EDITORS' CHOICE

edited by Stella Hurtley

ATMOSPHERIC SCIENCE

Air Supplies

Although uncertainty remains, the Archean atmosphere up to about 3 billion years ago is thought to have been rich in CO_2 and H_2O. An oxygen-rich atmosphere may have evolved in stages starting about 2 to 2.4 billion years ago, perhaps driven in part by the evolution or increased abundance of photosynthetic bacteria, which released oxygen.

Kasting *et al.* now suggest that the rise of methanogenic bacteria also left their mark on Earth's atmosphere. An enigmatic drop in the carbon isotope record of the early Earth may reflect abundant methane in Earth's atmosphere released by these bacteria. Coupled with the rise of oxygenic photosynthesis about 3 to 2.5 billion years ago, this event helped to pave the way to an oxygen-rich atmosphere. — BH

Geology **29**, 1003 (2001).

DEVELOPMENT

Jelly Belly

The process by which early embryonic germ tissues give rise to multiple organs and tissues involves the coordination of cell type determination and localization. In *Drosophila*, early mesoderm gives rise to heart, somatic, and muscle precursors.

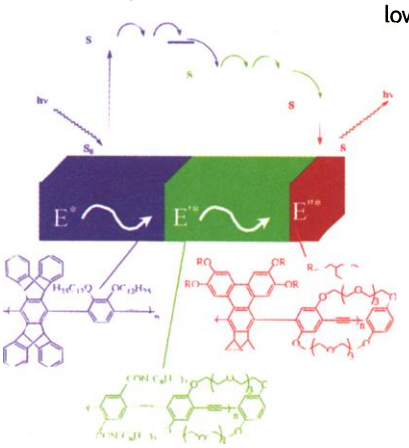
Weiss *et al.* report that Jelly belly (Jeb), a secreted protein containing an LDL receptor repeat motif, acts as an extracellular signaling molecule that regulates visceral mesoderm development. In the absence of functional Jeb, no differentiated mesoderm was detected, although other components of the mesoderm appeared normal. Although Jeb is synthesized in somatic muscle mesoderm precursor cells, it is internalized by adjacent visceral mesoderm precusor cells. A block in endocytosis reduced the presence of Jeb in target visceral mesoderm, suggesting that a receptor may be involved in the uptake of secreted Jeb by target cells. Jeb was initially identified as a target of the Tin homeobox transcription factor, and the cell migration defects observed in the visceral mesoderm of Jeb mutants indicate that this signaling molecule may convey differentiation and positional information to a specific population of mesoderm precursor cells. — LC

Cell **107**, 387 (2001).

POLYMER SCIENCE

Collecting the Light

Much in the way that the chlorophyll in plants collects sunlight, synthetic molecules have been designed to harvest incoming light. Light harvesting has been demonstrated with conjugated polymers, in which multilayered systems can exhibit an increase in surface fluorescence. These systems have been limited to thin films of up to 16 layers, because beyond this, internal energy losses reduce the light-collecting abilities.



Directional energy transfer through a sequence of excitations.

Now Kim *et al.* have overcome this problem by maximizing the one-dimensional energy transfer by using a series of photoluminescent polymers. The systems are designed to have a large spectral overlap, so that the emission spectra maxima of the lower layers are similar to the absorbance spectra maxima of the higher layers. Energy is transferred through the thickness of the sample, because any photons traveling back toward the substrate are not absorbed by the lower layers. The interfaces between the different materials create energy traps and thus a decrease in the photoluminescence. Nevertheless, the preferential transfer of the energy toward the surface is increased. These materials can be used as very sensitive sensors for light-trapping materials, such as the explosive TNT. — MSL

J. Am. Chem. Soc., 10.1021/ja016693g.

CHEMISTRY

Fluorous Catalysis

In fluorous biphasic catalysis, the catalysts are designed to be highly soluble in fluorous solvents. Reactions are usually run at high temperatures in a mixed organic-fluorous solvent that forms a single phase, and the catalysts are readily recovered at room temperature from the fluorous phase that separates from the organic solvent. The need for the highly fluorinated solvents has been seen in some circles as a critical drawback to this technique. Wende *et al.* now show that the fluorous solvent can be eliminated altogether in some cases by taking advantage of very large increases in solubility of the catalyst in organic solvents at temperatures at and above their melting points. For example, the addition of alcohols to the triple bond of methyl propiolate can be catalyzed by fluorous phosphines such as $P((CH_2)_2(CF_2)_7CF_3)_3$. These

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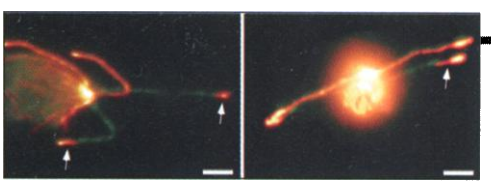


***Chlamydomonas* cells expressing hemaglutinin-tagged tubulin (red) are mated with nonexpressing cells. Tagged tubulin accumulates at the tips (arrows) of the previously nonexpressing flagella; all flagella are labeled green, and colocalization appears yellow.**

SOURCE: (LEFT) MARSHALL AND ROSENBAUM, *J. CELL BIOL.* **155**, 405 (2001); (RIGHT) KIM *ET AL.*, *J. AM. CHEM. SOC.*, 10.1021/JA016693G

