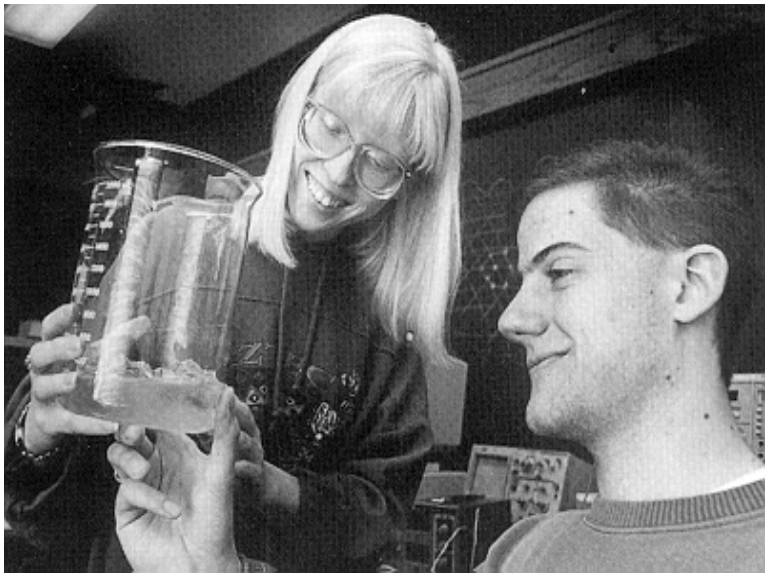

(From IWU Magazine, Fall 1995)

Sensuous curves in the physics lab

-Elaine Graybill

One of Narendra Jaggi's students, working on an experiment, made a glob of gel the shape of a cylinder and the size of a quarter, and left it in a beaker in the physics lab for the weekend. When Jaggi and students returned Monday, they were startled to find a lovely curvaceous transparent crystal-like object in the beaker that blended art and science in a unique way. No one knew where it came from. "We just thought Kimberly [Branshaw'95] had sneezed into the bowl," said Illinois Wesleyan physics chairman Jaggi, triggering some strange growth in the gel, "and we would never be able to reproduce it." He and IWU students Branshaw and Dana Deardorff '95 were able to reproduce the object and have even come to understand how and why it forms. The swollen gel consists of about 99 percent water and 1 percent a highly absorbent material. Interested in research into artificial muscles, the IWU students were looking at an absorbent substance that could bend with the application of a small electrical field, through "preferential absorption" of water on the side where the voltage is higher. Scientists don't understand exactly why that happens, Jaggi said, but what they do understand points "in a productive direction" in the development of artificial muscles. That's how it came about that the student made the gel at all and left it in the beaker, but the apparently random curves that grew from the cylinder were a mystery, especially because the gel had not been exposed to electrical stimulation. Jaggi, Branshaw and Deardorff eventually learned the following about the beautiful gel. It starts as a small cylinder and ends as a large cylinder about three days later, but it makes pretty shapes during intermediate stages of this growth process. As the gel grows larger, curves dissolve and smoother curves emerge. The number of curves decreases as an inverse function of the square root of time. When the object is allowed to shrink, it returns to its exact beginning size and shape. The growing object supplies its own energy through absorption of the water and swelling. Interestingly, the three investigators found that a long rod-shaped bit of gel swells and grows much more uniformly, without the dramatic curves. Jaggi is excited about the interest this work is generating among other scientists. "Once we publish our first paper, the field is likely to get flooded by other researchers," he said. This project illustrates to Jaggi the role of undergraduate research: "the enormous importance of recognizing your ignorance and learning how to approach problems that are not well posed."