EDITED BY STELLA HURTLEY AND PHIL SZUROMI

<< Almost in a Day's Work

Many plants coordinate their annual time of flowering with particular seasons of the year, and one indicator that they use to determine the change of seasons is day length. **Sawa *et al.*** (p. 261, published online 13 September; see the Perspective by **Rubio and Deng**) provide some insights into the molecular interactions that translate day length into flowering initiation. The day needs to be long enough for the blue-light–stimulated expression of proteins FKF1 (FLAVIN-BINDING, KELCH REPEAT, F-BOX1) and GIGANTEA (GI), to coordinate. The daily rise in expression of GI lags far enough behind the daily rise in expression of FKF1 that, in the shorter days of the year, daylight has waned by the time there is enough GI to form complexes with FKF1. With the longer days of spring and summer, there is enough time to form complexes and signal to the *CONSTANS* gene to trigger the flowering pathway.

Interior Design for Polymers

Separation systems need to achieve both high throughput and high selectivity. For polymer membranes, separations depend on the size of the cavities that lead to porosity on the Ångstrom scale (the free volume), but these cavities typically display a broad size distribution. Rodlike polymers with kinks can have more uniform cavitiy sizes but can also be difficult to process. **Park *et al.*** (p. 254) used processible forms of rigid polymers and a thermal postconversion process to create tailored free-volume elements with well-connected morphology in amorphous polymers. These materials formed membranes with outstanding transport and separation properties for small molecules and ions.

Sticky Is More Than Skin Deep

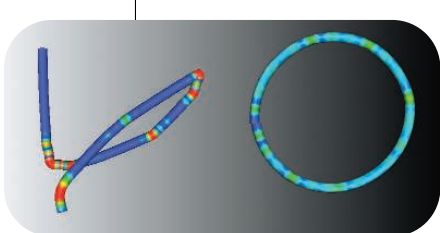
The feet of some climbing anthropoids and vertebrates can both strongly attach to surfaces as well as release, and attempts have been made to mimic patterned surfaces of adhesion pads. **Majumder *et al.*** (p. 258; see the Perspective by **Barnes**) have focused on the role of subsurface structures in altering adhesion. They show that fluid-filled micrometer-diameter channels in the subsurface region can significantly improve the adhesion of a soft elastomeric material. The fluid channels blunt the propagation of cracks that form as the film is peeled from the surface, and the fluid itself helps in the capillary adhesion of the material.

Earth-Like Planets

The search for Earth-like planets is accelerating as detection technology and methodology improves. Current and proposed space missions should find many more in the next few years. **Gaidos *et al.*** (p. 210) review our understanding of how Earth-like planets form around stars, and how many we might expect to harbor water and orbit at just the right distance from their host star to be potentially habitable.

Disturbing Dislocations

In an avalanche, a formation that appears to be stable suddenly fails with a large movement of material. This phenomenon also occurs on the very small scale, such as the motion of defects in crystalline materials, where stress-strain jumps are observed during deformation. **Csikor *et al.*** (p. 251; see the Perspective by **Sethna**) have used simulations to measure dislocation avalanche bursts in microcrystals subjected to various modes of deformation at various orientations with respect to the crystal axes. Universal behavior is seen for the avalanche size distribution for all cases. The size of the bursts scales with the inverse of the sample length, which indicates that there may be a lower limit on the size of a material that can be shaped and formed.



The Animal Side of a Green Alga

Organisms at the base of the eukaryotic tree share features with both plants and animals. **Merchant *et al.*** (p. 245) present the sequence of the green alga *Chlamydomonas reinhardtii,* one of the most basal green plants. Their analysis of the genome demonstrate that, despite its closer relation to the land plants, this alga retains genes and features shared with animals, such as motile cilia that have nine outer doublet microtubules surrounding a central pair. In addition, the authors investigate the genes and evolution of photosynthesis in the plant lineage.

