Biotechnology at OSU

Ready to play in the big leagues

Dispatch graphic by Mary Knueven
Football is fun, but genetics will shape the future. Can Ohio State University play with the big boys in both leagues?

Martin Kenney and William Jensen, both new to the campus this fall, know more than a little bit about the high-stakes scientific competition in biotechnology.

"Ohio State is a little late, but obviously there are some areas — such as agriculture — where, with an aggressive program, we could get, maybe not to the top of the heap, but very close," said Kenney, a specialist in the impact of biotechnology on rural economies and the Third World.

But apart from agriculture, Kenney thinks Ohio State's fledgling biotechnology program comes too late to catch up with established powers such as Harvard University, the Massachusetts Institute of Technology and the University of California.

"Those boys are just too far ahead," he said.

But Jensen, a UC botanist just hired as the dean of OSU's College of Biological Sciences, has a different view. "There's a lot of enthusiasm for change here," he said.

"Look, I was at a good university, I had an established position. I'm not exactly a fool. But I saw that there was something here to work with. I got the feeling this place is ready to move."

The competition may not be half as important as the challenge, said Max Lennon, OSU vice president for agricultural administration.

"Because of biotechnology, there are some bright, bright answers there (to U.S. farm problems)," Lennon told a seminar group last month. "Isn't that fascinating? It is to me. In my lifetime, I haven't seen anything with this kind of possibilities."

BIOTECHNOLOGY is one of those scientific whirlwinds that burst upon the public agenda before people even know what it means.

In broad terms, it is the manipulation of genetics and biological systems to manufacture a wide variety of products — from lubricants to pharmaceuticals — or to alter the growth and commercial value of plants and animals. It also includes the development of microorganisms that can initiate chemical processes important in such varied fields as medicine and pollution control.

"There's a tendency to underestimate it, to support it as a thing or a product, and it's not," said Thomas Wagner of Ohio University, a molecular geneticist widely known for his work in animal gene transfers.

"Biotechnology is a fundamental new methodology," Wagner said. "The only thing you can compare it to is the use of fire. It's going from chemistry and energy systems to biological systems (in manufacturing), and a lot of us believe it will be the fundamental production method of the future in all areas."

U.S. investment in the commercialization of biotechnology topped $1 billion in 1983, even though the first U.S. genetics firm only organized eight years ago, reports the U.S. Office of Technology Assessment.

"Research over the next 10 years may yield an increased understanding of the mechanism of carcinogenesis, genetic susceptibility to disease, the functioning of the immune system, the basis of debilitating diseases such as diabetes and arthritis, and some knowledge of brain function," said an OTA study last January. "Additionally, gene transplantation technology may reach a stage where some genetic diseases could be cured."

OSU MICROBIOLOGIST

John N. Reeve chaired a faculty committee that concluded in April 1983 that OSU had scattered talent in biotechnology but no concerted effort or plan to integrate those individuals into a biotechnology program.

The Reeve committee recommended building a biotechnology center and hiring an internationally recognized scientist to direct the work of a dozen or more specialists and to coordinate center programs with work in existing colleges.

The committee also recommended new departments and degree programs in biotechnology and at least $500,000 in new laboratory equipment.

Eighteen months later, Reeve is encouraged by the university's response.

"The general reaction I see is very positive," he said. "For a long time, biology did not get much visibility on this campus. But this is now an area the university can't ignore. It's absolutely an essential issue in view of the way the world is developing."

THE SEARCH for an OSU biotechnology director has produced two candidates: chemical engineer George T. Tsao of Purdue University and microbiologist Ananda M. Chakraborty from the University of Illinois Medical Center.

Tsao, director of Purdue's Laboratory of Renewable Resources Engineering, is an expert in alternative fuels. Most recently, he announced an experimental process to convert plant sugars into synthetic petroleum.

Chakraborty, professor of microbiology and immunology, has pioneered research in the use of microorganisms to decompose toxic wastes. In 1980, he was awarded a patent on a micro-organism to decompose oil spills, the first such patent ever allowed by the U.S. Supreme Court.

Both men have visited the campus several times, and the decision now lies with Provost Diether Haenick and President Edward Jennings.

The center itself reportedly will be built on West Campus, allowing construction of a second biology building — for classrooms and research offices — next to the existing Biological Sciences building on east campus.

NEW FACES are already ap-
This would include a $12.6 million increase for the OARDC in Wooster, with $6.9 million earmarked for basic studies and biotechnology.

At the same time, Ohio agribusiness is being urged to increase its investment in research and development to counter the strong challenge from foreign producers to a number of traditional Ohio farm markets.

"We're doing what we have to do to stay good in agriculture," Lennon said. "We have to have the biotechnology aspect in our college or we will be incredibly weak, exercising only half of our potential."

OHIO STATE is working closely with parallel programs at the Battelle Memorial Institute in Columbus, Ohio University in Athens and the Case Western Reserve University medical school in Cleveland.

Last summer, OU won a $3 million Edison Partnership Program grant from the state to develop an animal biotechnology center in Athens, and one of OSU's top animal scientists, Fannie A. Murray Jr., moved over to that program.

At the same time, the Edison board passed over Lennon's bid for $3 million to establish an agricultural biotechnology center at Ohio State.

There's "a healthy competition" between the two Ohio campuses, said Lennon, but cooperative animal genetics programs are continuing, and recruiting efforts are being coordinated to avoid duplication.

"In a practical sense, what OSU will be able to do will be determined by the people we can recruit," said Reeve. "What people forget is that the whole field of molecular biology is no more than 30 years old. . . . And the majority of people who are 35 and older were educated before molecular biology was a recognized science, so it's very difficult to find senior scientists in this area with an established reputation."

