antigens that will give protective responses against other diseases. And multivalent vaccines—providing protection against several diseases—will also be feasible, since it is possible to insert close to 20 foreign genes into the pseudorabies genome and still maintain viability, adds McDonald.

Syntro's human vaccine program is not as advanced, but again centers on herpes viruses as vectors. One of these, cytomegalovirus (CMV), is a particularly good candidate, explains McDonald, because it is relatively benign, replicates well in humans, has a narrow host range, and is amenable to engineering. The company is harnessing CMV as a potential drug delivery agent for treating infectious diseases. Parmeter explains that because the use of live viral vectors is a sensitive area—and may continue to be so—Syntro is targeting its human vaccines against diseases that are non-indigenous to the U.S. and those for which there are no other solutions. The first of these is likely to be for malaria.

By far the most popular vector for live viral vaccines is vaccinia. The technology for designing these vectors has been developed independently by Bernard Moss (National Institute of Allergy and Infectious Diseases, Bethesda, MD) and the team of Enzo Paoletti (New York State Department of Health, Albany) and Dennis Panicali (Applied bioTechnology, Cambridge, MA). Vaccinia vectors have been successful in generating immunity in experimental animals to a wide range of viruses, including hepatitis B, influenza, rabies, Friend murine leukemia, herpes simplex, respiratory syncytial, vesicular stomatitis, and HIV. The cloning scheme is common: a viral glycoprotein gene(s) is stably integrated into a nonessential part of the vaccinia genome (so the virus will remain infectious). The inserted gene must be aligned with the vaccinia promoter sequence, which regulates transcription of the foreign gene. Infected cells express both vaccinia and foreign protein coding sequences. Like pseudorabies virus, the vaccinia genome can tolerate the insertion of close to 20 foreign genes, while retaining its activity and expressing the foreign proteins correctly. As vaccines, recombinant vaccinia vectors have an equally important attribute: they are able to stimulate both humoral and cell-mediated immunity.

There is some fear, not yet quieted, that recombinant vaccinia vaccines could potentially elicit some of the same side effects as the vaccinia-based smallpox vaccine, including encephali-

titis. Engineering of recombinant, attenuated strains—for human and veterinary use—should overcome this drawback.

A pseudorabies-vaccinia vector being developed at Applied bioTechnology (Cambridge, MA) is nearing large-animal studies, having proven highly efficacious in murine challenge studies. Vice president of R&D Panicali explains that his group has devoted considerable time to developing the most attenuated and host-range-limited vaccinia vector possible. The company is also developing vaccines for swine and canine parvovirus, equine herpes, and feline panleukopenia.

In the human arena, Applied bioTechnology has targeted leprosy, tuberculosis, and AIDS. Panicali says that their model system for human immunodeficiency virus is simian immunodeficiency: the two are being studied in parallel. He explains that, because monkeys develop the disease (whereas chimpanzees don't), the simian model will be useful to investi-

gate whether, for instance, vaccinating animals that are seropositive but disease-free will prevent the disease from occurring.

The same techniques that are used to generate recombinant vaccinia vectors are also applicable to other members of this virus family, especially fowlpox. Applied bioTechnology, in conjunction with Battelle Memorial Institute (Columbus, OH), is developing a variety of vaccines for poultry diseases. Although fowlpox virus can only replicate in avian cells, recent work by Paoletti and his associates has proved that a recombinant fowlpox vector *can* express foreign genes in non-avian cells—in this case, rabies glycoprotein in human or monkey cells. Moreover, recombinant vaccines are able to protect experimental animals—including dogs, cats, and mice—from challenge with live rabies virus. Because the fowlpox vector does not replicate in animals, it may prove very useful as a delivery vehicle—while eliminating the safety concerns.

—Jennifer Van Brunt

ACADEMIC SHUFFLE

MIT CLOSES 'BIOTECH' DEPT.

CAMBRIDGE, Mass.—Everyone makes New Year's resolutions, but the one that emanated from the Massachusetts Institute of Technology (MIT) this year was a bombshell. In early January, MIT's dean of science announced plans to close the Department of Applied Biological Sciences—home to such world-class researchers as Charles Cooney, Alexander Klibanov, Robert Langer, Arnold Demain, and Dan Wang.

In the judgement of MIT's president, provost, and dean of science, the department lacked focus. According to Dean Gene M. Brown, just as "biotech is a term, not a discipline," there can be no such thing as a biotechnology department. With the department's small quota of faculty members—never to exceed 20—it would be impossible to cover all the disciplines that biotechnology encompasses.

The plan is to redistribute Applied Biological Sciences' resources—facilities and faculty—to strengthen other departments. The tenured faculty will be reassigned, while the non-tenured members will be dealt with on a case-by-case basis, says Brown. He stresses that the appointments of the non-tenured faculty (which range up to three years) will be honored, and graduate students will not be left hanging. Brown makes it quite clear that he intends to accomplish the transition—which might take about

18 months—painlessly.

What's the faculty reaction? "So far," says Brown, "I have received no angry or bitter responses." The general feeling seems to be one of surprise and disappointment. For some faculty, the issue is still too sensitive to discuss. For others, who were out of town at the time of the pronouncement, the news is still too fresh for them to have analyzed its implications. Wang, who heard the news from friends, was "very surprised." So was Cooney, who had "no idea" that such a decision was being considered. Langer, on the other hand, says he expected it might happen *someday*. Langer is adopting a wait-and-see attitude, but has "every expectation that it will be a simple reshuffling."

The faculty were not the only ones caught by surprise. So were members of the department's visiting committee, who annually review the department's problems and progress and advise MIT's senior administration accordingly. Committee member Richard Mateles, vice president for research at Stauffer Chemical Company (Westport, CT), says he would have expected such a decision to be discussed at all levels.

Whatever the fate of the soon-to-be disbanded department, the reshuffling should not affect the future of MIT's Biotechnology Process Engineering Center, which was founded in 1985.

—JVB