CELL BIOLOGY

Size Matters

Keeping a cell's organelles the right size is not a trivial problem. Marshall and Rosenbaum examined how *Chlamydomonas* cells control the size of the flagellum—a hairlike projection sticking out from the surface of the cell, composed of a precisely defined array of microtubules. Flagellar length appears to be tightly regulated, but the mechanisms governing length have not been clear. It appears that flagellar components are in a state of constant turnover. The cell establishes a balance between assembly at the tip and turnover by regulating intraflagellar transport of the key microtubule component, tubulin, to the tip. Blocking tubulin transport allows turnover to proceed, while inhibiting assembly, and leads to the shrinkage and resorption of the flagellum. Thus, in this case, the cell uses steady state assembly-disassembly to define organelle size. Adjusting the set point for the steady state would allow the cell to change the length of its flagella when necessary and can explain the phenotype of mutant cells that possess unusually long or short flagella. — SMH

J. Cell Biol. **155**, 405 (2001).

reactions can be run in octane at 65°C and the catalyst recovered as a solid at –30°C for further reaction cycles. — PDS

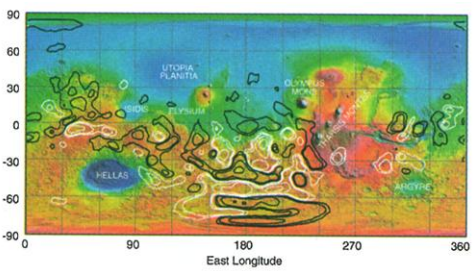
J. Am. Chem. Soc. 10.1021/ja011444d.

PLANETARY SCIENCE

Martian magnetism

The magnetometer experiment onboard the Mars Global Surveyor spacecraft has been mapping the magnetic field intensity of the Martian crust for several years in order to understand the physical and chemical evolution of Mars.

Connerney *et al.* have completed a detailed global map of magnetic intensity in the crust. Relatively high magnetic intensities of normal and reverse polarity form linear features only in the southern hemisphere where the crust is the oldest. These features indicate that Mars had an active dynamo that reversed its the magnetic field in the ancient past. More recently, the dynamo stopped, and so the younger crust shows no remnant magnetic signature. In addition, the oxidation state that would have been necessary to crystallize the appropriate magnetic iron oxides suggested by the magnetic signatures requires that the mantle-derived magmas interacted with an aqueous component. This provides more evidence for an early Martian environment that was more active and wetter than today. — LR



Topographic map of Mars with magnetic field contours.

Geophys. Res. Lett. **28**, 4015 (2001).

BIOMEDICINE

A Supporting Role in Tumor Suppression

The signaling pathways that regulate cell growth are themselves subject to regulation, and there is great interest in identifying the factors that control the activity of these pathways in vivo.

To investigate the regulation of the p53-Mdm2-Arf tumor suppressor pathway, Inoue *et al.* studied mice deficient in Dmp1, a nuclear phosphoprotein that transcriptionally activates the *Arf* gene. In their second year of life, mice lacking one or both copies of the *Dmp1* gene spontaneously developed tumors in many different tissues. Dmp1 loss accelerated tumorigenesis in a mouse lymphoma model, and the resultant tumors were notably devoid of mutations in *p53* and *Arf*, suggesting that Dmp1 is a potent modifier of the p53-Mdm2-Arf pathway. It is possible that the minor subset of human tumors that show no evidence of mutation in *p53* or *Arf* may, in fact, have mutations in the genes encoding key regulatory factors such as Dmp, producing the same disruptive effect on cell growth control. — PAK

Genes Dev., in press.

HIGHLIGHTED IN *SCIENCE*'S SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

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Chaperone-Mediated Repression

Chaperone proteins help to fold functional signaling proteins and also control the activity of their protein targets. In particular, the Hsp90- and Hsp70-type chaperones are involved in the assembly and control of transcriptional nuclear receptor complexes.

Hon *et al.* now present evidence for similar, yet distinct, roles for chaperones in the control of the transcription factor heme activator protein (Hap1), in *Saccharomyces cerevisiae*. Yeast respond to oxygen with increased production of heme, which activates Hap1 to promote transcription of genes involved in respiration and protection from oxygen damage. In the absence of heme, the activity of Hap1 is repressed by interactions with Hsp90 and the Hsp70 proteins Ssa and Sro9. Decreased expression of Ssa (and, to a lesser extent, decreased expression of Sro or its partner Ydj1) enhanced activity of Hap1 in the absence of heme but did not affect Hap1 activity in the presence of high concentrations of heme. This contrasts with the effect of Hsp90 on Hap1 or on nuclear receptors. Loss of Hsp90 reduces the transcriptional activity of its partners even in the presence of activators (steroid hormones or heme). These distinct modes of Hap1 regulation by different chaperones provide a means for precise regulation of Hap1 and suggest versatility in the control of transcription in complexes that contain multiple chaperones. — LBR

Mol. Cell. Biol. **21**, 7923 (2001).

CREDITS: CONNERNEY *ET AL.*, *GEOPHYS. RES. LETT.* **28**, 4015 (2001)