"Ohio State got caught with its pants down (on biotechnology)," said Kenney. "I think that's been recognized, and I think there's a big push on to do something about it to keep Ohio State a great university in national terms."
Report suggests University's role in biotechnology

By Earle Holland

If University administrators agree with a faculty committee, Ohio State could have a thriving biotechnology program, complete with a functioning research facility within two to three years.

That's what the ad hoc Committee on Biotechnology Planning recommended after looking at the potential the institution has for capitalizing on this growing research area.

In reviewing the current state of biotechnology studies at Ohio State, the report stated that "individuals are scattered in several colleges" throughout the institution.

The "focal group" of a biotechnology program could be drawn from the microbiology, biochemistry, genetics, botany, and entomology departments as well as members of the interdisciplinary Molecular, Cellular and Developmental Biology Program.

Other current researchers could be drawn from the chemistry, chemical and civil engineering departments, the College of Agriculture and the Pharmaceutical and Toxicological Research Institute on campus.

"What we have to do absolutely is to have one effort," says John N. Reeve, committee chairperson and professor of microbiology. "To have more than one effort in an area where competition is so intense is just nonsense."

"If we have one effort and if we are very clear as to what our strengths are already and where we would like to go, then we have a good chance to really create something very beneficial for everyone." Committee members fear that biotechnology companies will continue to hire premier faculty away from the University, depleting a supply of experts that is already sparse at best.

Reeve said that several Ohio State faculty in the field have been lost to industry already.

"The loss of faculty to industry isn't uncommon on a college campus," Reeve says, "but our supply of researchers in the biotechnology areas is fairly limited."

The report's recommendations include the following:

- A research-oriented, internationally recognized scientist should be hired as director of the Biotechnology Program at Ohio State to oversee biotechnology activities on campus;
- Ten to 15 new faculty should be recruited to strengthen those areas that are under represented or not established at the University. Those new faculty should have expertise in plant molecular biology, microbial fermentation, biological engineering, and protein/nucleic acid structure and function;
- The University should take advantage of the established strength within the College of Agriculture in the actual application of biotechnology;
- The biotechnology program should be centralized and a physical facility to house it, a Biotechnology Center, should be created through capital funding;
- The University should be willing to commit approximately $500,000 for the additional equipment that new faculty in these fields would need. An additional $200,000 would be required for other specialized equipment;
- "Biotechnology" should be offered as an undergraduate minor in several related departments. The committee suggested that a M.S. program in biotechnology might be considered but a Ph.D. program was not recommended;
- A Biotechnology Program Committee should be created, consisting of at least one faculty member from each department participating in the program, to determine which courses would be acceptable for a "minor" in biotechnology. Such a committee would be chaired by the Biotechnology Program Director.

The committee listed the areas that could be developed in the immediate future as "molecular biology of higher plants using in vitro DNA handling techniques and plant tissue culture; use of novel biochemical and immunological procedures on an industrial scale for product isolation and purification; and construction and exploitation for products of novel species of higher animals and plants."

Reeve pointed out that another area not mentioned in the report, the conversion of the new technology achieved in the laboratory to something that is commercially viable, holds great promise for the future.

"In fact," he says, "a major stumbling block now is the design and development of the physical machinery necessary to take microbial genetics up to an industrial scale."

The committee report explained that "the concept of biotechnology is so broad that a Department of Biotechnology does not seem appropriate. However, status as a center or institute may be correct.

"We decided early on not to dwell on the precise question of whether it should be a center, institute or whatever, 'because it would have bogged us down in discussions over administrative terminology," Reeves said.

"The concern of the committee is that biotechnology be centralized as a strong element within the University under the auspices of the Provost," the report explains.

The committee also pointed to the close but informal relationship that has developed between biotechnology researchers at neighboring Battelle Columbus Laboratories and those at the University. Members urged the University to become more directly involved in working with Battelle.

While the field of molecular biology "is fragmented at Ohio State," it continues to be the "driving force behind the biotechnology revolution," the report says.

While formation of a biotechnology program shouldn't depend on a reorganization of molecular biology on the campus, the committee recommended, "that the College of Biological Sciences should consider a reorganization to create a Department of Molecular Biology."

Time is a major factor in how successful a biotechnology program would be at Ohio State, the report explains. The University must "begin immediately" if it is to develop biotechnology as "an area of excellence."

The committee submitted its report in late spring to Provost Diether Haenicka.
Faculty meets to map future of biotechnology

By Cheryl Pentella

About 150 Ohio State faculty researchers interested in biotechnology recently gathered to discuss the University's future plans and expectations for this field.

The meeting was a means of gauging faculty opinion on the direction Ohio State should take in expanding biotechnology efforts here. According to Provost Diethe Haenicke, vice president for academic affairs and the sponsor of the meeting, the future of biotechnology research at Ohio State is contingent upon the input of faculty members.

Haenicke shared the platform with Jack Hollander, vice president for research and graduate studies, Patrick Dugan, dean of the College of Biological Sciences, Heinz Floss, chairperson of the Department of Chemistry, and Max Lennon, vice president for agricultural administration.

"I hope we don't appear so much as speakers on a platform but listeners. Because an important aspect is, of course, that we want to know what the ideas of the faculty are and what appears to you to be the best avenue of approach to take," Haenicke said.

Most of the issues raised during the meeting centered around the development of a biotechnology center at Ohio State and the role of a biotechnology program director. A search committee, appointed by Haenicke, is currently seeking applicants for the new post.

The questions posed by the faculty provided an overview of the status of biotechnology research on campus.

Bruce Zwilling, associate professor of microbiology, asked the panel what has been done, to date, to evaluate the University's strengths and weaknesses in biotechnology so that funds can be targeted to prevent "pouring dollars into a massive sponge which essentially dilutes your efforts."

According to Haenicke, the administration prefers the new biotechnology director to approach the subject with a "fresh" outlook and to begin that assessment process.

