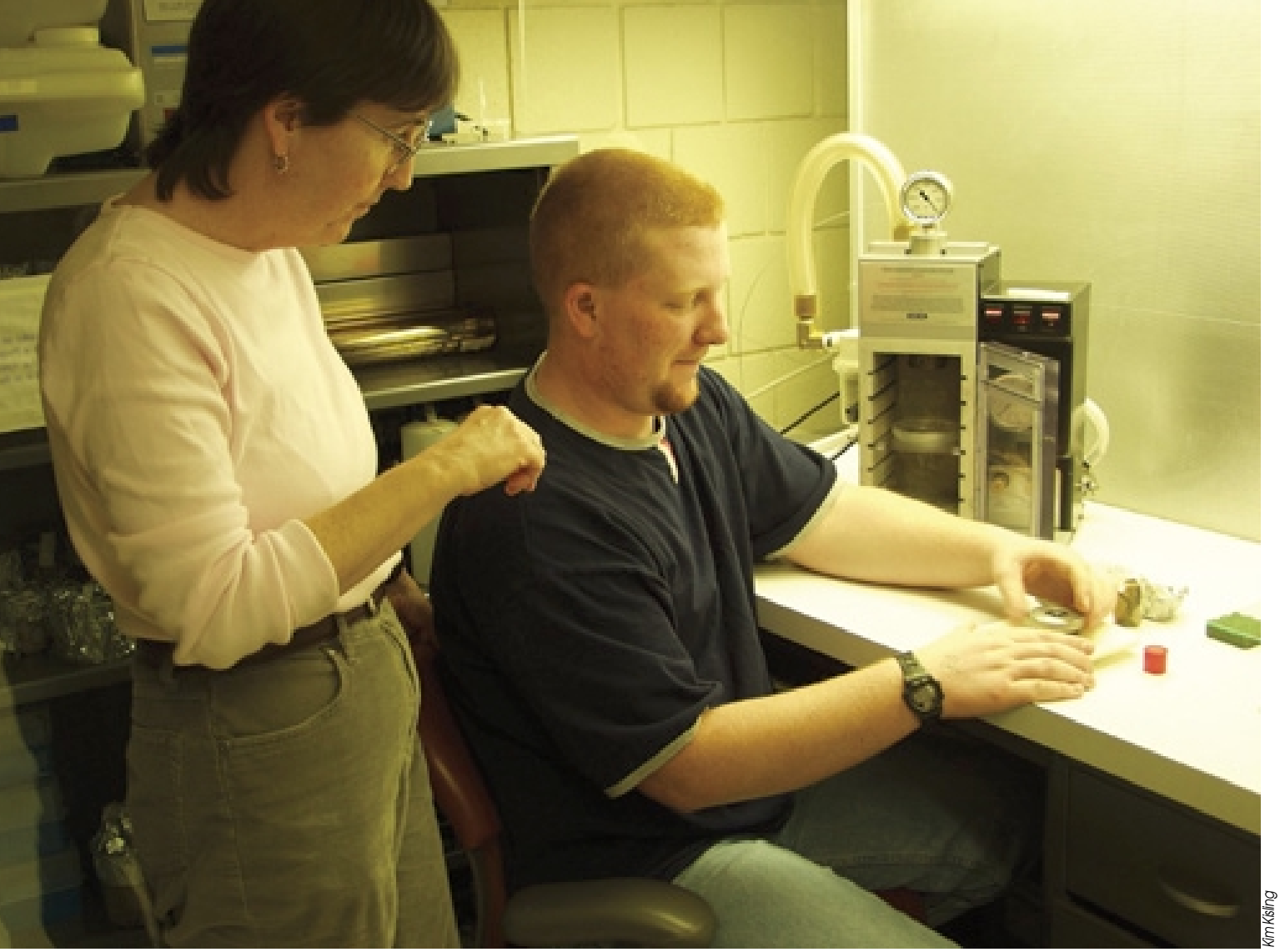


Kim Kisling

Colleen Sweeney and David King work to prepare the tissue for the plant transformation process that is done by the OSU plant and soil sciences' gene gun. The gene gun machine isn't the only way to transform plants, but Sweeney said it works best for the projects they are researching.

OSU researchers shoot into the future

Shhhhhhhhhhhh – pop.

The gene gun sounds off as Colleen Sweeney works to engineer a tiny speck of wheat to resist disease and fungi.

She meticulously maneuvers the newly developed wheat gene out of the machine and quickly recaps it to prevent dust particles and airborne microbes from spoiling her new creation.

"The gene gun isn't the only way to transform genes, but it's the most successful with certain kinds of material," Sweeney said. "The gene gun has been a great tool to allow students to learn the basics of biochemistry and molecular biology."

From an idea of Cornell University scientist John Sanford, Oklahoma State University is able to use the gene gun to genetically enhance wheat to be resistant to fungi, viruses and drought.

Plant and soil sciences senior David King takes part in the project and has gained valuable experience by genetically enhancing wheat.

"With the gene gun, we can begin to understand how the process works," King said. "The hard part of genetically engineering a plant is that only one out of a thousand of the cells will actually take the gene in and incorporate it into the chromosome."

