AVIAN INFLUENZA

Transgenic Chickens Could Thwart Bird Flu, Curb Pandemic Risk

The chicken soup of the future might just be made from transgenic birds that can't get bird flu—if regulators decide they're safe and consumers don't object. U.K. scientists have created transgenic chickens that can't pass on avian influenza, a disease that decimates poultry flocks and that flu scientists fear could spawn an influenza pandemic among humans.

The study, published in this week's issue of *Science* (p. 223), "is extremely interesting as a proof of principle," says Timm Harder, a bird flu researcher at the Friedrich Loeffler Institute in Greifswald, Germany. But whether the chickens and their eggs are safe to eat—and whether the public will buy them—is an open question, Harder notes.

Avian influenza, which comes in many different subtypes, is primarily a disease of wild birds, but it occasionally ends up infecting poultry flocks, in which so-called highly pathogenic strains can spread like wildfire. For the virus, infected poultry flocks are a potential bridge to the human population, and the worry is that avian viruses could trigger a pandemic if they adapt to humans, says Laurence Tiley, a molecular biologist at the University of Cambridge in the United Kingdom and the last author of the new paper. The team also included scientists from the Roslin Institute and the Royal (Dick) School of Veterinary Medicine, both part of the University of Edinburgh, and the Veterinary Laboratories Agency in Weybridge.

Tiley and his colleagues equipped chickens with a so-called RNA-expression cassette, a piece of DNA that makes the birds produce a small, hairpin-shaped piece of RNA that acts as a decoy to polymerase, a key viral enzyme. Instead of binding to the virus's genome, which it helps replicate, polymerase now attaches itself to the hairpin RNA, rendering the enzyme useless. When transgenic chickens were exposed to the deadly H5N1 flu virus, they still succumbed to it. But they didn't pass the virus on to healthy cagemates—neither regular nor transgenic.

That means that only one or a few chickens would become infected if H5N1 entered a flock—in itself a big improvement, says Tiley. But the ultimate goal is to make the chickens completely impervious to the disease by adding several more gene constructs, as well as to introduce resistance against Newcastle disease and Marek's disease, two other viral threats.

Tiley and his colleagues chose their decoy carefully: It matches a short sequence on each of the eight genetic elements of the viral genome to which polymerase binds. To overcome resistance, the virus would have to change not only its polymerase enzyme but also the binding sequence in all eight gene segments, which Tiley says is extremely unlikely. It's "a smart strategy," says Carlos Lois of the University of Massachusetts Medical School in Worcester, but perhaps not foolproof, given that flu is a

RESEARCH FUNDING

Japan Boosts Competitive Grants at Expense of Big Science

TOKYO—Under what Prime Minister Naoto Kan calls "a budget for the reinvigoration of Japan," the country's main research grants program is slated for a whopping 32% increase to $3.2 billion in the coming year. Rank-and-file researchers are sure to be pleased with the better odds of winning support under the fiercely competitive program, says Kazuaki Kawabata, the education ministry's director of research and development policy.

With an emphasis on social welfare spending and "innovative research" to stimulate the economy, the record-breaking $1.1 trillion budget for the fiscal year starting in April is the first drawn up from scratch by Kan's Democratic Party of Japan, which captured the legislature in August 2009. Government-wide science spending has yet to be compiled. But the education ministry, which oversees most research, will see its S&T budget rise 3.3% to $20.2 billion. "Given the nation's fiscal circumstances, I think we have to be very grateful," says Kawabata.

The biggest percentage increase is going to Grants-in-Aid, the main source of support for individuals and small groups. In recent years only 20% of grant applications were successful, leaving a lot of deserving research unfunded, says Kawabata. In addition to giving the program its biggest single-year boost since its establishment in 1965, the administration is planning to relax rules requiring grants to be spent in the year they are awarded. Researchers have long wanted more flexibility in managing money.

In response to other requests from the scientific community, the new budget will expand existing programs and add new ones to foster the career development of younger researchers and ease the return of women to the research workforce after maternity leave, with support growing 5.4% to $414 million.

The Democratic Party's strategy to lean on research to spur economic growth is evident in its support for "innovative" research in life sciences and green technologies, which is rising 9% to $932 million. The portfolio includes stem cells and other aspects of regenerative medicine, next-generation cancer treatments and neuroscience, and creation of a new program under the Japan Science and Technology Agency that will look for "game changing" research in areas such as cost-efficient solar panels, says agency president Koichi Kitazawa.

For rent. A tight budget means the scientific drilling vessel *Chikyu* will spend half the year leased out for oil exploration.

CREDIT: JAMSTEC/IODP

Published by AAAS

Flu fighters. These transgenic chickens still die from bird flu; the ultimate goal is full resistance.

"master of mutability."

