Biology

New twist in the tale of long tails

While many fancy tails displayed by male birds serve solely to attract mates (SN: 2/6/93, p.84), not all tails serve this purpose. To find out whether long tails evolve primarily as sex symbols or aids to survival, British biologists analyzed the aerodynamics of various tail shapes. In general, longer tails add more drag, but long tails with shallow forks can improve flight efficiency, Andrew Balmford, now at the Zoological Society of London, and two colleagues report in the Feb. 18 NATURE. For the study, they calculated the lift and drag of various tail models and measured the tail feathers in 600 preserved bird skins. Birds that spend much of their time flying often possess these efficient tails. In these species, the females also tend to evolve such tails, the researchers note.

Does a warmed brain learn better?

When laboratory rats explore new mazes or learn to find objects, specific areas of their brains change the type of electrical signals they give off, increasing the strength of some aspects of these signals. Neurobiologists monitor these changes to try to correlate nerve cell activity with the animal's behavior. In this way, they study how animals learn to get around in their environments.

But Norwegian researchers now report that alterations in the signals may simply reflect changes in brain temperature. When the body gets moving, the brain gets hotter, and the nerve cells produce faster signals, says Per Andersen of the University of Oslo.

He monitored temperatures in different parts of the brains of rats allowed to explore new cages and to swim in cool water. Blood warmed by moving muscles increases brain temperature by as much as 3°C, he and his colleagues report in the Feb. 26 SCIENCE.

They also warmed the rats' brains slightly with probes and monitored whether exploring a new place causes further alteration of the electrical signal. It did not, Andersen says.

Thus, temperature rise — not the act of learning — alters the character of electrical signals generated by these nerve cells, they conclude. "The temperature effect does not say that the animal does not learn," Andersen told SCIENCE NEWS. "It just says that the brain is not as homeothermic as we think."

The Norwegian finding hints that changes in brain temperature may affect the way information is transmitted or stored in the brain, notes Bruce L. McNaughton, a neurobiologist at the University of Arizona in Tucson. Scientists still need to confirm that mammals other than rodents undergo changes in brain temperature. Nevertheless, "we are vigorously pursuing that [temperature] may be an important modulator," he adds.

Vanilla, beef-broth compound flavor syrup

On the eve of the annual maple syrup season, scientists have determined that the syrup's flavor comes from substances also found in beef broth. In addition, the sweetness results in part from another flavor chemical, vanilla, says Robert Lindsay, a food scientist at the University of Wisconsin-Madison.

He and his colleagues discovered flavor compounds called furanones in processed sap. The darker the syrup, the higher the furanone content and the more intense the flavor, up to a point, says Lindsay. Light-colored syrup costs more, but people who tasted various syrups preferred darker ones, he adds.

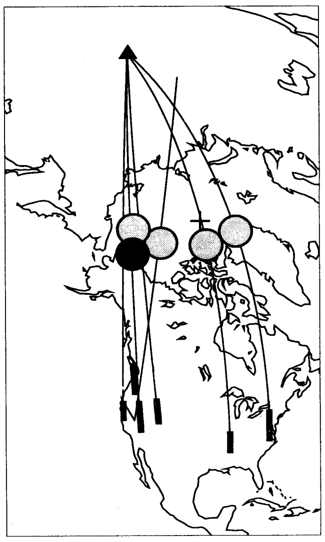
His group also determined that sap contains vanillin molecules attached to a sugar. Typical boiling frees 30 percent of these molecules, says Lindsay.

But adding enzymes can actually release more, for a sweeter syrup, he adds. "My feeling is that some of this [new technology] will make it into the industry in the next five or more years."

Earth Science

A-blast lights up core-mantle boundary

It was a shot heard halfway 'round the world. In May 1992, an underground nuclear test in China punched a 1-second seismic pulse thousands of miles into the Earth. Meanwhile, scientists on the other side of the Pacific Ocean had their "ears" to the ground, hoping to record telltale changes in the pulse as it grazed the boundary between Earth's rocky mantle and its molten, metallic core.



Vidale, Benz/NATURE

Rumblings from an underground nuclear test (black triangle) helped scientists pinpoint an anomalous region of Earth's mantle, located 2,700 km beneath the dark circle. Dark rectangles mark the seismic networks in the United States and Canada that detected the region. White circles represent homogenous mantle.

The scientists' ears consisted of a continent-spanning network of 1,062 seismometers scattered among 14 earthquake-listening sites in Canada and the United States, forming the most geographically widespread network ever focused on a single source of seismic waves. Using hundreds of measurements from these sites, John E. Vidale and Harley M. Benz of the U.S. Geological Survey in Menlo Park, Calif., have identified a distinct island of material that lies some 2,700 kilometers beneath northern Alaska, they report in the Feb. 11 NATURE.

The newly identified structure measures approximately 300 km across and 130 km thick, the smallest feature yet pinpointed near the important core-mantle boundary, Vidale says. The scientists could detect this relatively small structure because seismic waves passing through it speeded up slightly, indicating a difference in temperature or chemical composition between it and the surrounding mantle material.

Vidale attributes the improved measurements to the nature of the Chinese test explosion and to the number of widely dispersed seismometers listening to it. The blast, a short, powerful pulse of known geographical origin, enables scientists to identify more precisely details of the core-mantle boundary. "We have a high-resolution picture of one [small] place now, using this very sharp, powerful explosion," Vidale says.

By combining measurements of earthquakes, researchers had previously shown that the 250- to 300-km-thick layer over the core-mantle boundary varies significantly in its physical properties (SN: 6/11/88, p.378). Geoscientists have turned their attention to these variations, or heterogeneities, seeking to understand more clearly the interactions between Earth's mantle and its core.

Geoscientists aren't sure whether the heterogeneities stem from chemical reactions between the core and mantle or from the downward flow of cooler, denser material from the upper mantle. But resolving this question may help them explain some important geologic processes assumed to originate at the core-mantle boundary, Vidale says.

"That we can actually identify one structure will hopefully help us to figure out what this heterogeneity is," he notes. "It's really the highest resolution picture [of a structure near the core-mantle boundary] so far."