Cells line up for a complex future

BY training cells to grow in precise patterns, researchers have come one step closer to growing complex tissues such as nerves or blood vessels in the laboratory. Their ideas could also pave the way for living electronic circuits.

Most cells will only grow attached to a surface, so George Whitesides and colleagues at Harvard University generated a pattern of sticky and unsticky surfaces for the cells they were studying. They hoped that the cells would only grow on the sticky surfaces. Using a tiny rubber stamp cast from a silicon chip, the researchers made a repeating pattern of plateaus and valleys in clear plastic. A flat stamp spread the sticky material on the plateaus, and the plastic was dipped in a repellent material to coat the valleys.

Cells encouraged to grow on this terrain unswervingly chose the plateaus, even when the sticky areas were only a single cell wide (*Proceedings of the National Academy of Sciences*, vol 93, p 10775). If the sticky and repellent materials were swapped the cells chose the valleys instead.

The potential applications are numerous. "If you help cells to align like this you can make something that begins to look like a nerve or a capillary," says Whitesides. And nerve cells trained to grow in complex patterns could be linked to conventional electronics to make hybrid circuits. "Being able to manipulate where cells go is very important," says Jeffrey Hubbell of the California Institute of Technology in Pasadena.

He believes this system could help overcome the body's tendency to form scars around implanted medical devices. Scarring could be reduced if the implant's surface texture encouraged blood vessels to grow towards it. "This system has the potential to change the way we make medical devices," he says.

William Wells, San Francisco

Cells inherit a sense of timing

ANIMALS, plants and even bread moulds have daily rhythms of activity, governed by internal molecular clocks. Biologists have now shown that a single-celled organism which reproduces many times per day also has a similar "circadian" clock. This means it can anticipate events that occur only once every few generations.

Researchers led by Carl Johnson of Vanderbilt University in Nashville studied *Synechococcus*, which belongs to a group of primitive photosynthetic organisms called cyanobacteria. Because *Synechococcus* cells depend on light for energy, says Johnson, "when the lights go out they need to shut things down". The researchers worked with a particularly fast-reproducing strain which passes through several generations every day, before resting at night.

Many biologists have assumed that circadian clocks cannot pass their timing information from one generation to another. This means that *Synechococcus*'s cycle of activity should break down without the regular cues of dusk and dawn. But when Johnson's team put their colonies under constant light, the daily cycle of cell division and rest continued (*Proceedings of the National Academy of Sciences*, vol 93, p 10183). Clearly, *Synechococcus* possesses a circadian clock that can be passed down the generations.

"Conceptually, this bothers some people," says Susan Golden of Texas A&M University, who has made similar observations of the same strain, which have not yet been published, working with researchers at Nagoya University in Japan. But in organisms that reproduce by cell division, she says, there is no reason why a sense of time cannot be inherited. Circadian clocks depend on proteins whose concentrations inside a cell cycle up and down. Provided these proteins are divided equally between daughter cells after division, a clock should keep perfect time. **William Wells**