Bionic eye heralds cyborg revolution

By Roger Highfield, Science Editor
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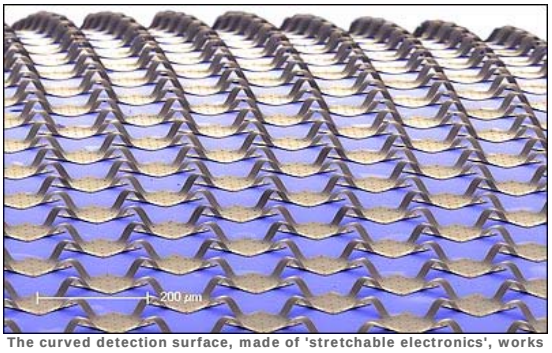
An electronic eye that works like the real thing foreshadows the development of a new generation of bionic eyes and other "cyborg" technology seen in the film "Terminator" and other Hollywood sci-fi movies.

- World's first commercial bionic hand
- Hacking fears over wireless pacemakers
- 'We can rebuild him. We have the technolgy.' Almost.

The electronic eye uses a curved detection surface like a human eye, made of "stretchable electronics."

The first of its kind, the bionic eye produces exceptional images with lower distortion and with a broader field of view than possible with conventional flat camera microchips.

However, the underlying approach to producing flexible electronic surfaces of silicon chip sensors could find uses in moulding chips to the human body and 'smart' prosthetics, leading to new opportunities for doctors to boost the body with electronics.



The curved detection surface, made of 'stretchable electronics', works like a human eye

Conventional imaging technologies have been developed for use in rigid semiconductor materials, glass plates and plastic sheets, all of which are flat in nature.

The new technique creates an array of silicon detectors and electronics in a stretchable, interconnected mesh that allows flat layouts to be transformed into curved shapes.

A team led by Profs John Rogers at the University of Illionois, Urbana Champaign, and Yonggang Huang of Northwestern University in Evanston, describe in Nature how they used well established electrical materials and processing but in unusual designs that allow large amounts of compressibility and stretchability, thanks to the flexible mesh of wire-connected sensors, each of which is a pixel in the resulting camera.

Researchers are testing the same design principles in a range of other applications, including as a thin, wrap around monitor to detect electrical signals crackling across the undulating surface of the human brain.

Conventional digital cameras use flat chips based on rigid, brittle semiconductor wafers that fracture at strains of less than 1 per cent.

While such a conventional flat array of sensors cannot flex without damaging its light-sensitive pixels, the new technology puts the strain on the wires, each flexing as much as 40 per cent.

Since the wires absorb the strain, the pixels are barely stressed, even when affixed to the hemispherical retina-shaped housing of the new experimental camera.

"Mechanics helps to reduce the stresses and strain in components, and guide and optimise the system design," said Prof Yonggang Huang.

The current sensor array, shaped around a rubber cup, includes only 256 pixels, but because the technology is based on established materials and manufacturing processes, the

researchers ultimately expect more sophisticated sensors in higher density arrays.

"We believe that some of the most compelling areas of future application involve the intimate, conformal integration of electronics with the human body, in ways that are inconceivable using established technologies," said Prof Rogers

"This approach allows us to put electronics in places where we couldn't before," Prof Rogers added. "We can now, for the first time, move device design beyond the flatland constraints of conventional systems."

Over the last 20 years, many research groups have pursued electronic eye systems of this general type, but none has achieved a working camera.

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