EDITORS' CHOICE

edited by Gilbert Chin

PHYSICS

Atomic-Scale Length Standard

The unit of length has come a long way since the cubit (the distance from fingertip to elbow) was used in the ancient world. Naturally, this was not very useful for accurate and reproducible measurement, and subsequent standardization of length resulted in the meter. Demands for increased accuracy have displaced the meter with the distance traveled by light from a helium-neon laser in 1/299,772,458th of a second; but for atomic-scale distances, even this measure is too coarse. At present, the most accurate definition of length is based on the lattice constant of ultrapure crystalline silicon held under strict temperature and pressure conditions, which makes widespread reproduction of results between different laboratories difficult.

Shvyd'ko *et al.* have updated a technique that is relatively insensitive to ambient temperature and pressure. By calibrating the γ-rays emitted from an excited iron-57 atom against almost exact Bragg backscattering from a reference silicon crystal, they found that the γ-ray wavelength can be determined to be 0.08625474 nanometers with an accuracy of better than 0.19 parts per million. — ISO

Phys. Rev. Lett. **85**, 495 (2000).

ECOLOGY & EVOLUTION

Diversity Ad Infinitum

Microorganisms remain one of the thornier sectors in the quest to quantify the number of living species. Morphological species delimitation, which is not always straightforward at the macroscopic level, becomes quixotic where bacteria, fungi, and protozoa are concerned. Among the fungi, estimates of global species diversity have reached as high as 1.5 million, or six times as many species as the higher plants.

Endophytes are fungi that are ubiquitous in plants, inhabiting root, stem, and leaf tissues in harmless commensal association. Several recent studies have suggested that endophytes might comprise a substantial component of fungal diversity. Arnold *et al.* find 418 morphospecies (estimated to account for about 350 genetically distinct species) of endophyte growing at low abundance within just two tree species in two Central American rain forest sites. After a larger fraction of the tropical forest flora has been sampled, and taking into account data on host preference and spatial variability within hosts and between sites, the fungi may grow to rival the arthropods as one of the most speciose groups on Earth. — AMS

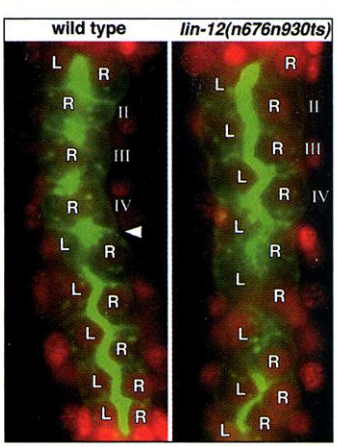
Ecol. Lett. **3**, 267 (2000).

DEVELOPMENT

A Sinister Twist

Despite outward appearances, humans are not bilaterally symmetric—our internal organs show pronounced left-right asymmetries in morphology and placement. How do these asymmetries arise during development?

The intestine of the nematode *Caenorhabditis* develops as a simple tube that eventually adopts a characteristic left-handed "twist" as a result of circumferential movements of cells at the anterior end. Hermann *et al.* find that induction of this twist requires the LIN-12/Notch signaling pathway. Initially all intestinal cells contain comparable levels of the Notch-related receptor LIN-12; however, contact with nonintestinal cells that express the Delta-related ligand LAG-2 and are present only on the left side of the intestine results in a selective reduction in LIN-12 levels on that side. This asymmetric pattern of LIN-12 is thought to underlie subsequent asymmetric cell-cell interactions involving a different LIN-12 ligand, APX-1, which in turn lead directly to the intestinal twist. — PAK



Wild-type (left) and untwisted (right) intestinal cells (green).

SOURCE: (LEFT TO RIGHT) HERMANN *ET AL.*, *DEVELOPMENT* **127**, 3429 (2000); WU *ET AL.*, *EMBO J.* **19**, 3727 (2000).

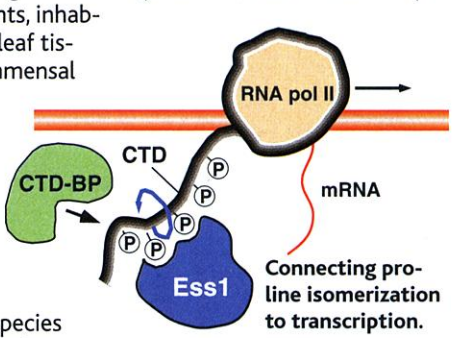
Development **127**, 3429 (2000).

MOLECULAR BIOLOGY

Isomerization of the Peptide Bond

Prolyl isomerases are most familiar as the targets of the immunosuppressive drugs cyclosporin and FK506, which bind, respectively, to cyclophilins and FK506-binding proteins (FKBPs). An as yet intractable puzzle has been the cellular function of these enzymes, which generally are not essential for viability.

Wu *et al.* have studied a third class of prolyl isomerases, typified by Ess1 which is essential for growth in yeast. Unlike the other two kinds, Ess1 contains a WW domain (so-called for two invariant tryptophans) in addition to the catalytic domain; the WW domain is known to interact with phosphoserine-proline sequences. From a combination of genetic (to identify suppressors) and biochemical (to characterize interactions)



Connecting proline isomerization to transcription.

experiments, they conclude that Ess1 functions by binding to the C-terminal domain (CTD) of RNA polymerase. Thus, Ess1 would control the recruitment of transcriptional regulatory factors via their interactions with the CTD—which is known to include many copies of a seven-residue repeat containing two serine-proline motifs.

