Towards a natural pacemaker

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Artificial heart pacemakers have saved and extended the lives of thousands of people, but they have their shortcomings - such as a fixed pulse rate and a limited life. Could a permanent biological solution be possible?

Richard Robinson and colleagues at New York's Columbia and Stony Brook Universities certainly think so, and their work published in the latest issue of The Journal of Physiology brings the dream a step closer to reality.

The body's own natural pacemaker, called the sinoatrial (SA) node, is extremely vulnerable to damage during a heart attack, often leaving the patient with a weak, slow or unreliable heartbeat. The heart has limited ability to recover from the damage, so the conventional approach is to fit an electronic device to monitor and control the beat directly.

Therapies to help raise the heart rate biologically could be a much better solution, but there are some major hurdles. The way electrical signals are generated in the SA node - and hence the heart rate - are far from simple. There are three separate electrical pathways between cells, called HCN or 'funny' channels (because of their complex behaviour), that could be involved.

Dr Robinson's work helps to shed light on the secrets of the HCN channels, but more importantly describes a cell culture they have developed that accurately mimics HCN function in whole mammalian hearts, making future research in the area far quicker and easier.

The researchers used their new cellular model to genetically 'rewire' two of the HCN channels. The resulting heart rate was very rapid with irregular pauses, just as has already been observed in dogs and mice.

It is early days - but the valuable new computer and cellular models are ideal for testing potential new drugs to influence heart rate and pave the way for new genetic biological pacemakers to be developed.

Dr Robinson commented that the new developments "will facilitate the development of practical biological pacemakers by allowing more complete and rapid assessment of individual channel mutations through combined culture and simulation studies prior to full testing in animal models."

Source: Wiley (news : web)