EDITORS' CHOICE

edited by Gilbert Chin

BIOMEDICINE

Desperately Seeking a Diabetes Gene

Non-insulin-dependent diabetes mellitus (NIDDM) affects 10-20% of people over age 45 in many developed countries, and it is increasing in incidence. An example of a complex trait, NIDDM is thought to arise from a combination of environmental and genetic factors, and the genetic contribution is likely to arise from several interacting genes, each carrying critical, yet subtle, alterations.

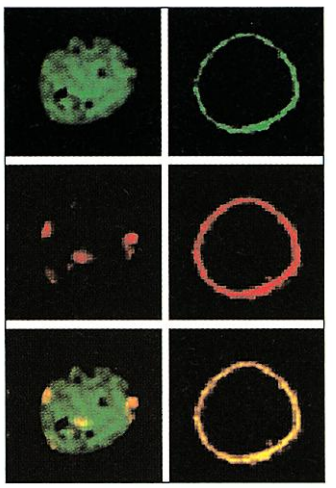
Undaunted by the complexity of their task, Horikawa *et al.* report progress in the search for genetic variations that influence the propensity to develop NIDDM. Using positional cloning methods, they found that specific polymorphisms in CAPN10, a chromosome 2 gene that encodes a widely expressed calpain-like cysteine protease, are associated with NIDDM in both Mexican-American and Finnish populations. Whether these genetic variations in CAPN10 are causal factors in the disease or merely co-segregating markers is unclear, but this question can now be addressed in clinical and laboratory studies. — PAK

Nature Genet. **26**, 163 (2000).

CELL BIOLOGY

Rebuilding the Network

The nucleus is surrounded by a double membrane, the nuclear envelope, which is in turn lined by a network of proteins known as lamins. In mammalian cells, the nuclear envelope and the nuclear lamin network must disassemble to allow mitosis to proceed, and then reassemble.



Recruiting AKAP149 (green) and PP1 (red) to the nuclear envelope.

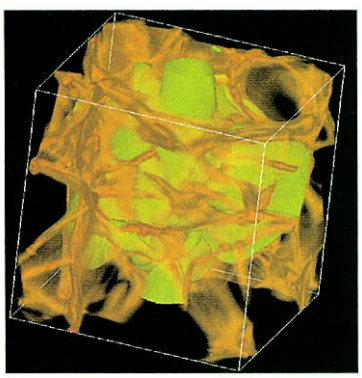
Steen *et al.* examined the requirements for nuclear reassembly and discovered that the protein AKAP149 (A-kinase anchoring protein 149) is important in recruiting lamin B to the reformed nuclear envelope in interphase cell extracts. In addition to binding the A-kinase, AKAP149 also binds protein phosphatase type 1 (PP1), which dovetails with the modulation of organelle structure by phosphorylation and dephosphorylation cascades during mitosis. Understanding how these cascades control the localization of key enzymes that contribute to the changes in cellular architecture before, during, and after mitosis can now be studied in reconstituted systems that faithfully reproduce intracellular processes. — SMH

J. Cell Biol. **150**, 1251 (2000).

ASTROPHYSICS

Old Metals, New Stars

After the Big Bang, the universe may have been populated by supermassive stars; these hypothetical population III stars are possible progenitors for population II stars, which are old red stars found in galaxies today and are rich in elements heavier than helium. There is keen interest in understanding how star formation and stellar distribution may have progressed from the meager beginnings of a few stars to the luminous tapestry of billions of stars in clusters and galaxies.



Metal-rich filaments (orange) of the interstellar medium.

Nakasato and Shigeyama use a three dimensional hydrodynamic model to investigate the formation of population II stars. Starting with a heterogeneous interstellar medium (ISM), they exploded a 20 solar mass supernova and modeled the distribution of metallic elements added by the supernova remnant. They found that the filaments of the ISM became enriched in metals and that population II stars born in these regions would contain the appropriate abundance of heavier elements. Thus, this model and subsequent numerical investigations may provide a glimpse of the proto-stellar framework from which the next generation of stars and galaxies formed. — LR

Astrophys. J. **541**, L59 (2000).

