IN SCIENCE JOURNALS
Edited by Caroline Ash

MEDICINAL CHEMISTRY

Are better drugs just a click away?
Drugs that show promise in preclinical models often fail in the clinic, in part because of limited information on drug localization within cells and across tissues. In a proof-of-concept study, Tyler et al. applied click chemistry methods to study the localization of bromodomain inhibitors. These are cancer drugs that alter chromatin structure and gene expression. Clickable derivatives of the drugs localized within chromatin and showed that the drugs exhibit distinct modes of binding at responsive and unresponsive genes. In a mouse leukemia model, the click-probes revealed that the drugs accumulate to different extents in the spleen and bone marrow, which are two tissue sources of leukemic cells. —PAK
Science, this issue p. 1397

GLOBAL FIRE ACTIVITY

Burn less, baby, burn less
Humans have, and always have had, a major impact on wildfire activity, which is expected to increase in our warming world. Andela et al. use satellite data to show that, unexpectedly, global burned area declined by ~25% over the past 18 years, despite the influence of climate. The decrease has been largest in savannas and grasslands because of agricultural expansion and intensification. The decline of burned area has consequences for predictions of future changes to the atmosphere, vegetation, and the terrestrial carbon sink. —HJS
Science, this issue p. 1356

FOREST ECOLOGY

Maintaining tree diversity
Negative interaction among plant species is known as conspecific negative density dependence (CNDD). This ecological pattern is thought to maintain higher species diversity in the tropics. LaManna et al. tested this hypothesis by comparing how tree species diversity changes with the intensity of local biotic interactions in tropical and temperate latitudes (see the Perspective by Comita). Stronger local specialized biotic interactions seem to prevent erosion of biodiversity in tropical forests, not only by limiting populations of common species, but also by strongly stabilizing populations of rare species, which tend to show higher CNDD in the tropics. —AMS
Science, this issue p. 1389; see also p. 1328

DEVICE TECHNOLOGY

Carbon nanotubes on the roadmap
The formal challenge for high-performance transistors is to fit within ever smaller devices. They need to shrink from a lateral dimension of about 100 to 40 nanometers. Cao et al. fabricated tiny devices by using a single semiconducting carbon nanotube, as well as arrays of these nanotubes. High performance (a high saturation on-state current >1.2 milliampere per micrometer and a conductance >2 millisiemens per micrometer) was delivered by making end-bonded contacts to the nanotubes with cobalt-molybdenum alloys. —PDS
Science, this issue p. 1369

NEURODEVELOPMENT

Building the neural tube
The development of the neural tube is regulated by a pair of morphogens acting in opposing gradients. The mature neural tube is built from a variety of different cell types organized in a consistent dorsal-ventral pattern. Zagorski et al. asked how this pattern is defined in a reproducible way from individual to individual. The morphogens define positions most accurately toward the top of their respective gradients, but things get a bit messy in the middle. Modeling the gene regulatory network’s response as a maximum likelihood estimation from the combined input of both morphogens, however, succeeds at defining even the intermediate positions. Thus, the computation of position by the gene regulatory network establishes accurate tissue patterning despite messy inputs. —PJH
Science, this issue p. 1379

SPACE ROBOTS

Get a grip
Grabbing a smooth object requires a delicately sensed combination of pressure and friction—something that humans do routinely, but that is complicated for a robot. Imagine grabbing things in a...
low-gravity environment that may also be under vacuum conditions. In outer space, neither vacuum nor sticky pads may hold. Jiang et al. devised a robotic gripper using gecko feet–inspired dry adhesives that can be activated or deactivated by shearing motions. Small adhesive patches can be mechanically coupled to allow for load sharing over a large area. By attaching these to a wristlike structure that is stiff at low forces, but becomes compliant at larger ones, objects can be moved without damaging the adhesives. —MSL

ANTHROPOLOGY
An early skull cult from Neolithic Turkey
Veneration of human skulls is well known from many Neolithic sites in Anatolia and the Levant. Gresky et al. discovered a new manifestation of the cult from the important site of Göbekli Tepe, which was occupied between 9600 and 8000 BCE. The site is distinguished by T-shaped monolithic pillars found in massive megalithic buildings. Three skulls were found that show signs of perimortem modification, including deeply incised grooves, circular perforations, cut marks indicative of defleshing, and, in one instance, the application of red ochre. The placement of these modifications indicates that the skulls were likely suspended by cords and displayed in a ritual context. —MSA

