally throws the miracle out of the window"—since the priest found solace exactly when his faith was tested.