CHEMISTRY

Hard-Core Electrochemistry

The [4Fe-4S] clusters of ferredoxin proteins can assume a wide range of oxidation states. Gorman and Smith have used these cube-like clusters as the core unit for polymer dendrimers, which are branched structures that increase in overall size with each succeeding round (or generation) of synthesis. They determined how the redox properties varied with generation number and found that this variation differed for molecules in solution versus those cast directly as films onto electrodes. The redox potentials in films shifted by half a volt as dendrimers grew from second- to fourth-generation, but the redox potential of solvated dendrimers did not change. Films exhibited similar overall electron transfer rates with increasing generation number, but rates in solution dropped two orders of magnitude between the second and fourth generation. The authors suggest that an electron-hopping mechanism functions efficiently in films in which the [4Fe-4S] clusters reside close to one another, but is not fast enough to operate in solvated dendrimers, which contact the electrode surface only transiently. — PDS

J. Am. Chem. Soc., **122**, 9342 (2000).

BIOCHEMISTRY

Web Assembly

The construction of mechanical supports, such as cellulose in plants and collagen in animals, results from the conversion of small, soluble parts into a large, insoluble matrix. The difficulty in controlling this transition has contributed to the obstacles in identifying intermediates and determining their modes of assembly. One of the most tantalizing biomaterials in this regard is spider silk—effortlessly produced, remarkably strong, and extremely light.

Winkler *et al.* describe an approach aimed at introducing a switch with which the formation of the β-sheet structures observed in the final product might be regulated. They have engineered into a synthetic silk gene a recognition site for a

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SOURCE: (LEFT) NAKASOTO AND SHIGEYAMA, *ASTROPHYS. J.* **541**, L59 (2000); (RIGHT) STEEN *ET AL.*, *J. CELL BIOL.* **150**, 1251

protein kinase; adding bulky and anionic phosphoryl groups to the protein interferes with β-sheet formation, as assessed by circular dichroism and infrared spectroscopy, and increases its solubility four-fold. This technique, together with a previously described disulfide switch, may enable us to begin teasing apart the details of how spider silk is fabricated. — GJC

Biochemistry, in press.

GEOCHEMISTRY

Tracing Tektites to Their Craters

Impacts on Earth that create craters with diameters larger than about 3 kilometers may eject melt droplets from the surface. These droplets do not escape Earth's gravity and are distributed globally as glasses (tektites) or glasses with microcrystals (krystites). Strewn fields or thin layers of tektites have been identified, and the challenge is to associate these glassy concentrations with a particular impact. Once these are connected, models can be developed to understand the size and composition of the bolide, as well as the impact's effect on the surface and atmosphere.

Whitehead *et al.* analyzed the major element and Sr and Nd isotopic characteristics of one microtektite layer and two microkrystite layers from deep sea drilling cores from the Atlantic, Pacific, and Indian Oceans. The 35.5-million-year-old microtektite layer has chemical characteristics which correlate with the Chesapeake impact structure on the east coast of North America, as previously suggested. The two, slightly older, lower microkrystite layers show a chemical correlation with the Popigai impact structure in Siberia. These geochemical markers can now be used to model the physical process of these impact events. — LR

Earth Planet. Sci. Lett. **181**, 473 (2000).

CLIMATOLOGY

A Calcium Thermometer

Sea surface temperature (SST) influences many of the biological, chemical, and physical processes that connect ocean and atmosphere, and paleoclimatologists have used a host of different proxies to infer SSTs during the Quaternary. Considerable disagreement exists, however, because most methods register other factors in addition to temperature, such as glacial ice volume, salinity, interspecies metabolic differences, and possible variations in the chemical composition of the oceans.

The calcium isotopic ratios of foraminifera are a potentially valuable and robust thermometer because, by involving only one element, they are not affected by many of the chemical and biological processes that can complicate the interpretation of other temperature proxies. Nägler *et al.* report calcium isotope ratios from a single species of foram, *Globigerinoides sacculifer*, cultured at different temperatures in the laboratory, and analyses from an equatorial East Atlantic sediment core. Their experiments show a clear dependence of $^{44}Ca/^{40}Ca$ on temperature, which they then apply to their marine core samples to produce a history consistent with a Mg/Ca-based temperature reconstruction of the past 240,000 years. They find that the SST at their core location increased by between 2 and 4° C during the last deglaciation. — HJS

Geochem. Geophys. Geosys. **1**, 2000GC000091 (2000).

PALEONTOLOGY

Feeling the Heat

Thermoregulation in large dinosaurs has been a preoccupation of palaeontologists for many years. Were they like modern reptiles (ectotherms), which rely on external sources of heat to maintain body temperature, or like mammals (endotherms), which maintain a relatively constant temperature via metabolic heat production? Evidence from fossil morphology has been inconclusive.

Crocodile (left) and theropod (center) teeth.

Fricke and Rogers take a new approach to this question, by measuring the oxygen isotope ratios found in tooth enamel of Cretaceous theropod dinosaurs and coexisting crocodilians across a range of latitudes. The isotope ratio is a signature of the temperature conditions under which bones and teeth originally were formed. The crocodilians showed a shallow spread of ratios consistent with ectothermy, while the dinosaurs showed a pattern similar to that of present-day endothermic mammals and birds. The door is now open to the investigation of the degree of thermal regulation across a wide range of fossil animals. — AMS

Geology **28**, 799 (2000).

CREDIT: HENRY FRICKE/COLORADO COLLEGE.