"Very few people in the central administration can make these specific recommendations. We need someone who can analyze it in a broader, less parochial fashion... Someone who can survey the land and make assessments," Haenicke said.

Meanwhile, the provost's office has contacted deans in every college to compile preliminary information on faculty involved in biotechnology to begin building a network of researchers that will participate in the development of the center and ultimately its operation.

The Colleges of Agriculture, Biological Sciences, Medicine, Engineering, Pharmacy, and Mathematical and Physical Sciences currently are involved in a vast array of biotechnology-related research at Ohio State.

Zwilling also expressed concern that unless the University is willing to commit a significant amount of funds to the program, the effort may amount to little more than "tokenism."

Haenicke noted that the president is willing to give substantial financial support to the effort. The strength of that commitment is evident in the Ohio Eminent Scholars Program proposals before the Ohio Board of Regents, the provost said.

Three of the 13 Ohio State proposals that have made it into the final screening are biotechnology-related including plant biotechnology, molecular genetics, and an animal biotechnology program. If the regents select these programs, Ohio State must allocate approximately $500,000 for each new endowed chair, plus funds for equipment and other support, to qualify for state matching funds that will allow the University to hire scholars in these areas.

Philip S. Perlman, professor of genetics, raised the question that he feels is likely to be on the minds of the future candidates for the biotechnology director's post when they visit the campus. "Where is the biotechnology center?"

"It will not be here when this new person arrives on campus," Haenicke said, adding that while space has been planned between Parks Hall and the Biological Sciences Building, there are no firm figures on how much space will be needed, another task that will be left up to the new director.

At the time of the meeting, the search committee had received 42 applications and was awaiting responses from 20 additional nominees who had not actually applied for the position, said Dean Dugan, chairperson of the committee.

The committee hopes to have the director selected and approved by October.

The committee is seeking candidates with a "high-level of scientific competence in a biotechnology related area, administrative skills and interdisciplinary skills," Dugan said prior to the meeting. "We are looking for someone with a broad view, an understanding of the panorama of what constitutes biotechnology within the University setting," he added.

Zwilling noted that the "heterogeneity" of Ohio State's biotechnology effort raises difficult organizational questions and contributes to a lack of collaboration between researchers.

According to Heinz Floss, the University's biotechnology director must be able to foster strong communications between the various disciplines.

"In developing a campus-wide biotechnology program, one of the most important elements of a successful program is not only to invest resources in attracting more talent and building better technical facilities, we also have to foster very active communications between the practitioners of biotechnology," Floss said.

At present, he observed, Ohio State's biotechnology effort is characterized by a notable lack of interaction and cohesiveness between different disciplines.

"An essential aspect of building a coherent program is to bring people together from diverse units," he added.

The individual charged with that responsibility must be able to reconcile a very broad constituency involved in research on campus and form discussion groups that share a common interest in certain areas of biotechnology.

As part of that effort, Floss feels common facilities are necessary. "It is very important to set stages where people will naturally want to go and interact," he added.
Some participants at the meeting questioned whether the administration had decided that Ohio State's biotechnology effort will take place in a center or will be designated as a program conducted under the auspices of an existing academic unit, a determination that could influence the dissemination of funds for research.

According to John N. Reeve, professor of microbiology who chaired the Ad Hoc Committee on Biotechnology Planning, the committee, in its April 1983 report, chose not to classify the entity as a center, program or institute.

But, by its definition, a center could allow for a more integrated mechanism, Haenicke added.

He envisions a center with its own budget to distribute funds and positions in "creative, imaginative ways." For example, the center could invest in special laboratory equipment or personnel to augment a particular research area by providing seed money and also encouraging individual units that would benefit from the purchase to invest as well, Haenicke added.

In the immediate future, the biotechnology effort is unlikely to produce a degree-granting program or department. However, Reeve anticipates that over time a sequence of courses will be developed to allow students to emphasize biotechnology as a minor within their chosen field of study.

For its part, the College of Agriculture has already begun to make long-range plans to strengthen its biotechnology effort, said Max Lennon.

"We have believed for quite some time, that the agricultural application is probably the most likely commercialization of this technology," he said.

The college asked faculty "where are our strengths? How do we invest?" Lennon said. The faculty responded by organizing four groups that represent researchers focusing on animals, plants, food and waste to recommend how the college should invest its resources.

"The challenge that we have in agriculture is to invest in such a way that we can bring to the agricultural community the exciting discoveries that are now occurring in the basic biological sciences. We know that the way to be successful is to have faculty that are working as a team."

The college recently has established a working relationship with Battelle Columbus Laboratories to augment this effort. "We now have a signed linkage with Battelle in agricultural biotechnology. That means that we are going to join forces and to offer each other our support as we do our best to attract resources. We have, we think, significant opportunities both in the state of Ohio to attract industrial support as well as grants and federal funding."

Some faculty members indicated concern that agriculture's aggressive lead made it appear there would be directors for two centers — agriculture and the rest of the University.

Lennon assured the researchers that agriculture maintains a "very firm commitment" to the University-wide effort.

"We in agriculture cannot be successful unless we have the support of the University in general," he added.

According to Jack Hollander, the new frontier in biotechnology is characterized by its highly interdisciplinary nature.

While society has made use of biotechnologies for centuries, this latest movement relies heavily on the close tie between basic research and its practical applications, noted Hollander.

"It even crosses basic paradigms — that of basic research and real world problems. Its major challenge will be to tie together basic research with these real-world problems."

If the biotechnology center is to be a catalyst for a successful program, the University should concentrate its efforts on "main line" research areas, Hollander added.
Ohio State University is looking for top scientists and millions of dollars to improve its standing in the red-hot field of genetics and biotechnology, the manipulation of biological systems to make a product.

A faculty committee has proposed an ambitious program, including the construction of a biotechnology center on the Columbus campus and the hiring of at least a dozen new faculty members.

