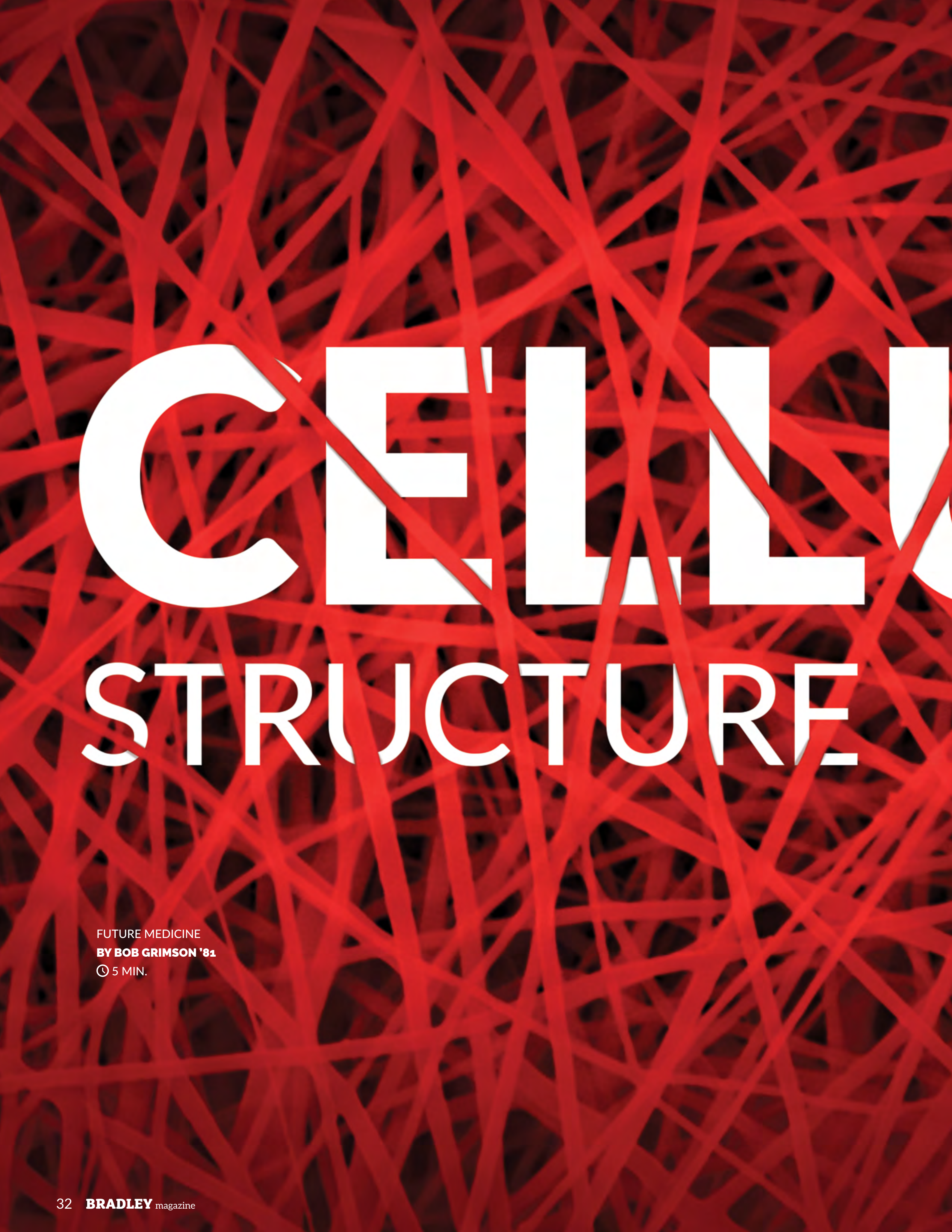

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FUTURE MEDICINE

BY BOB GRIMSON '81

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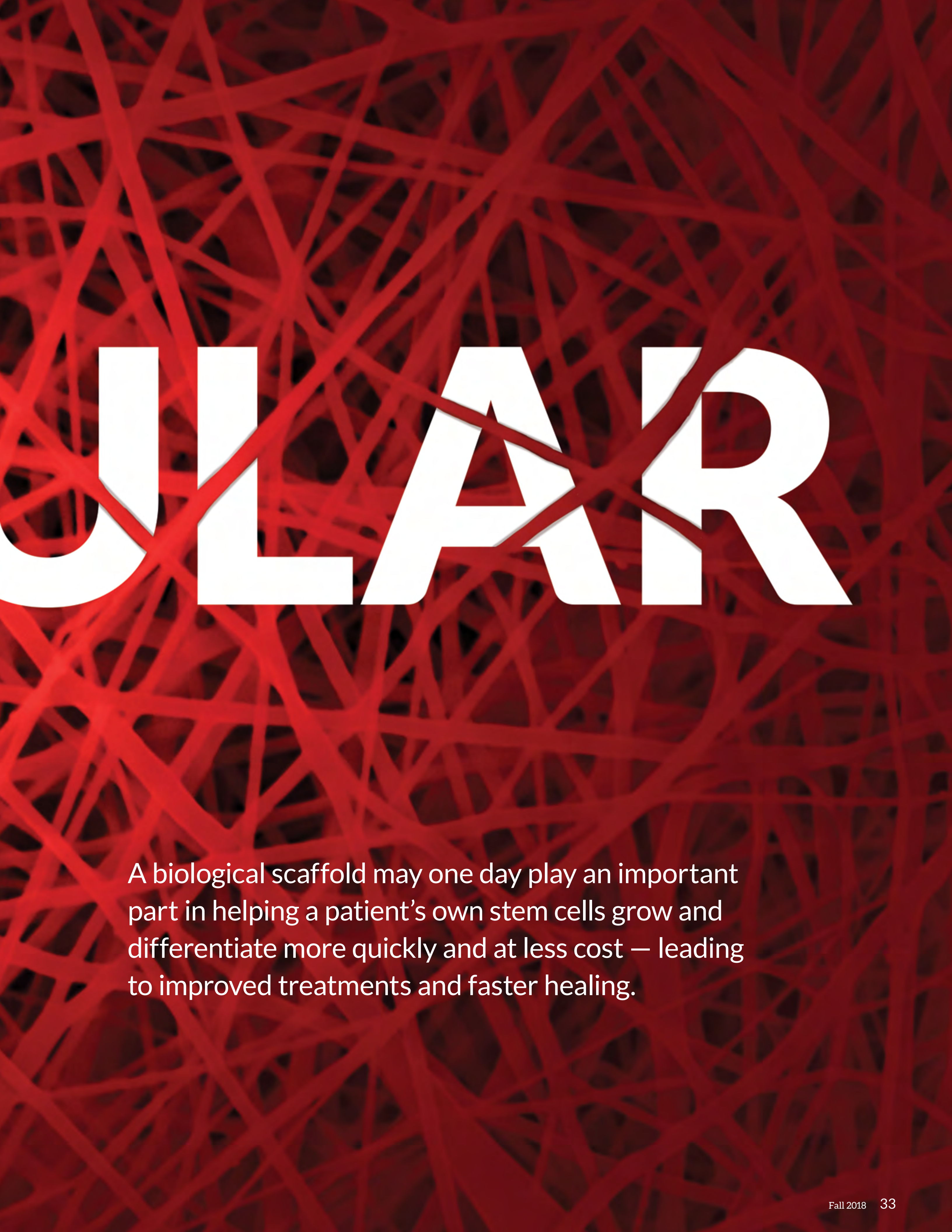

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A biological scaffold may one day play an important part in helping a patient's own stem cells grow and differentiate more quickly and at less cost — leading to improved treatments and faster healing.

If you've ever had even a minor burn, you know it can be uncomfortable and painful. With more extensive injuries, you run the risk of major infection or scarring. Or if you have any kind of nerve damage from a disease or an accident, the suffering can be debilitating.

