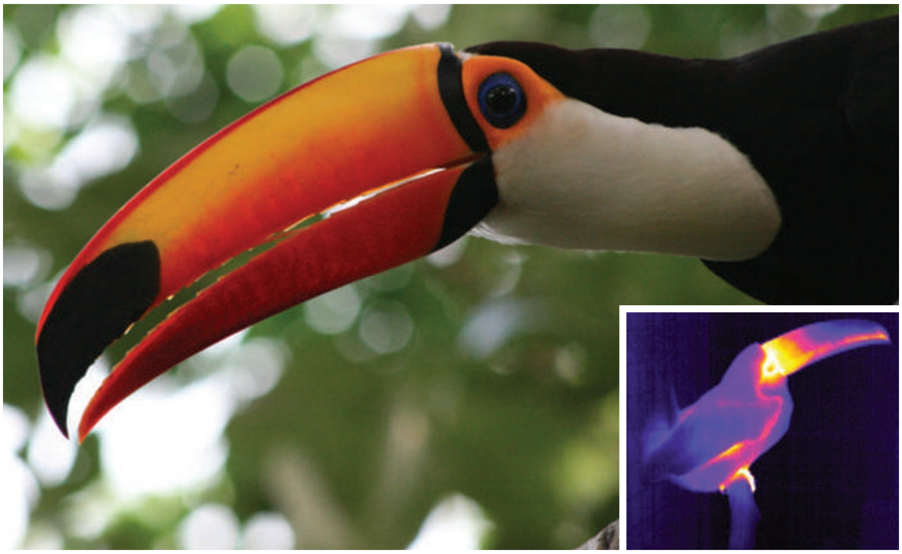
RESEARCH HIGHLIGHTS

Chill bill

Science **325,** 468–470 (2009)

Guinness adverts notwithstanding, suggestions for the purpose of a toucan's enormous bill have ranged from sexual ornamentation to peeling fruit. Glenn Tattersall of Brock University in St. Catharines, Canada, and his colleagues have discovered another use: keeping cool.

Toucan bills, which contain a network of blood vessels, are among the most effective heat-loss instrument in any animal yet studied. The authors placed toco toucans (*Ramphastos toco*) in an experiment chamber and subjected them to different temperatures while observing them with infrared imaging (see image, inset). Depending on activity levels and ambient temperature, adult bills accounted for as little as 5% and as much as 100% of total body heat loss.



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PHYTOLOGY

Tree carbon recalibrated?

New Phytol. doi:10.1111/j.1469-8137.2009.02971.x (2009)

In addition to dispersing into the soil and, ultimately, out into the atmosphere, carbon dioxide produced by tree roots can travel up the stem. The presence of this newfound pathway suggests that scientists have underestimated the amount of energy consumed by underground forest metabolism.

Doug Aubrey and Robert Teskey from the University of Georgia in Athens measured CO_2 levels in the soil as well as in sap and water taken up by four eastern cottonwoods (*Populus deltoides*) at an experimental plantation in South Carolina. They estimated that twice as much CO_2 entered the stem's xylem as diffused into the soil, providing evidence that below-ground respiration might exceed that by leaves and woody tissue.

Although preliminary, the study suggests that scientists need to reconsider the way they calculate forest carbon budgets.

NANOCHEMISTRY

Protein fondue

Angew. Chem. Int. Edn doi:10.1002/anie.200903100 (2009)

Proteins, like many other nanometre-scale objects, cannot normally exist in the liquid state. Instead they sublime or degrade upon heating.

Building on others' work with inorganic nanoparticles, Stephen Mann at the University of Bristol, UK, and his colleagues show that it is possible to generate liquid proteins by substituting a positively charged polymer for their carboxy-terminal groups. They then added another polymer, this time negatively charged. After removing water, the team heated the solid until it formed a liquid crystal, which melted at 50 °C. The protein melt returned to its solid phase at −50 °C.

The solid-to-liquid phase change is possible because the polymer extends the range of intermolecular forces. It is likely that the method could be generalized for a wide range of biological nanostructures.

CANCER BIOLOGY

Cancer's metabolic roots

Science doi:10.1126/science.1175689 (2009)

A mutation in a protein involved in cell respiration makes people susceptible to a rare type of tumour, a new study finds.

Jared Rutter at the University of Utah School of Medicine in Salt Lake City and his colleagues used yeast to uncover the function of SDH5, a previously uncharacterized mitochondrial protein. The protein is required for the assembly of functional succinate dehydrogenase (SDH), a crucial enzyme in both the citric-acid cycle and electron-transport chain. The human version of the protein has the same functions.

Previous work has linked other human mutations that knocked down SDH activity to neuroendocrine tumours called paragangliomas. The authors found that individuals in a family with hereditary paragangliomas had mutations in the gene encoding human SDH5.

MICROFLUIDICS

The sounds of science

Proc. Natl Acad. Sci. USA doi:10.1073/pnas.0900043106 (2009)

Microfluidic systems use networks of tiny chambers and channels to mix small volumes of solution. Controlling these systems often requires cumbersome pumps and valves that are much larger than the microfluidic devices themselves.

The problem struck a chord with Mark Burns and his colleagues at the University of Michigan in Ann Arbor. So the team attached a microfluidic device to a series of resonant acoustic cavities that respond to different frequencies (pictured left). When resonant, each cavity applies a specific output pressure to the microfluidic system. The pressure applied — and thus the movement of fluids along channels — can be controlled using a simple melody. The authors hope that their tiny tunes will lead to more compact control systems for microfluidics.