While there has been no public response from OSU President Edward H. Jennings, one backer said only the details have to be worked out.

"The commitment is there to do something; it's solid," said A. Max Lennon, OSU's new vice president for agricultural administration. At least in agriculture, he said, the money will be sought from federal sources and industry.

HISTORICALLY a leader in agriculture research, OSU has not established a reputation in genetic engineering or other technologies that are revolutionizing plant and animal breeding and major industries such as chemicals, food and pharmaceuticals.

According to J. Bruce Griffing, chairman of the OSU Department of Genetics, "We don't have more than two or three people, for example, doing work on recombinant DNA (the technique of recombining genetic material)."

Robert M. Mayer, a biochemist, said, "The foresight that was required five or 10 years ago to bring in faculty with that kind of expertise just wasn't there, but I think that's changing now."

CHANGES include:
- A new dean for the OSU College of Biological Sciences. Patrick R. Dugan, the microbiologist who's headed the college since 1978, will return to research and teaching.
- A new genetics chairman to replace Griffing, who is retiring.
- The hiring of new faculty researchers, some with national reputations, in fields such as animal, plant and food biotechnology; genetics; molecular biology; and biochemistry. The faculty study committee, chaired by microbiologist John N. Reeve, recommended 12 to 15 new scientists. Griffing said it could total 25 new appointments.
- A new OSU Biotechnology Center to pull together scattered and uncoordinated programs.
- Lennon said he hopes to increase the annual volume of OSU agricultural research to $50 million, from $24 million, within six years.

"OUR INTENTION is to bring the brightest minds available worldwide into our research group so our agriculture and agricultural research can compete in world markets," he said.

Lennon, agriculture dean at the University of Missouri until last spring, said OSU's agriculture research program is small compared to the importance of agriculture and food production in the Ohio economy.

"We have incredibly exciting research going on here... But unless we can move these discoveries into the food industry, we'll lose a significant portion of our industry to other areas."
Biotech
Its unusual growth at Ohio State

By Tom Spring and Earle Holland

Biotechnology really hit its stride two years ago.

The world was abuzz with the wonders of a new science offering new techniques for rebuilding Mother Nature's intricate realm.

Biotechnology is a direct descendent of the controversy that developed over recombinant DNA research.

Its proponents predicted disease-resistant crops, uniquely crossbred livestock, and huge vats producing enormous quantities of once rare biochemical resources—substances such as interferon, human growth hormone, and insulin.

Opponents considered the new synthetic organisms akin to Frankenstein's monster and promised legal action to protect the populace. They believed these new organisms would at best overpower existing plants and had a chance to look at the problems in a much more introspective way than many other institutions have," Reeve explains.

"We're in good shape. I think the institution is going to benefit from it [the delays] in the long run."

That this academic committee chair is generally pleased with these delays typifies how progress is sometimes made at a university.

More often than not, the direction a university takes in a particular field is just as dependent on influence sent up the chain of command as it is on a mandate from above.

The committee report called for the hiring of a nationally recognized researcher to head up a new interdisciplinary biotechnology research center. It suggested the hiring of more than a dozen new faculty researchers and acquiring nearly three-quarters of a million

plant, food, and environmental biotechnologies.

The animal biotechnology group seeks ways to use genes to regulate more precisely economically important traits in swine, poultry, and cattle. The animal biotechnology group has become the top biotechnology research group at Ohio State and one of the best animal research groups in the United States, says Lennon.

The plant group is exploring ways to alter plant growth, production, and health.

The food group is applying biotechnology to food processing to improve control and reduce costs.

The environmental sciences group is interested in the control and use of various wastes, energy retrieval, and pesticide degradation.

The major emphasis in all areas is to
animals. At worst, they become some hitherto unknown pathogen against which we would have no defense.

In part, both scenarios have partially come true.

Biotechnology is now producing a host of things once thought impossible. And it is doing so better and cheaper than is possible naturally.

Its opponents have taken the issue to court to keep what has proven beneficial in the laboratory from being tested in the wilds.

That hasn’t stopped corporations and universities from jumping on the biotechnology bandwagon in hopes of reaping a share of its fortunes. And who actually benefits from this competition to redesign life is yet to be seen.

When the new director of the University’s biotechnology center arrives on campus next year, it will represent the first recommendation to be implemented since a blue-ribbon panel submitted its plan in 1983 for making Ohio State a center for biotechnology research.

One success after nearly two and a half years seems hardly a record to celebrate, but John Reeve, the professor of microbiology who chaired the ad hoc committee on biotechnology planning, is anything but glum at the progress of this field on campus.

While the committee’s plan hasn’t been followed, biotechnology research has evolved steadily at Ohio State and has led to at least two, and maybe three, strong new research units.

“We’re really fortunate in that because of the long gestation period, we have
donars in new equipment and new academic programs to train researchers in this field.

There was also mention of a new building to house the center, or, at the least, redesigning campus space to accommodate it.

And when the report was made public, there was much talk about how the creation of a new independent research unit would mesh realistically and bureaucratically with other university programs

In reality, much has been accomplished that meshes nicely with the intent of the committee, if not its precise recommendations.

While one search committee concentrated on finding the best candidate for the job of campus biotechnology guru, other search committees in several departments were incorporating biotechnology research needs into their own deliberations. They did so by determining how both their needs and those of the biotechnology center could be served at the same time.

In some cases, this meant modifying the positions that were being filled. In others, it meant swapping a position or two from one department to another.

The most obvious example of this success comes from the College of Agriculture, where at least seven positions have been filled by new faculty whose work has a direct link to biotechnology research. Close to $1 million has been spent for salaries, equipment, and remodeling to accommodate new research.

Under the direction of Vice President for Agricultural Administration Max Lennon and with the impetus of an aggressive agriculture program, two new biotechnology research facilities have been created—an animal program area at

the Ohio Agricultural Research and Development Center at Wooster and a plant program area in Columbus.

