CHEMISTRY

Splitting with sunlight

Angew. Chem. Int. Edn doi:10.1002/anie.201003110 (2010)

The ability to split water into hydrogen and oxygen could be an important step in the development of renewable fuels. The use of haematite, a form of iron oxide, as an electrode to drive this reaction with the help of light is well established. This material is stable in water and can be made from low-cost abundant elements. However, it has not been as effective as titanium or tungsten oxide electrodes.

Now Kevin Sivula, Michael Grätzel and their colleagues at the Swiss Federal Institute of Technology (EPFL) in Lausanne have made two alterations to boost haematite's water-splitting ability.

They altered the compound's nanostructure to improve its electronic properties and deposited nanoparticles of iridium oxide — a water oxidation catalyst — on its surface. The performance achieved is not at a commercially useful level, but is superior to that previously described for other oxide-based materials.

CANCER BIOLOGY

Blood vessel regulator

Nature Med. doi:10.1038/nm.2186 (2010)

Growing tumours rely on a good blood supply to feed them, so the identification of a small RNA molecule that switches on blood-vessel growth in tumours provides a potential target for anti-cancer drugs.

Small regulatory RNAs called microRNAs are known to regulate vascular development. To find microRNAs that initiate this process in tumours, David Cheresh at the University of California, San Diego, and his colleagues looked for microRNAs in human embryonic stem-cell models of blood vessel development. One, called miR-132, was highly expressed in human tumour vasculature, but not in normal tissue.

The microRNA boosted the growth of human blood vessel cells in culture, whereas reducing miR-132 expression in mice stunted blood vessel growth and shrank transplanted human breast tumours. The molecule turns on vascularization by suppressing RASA1, a protein that inhibits blood vessel development.

CLIMATE SCIENCE

Hotter heatwaves

Geophys. Res. Lett. doi:10.1029/2010GL043898 (2010)

Regional changes in extreme summer temperatures could exceed average global warming by several degrees, according to Robin Clark and his colleagues at the Met Office Hadley Centre in Exeter, UK.

They ran 224 simulations of climate responses to an atmospheric carbon dioxide level double that of today's to determine the corresponding changes in regional heat extremes. They found that in many geographical areas in the Northern Hemisphere, even the lower estimates of changes in heat extremes exceeded the global average increase in temperature.

Furthermore, 44 simulations that produced an average of 2 °C of global warming predicted that single-day extreme temperatures could increase by 6 °C or more in large parts of Europe, North America and Asia. Regional changes in excessively hot days and heatwaves are related to variability in reductions in soil moisture, the authors suggest.

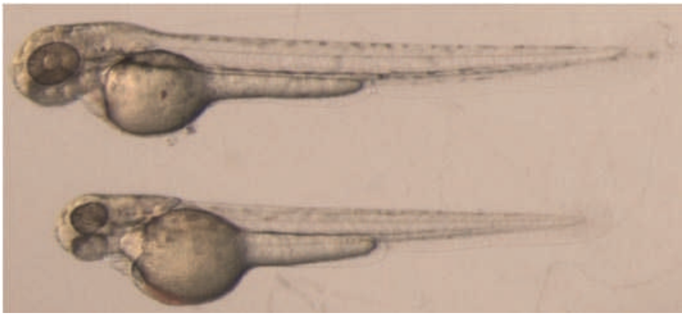
DEVELOPMENTAL BIOLOGY

New hearts need jolts

Proc. Natl Acad. Sci. USA doi:10.1073/pnas.0909432107 (2010)

A developing heart, at least in zebrafish, needs electrical conduction to grow into a functional organ.

Neil Chi at the University of California, San Diego, Didier Stainier at the University of California, San Francisco, and their colleagues focused on a zebrafish mutant (pictured bottom) in which the heart contracts asynchronously and eventually fails. Genetic analysis revealed that the mutated gene is *cx46*, which codes for a protein that connects adjacent cardiac cells, allowing electrical impulses to move from cell to cell and thus coordinate heart contraction.



N. CHI

Mutant hearts had abnormal conduction and slower transmission of electrical signals than hearts in normal zebrafish (top). The cardiac cells also had deformed shapes. Mice lacking the same gene had similar conduction defects, some of which have been linked to human heart malfunction and failure.

The authors suggest that electrical stimulation may improve the effectiveness of experimental tissue-repair techniques that transplant cells into damaged hearts.

JOURNAL CLUB

Dov Sax
Brown University, Providence, Rhode Island

A conservation biologist considers the role of nature reserves in a warming world.

Over the next 100 years, climate change is expected to extirpate many species from their current locations. As a scientist who studies these effects, I was surprised by the magnitude of a recent projection. Of the nearly 500 protected reserves in the San Francisco Bay area of California, more than 98% are expected to have entirely different summer temperatures going forwards, with no overlap between the warmest conditions found within these areas now and the coolest conditions in the future.

David Ackerly at the University of California, Berkeley, and his team studied the pace of climate change in the western United States (D. D. Ackerly *et al. Divers. Distrib.* **16,** 476–487; 2010). By mapping current temperatures and those projected by a moderate warming scenario, they found that the geographical locations of specific temperatures will move by as much as 4.9 kilometres per year. This means that conditions currently experienced at a particular location could shift by hundreds of kilometres in just 50 years.

These findings have important implications for the design and management of protected areas. With climate change, most reserves will not maintain conditions that are suitable for the set of species that exists there at present. To survive, many species will need to move, either on their own or with human assistance. Accommodating this will require a major change in the perceived role of nature reserves. Traditionally, these have been managed as 'museums' that maintain historically accurate compositions of species and ecosystems. In the future, we may need some reserves to function as 'way stations', with transient compositions of species. This may be the only way to promote the long-term conservation of species that can no longer survive in their present locales.

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