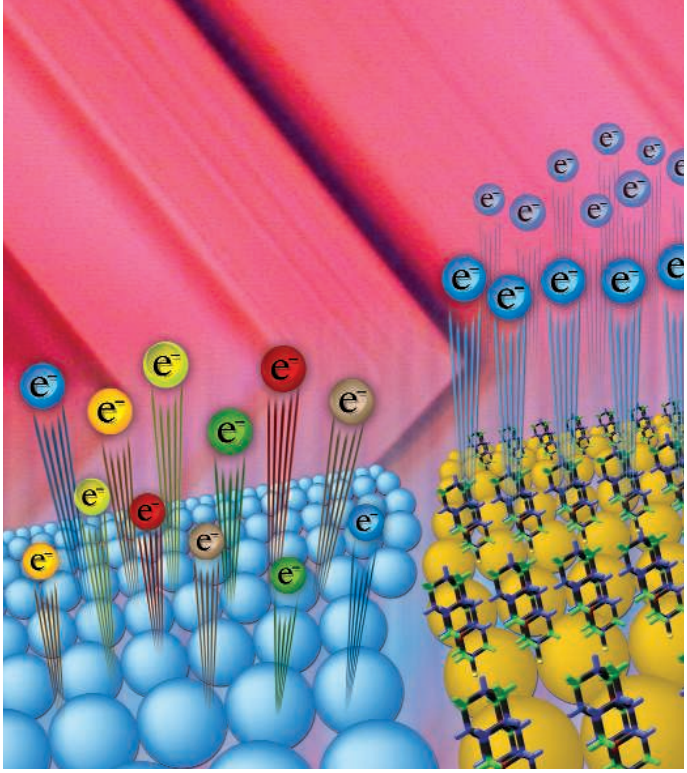
EDITED BY STELLA HURTLEY AND PHIL SZUROMI



<< Electron Emits with Ease

Negative electron affinity materials readily emit electrons, which make them potentially useful in field-emission displays and electron microscopes. Bulk diamond is known to be one such material, but issues with emission uniformity and electronic transport have led to a search for other candidates. Diamondoids (C_{22} and higher polymantanes) are molecules that have been extracted from petroleum, which contain 4 to 11 diamond-crystal cages terminated by hydrogen atoms. A photoemission study by **Yang *et al.*** (p. 1460) of functionalized self-assembled monolayers of diamondoids shows that they are also negative electron affinity materials and can provide a nearly monochromatic source of photoemitted electrons.

X-ray Visions

The success of x-ray diffraction for determining atomic structures has inspired further efforts to extend its use to materials that are less crystalline in nature and to determine structural changes on the time scales characteristic of changes in electronic structure and bonding. **Gaffney and Chapman** (p. 1444) discuss a new generation of x-ray facilities whose incident beams start out as electron bunches from a linear accelerator and are then converted to coherent pulses of x-rays. The pulsed nature of the x-ray beam allows characterization of ultrafast dynamics, and the beam's coherence will allow imaging of noncrystalline materials with atomic resolution.

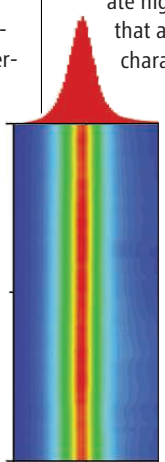
Harvesting Light Coherently

Photosynthesis relies on the remarkable efficiency of energy transfer among the complex protein domains that absorb sunlight and channel energy into chemical reactions. **Lee *et al.*** (p. 1462; see the Perspective by **Parson**) used a two-color photon-echo spectroscopic technique to explore the early dynamics of energy transfer between two components of the photosynthetic reaction center from purple bacteria. Upon photoexcitation, a bacteriophytin and accessory bacteriochlorophyll stay coherently in phase within each protein for significantly longer times than do the individual components across the ensemble. Modeling of the data implicates vibrational coupling through the protein structure in maintaining this coherent state and thereby facilitating efficient energy migration.

CREDITS (TOP TO BOTTOM): YANG *ET AL.*; COGNET *ET AL.*

Stepwise Quenching

When excited by visible light, semiconducting single-walled carbon nanotubes (SWNTs) generate highly mobile excitons, and processes that annihilate these excitons lead to characteristic fluorescence in the near infrared. Chemical reactions at the sidewalls of the nanotube, such as protonation, can quench this photoluminescence. **Cognet *et al.*** (p. 1465) have used the quenching process to follow side-wall reactions by placing SWNTs in agarose gels and diffusing in reversible reactants (acids or bases) or irreversible reagents (diazonium salts). Stepwise changes in luminescence correspond to quenching of excitons at localized sidewall sites. An analysis of these stepwise changes reveals that the excitons move in a diffusional manner and explore ~10,000 sites during their lifetimes.



