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Electricity to heal wounds

Researchers in Aberdeen have made an exciting breakthrough in showing that electricity has a major impact on the healing of wounds.

The research team – one of just a handful of groups in the world studying direct current electrical fields in the body and their control over cell behaviours - believe their findings have the potential to open up pioneering methods for treating wounds and other injuries.

The University of Aberdeen team detail how electricity works in a wound in a paper which appears tomorrow (July 27) in *Nature*. The team have discovered a couple of proteins and genes within cells which play a key role in steering the cells to heal wounds in response to the naturally occurring electrical signals found at wounds.

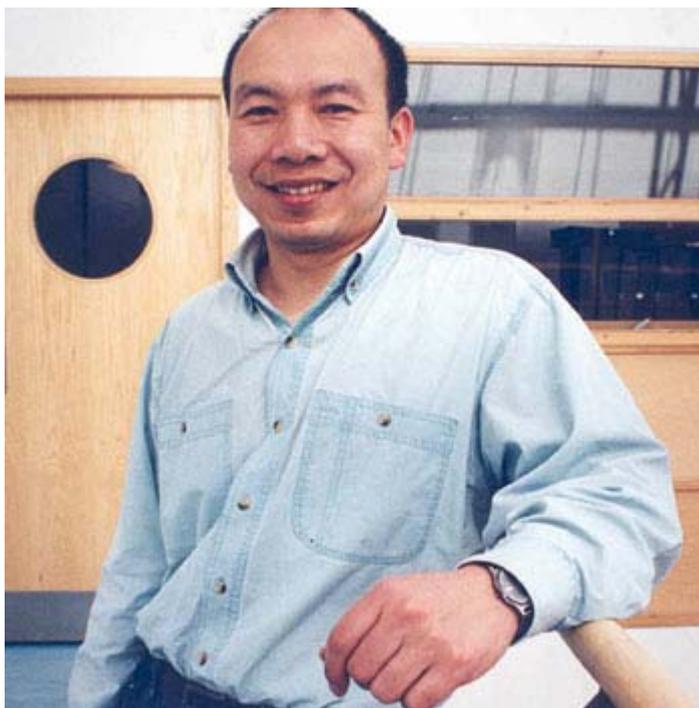
The scientists also found that when they applied an electrical field to a wound, this altered the way that cells, attempting to repair the wound, moved around. Varying the voltage of the electric fields also made a difference, affecting the speed in which the wound healed.

Professor Min Zhao, from the University of Aberdeen, said: “Our studies show that electricity in the body is far more important than previously thought and that it has significant potential in wound healing and possibly also regeneration.”

Electricity flows throughout our body. Italian scientist Luigi Galvani was the first to discover this with his experiments involving animal electricity in frogs in 1780. In the next century German physiologist Emil Du-Bois Reymond showed the existence of electrical currents in nerves and at wounds.

Du-Bois Reymond made a wound in his arm and measured the naturally occurring electrical field at that wound. His experimental work laid the foundations for all future work in electrophysiology. Without the early pioneers, we wouldn't have the technology used in medicine today, such as ECGs – electrocardiograms. Those pioneers laid the foundation for our understanding that the electric activities of the nerves in our body are the basis of how we see, feel and hear and of how we control muscle contraction so that we can move.

While electrophysiology continues to progress and form a solid branch of science, the area of electrical fields in wound healing has been virtually neglected, according to Professor Zhao who is



collaborating on this area of research with a number of University colleagues including Professor Colin McCaig, Head of the School of Medical Sciences, Professor John Forrester, Head of Ophthalmology and Dr Bing Song. This work also involved international collaborators from America, Japan and Austria, including Professor Josef Penninger, current director of the Institute of Molecular Biotechnology of Austrian Academy of Science.

The team have been studying skin wounds and cornea wounds in the lab.

Professor Zhao first became interested in how wounds heal themselves while he was a trauma surgeon in China. He said: "When a wound occurs it is remarkable how the cells in our body know where to go to heal the wound."

There are a number of reasons which are the accepted thinking as to why if you cut or wound yourself cells move into the breached area and begin their repair work. These include cells moving until they make contact with each other and wounded cells releasing chemicals that attract other cells.

However, the Aberdeen scientists have shown that by applying an electrical signal to a wound, they were able to override what normally happens to cells, which in turn enabled the scientists to control the cell's movement and how the wound healed.

Professor Zhao said: "What is really important is that we show that the naturally occurring electric fields at wounds are playing an important role in guiding cell movements during wound healing. Scientifically, our findings offer a novel perspective in understanding how cells move to heal, and what genes and molecules the cells use to detect the electric fields.

"Clinically, our findings offer a novel approach to speed up healing and to treat chronic and refractive wounds. Those conditions are huge burdens personally and economically. We have identified several possible targets to develop novel techniques to enhance and manage wound healing."

Wound electric fields are created in the body by structures called ion pumps or transporters which move ions of positive or negative electrical charge in a particular direction. The researchers applied chemicals to the wound which were known to increase or decrease the movements of electrically charged ions..

Professor Zhao said: "It is a little like controlling a battery. If we enhance the pumping power of the ions, we increase the electric current flow at the wounds and this helped to speed up the healing process and to drive it in the right direction."

He added: "We hope our next step is a clinical trial to see if we can translate our findings into patient care. We want to find out if the drugs we have tried in our lab tests could actually be used to develop eye drops to help eye wounds or dressings used in the treatment of other wounds."

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Notes to Editors:

Professor Colin McCaig is available for interview contact: 01224 555706.

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