Archaeology

Buried 'butter' brought to light

Analyst **129,** 270–275 (2004)

People digging up slabs of peat for fuel in Ireland and Scotland sometimes find lumps of white, waxy material embedded in the bog. This 'bog butter' seems to be the remains of fatty foods that were buried between about 400 BC and the Middle Ages, to preserve them in the cool anaerobic conditions.

Robert Berstan *et al.* have now analysed the fat molecules in bog butter to figure out its origin. They say that some of it originates from dairy products such as real butter, whereas some derives from animal fatty tissue. In both cases, the material is transformed over time to a waxy substance similar to adipocere, which is found in human corpses buried or recovered from the sea.

The precise composition of the fatty compounds — the length of their carbon chains, and their ratio of carbon-12 to carbon-13 — preserves a signature of their origin, which the researchers discerned using chromatography and mass spectrometry. Out of nine Scottish bog butters, they found that six come from dairy products and three from animal fat, showing that bog burial was used to preserve (or perhaps modify) diverse foodstuffs in ancient times. **Philip Ball**

Cancer

Communication breakdown

J. Cell Sci. doi:10.1242/jcs.01000 (2004)

It is generally assumed that cancers start when carcinogens, such as harsh chemicals, create mutations in a cell's DNA that trigger uncontrollable proliferation. For one case at least, Maricel V. Maffini *et al.* challenge that view. They show that cells may become cancerous only after neighbouring tissues, rather than the cells themselves, have been exposed to carcinogens.

The researchers studied cultured tissues of the rat mammary gland, a model of breast cancer in which malignancies are thought to arise in the epithelium rather than the adjacent stroma. They transplanted epithelial cells that had been exposed to either saline or a chemical mutagen into stromal fat tissue that had also been exposed to either saline or a chemical mutagen.

Maffini *et al.* found that healthy epithelial cells transplanted into the chemically treated fat tissue became cancerous, regardless of whether the cells had been mutated themselves. Conversely, chemically treated epithelial cells grew into apparently normal mammary gland ducts when injected into healthy stromal tissue.

The authors suggest that the carcinogen wrecks normal communication between stromal and epithelial cells, and that this encourages epithelial cells to start growing into tumours. The finding implies that other cancers may also form because of a breakdown in signalling between adjacent tissues. **Helen Pearson**

Behavioural genetics

Good relations

Curr. Biol. **14,** 510–513 (2004)

Western lowland gorillas (*Gorilla gorilla gorilla*) are unusual in that males from neighbouring social groups often mingle without aggression. One explanation for this peaceful coexistence, stemming from DNA analyses, is that the males are related to one another.

Brenda J. Bradley and her colleagues took DNA samples from hair and dung at gorilla nest sites over a 50-km^2 area of central Africa. They identified 14 silverbacks (mature males), only two of which were unrelated to any of the others analysed. Furthermore, males that lived closer together tended to be more closely related — a pattern not seen in females.

Western gorilla groups usually contain just one silverback, with other males emigrating a short distance as they mature. This, the authors argue, is the basis of their neighbourly behaviour, and is similar to the short-distance male emigrations that characterize marriage in many human societies. Groups of mountain gorillas (*Gorilla gorilla beringei*), on the other hand, often feature several silverbacks and little emigration, which may explain the more frequent fights between males of rival groups. **Michael Hopkin**

Plant biology

Autumn's genes

Genome Biol. **5,** R24 (2004)

The size and slow growth of trees make them a challenging subject for molecular biologists. Nevertheless, Anders Andersson *et al.* have applied a genomic approach to the study of aspen (*Populus tremula*), and in so doing have provided a molecular picture of the changes that a tree undergoes as winter approaches.

The authors constructed microarrays with which to quantify the genes that were expressed in leaves from a single wild aspen tree during five weeks in August and September. Aspens are deciduous, so they lose their leaves in autumn. During this process, many valuable chemicals — such as the green pigment chlorophyll — are recycled for use in following years, leaving behind brown and gold carotenoid and flavonoid pigments.

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Andersson and colleagues' data show the wide-ranging shift in gene expression that underlies these events. For instance, more than one week before any outward signs appear, protein production increases as leaves start making proteases and other degradative enzymes. Moreover, the production of enzymes involved in photosynthesis ceases, and enzymes that generate energy by burning fats and sugars are made instead. These data provide a map of autumn's molecular fluxes — and also identify 35 genes expressed nowhere else but in autumn leaves. **Christopher Surridge**

Organic chemistry

Art or science?

J. Chem. Inf. Comput. Sci. doi:10.1021/ci030415e (2004)

Chemists often claim that the synthesis of organic molecules is more of an art than a science, because of the creativity needed to design a sequence of reactions to produce a precise, complex molecular architecture. Their designs are guided by retrosynthetic analysis — thought experiments that break complicated molecules into simpler units, which serve as starting materials for a real synthesis. The rules of retrosynthesis, derived through experience, always strive for the simplest starting materials within the constraints of what is practically possible.

Christoph Rücker *et al.* have now found that these rules are underpinned by mathematical bedrock. They have used different numerical indicators of molecular complexity — such as how the atoms in a molecule are connected — to plan a range of chemical syntheses. These simple mathematical rules give very similar answers to the heuristic rules of retrosynthesis, and can also rank different options according to how much they simplify the synthesis. The authors conclude that this seemingly artistic part of chemistry is actually deeply scientific.

Rücker *et al.* admit that there are many aspects of chemistry that are still beyond the reach of simple indices. But they recall the words of Immanuel Kant, written in 1786: "In any particular natural philosophy there is only as much real science as there is mathematics to be found in it." **Mark Peplow**