In addition, four interdisciplinary biotechnology research groups have been formed. Those programs, drawing on existing college strengths, are in animal,

reduce production costs, increase product value, or both.

A strong economy, along with a desire to make Ohio State one of the top five agricultural colleges in the nation, requires biotechnology development, says Lennon.

“We must have available to Ohioans in food and agriculture a technology that will allow them to control costs in a very, very competitive marketplace,” Lennon says. “Biotechnology offers some exciting possibilities in cost control.”

Chuck Curtis, chairperson of the plant pathology department, says, “There’s a strong potential for biotechnology to significantly reduce our farmers’ needs for high capital, natural resources, and energy.”

According to Curtis, developing agricultural biotechnology programs, in addition to attracting students to the college, will enable the college to give farmers the information they need to compete and prosper.

“I think all of the colleges that are aware of the biotechnology program have been making policy decisions and faculty hirings on the understanding that this field is here to stay,” Reeve says.

“Although we have not activated a biotechnology center, the new director will find a university that is already very committed and is well on its way to integrating that program into the rest of the University’s activities.

“The University has made a lot of progress in recognizing that biotechnology is where a lot of the future in biology programs will be.”

In fact, Reeve sees the seemingly slow pace with which biotechnology has grown here as an advantage, a silver lining to a seemingly dark cloud. The delay in hiring a biotechnology director is a perfect example.

“I think to some extent it’s a credit to
the University that it insists on excellence, that it is not prepared just to fill the position. The people who have been considered are the very best available,” he says.

As to the other recommendations of the committee—the new research equipment and additional space for biotechnology studies—these haven’t stayed in limbo either.

While the specifics haven’t been decided yet, there has been discussion of relocating much of the biotechnology work to the West campus as academic classes are phased out there. And with that would probably come additional funds for specialized equipment.

The committee’s report had been general in its recommendations in most cases except one—the need for molecular biologists.

Since the report was completed, at least two academic departments and a state program have been involved in fulfilling that need.

The agronomy, botany, and plant pathology departments have been extensively recruiting molecular biologists during the past two years even though a formal biotechnology program hasn’t existed.

More importantly, two of the nine Ohio eminent scholars funded statewide by a special state of Ohio program are slated to be molecular biologists. These positions represent a clear recognition by
Patti Lorenzen, a research technician in the microbiology department's fermentation facility, adjusts one of several computer-controlled fermenters that are often used to synthesize antibiotics and to genetically manipulate the productivity of certain bacteria.

"I think people have had a chance to digest questions about the role of biotechnology here and to make their own sorts of decisions of how to proceed. "

"If we had just gone ahead and imposed a structure from above, it might have been much more of a problem in the long run."

Tom Spring is an associate editor in the Office of University Communications.
The political forge of public policy

In late 1983, environmentalist Jeremy Rifkin filed suit in federal court to block a proposed field test of a synthetic organism at the University of California.

The project involved releasing a genetically altered frost preventive bacteria on a small test plot of potato plants. Rifkin’s suit was based on the premise that an adequate environmental impact study had not been performed on the environmental effects of the experiment.

Ohio State’s Martin Kenney believes that the controversy over the project provides an ideal case study for regulatory policy-making regarding technological innovation.

Kenney, an assistant professor of agricultural economics and rural sociology, is spending this year studying exactly how government officials, researchers, industry, and environmental groups have interacted concerning this proposed field test.

“This study will establish a historical record of one of the most important environmental debates in history,” Kenney says, adding that, “perhaps thousands of new, synthetic organisms will be introduced into the environment in the foreseeable future.”

Kenney will collect copies of documents from at least four federal agencies and news reports in the public press that are relevant to the case. He also plans to interview the key players in this controversy including the researchers, environmentalists, legislators, and government officials.

When this information has been gathered, he hopes to plot the path by which the ultimate decision in this case was reached.
The selling of biotechnology—a chronology

The following is a rough chronology of major events surrounding the commercial development of biotechnology. While it isn't meant to be an all-encompassing review of progress in the field, it should provide readers with a good idea of how biotechnology came into its own as a commercially viable science.

1973: First gene is cloned.
1974: First expression of a gene cloned from a different species of bacteria.
1975: U.S. guidelines for recombinant DNA research are outlined at Asilomar Conference. The first hybridoma (a new cell made by fusing an antibody-producing cell with a cancer cell) is synthesized.
1976: Genentech becomes first firm in the country to exploit recombinant DNA technology.
1978: First product made using recombinant DNA technology, somatostatin, a hormone that inhibits the release of another hormone that controls growth, is synthesized.
1980: Diamond vs. Chakrabarty—U.S. Supreme Court rules that microorganisms can be patented under existing laws. Cohen/Boyer patent is issued on the technique for the construction of recombinant DNA.
1983: First plant gene expression in a plant of a different species is achieved.
1984: Judge John Sirica thwarts the scheduled environmental release of recombinant DNA organisms. Stanford University is awarded Cohen/Boyer patent on basic recombinant DNA process.
1985: Federal appeals court rules that National Institutes of Health could continue to approve genetic engineering experiments which were publicly funded. Privately funded researchers are not required to receive NIH approvals. Approval for field tests for deliberate release of organisms into the environment shifts from NIH to the EPA.

Sources: Commercial Recombinant DNA: An International Analysis, published by the Office of Technology Assessment, and Nature, the British weekly science journal.
Conference centers on capabilities

By Kristi Ferguson
Lantern staff writer

Faculty and students involved in biotechnology studies at Ohio State joined international experts from science and industry Wednesday for the second annual Biomedical and Agricultural High Technology conference.

About 150 guests registered for the conference sponsored by several departments of Ohio State.

