Institute of Child Health and Human Development in Bethesda, Maryland, and his colleagues looked at the efficiency of the signal sequence on the mammalian prion protein (PrP), which can cause neurodegenerative disease when misfolded or mutated.

They found that roughly 10% of PrP made by cells is misdirected, which is consistent with previous work. The authors engineered disease-causing versions of mutant PrP with signal sequences that more efficiently guide the protein to its destination. Mice producing the modified proteins were protected against neurodegeneration.

The work highlights a potential contributory factor to prion diseases.

ORGANIC CHEMISTRY

Catalysts cooperate

Science **327,** 986–990 (2010)

The products of chemical reactions often have different spatial arrangements, or stereoisomers, of which only one is useful (as a drug, for example). As a result, many chemists are focused on controlling such reactions to select only the desired product.

Eric Jacobsen and his colleagues at Harvard University in Cambridge, Massachusetts, have developed one such strategy involving two cooperating catalysts. They first use an acid catalyst to transform a molecule's nitrogen-based imide group into a reactive iminium ion. A second catalyst then cradles this ion through a network of weak intermolecular attractions — much like the way that biological enzymes position their substrates. This ensures that one reaction orientation is favoured, meaning that only one stereoisomer is formed. The reaction is 5–10 times slower than its one-catalyst variant, but highly selective.

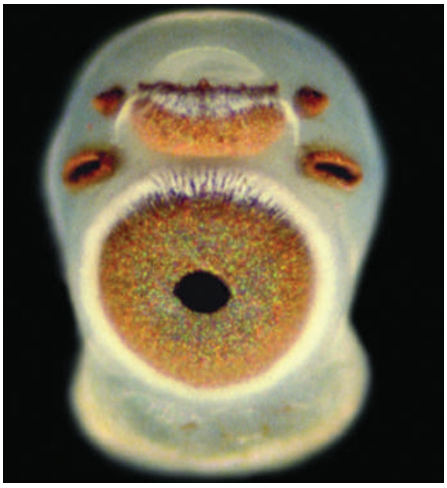
BIOLOGY

Colour-blind

Proc. R. Soc. B doi:10.1098/rspb.2009.2248 (2010)

Box jellyfish (Cubomedusae) have a complex system of 24 eyes that comprises pits, slits and two types of lens (a set of six eyes is pictured below). But whether they can perceive colour has been a matter of debate.

Now, Megan O'Connor of Lund University in Sweden and her colleagues have identified the visual pigment present in the lens eyes of the *Chiropsella bronzie* jellyfish. Using microspectrophotometry and antibodies for zebrafish visual pigments, they found just one type of pigment. For colour vision, two or more are necessary.



GENETICS

Male regulator switched

PLoS Genet. **6,** e1000844 (2010)

'Jumping genes', or transposable elements, are tracts of DNA that can move around in the genome and are thought to offer potential for rapid rewiring of gene-regulatory networks. Researchers have found evidence of this in medaka fish (*Oryzias latipes*).

About 10 million years ago in an ancestor of the medaka fish, a gene called *dmrt1a* — which occurs downstream in a sex-determination cascade — duplicated. One copy, *dmrt1bY*, later became a master 'maleness' regulator at the top of the cascade. To figure out how this happened, Amaury Herpin of the University of Würzburg in Germany and his colleagues analysed the regulatory region of *dmrt1bY*.

They found that a mobile piece of DNA had inserted into this region shortly after the gene duplication. Both the Dmrt1a and Dmrt1bY proteins bind to this transposable element to reduce expression of the *dmrt1bY* gene. This suggests that insertion of the mobile DNA rewired this gene network.

R. SOC.

DEVELOPMENTAL BIOLOGY

Heads or tails

Dev. Biol. **339,** 188–199 (2010)

Non-parasitic flatworms called planarians readily regenerate damaged body parts by choreographing a large adult stem-cell population. Michael Levin at Tufts University in Medford, Massachusetts, and his colleagues have identified physiological signals that control regeneration in these creatures.

The researchers inhibited these signals with chemicals that block communication between cells. The worms then regenerated heads in abnormal positions, continuing to do so even after the new heads were amputated. The team suggests that the signals enable planarians to determine a wound's location and orientation, and decide which structure to regenerate.

Understanding the mechanisms that guide stem cells in forming complex tissues in three dimensions is key to unlocking the full potential of regenerative medicine.

JOURNAL CLUB

Luke Harmon
University of Idaho, Moscow

An evolutionary biologist ponders the pace of evolution.

Studies of evolution 'in action' in creatures such as sticklebacks, lizards and mice have taught us that evolution can proceed rapidly. Given this lightening-quick tempo, why are there so few species on Earth, and why are they so similar to each other?

One possible answer comes from long-term studies of Galapagos finches. During drought years, when small seeds — the birds' preferred food — were scarce, the birds evolved larger beaks to help crack open bigger seeds. However, these changes were reversed during wet years, when smaller seeds again became prevalent. This sort of reversal can occur repeatedly, implying that much of the evolutionary change we observe over short timescales is only temporary.

A study of patterns of natural selection over time suggests that such evolutionary reversals might explain the slower pace of evolution over longer timescales. Adam Siepielski of Dartmouth College in Hanover, New Hampshire, and his colleagues used published reports to gather more than 5,500 estimates of the strength and direction of natural selection in the wild (A. M. Siepielski *et al. Ecol. Lett.* **12,** 1261–1276; 2009). By focusing on studies in which selection was measured more than once, the authors were able to see for the first time that aspects of selection change rapidly in direction, strength and form from generation to generation.

This new perspective, if correct, has profound implications. First, we should not be surprised to observe rapid evolution in natural settings, even over human lifetimes. At the same time, we should not expect evolutionary change that can be measured in real time to be permanent. More synthetic studies — combining observations of evolution in action with historical data — are needed to better understand the relationship between evolution in 'real time' and evolution in 'deep time'.

Discuss this paper at **http://blogs.nature.com/nature/journalclub**