Plant biology

Chestnuts clock out in winter

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Do plants put their internal clocks on pause when winter arrives? According to Alberto Ramos *et al.*, such a disruption indeed takes place in the European chestnut.

Ramos *et al.* examined parts of adult trees — including stems, leaves and buds — for gene products associated with the circadian clock. They found that the chestnut clock behaves like that of the flowering plant *Arabidopsis thaliana* during the growing season, but acts differently in colder months.

During June, expression of the genes *CsTOC1* and *CsLHY* (counterparts of two *Arabidopsis* clock genes) followed strong cycles. But their expression remained high and did not oscillate when the trees encountered colder temperatures and entered dormancy. Normal cycling of *CsTOC1* and *CsLHY* expression resumed when chestnut seedlings in the lab were exposed to warmer temperatures. The findings suggest that woody and herbaceous plants use different methods for adjusting their clocks to the cold.

Roxanne Khamsi

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Network theory

On Broadway

Science **308**, 697–702 (2005)

Another opening, another show. But what makes it a success? According to Roger Guimerà and colleagues' analysis of Broadway musicals, the answer is maximizing experience and innovation by means of a well-mixed and well-connected production team, with a dash of fresh faces.

Underlying such teams is a network of collaborations, and Guimerà *et al.* investigate these in terms of team size, which grows with the complexity of the task; the probability of being an established team member, or 'incumbent', hence experienced and well connected; and the likelihood that an incumbent chooses to work again with a previous collaborator.

Simulating team-building in the phase space determined by these parameters, the authors find a phase transition to a large connected cluster. This means that there are optimum values of the parameters for which a complex network of contacts exists that is the basis for success.

The same is true of some research teams. For collaborations in social psychology, economics and ecology — and using journal impact factor as a measure of success — Guimerà *et al.* conclude that it's getting the right combination of newcomers and incumbents that counts. Curiously, however, astronomy doesn't fit the pattern.

Alison Wright

Cell biology

Prion progress

Cell **121,** 195–206 (2005)

Are prions — infectious proteins — the sole cause of disorders such as Creutzfeldt–Jakob disease and scrapie? Joaquín Castilla *et al.* add to the case that they are.

According to the prion hypothesis, normal prion proteins become twisted out of shape, and then convert further normal proteins into the same warped form. One way of testing the hypothesis is to generate misshapen prions *in vitro* and see if they cause disease *in vivo*. Researchers have succeeded in doing this with yeast prions. They have also generated mammalian prion-like protein fragments *in vitro*, and used them to cause disease in transgenic mice engineered to overexpress the same fragments.

Castilla *et al.* go further. Tweaking one of their own techniques, called 'protein misfolding cyclic amplification', they used extracts of scrapie-infected hamster brains to 'seed' the conversion of normal prion proteins into the abnormal form *in vitro*. Numerous cycles produced samples containing practically none of the original brain extracts. When wild-type hamsters were infected with prions that had been generated *in vitro*, the animals showed typical signs of scrapie.

Amanda Tromans

Chemistry

Molecular bends

Angew. Chem. Int. Edn Engl. **44,** 2382–2385 (2005)

Heating usually speeds up chemical reactions — the extra energy causes molecules to vibrate more, which stretches interatomic bonds and makes them more likely to break. Hans A. Bechtel and colleagues find that heating also increases the bending of molecular bonds.

Compared with stretching vibrations, bending vibrations have a lower frequency and are less energetic, so have remained largely unexplored. Bechtel *et al.* studied the reaction of methane (CH_4) with atomic chlorine, which occurs in atmospheric chemistry and is a common model for investigating reaction rates.

They show that, counterintuitively, bending excitation increases the chances of methane reacting by at least a factor of two, implying that shearing motion, as well as stretching, can help to break C–H bonds. They also find that the energy involved in the movement of methane's atoms leads almost exclusively to motion of the escaping reaction products, rather than being retained as vibrational energy in the products — something not predicted by theory. Targeting bending excitation of molecules may boost rates in other reactions, the authors suggest.

Mark Peplow

Drug delivery

Shake-up for injections

Colloids Surf. A **260,** 7–16 (2005)

Many drugs are built on a hydrocarbon molecular scaffolding, and so are hydrophobic and rather insoluble in water. This makes intravenous injection of water-based solutions impossible. Often, such drugs are dissolved in oils that are then dispersed in water using surfactant emulsifiers — but both the oils and the surfactants may degrade into harmful compounds.

R. M. Pashley and co-workers recently found that water and oil mixtures from which dissolved air has been removed are much better at dispersing oily and greasy substances. Pashley and M. J. Francis have now shown that degassed oils dispersed in degassed water could be a suitable method for delivering hydrophobic drugs.

Simply shaking common drug-delivery oils, in degassed form, such as soybean oil, degassed water for a few seconds produces a dispersion of uniform droplets about 1–3 μm in diameter, which could act as robust 'parcels' for the safe intravenous injection of drugs. Liquid, water-insoluble drugs such as propofol (a sedative) and griseofulvin (used to treat skin infections) could be dispersed directly in degassed water without any carrier oil.

Philip Ball