"We're trying to demonstrate the overlap of biotechnology techniques across campus in areas such as medicine, chemistry, engineering, pharmacy, agriculture, dentistry, veterinary medicine and botany," said Donald Witkak, professor of pharmacy and pharmacology and chairman of the conference.

"Biotechnology is a natural for Central Ohio because we have one of the largest universities in the world with all the important fields on one campus," Witkak said.

The conference will also bring visibility to Ohio State's biotechnology research efforts and may attract high technology industry to Central Ohio, he said.

"Biotechnology will do a lot for us and everybody will be affected," Witkak said.

He said biotechnology will help solve some of the major diseases by enabling large quantities of the chemicals involved to be produced and studied. For example, he said, diseases of the central nervous system such as schizophrenia, depression and epilepsy are now just controlled with medicines and not understood very well because the chemicals involved in these diseases are produced in very small amounts in humans.

Biotechnology will enable scientists to study and understand the chemicals involved in these central nervous system diseases and find cures for them.

Faster growing plants and animals with stronger resistance will also be developed through biotechnology, Witkak said.

He said lawyers and communicators will also become involved with biotechnology in determining and reporting safety factors and developments to the public.

Presentations at the conference cover many technical areas, as well as social, economical and ethical issues of modern biotechnology.

Exhibits from industry, such as the architectural firm that planned Ohio State's cancer research center and research park for West Campus, as well as student projects, are also on display.

The conference will continue through Friday at the Hyatt Regency Hotel. For registration information call 422-4230.
Biotech plays key

By Kristi Ferguson
Lantern staff writer

As businesses, industries and universities continue to find biotechnology research more profitable, higher education may suffer, said Martin Kenny, professor of rural sociology.

Despite that most American universities receive less than 10 percent of their research support from industry, Kenny said biotechnology has become increasingly marketable over the last 10 years, and small companies have offered funding to university research programs and given stock to university researchers to gain priority or exclusive access to research results.

The company will use the new technologies to make more money, and its stock will grow in value, and then professors can make a profit by selling their stock, he said.

When this happens, graduate students can be exploited because their studies concentrate on research, and all students are going to have trouble relating to and learning from professors who are more linked to companies than universities, Kenny said.

Biotechnology is the commercial use of biological materials. Older commercial applications include using yeast and bacteria to make bread and cheese. Newer applications range from changing bacteria into insulin producers to creating new plants that can be patented.

These newer technologies were developed in university biology departments and have been very profitable for industry and the private sector since 1976 with the founding of Genetech, a California-based company which was the first to successfully market biotechnology, Kenny said. Many companies that market biotechnology have sprung up since 1976.

According to the most recent issue of the publication, Research at the Ohio State University, from 1983 to 1984, industry funded 8.3 percent of the university's total research.

"Universities in the United States, and in most countries, tell society the truth it doesn't want to hear. It is separated to some degree from the influence of business and government," Kenny said. "People look to universities to create knowledge and educate students, not make money. If universities get caught up in research secrecy, this will end."

Kenny spent three years interviewing and researching to formulate these conclusions in his book, "Biotechnology: The University-Industrial Complex," which was published in September. He has been a professor of rural sociology at Ohio State since 1984 and also conducted biotechnology research in Latin America, the Philippines, Europe and Japan during the last two years.

"My book is a demand that we look to see where this technology is taking us, before it's too late," Kenny said. "I tried to provide the background to start discussion and debate."

Kenny's concerns focus on the effects of biotechnology research results becoming more and more profitable.
role in industry

He said universities may also "sell" their biotechnology labs to the company offering the greatest funding for research.

"Universities must be concerned with such conflicts of interest," Kenny said.

In March 1983, an ad-hoc committee reviewed university and industry relations for research at Ohio State and adopted policies regarding conflict of interest, contract agreements and patents.

"Nothing of importance has changed since these policies were established," said Tom Sweeney, associate vice president for research and graduate studies.

Ohio State will be facing similar issues as it continues developing the biotechnology research unit established in September, Kenny said. Renovation of Rightmire Hall on West Campus for the Biotechnology Center will begin in December and faculty are currently being recruited.

"Our goal is a three-way partnership between Ohio State, the federal government and industry to promote and coordinate biotechnological activities," said Pappachan Kolatukkudy, professor of bio-chemistry and director of the biotechnology center.

"Most universities have formulated reasonable plans to allow their faculty to interact with industry. And biotechnology will have no different secrecy than, say defense research from the past," Kolatukkudy said.

"Interaction between faculty and industry is important because industry puts the technologies into use for society as a whole," Kolatukkudy said. "Increasing the number of our faculty that industry seeks is our goal, because that means they are the best."

Kolatukkudy said university faculty and administrators will discuss Ohio State's place in biotechnology and future goals at a planning conference Dec. 17. He said industry will be consulted, but will not participate in the conference.
In early May researchers at the University of Toledo reported that they had successfully transferred the genes of a bacteria into the chromosomes of a corn plant. It was the first time anyone had found a way to bioengineer the nation's No. 1 agricultural product.

The breakthrough is likely to produce disease-resistant varieties of corn, corn that grows in drought conditions, or corn with the protein content of beef.

In the next 20 years it may mean corn plants can be used as “factories” to produce pharmaceutical products, such as insulin.

“This work is just one small piece of the puzzle,” said Stephen Goldman, who, along with Anne Graves, carried out the research at the university. “From this point, useful transitions to make the plant more nutritious or better yielding are possible. This is just the edge,” he said.
Answers in biotechnology

Biotechnology is the long-range solution to agriculture's economic problems, according to scientists, such as Goldman, Tom Wagner, director of the Edison Animal Biotechnology Center in Athens, Ohio, and Tappachan Kolla-tukudy, director of the Ohio State University Biotechnology Center.

"Price supports are just Band-Aids for agriculture's problems. The long-term answers lie in the development of biotechnology," said Kollatukudy, whose 1-year-old center specializes in plant and microbe biotechnology.

