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## Nanotechnologist Plans to Build Things with Bricklike Corn Molecules

University of Illinois nanotechnologist Graciela Wild Padua is intrigued by the bricklike shape of the corn zein molecule. She thinks it's particularly suited as a building block for tiny structures small enough to be measured in nanometers: cages, for example, that could carry biocompounds to targeted sites in the human body or scaffolds on which to grow neat sheets of skin cells instead of bulky clumps of tissue.

Nanotechnology is most often mentioned in connection with microelectronics, with tiny computer chips and wires that can be measured in nanometers. A nanometer is one-thousandth of a micron, and a micron is one-thousandth of a millimeter.

And zein is just a waste product in the corn-to-ethanol process. But this corn byproduct won't be wasted much longer if Padua, a researcher in ACES' Department of Food Science and Human Nutrition, and the Illinois Corn Marketing Board (ICMB) which is funding the research have their way. This is just one of several projects being funded by Illinois corn checkoff dollars that seek to make ethanol production more efficient and surface additional byproducts to add value to the ethanol production process.

"The corn zein molecule has a very special bricklike shape, and we think we can build with it in much the same way that children play with Lego bricks and make towers," she said. Padua hopes that eventually scientists will be able to make "boxes, tubes, or cages" from zein, and these structures will carry other molecules inside them.

"A physician may want a particular drug to attach itself to a particular part of the body or act upon only a certain kind of tissue," she said. "A cancer treatment would be an example."

"These chemical molecules will have to remain intact until they reach their intended site," she said, "so they'll need to be wrapped and carried in something else. Otherwise, they could be degraded in the stomach or expand in other channels." That "something else" could be a corn zein carrier.

Padua said there is also interest among scientists in finding materials suitable for frames to support the growth of cells in sheets for medical purposes. Again, a scaffold built of corn zein molecules could fill the bill.

And, when scientists need to channel cell growth, they require a structure that guides the cells in certain directions. "Some scientists are interested in growing single neurons, for instance, but you'd have to channel the dendrites to go to certain places. They couldn't just grow wildly because they have to be connected to certain points. Zein molecules could provide that sort of structure," she said.

The researcher said they're not quite there yet. "Right now, we're

manipulating the environment in the lab, and we're attempting to build lines and walls from molecules of corn zein."

The scientists are changing the solvent and adding or removing certain ions or materials that could alter zein's reactivity, making it stickier and thus better "building" material.

"Right now, we're concentrating on getting zein to perform predictably as a building material so we can recommend that it be used in these other ways," she said.

Padua said it's not easy building scaffolding or other structures at the molecular level because "molecules tend to go their own way. But preliminary research with corn zein has been promising. Because zein molecules are so bricklike, we should be able to line them up precisely one right after another and make things with them."

It's exacting work, done one molecule at a time. But Padua sees potential in these bricklike molecules. She believes they have a part to play in twenty-first century medicine.

Other researchers working on the project are Qin Wang, Jin-Feng Wang, Antony Crofts, and Phillip Geil. Preliminary research has been published in the *Journal of Agricultural Food Chemistry* and *Biomacromolecules*. Funding was aso provided by the Illinois Agricultural Experiment Station.

**Source: Graciela Wild Padua, (217) 333-9336, gwpadua@uiuc.edu**