NEONICOTINOIDS
Damage confirmed
Early studies of the impacts of neonicotinoid insecticides on insect pollinators indicated considerable harm. However, lingering criticism was that the studies did not represent field-realistic levels of the chemicals or prevailing environmental conditions. Two studies, conducted on different crops and on two continents, now substantiate that neonicotinoids diminish bee health (see the Perspective by Kerr). Tsvetkov et al. find that bees near corn crops are exposed to neonicotinoids for 3 to 4 months via nontarget pollen, resulting in decreased survival and immune responses, especially when coexposed to a commonly used agrochemical fungicide. Woodcock et al., in a multicounty experiment on rapeseed in Europe, find that neonicotinoid exposure from several nontarget sources reduces overwintering success and colony reproduction in both honeybees and wild bees. These field results confirm that neonicotinoids negatively affect pollinator health under realistic agricultural conditions. —SNV
Science, this issue p. 1395, p. 1393; see also p. 1331

PLANT EVOLUTION
Genomics trace plant gene evolution
MADS-box genes have essential functions in plant development and morphology. However, in plants, as a result of multiple rounds of whole-genome duplications combined with specific gene gains and losses, the relationships and evolution of this gene family have been difficult to trace. Zhao et al. applied a network-based phylogenetic analysis examining synteny—the location of genes and their relative position within the genome—across all identified MADS-box genes from 51 plant species. Through this analysis, the relationships, approximate timing, gains and losses, and specific movements of these genes within the genome could be traced. This allows for a better understanding of how evolution has acted on a key regulatory gene family in the plant kingdom. —LMZ

PHYSIOLOGY
Characterizing a 12-hour biological clock
A mathematical analysis of changes in gene expression in mouse liver, designed to detect oscillations of various frequencies, showed more than 3500 genes whose expression cycled with a 12-hour period. This is distinct from circadian gene expression, which is coupled to the 24-hour light cycle, and has been noted before in marine animals, perhaps because of a need to synch with 12-hour tidal changes. Zhu et al. found that gene products associated with 12-hour cycles are particularly related to metabolic function, endoplasmic reticulum stress, and the unfolded protein response. The 12-hour clock
BIOENERGY
The promise of cellulose
Cellulosic bioenergy, obtained from the lignocellulose that makes up nearly half of plant biomass, has considerable potential as an environmentally friendly energy source, but it still requires substantial resources to produce. Robertson et al. review the trade-offs between the use of cellulosic biofuels and climate mitigation, biodiversity, reactive nitrogen loss, and water use to direct more effective policies for their production. Growing native species on unfarmed land is a promising way forward. —HJS
Science, this issue p. 1349

STRUCTURAL BIOLOGY
Strong under pressure
Human cytomegalovirus (HCMV) is a member of the herpesvirus family that can cause life-threatening infections in those who are immunocompromised. HCMV encodes a genome that is about 50% larger than that of herpes simplex virus 1 (the virus that causes cold sores), but these two viruses have similar-sized capsids. Yu et al. used cryo–electron microscopy to determine the structure of the HCMV capsid to 3.9-Å resolution. This is the first high-resolution capsid structure from the herpesvirus family. It reveals extensive interactions that stabilize the capsid to withstand the high pressure that comes from accommodating such a large genome. —VV
Science, this issue p. 1350

ECONOMICS
Costing out the effects of climate change
Episodes of severe weather in the United States, such as the present abundance of rainfall in California, are branded as tangible evidence of the future costs of current climate trends. Hsiang et al. collected national data documenting the responses in six economic sectors to short-term weather fluctuations. These data were integrated with probabilistic distributions from a set of global climate models and used to estimate future costs during the remainder of this century across a range of scenarios (see the Perspective by Pizer). In terms of overall effects on gross domestic product, the authors predict negative impacts in the southern United States and positive impacts in some parts of the Pacific Northwest and New England. —GJC
Science, this issue p. 1362; see also p. 1330