"Biotechnology and agriculture are inevitably linked," said Wagner, who is researching animal biotechnology.

"Agriculture is the husbanding of life forms to generate marketable products. Biotechnology is the design and utilization of living organisms to generate marketable products. Biotechnology is going to make farmers more competitive," he said.

Scientists at the Edison center work in conjunction with researchers at Case Western Reserve University in Cleveland and the OSU Agricultural Research Development Center in Wooster, Ohio.

By inserting new genes into pigs, for instance, the group hopes it will develop leaner, faster-growing hogs.

The goal is to develop animals that will cost the farmer less to feed. It also will allow farmers to market more animals in a shorter time period.

EABG scientists also are working to develop chickens that won't be susceptible to viral diseases. Cutting losses from viral deaths, which number in the millions per year, will save farmers money, according to Wagner.

"If you can reduce feed costs by 25 percent and cut the storage space required for feed by 20 percent, you're going to dramatically increase profit margins for pork producers," he said. "If you can trim disease losses in chickens, you save poultry producers money."

Revolution to start slowly

"Most of the biotechnology revolution will not happen immediately," admitted Frederick E. Hutchinson, vice president for agricultural administration at OSU. "We're still learning at the cellular level what genes operate plants and animals."

"We understand how to cut and splice genes," said Kollatukudy. "We can transfer them to new chromosomes, but we still need to know which gene controls the trait we want to alter. We are Ohio State's Biotechnology Center, but the emphasis is on the big 'B.' Later we will focus on the little 't.'"

Kollatukudy said OSU is working on the interactions between soil microbes and plants. He said several departments at the university will cooperate on work that could eventually prevent bacterial diseases in corn or soybeans.

The OSU center will also be trying to enhance the relationship between legumes, such as alfalfa, and the soil bacteria that produce nitrogen on the plants' root nodules. Eventually, Kollatukudy predicts, non-legume plants, such as corn or wheat, will be altered to
produce nitrogen — in effect to create a self-fertilizing plant.

"For the farmer these things will cut inputs and increase outputs," he said. "The coming technology will change the agricultural industry dramatically."

But not all plant improvements from biotechnology reside in the distant future.

In October, Monsanto Chemical Corp. scientists harvested the first field tests of three types of genetically altered tomatoes. When the seedlings were planted in June, they didn’t show any signs of being different. By October the condition of the plants portrayed their genetic makeup.

In one test, a toxin-producing gene from a common soil bacteria was spliced into the chromosome of a tomato plant. The poison produced by the gene is harmless to humans but deadly to some caterpillars that attack tomato plants, including the tobacco hornworm. In rows beside tomato plants striped by the caterpillar stand plants where only a few bugs had killed the peace.

In another test, tomatoes were altered by the introduction of three genes to produce the protein coat of the tobacco mosaic virus, or TMV. Researchers placed the virus on the leaves of resistant and normal plants. All of the normal plants were infected with the disease. Only 10 percent of the resistant plants were injured.

TMV can cause an estimated $50 million in damage to the U.S. tomato crop, according to Monsanto scientists. Similar viruses cause about $500 million in damage to wheat and $300 million to potatoes.

Roger Beachy, the researcher from Washington University in St. Louis who developed the technique for TMV gene transfer, said he will continue experiments on other vegetables, rice and cereal grains.

Weeds die; tomatoes live

In the third test, Monsanto planted tomatoes altered to carry a gene that prevents damage from their herbicide, Roundup, which destroys weeds. The compound does not persist in the soil for long times, but is equally deadly to most plants. It works by interfering with photosynthesis.

"The weeds died, the tomatoes survived," according to Earle H. Harbison, Jr., president and chief executive officer of Monsanto.

According to the magazine Technology Review, Roundup-resistant plants will cut herbicide costs of California tomato growers from $130 an acre to $30 per acre.

"In agriculture, we believe that biotechnology offers the most exciting and dramatic prospect for improving the reliability and efficiency of farming since man first began tilling the soil," Harbison said.

Agrigenetics, a subsidiary of Lubrizol in Mentor, Ohio, has invested more than $10 million in agricultural biotechnology, according to Bruce H. Grasser, senior vice president for commercial development at Lubrizol Enterprises, the company’s wholly-owned venture development arm, also in Mentor.

"Since our first entries into the world of commercial agriculture coming in the next two years," said Grasser. "First it takes time to grow the seed supply necessary and, second, the farm market is very conservative. Growth will come slowly in this area.

Agrigenetics is working on improving the oleic acid content of sunflowers. Oleic acid is a monounsaturated fat believed to be helpful in preventing hardening of the arteries. The company is also working to improve the oil content of rapeseed for edible and industrial uses, and to alter corn genes to improve yields and stalk strength, according to Grasser.

Some call it playing God

The breakthroughs in biotechnology have produced numerous acquisitions of seed companies by chemical manufacturers. Grasser compares the situation to a pipeline. "The research goes in one end. Chemicals come out the other pipe, but the final product for the farmer is the seed. It’s the marketing vehicle for plant biotechnologists."

Grasser predicts biotechnology will make the farmer’s life easier. "If a plant is resistant to insects, the farmer doesn’t have to worry about how to apply chemicals. He doesn’t have to worry about timing applications so they won’t harm beneficial insects like bees."

"Biotechnology will simplify the life of the farmer," said Kollatukudy. "A cow is a cow. Now the farmer is selling milk. In the future he may be selling a pharmaceutical chemical produced by an alteration of the cow’s protein manufacturing genes."

However, Wagner said biotechnology is going to force the farmer to be a better manager. "Plants or animals with enhanced performance require more management per unit."

And biotechnology has its critics. "I call it playing God," said veterinarian Michael Fox, director of the Humane Society of the United States.