Flu-resistant chickens would have several advantages, says Harder. Bird flu vaccines work against only one subtype, they need to be updated frequently as the virus evolves, and they don't fully protect against infection, giving the virus a chance to spread silently. Flocks with built-in resistance would put an end to all that.

Transgenic chickens could theoretically replace nontransgenic breeds worldwide in a few years, says Michael Greger, director of Public Health and Animal Agriculture at the Humane Society of the United States located in Washington, D.C. That's because the trade in both broiler and egg-laying chickens has become consolidated in a handful of companies, which essentially determine what stocks are used by chicken farmers worldwide.

But Harder points out that these companies don't sell to the vast number of people in the developing world who have a small flock in their backyard or on their rooftop—and that's where avian influenza has been the most difficult to control. The strategy for reaching these small holders, says Tiley, would not be to make them buy their stock from big breeders; instead, he says, it should be possible to provide them with flu-free chickens that they can breed themselves.

–MARTIN ENSERINK

CREDITS (FROM TOP): THE ROSLIN INSTITUTE/UNIVERSITY OF EDINBURGH; PHOTOS BY NORRIE RUSSELL; (SOURCE) MINISTRY OF EDUCATION

For big science, however, the budget offers a mixed bag. Soon after coming to power, the Democratic Party staged a series of hearings that questioned spending on space, earth science, and a next-generation supercomputer (*Science*, 20 November 2009, p. 1046). The new budget, plus money from a supplementary budget adopted last November, provides funding to keep the supercomputer, planned to be the world's fastest, on track for completion in 2012.

JAPAN'S S&T BUDGET UPS AND DOWNS

Basic Grants	▲ UP 32%	to $3.2 billion
Life and Green Sciences*	▲ UP 9%	to $932 million
Young/Women Scientist Aid	▲ UP 5.4%	to $414 million
Major Facilities Construction	▲ UP 2.7%	to $965 million
Space Programs*	▲ UP 0.8%	to $2.2 billion
Earth Sciences	▼ DOWN 2.4%	to $631 million
Atomic Energy	▼ DOWN 3.7%	to $2.5 billion

*These items include support from a supplementary budget.

Winners and losers. The education ministry's science budget will rise 3.3% to $20.2 billion in 2011, with small grants winning the lion's share of the increase.

The space budget will rise a slim 0.8% to $2.2 billion, including $36 million to begin development of a second asteroid-return mission to succeed the Hayabusa sample-return project. Previous administrations had rejected a follow-up to Hayabusa, which was once thought lost in space. But popular interest after the craft returned to Earth this year with asteroid dust apparently warmed political hearts.

Other big science efforts are in for a rough ride. Spending on atomic energy research will drop 3.7% to $2.5 billion. And polar, oceanographic, and earthquake research is being squeezed 2.4%, to $631 million, including a roughly 4% cut for the Japan Agency for Marine-Earth Science and Technology (JAMSTEC), to $433 million. It will be the second annual budget cut in a row for JAMSTEC, which operates the deep-ocean drill ship *Chikyu*. Asahiko Taira, a JAMSTEC executive director, says each of the agency's divisions will have to tighten its belt. And they plan to lease *Chikyu* for commercial oil drilling for half of the year.

The budget will go before the legislature for approval this month. **–DENNIS NORMILE**

ScienceInsider

From the *Science* Policy Blog

The *British Medical Journal* has accused gastroenterologist Andrew Wakefield of committing scientific fraud in the publication of a **1998 paper in *The Lancet* linking vaccines to autism**. The paper had previously been retracted after a government investigation. http://scim.ag/Wakefield_inquiry

Despite a grim employment picture for would-be academic researchers, an outside panel says that the U.S. National Institutes of Health (NIH) should **maintain or even increase the number of graduate students and postdocs** it supports. It's part of the latest review by the National Research Council of NIH's main training program, the National Research Service Award. http://scim.ag/more-NRSA-awards

A new study by the U.K. Academy of Medical Sciences finds that British **biomedical researchers are drowning in paperwork**. The study suggests a new independent agency to coordinate and streamline the system. http://scim.ag/UK_paperwork

New White House Chief of Staff William Daley believes that **optimizing the federal innovation enterprise** might require "reorganization" of agencies. "You can't understand how screwed up it is," he said last month. Daley also defended a private-public joint research program from opponents on Capitol Hill during a stint as commerce secretary in the late 1990s. http://scim.ag/Daley_named http://scim.ag/Daley_ATP

The America COMPETES Act, which President Barack Obama signed last week, seeks to **strengthen education programs at NSF** with changes to graduate training programs, more support for undergraduate research, and a new program to train prospective science teachers. Meanwhile, Energy Department officials were glad that the final version of the act, though stripped down, authorizes small but steady increases for the Office of Science through 2013. http://scim.ag/COMPETES_ED http://scim.ag/COMPETES_DOE

For more science policy news, visit **http://news.sciencemag.org/scienceinsider**.

Published by AAAS