NEURODEVELOPMENT
Reopening a critical period
Young brains, compared with adult brains, are plastic. This phenomenon has given rise to the concept of critical periods, during which acquisition of certain skills is optimal. In mice, an auditory critical period is only open in early postnatal days. The youthful brain tunes circuits to sounds in its environment in a way that the adult brain does not. This facility may form the basis for childhood language acquisition in humans. Blundon et al. show that by manipulating adenosine signaling in mice, some plasticity of the adult auditory cortex can be regained (see the Perspective by Kehayas and Holtmaat). Disruption of adenosine production or adenosine receptor signaling in adult mice leads to improved tone discrimination abilities. —PJH
Science, this issue p. 1352; see also p. 1335

NEURODEVELOPMENT
Specialization in brain neurogenic niche
The adult mammalian brain generates neurons from the subventricular zone (SVZ). In mice, Paul et al. were able to link environmental signals with the type of neurons that are generated and showed that anatomical sub specialization occurs in the SVZ. Neural circuits that respond to hunger or satiety enervate a subregion of the SVZ and retune the production of new olfactory neurons just from that portion of the subventricular niche. —PJH
Science, this issue p. 1383

OPTICS
To bunch or to antibunch
Particles of matter can be classed as either as bosons or fermions. Their subsequent behavior in terms of their physical properties and interactions depends on which quantum statistics they obey. Photons, for instance, are bosons and tend to bunch. Electrons are fermions and tend to antibunch. Vest et al. show that surface plasmon polaritons, a hybrid excitation of light and electrons, can exhibit both kinds of behavior (see the Perspective by Faccio). By tuning the level of loss in their system, bunching and antibunching of interfering plasmons can be seen. —ISO
Science, this issue p. 1373; see also p. 1336

SOLAR CELLS
Healing defects with triiodide ions
Deep-level defects in inorganic perovskites decrease the performance of solar cells through unproductive recombination of charge carriers. Yang et al. show that introducing additional triiodide ions during the formation of layers of formamidinium lead iodide, which also contain small amounts of methylammonium lead bromide, suppresses the formation of deep-level defects. This process boosts the certified efficiency of 1-cm² solar cells to almost 20%. —PDS
Science, this issue p. 1376

PLANT SCIENCE
Active transport of aromas
Volatile organic compounds (VOCs) serve as invisible lines of communication among host plants, pathogens, commensals, community groups, and, with flowers, their pollinators. Studying petunia flowers, Adebesin et al. show that VOCs do not passively diffuse out of the cells but are actively shuttled across the plasma membrane by an ABC (ATP-binding cassette) transporter (see the Perspective by Eberl and Gershenzon). Disabling the transporter results in damage to the cell’s membranes by intracellular accumulation of VOCs. —PJH
Science, this issue p. 1386; see also p. 1334

EMERGING INFECTIONS
Antiviral gets the jump on coronaviruses
Coronaviruses can jump from animal reservoirs into the human population with devastating effects, as in the cases of the SARS (severe acute respiratory syndrome) and MERS (Middle East respiratory syndrome) viruses. Sheahan et al. tested a small-molecule inhibitor, which has shown activity against Ebola virus, as a potential cue for coronavirus infection. This drug was effective against multiple types of coronaviruses in cell culture and a mouse model of SARS and did not seem to be toxic. —LP
The WNT signaling pathway powers the growth of various tumors, particularly colorectal cancer (CRC). However, WNT-targeted inhibitors are toxic to normal gastrointestinal tissue, precluding their clinical use. Li et al. found that a small-molecule activator of the kinase CK1α suppressed WNT activity in CRC cell lines and prevented tumor growth and increased survival in mouse models of primary and metastatic CRC. This inhibitor was selective for cells with high WNT activity and low CK1α levels and was minimally toxic to normal gastrointestinal epithelium.
—LKF

ELECTROCHEMISTRY

Separating charges is a gas

Solid and liquid electrolytes allow for charges or ions to move while keeping anodes and cathodes separate. Separation prevents short circuits from occurring in energy storage devices. Rustomji et al. show that separation can also be achieved by using fluorinated hydrocarbons that are liquefied under pressure. The electrolytes show excellent stability in both batteries and capacitors, particularly at low temperatures.
—MSL

Science, this issue p. 1351
Antiviral gets the jump on coronaviruses
Lindsey Pujanandez

Science 356 (6345), 1346-1348.
DOI: 10.1126/science.356.6345.1346-q