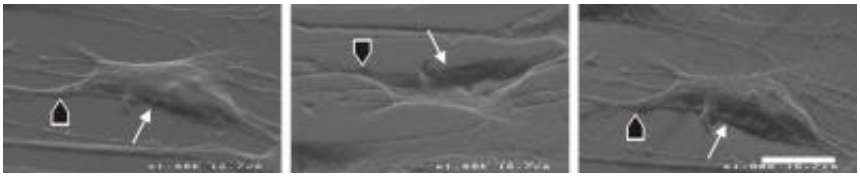
# Scientists Create Uncanny Cell Replicas for Treatment, Research

September 12 2006



The Schwann cell on the left is real; the cell on the right is a replica. In the center is an impression, taken from a real cell, that is used in a two-part molding process. Cell replicas could be used in medical treatments to repair damaged nerves or in laboratory research. Credit: Jan Bruder and Diane Hoffman-Kim/Brown University

Call them genuine fakes. Brown University biomedical engineer Diane Hoffman-Kim and her research team have made plastic replicas of real cells through a novel two-part molding process. The copies looked so authentic, Hoffman-Kim couldn't tell if they were real or rubber at first.

"When I saw the images from the microscope, I said, 'OK, I can't tell the difference,'" Hoffman-Kim said. "It was pretty amazing – and just what we wanted."

A description of the replicas, their ability to support cell growth, and their possible applications in science and medicine are published in *Langmuir*, a journal of the American Chemical Society.

The main cells used in the experiments were Schwann cells, which protect peripheral nerves by wrapping around their axons to create insulating myelin sheaths. Schwann cells also direct axon growth during cell development and repair.

Hoffman-Kim, an assistant professor in the Department of Molecular Pharmacology, Physiology and Biotechnology and the Division of Engineering, said the realistic replicas could be used in laboratories to help scientists understand how these critical support cells sustain and direct nerve growth.

The replicas could also, eventually, be used in hospitals to help doctors regenerate nerves. If a patient's nerves are severed during an auto accident or other injury, a device coated with the imitation cells – a contraption called a nerve guidance channel – could be implanted into the injured area to help stimulate nerve growth and repair damaged tissue. Tissue engineers around the world are testing nerve guidance channels in animals and, in a few cases, in humans.

"If the goal is to regenerate nerves, you want to create the right environment for cells to grow," Hoffman-Kim said. "One way to get the environment right: Make the surface that cells grow on as realistic as possible."

But the cell duplication technique could have all sorts of applications. In the Langmuir article, Hoffman-Kim and her team also show results from experiments in which smooth muscle cells were reproduced. Researchers plan to experiment with other cell types.

"What's exciting about the approach is that it could be broadly applied in both bench science and in tissue engineering," she said. "Researchers are always trying to get cells to grow well outside the body. A lot of factors affect that growth, like air temperature or the carbon dioxide supply in

the lab incubator. Topography, or the surfaces cells grow on, also plays a role."

Jan Bruder, a graduate student in Brown's Artificial Organs, Biomaterials and Cellular Technology program, is the lead author of the journal article. With Hoffman-Kim, Bruder came up with the idea for the two-step molding process – one akin to making sculpture.

Cells were grown in the lab then preserved in chemicals for stiffening. Next, researchers poured liquid silicon over the cells and let the mixture harden. Now for the tricky part – peeling the thin, transparent membrane off without tearing it. The result: An impression. To make a relief, which would show shapes rising up from the surface, the pour-and-peel process was repeated.

To see if the cells looked authentic, the team had to pinpoint cells on the original model and find those same cells on the replica. Then, using four kinds of microscopes, they measured the cells' length and height for comparison. The fakes were the same size – and they looked arrestingly real, right down to tiny bumps in the nucleus. The team then used the replicas to grow neurons taken from rats. The experiments worked.

Source: Brown University