Even the organizations that represent farmers are split over biotechnology.

At the crux of the controversy is the question of patenting new animal life forms. In 1970 the Patent Variety Protection Act assured that biologically engineered plant products could be patented. Last April the Supreme Court upheld the patent rights for animals, too.

However, there have been several moves in Congress to override the court. "Patenting would create a whole new set of economic and legal head-
Royee Mohan, OSU graduate student, prepares to extract genetic materials from tomato samples.
aches for many farm families who would be potential consumers of new animals developed by biotechnology corporations. Stewart Huber, president of the National Farmers Union Milk Marketing Cooperative, told a subcommittee of the U.S. House.

Huber said patents would give a few large corporations exclusive rights to new animals whose development was possible only because of the vast amount of publicly-financed research on genetic engineering. Ann Sorensen, author of the American Farm Bureau Federation's defense of animal patents, said that the opposite is true.

"If genetically altered animals are denied patent protection, the livestock industry will become concentrated in the hands of a few. By protecting research investments, you provide maximum encouragement for small companies and individuals who otherwise could not afford to enter the area."

"Without patent protection the products of biotechnology would never be brought to the market," said Kollataky. "If you take them away, who will spend the money to develop these products?"

"Not Lubrizol. "Patents are critical for industry. If we can't patent a product, we have no way to recoup our costs to develop it," Grassner said.

And Lubrizol is not interested in becoming a farmer. "The farmer should do what he does best. We aren't interested in owning land. We will operate by contracting with farmers to grow crops for our market. We'll offer a guaranteed price and technical advice," he said.

Testifying before the Senate Agriculture Committee last week, Harbison urged Senators to recognize biotechnology as an economic opportunity for the nation. "There is something missing," he suggested.

"Many governments have formally recognized biotechnology and genetic engineering as important to the economic futures of their nations. In this country, by contrast, biotechnology is still perceived as a regulatory and legal problem, not an economic problem. There is no clear signal to 'go for it.'"
Biotechnology class offered for first time

By Jane Schmucker
Lantern staff writer

Biotechnology has been heralded as the wave of the future, it could supply a cure for cancer and the solution to third world hunger. But until this quarter, Ohio State did not have a class for students interested in the issues of biotechnology.

When Mark Lagrimini, assistant professor of horticulture, came to Ohio State a year and a half ago, he was surprised the university did not offer a course related to biotechnology. So he designed an introductory course for students from all backgrounds and majors.

Biotechnology is a science similar to genetic engineering. It is the application of molecular biology and genetic engineering to industrial, medical and agricultural problems.

While at work, a biotechnologist might develop a plant more tolerant to insects by introducing a new gene.

Lagrimini compares biotechnology to a computer. "It's not quite as pervasive as computers, but it's something everyone will deal with."

Current biotechnology research is something students need to be aware of to make informed decisions, he said. "Biotechnology decisions will need to be made everywhere from the doctor's office to the voting booth."

He recommends the study of biotechnology to students interested in business, engineering, communications and science.

"If I was a stockbroker I would want to know something about biotechnology so I could make decisions about companies in this field," Lagrimini said.

Although the course is offered under the horticulture department, it will deal with medical, ethical and financial issues as well as agricultural ones.

Jill Pfister, secretary of Agricultural Administration, said the College of Agriculture is very positive about the new course. "Every science oriented student ought to have it," she said.

Brooks Haderlie, a continuing education student from Columbus said he wants to get an update and an overview of biotechnology that he can apply to his work at Chemical Abstracts Service.

"It sounds interesting," he said. "It's something I can use."

The first third of the course will focus on the biology needed to understand the business, ethical and regulatory issues of the biotechnology work currently being done and projected for the future, Lagrimini said.

"Biotechnology is a scary word to some people," Lagrimini said. "Hopefully this course will give people a better understanding of it."

Biotechnology Issues, listed as Horticulture 294, is offered at 1 p.m. Monday, Wednesday and Friday in Koffolt Labs 205.

Mark Lagrimini, assistant professor of horticulture, compares tobacco plants used in his biotechnology research project. The plants are the same age but have genetic variations.
OHIO STATE, TRANSGENE JOIN IN GENE THERAPY PROJECT

COLUMBUS, Ohio -- The Ohio State University has joined a French biotechnology firm in a partnership that could lead to the commercial use of a new gene therapy approach.

The institution agreed today to sell a two year option to study the use of retrotransposon technology to TRANSGENE, a French biotechnology firm. The agreement allows the company to seek an exclusive license for commercial use of the technology. Ohio State has applied for a patent on the techniques.

The retrotransposon approach was developed by Clague Hodgson, former assistant professor of dairy science at Ohio State and at the Ohio Agricultural Research and Development Center, as part of a National Institutes of Health-supported project. Hodgson left the university in 1991 and is now chief of the division of cancer biology at the Creighton Cancer Center at Creighton University in Omaha, Neb.

Retrotransposons are mobile genetic elements that are able to carry with them specific therapeutic genes into cells or tissues. Current gene therapy research has centered largely on the use of retroviruses as the mechanism for carrying new genes into the cell. Retrotransposons provide a new and potentially effective vector for gene therapy. Presently, synthetic

- more -
derivatives of retrotransposons are being adapted for specific gene therapy experiments.

Gene therapy methods have been proposed for use against certain hereditary diseases such as muscular dystrophy and cystic fibrosis. A limited number of human experiments have been attempted and clinical trials involving gene therapy are expected in the near future.

TRANSGENE is based in Strasbourg, France. Created in 1980 by P. Chambon, Ph. Kourilsky and J.P. Lecocq, it has achieved several major targets in the domain of vaccines (rabies, HIV) blood coagulation (hirudin, Factor VIII and IX) and more recently gene therapy. With 130 people including 50 PhDs and senior scientists, TRANSGENE is one of the major European biotechnology companies.

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