The process of transferring genes is a controversial topic.

"We try to stick to the basics in order to stay away from the moral issue of whether it's right or wrong to genetically engineer genes," Sweeney said.

To get a gene that is resistant to a specific disease or fungus, researchers have to find a variety of wheat or grass that already contains the gene of interest. Then, they take it out and insert it into tissue of the plant they are trying to make resistant.

"We are currently doing research to insert a gene that is a quality improvement project to enhance the gene capabilities of wheat that are already present," Sweeney said.

What OSU researchers do in their labs are just the basics of science and the beginning of the cycle to create a genetically engineered product.

"Other researchers use our engineered plants to produce new varieties of wheat which the farmer grows," Sweeney said.

Sweeney said OSU researchers are using the $10,000 gene gun machine as a tool to accelerate a gene of interest into wheat tissue culture cells.

"The gene gun allows us to genetically engineer any plant by regenerating whole plants from cells or small pieces of tissue," said Arron Guenzi, associate professor of plant and soil sciences, who also conducts research with Sweeney.

Although it does not resemble a

Kim Kisling

Plant and soil sciences senior, David King, is researching wheat and learning how to genetically enhance genes of interest that already exist in plants.

handgun or shotgun, the gun consists of a highly pressurized upper chamber and a low-pressure lower chamber with a diaphragm in the middle.

When the diaphragm is punctured, pressure from the upper chamber emits a shock wave that hits the projectile, discharging it forward until the projectile hits a porous screen, which stops the plastic disk.

The DNA-coated gold particles hit the targeted cells at a velocity high enough to puncture the cell wall and membrane. The genes are released and diffused into the nucleus of the cell.

Once the gene enters the nucleus, it is incorporated into a chromosome, which gives the plant a new genetic trait.

Gold or tungsten particles are used because they are strong enough to pierce the cell wall, but are not toxic to the plant cells.

However, individual gold particles have a tendency to stick together and crush the cell, creating pit damage.

Sound complex? King said the most complex part is actually getting the gene prepared for the gene gun.

"Getting your gene put together with your marker genes and onto the gold particles is the complex part," King said.

King said the process of transforming a gene could happen in nature; however, it doesn't happen often.

"With the gene gun, it makes the intake of the DNA into the genome more likely to happen," King said.

After transforming the gene, King places the plastic container containing the coated genes under a light with a filter that allows him to view the areas of the tissue that have been engineered with the gold particles.

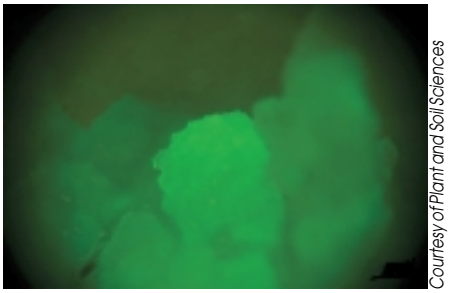
"After bombarding the gene," King said, "we put it through a tissue culture process, which is a primary step to being able to tell which plants have been transformed."

The tissue culture process includes putting the tissue into numerous media that stimulate shoot and root growth. Eventually, the small plant is moved into a pot, where the DNA is tested to see if the transformation was successful.

With such a promising future, the plant and soil sciences department is working to qualify for grants that will help further research.

"It is expensive to operate the facility," Sweeney said. "There has to be money in order for the research to continue in the lab."

The National Science Foundation and the State Regents for Higher Education in Oklahoma board provided the Experimental Program to Stimulate Competitive Research grant that was used to establish the lab, but that money is almost exhausted and now the faculty are probing for new ways to keep the laboratory in operation.



Courtesy of Plant and Soil Sciences

When the DNA-coated gold particles are injected into the plant tissue, they appear fluorescent green under the lab microscope.

"By having to close the facility, it would slow down or stop some of our basic and applied research on trying to utilize biotechnology to improve the productivity and utilization of plants of economic importance to Oklahoma, such as wheat," said Guenzi.

OSU isn't the only one that has a gene gun. Some laboratories use the gun to do research on genes that can fight against cancer and other diseases.

For example, results from a study done in 1997 indicated that human cancers such as melanoma might be useful candidates for gene gun therapy on targeting skin tissues.

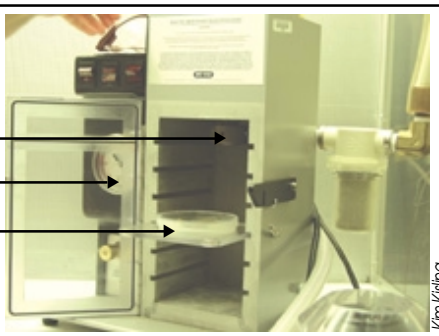
In fact, private biotechnology companies produced some corn and soybean varieties already on the market using a gene gun.

Even though the process is distrusted by some environmentalists who oppose tampering with nature, proponents say genetic manipulation holds out the promise of producing crops that will not just grow faster and bigger and be capable of delivering vaccines, but will also thrive without high doses of chemical pesticides.

"Because of everything the machine is capable of," Sweeney said, "the possibilities are endless."

By Kim Kisling
Burlington, Okla.

OSU's Gene Gun



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