Arévalo-Rodríguez *et al.* have examined the interactions of cyclophilin and Ess1 with components of a chromatin remodeling complex, while Verdecia *et al.* describe the structure of a WW domain bound to the doubly phosphorylated heptad repeat. — GJC

EMBO J. **19**, 3727 (2000); *EMBO J.* **19**, 3739 (2000); *Nature Struct. Biol.* **7**, 639 (2000).

CLIMATOLOGY

A Head Start on Cooling

The Younger Dryas, a period of cooling between roughly 13,000 and 11,500 years ago that interrupted the warming that ended the last deglaciation, is clearly visible in many Northern Hemisphere climate records. Whether such cooling extended into the Southern Hemisphere has been hotly debated.

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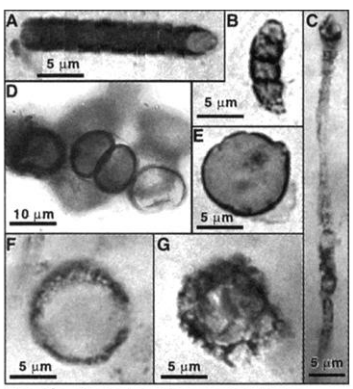
Newnham and Lowe analyzed pollen from a peat bog in New Zealand and find evidence for a cooling event that began around 13,600 years ago and lasted approximately 1000 years. This interval of cooling occurred 600 years before the Younger Dryas, which suggests that this climate event may have registered first in the Southern Hemisphere and then propagated into the Northern Hemisphere. Such a delay in the appearance of the climate signal could implicate thermohaline circulation as the agent of transmission. Another possibility, which arises because of the uncertainties in comparing different types of records, is that these events were nearly synchronous, which would imply that an atmospheric (and thus virtually instantaneous) connection between the hemispheres transmitted the change in temperature. In any event, a delayed response to the Younger Dryas by the Southern Hemisphere appears to be ruled out. — HJS

Geology **28**, 759 (2000).



Fossils of early microorganisms.

NEUROSCIENCE

In Touch with Reality

It is by now well established that the medial temporal lobe of the human brain, encompassing such important structures as the hippocampus, is crucially involved in the storage of new information. Less is known, however, about the appropriate retrieval of stored memories. In spontaneously confabulatory patients—people who have an inability to distinguish between memories relating to ongoing reality and memories that are no longer relevant—behavioral deficits are correlated with lesions in the anterior limbic and paralimbic areas of the brain.

In a brain imaging study, Schnider *et al.* presented a group of healthy subjects with a task that required the selection of currently relevant memories. Their data indicate that the anterior limbic system, particularly the medial orbitofrontal cortex, monitors reality and also suppresses memory traces and mental associations that have no current behavioral relevance. This mechanism would allow for the free flow of mental associations while at the same time ensuring that our actions are grounded in the present. — PRS

J. Neurosci. **20**, 5880 (2000).

GEOLOGY

Assaying Ancient Bacteria

The Precambrian fossil record extends back to about 3.5 billion years ago, and chemical evidence for the possible appearance of life extends several hundred million years earlier. Determining the evolution of metabolic pathways of bacteria is important for inferring how bacteria may have influenced the chemistry of rocks and Earth's atmosphere. Some information has been obtained from isotopic studies because metabolic pathways can produce distinct isotopic signatures; but these have required large samples and it often was unclear if the analyses represented a specific organism.

House *et al.* used the ion microprobe to conduct carbon isotopic analyses of some individual Precambrian microfossils. Analysis from fossils as old as 2.1 billion years ago are consistent with carbon fixation by two processes—the Calvin cycle and the acetyl-CoA pathway—and establishes the presence of cyanobacteria. Rasmussen and Buick used carbon isotopes to show that there was enough organic material produced by marine biota about 3.2 billion years ago to generate significant amounts of petroleum. — BH

Geology **28**, 707 (2000); *Geology* **28**, 731 (2000).

BIOCHEMISTRY

Starched Ties

Interactions between carbohydrates at cell surfaces can mediate cellular recognition—for example, lymphoma and melanoma cells interact through the Gg3 and GM3 glycolipids. How these interactions actually lead to signal transduction has been unclear, in part because the binding strength between carbohydrate groups has been difficult to quantitate. Matsuura *et al.* show that surface plasmon resonance has sufficient sensitivity to identity the determinants of binding. They attached carbohydrates to sphingolipids on gold-coated glass slides and exposed them to solutions that contained *N*-glycosides linked to polystyrene. Comparisons between different binding pairs show that removing the acetylated amino group of the sialic acid reduces by one order of magnitude the binding affinity between GM3 and Gg3. — PDS

J. Am. Chem. Soc., in press.

CREDITS: HOUSE *ET AL.*, *GEOLOGY* **28**, 707 (2000).