Two Bradley student-research projects are on the path to bringing major relief in the future. With the goal of using a patient's own stem cells, if successful, both projects could eliminate the expense and side-effects of anti-rejection meds and in the case of burns or skin injuries, give the affected area an improved appearance over current treatments.

HEALING BURNS

Working under the supervision of Associate Professor of Biology Craig Cady, **Jack Blank '19** created a nanoscale polymer scaffold that provided a structure for successful stem cell growth.

"We partnered with the plastic surgery department — they isolated some stem cells directly from patients, from the base of the hair follicle and epithelial tissue," Blank said of the project begun in 2016 with Southern Illinois University's medical school. "What we wanted to do was take those stem cells, which are already prone to differentiate into functional skin, and embed them on some form of substrate where they could grow and then be easily implemented in clinical treatments."

He added that similar scaffolding exists but it's made from cadaver tissue and can cost thousands of dollars. Plus, with outside tissue there is a chance a patient's body will reject it.

Using a patient's own cells cuts costs and rejection

Latest projects target skin and nerve cells

Tissue "scaffolds" help stem cells grow and work better

iPS stem cells are made from skin cells

"The whole point is to make it much more accessible to patients," Blank said. "Studies indicate that these stem cells may differentiate into tissue that looks more natural and normal, but the cells need a way to be introduced safely and effectively to the patient."

Blank's project used a bio-compatible polymer that was electro-spun with applied voltage, forming nanoscale fibers one-billionth of a meter in size to which stem cells could adhere and hopefully differentiate. Collagen was used to increase cell proliferation and the likelihood of successful differentiation. However, the electro-spinning process caused some unexpected changes.

"We did some analysis (after electrospinning) and found the structure of the materials utilized was altered in order to integrate into the scaffold... but it was still effective at doing everything we hoped," Blank said.

RESTORING DAMAGED NERVES

Also working with Cady is **Jaclyn Conway '19**, whose project involves building another nanofiber material to anchor stem cells where they're needed. She's analyzing the chemical factors that promote turning stem cells into nerve cells and how to incorporate those chemicals into the material. The result would help surgeons replace damaged nerve tissue more easily.

"The bottom line is in traumatic injury, this would replace nervous tissue that's been lost to disease, injury or surgical removal," said Cady, who has a background in neurophysiology. "This material looks like a (facial) tissue but the stem cells absolutely love it. In fact, it's hard to get them off the material."

Along with researching a suitable material for stem cell growth, Conway hopes to discover the proper chemical mix and release rate to promote nerve cell development. Cady noted too much of the chemicals or too fast a release kills the cells. Too little or too slow and they won't change into nerve tissue. It's a process normally regulated by our bodies.

LAB: DUANE ZEHR.

ABOVE:

In the biology lab, Blank and Conway examine their project building a nanofiber material to anchor and sustain stem cells. "It's really an innovative concept," said Cady.

PREVIOUS PAGE:

A bio-compatible polymer that was electro-spun with applied voltage, forming nanoscale fibers one-billionth of a meter in size to which stem cells could adhere.

"Because Jaclyn's embedding (chemicals) into the material, it's released slowly, almost like a timed-release tablet," Cady said.

Stem cell research has been controversial when embryonic stem cells are used. Those come from human embryos which are subsequently destroyed. Cady said Bradley's research uses induced pluripotent stem (iPS) cells and bone marrow stem cells. With iPS cells, four genes are added to skin cells, changing them into embryonic-like stem cells. Cady brought a $2,000 vial of iPS cells to Bradley several years ago and they have turned into $150,000 worth of frozen cells for research projects.

He said it was "incredibly unusual" for undergraduates such as Blank and Conway to do this type of research. "I wish I'd had that opportunity when I was an undergraduate," he said. "They're doing research with human stem cells and making human tissue from stem cells. If (Blank and Conway) were at a large campus, they'd be cleaning (lab) dishes." B