Earthquakes Zones in Parallel

Benioff zones are strips of descending plates in subduction zones that host earthquakes. Some areas are known to host double Benioff zones (parallel strips where earthquakes occur), but it has been thought that most of these zones occur as single swaths. **Brudzinski *et al.*** (p. 1472; see the Perspective by **Rietbrock**) analyzed databases of earthquakes and located earthquakes within the descending slabs of lithosphere. Two parallel seismic stripes, rather than a single broad zone, were found in most cases. The widespread occurrence of double Benioff zones sets limits on the formation mechanisms of earthquakes.

From Variety to Variation

Flowers and groupings of flowers (inflorescences) come in an astonishing variety of shapes and sizes; however, theoretically many more possibilities could have evolved. To explain why the biological forms we see in nature represent such a small part of theoretical possibilities, **Prusinkiewicz *et al.*** (p. 1452, published online 24 May; see the cover) combine genetic and theoretical studies on inflorescence architecture. By showing how interactions between development and selection operate within higher-dimensional fitness spaces, the authors reveal likely routes and constraints on the evolution of biological forms. Furthermore, the study tests this model by examining the expression of two genes that influence architecture in the model plant, *Arabidopsis*.

Transcriptional Profiling of Tissue

The progression of a tissue from a healthy to a diseased state is typically accompanied by

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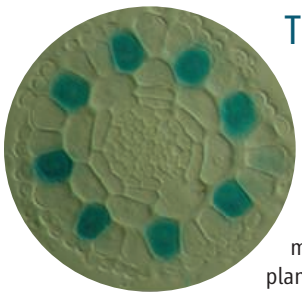
changes in the expression of hundreds to thousands of genes. A number of existing methods allow these transcriptional changes to be monitored, each method with its own strengths and weaknesses. **Kim *et al*.** (p. 1481) describe polony multiplex analysis of gene expression, or PMAGE, that allows for more precise quantification of transcripts and detection of low-abundance transcripts. Application of PMAGE to a mouse model of hypertrophic cardiomyopathy revealed changes in the expression of many low-abundance transcripts even before the appearance of pathological changes in the heart.



The Root of the Problem

Mosses exhibit a relatively primitive life-style with only a haploid gametophyte phase, compared with flowering plants, which have two distinct phases in their life cycle—a brief haploid gametophyte phase employed during reproduction, and the diploid sporophyte phase, which makes up the physical bulk of the plant. **Menand *et al*.** (p. 1477) analyzed angiosperm root hairs and their moss counterparts, rhizoids. Root hairs in the diploid angiosperm plants bury themselves in the soil and absorb nutrients. In the haploid mosses, rhizoids or caulonema perform a similar nutrient absorption and anchoring function, but are not related to root hairs at the cellular level. However, it now seems that related transcription factors direct the development of both cell types, indicating a closer relationship than previously assumed.

Importance of Non-Gene Transcription

Much larger proportions of many eukaryotic genomes are transcribed into RNA than can be accounted for by their protein coding potential. The function of this "non-gene" transcription is unclear. **Kapranov *et al*.** (p. 1484, published online 17 May) analyzed both long and short unannotated RNAs in human cells and found that a significant fraction of the longer transcripts may serve as precursors for the shorter RNAs. The short RNAs tend to cluster at the 5′ and 3′ ends of genes, and their numbers are often correlated with the expression of the underlying gene. Many of the 5′ RNAs are found in conserved regions, suggesting that they may play important roles in gene or genome-related functions.

Probing the Genetics of Heart Disease

Certain life-style factors, such as smoking, greatly increase the risk of developing heart disease, but genetic factors also contribute. In independent studies, **McPherson *et al*.** (p. 1488, published online 3 May) and **Helgadottir *et al*.** (p. 1491, published online 3 May) used genome-wide association scanning to identify DNA sequence variants at chromosome 9p21 that increase the risk of heart disease in Caucasian populations. The 20 to 25% of Caucasians with two copies of the so-called "risk allele" had a 30 to 40% higher risk of heart disease compared with individuals with no copies of this allele. The genomic region of interest falls outside the boundaries of annotated protein-coding genes, so the mechanism by which it influences heart disease remains mysterious. Intriguingly, DNA sequence variants within the same general region of chromosome 9p21 have recently been shown to increase the risk of type 2 diabetes.

Allergy-Blocking Transmitters

The endocannabinoid system performs various regulatory functions and has been implicated in a growing number of physiological roles, both in the central and peripheral nervous systems and in peripheral organs. **Karsak *et al*.** (p. 1494) now find that this influence extends to regulation of allergic response. Mice lacking the two known cannabinoid receptors showed a strong tendency toward developing cutaneous contact sensitivity in response to distinct allergens. Blocking the receptors with antagonists had a similar effect, while absence of the gene encoding an enzyme responsible for breaking down cannabinoids increased resistance of mice to contact sensitivity. The regulation of the endocannabinoids or their receptors might be useful in treating allergies, although their role in the wider context of human allergy needs to be explored.

CREDIT: MENAND *ET AL.*