Maintaining Diversity Sans Sex

Some obligate asexual species, including the bdelloid rotifers, have survived for long time periods despite the absence of the benefits of

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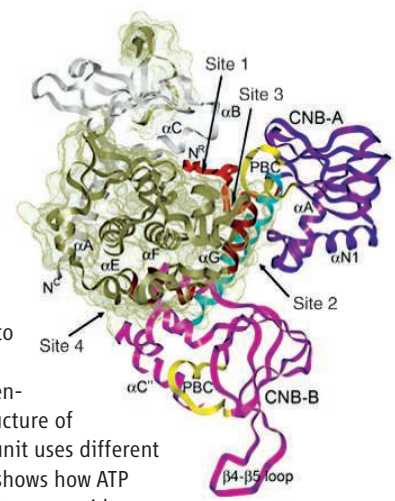
sexual reproduction. These rotifers have ~400 ''species,'' yet the means by which these asexual lineages diverge and survive, while presumably accumulating deleterious mutations, is unknown. **Pouchkina-Stantcheva *et al.*** (p. 268; see the Perspective by **Meselson and Mark Welch**) describe an evolutionary mechanism by which genetic and functional diversity can arise in asexuals, and only in asexuals, by divergence of former alleles; in this example, members of the LEA proteins that function in desiccation tolerance.

MicroRNAs Strike a Balance

Hundreds of microRNAs (miRNAs) are thought to repress thousands of target messenger RNAs (mRNAs), but it has been difficult to study the interaction between individual miRNA-mRNA pairs. **Choi *et al.*** (p. 271, published online 30 August) developed a way to block the interaction between a miRNA and specific target sites. Antisense morpholino oligonucleotides complementary to miRNA binding sites could protect specific mRNAs from miRNA-mediated repression. Applying this technology during zebrafish embryogenesis, they found that the miRNA miR-430 inhibits an antagonist and an agonist of the Nodal signaling pathway. Loss of repression led to an imbalance of signaling and abnormal development.

Unraveling PKA Isoform Specificity



Cyclic adenosine monophosphate (cAMP) is a signal for cellular stress that, in mammalian cells, binds to cAMP-dependent protein kinase (PKA) to activate diverse signaling pathways. Functional diversity is achieved partly by isoform diversity in the catalytic and regulatory (R) subunits of PKA. In particular, there are two main classes of regulatory subunit, type I and type II, that inhibit C in the absence of cAMP. To gain insight into the molecular basis for isoform diversity, **Wu *et al.*** (p. 274) have determined the structure of an RIIα holoenzyme and compared it to the previously determined structure of an RIα holoenzyme. The structure shows that the C subunit uses different docking motifs to interact with different inhibitors and shows how ATP differentially regulates the two holoenzymes. The insights may guide design of isoform-specific activators or antagonists for PKA.

Culprit in Honey Bee Collapse

The dramatic disappearance of honey bees in the United States is threatening the capability of commercial bee-keeping operations to supply pollinators for valuable crops. This devastation appears to be associated with an infectious agent sweeping through honey bee populations and resulting in the loss of 50 to 90% of colonies. Using a metagenomic technique, **Cox-Foster *et al.*** (p. 283, published online 6 September) sequenced the entire range of microbial flora associated with affected and healthy bee colonies. Comparison implicates Israel acute paralysis virus (IAPV) as a contributor to honey bee colony collapse disorder.

Slowing Tumor Growth with a One-Two Punch

Drugs that inhibit receptor tyrosine kinases (RTKs) have emerged as promising anticancer therapies in clinical trials, but certain solid tumors such glioblastoma multiforme (GBM) respond poorly to them. Work by **Stommel *et al.*** (p. 287, published online 13 September) may help explain why GBM, an aggressive form of brain cancer, is so refractory to this class of drugs, which are typically administered as single agents. Glioblastoma cells display concomitant activation of multiple RTKs, all of which stimulate the phosphatidylinositol 3-kinase (PI3K) signaling pathway, a critical driver of cell growth. In preclinical models, combinations of agents targeting multiple RTKs were more powerful than single agents in inhibiting the PI3K pathway and slowing tumor cell growth. These results suggest a potential strategy for optimizing the efficacy of RTK inhibitors in GBM, an idea that can now be tested in clinical trials.

CREDIT: WU *ET AL.*

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