

REACTION DYNAMICS

Deuterium fluoride gets born shivering

Modern spectroscopic techniques can analyze collisions between gas phase molecules in exquisite detail, highlighting exactly which vibrations and rotations come into play. However, much chemistry of interest takes place in solution, where it's harder to tease out what happens. Dunning *et al.* applied infrared spectroscopy to study solution-phase formation of deuterium fluoride (DF) from F atoms, a longstanding test bed of gas phase dynamics. The DF product vibrated for a surprisingly long time before dissipating its energy to the surrounding solvent molecules. — JSY

Science, this issue p. 530

ANIMAL COGNITION

Even chicks may count from left to right

For the most part, humans represent numbers across a mental number line, with smaller numbers on the left and larger numbers on the right. Some have argued that this is due to culture rather than being innate. Rugani *et al.*, however, show that 3-day-old chicks share this representation of numbers, consistently seeking lower numbers to the left of a target and larger numbers to the right (see the Perspective by Brugger). These results suggest that there may be an innate spatial representation of numerical values that we share with other animals. — SNV

Science, this issue p. 534; see also p. 477

IDENTITY AND PRIVACY

Where and when you spend reveals who you are

How do you ensure individual privacy when analyzing bulk information? De Montjoye *et al.* used 3 months of data on financial traces of 1.1 million people to determine the privacy bounds of credit card metadata. The risk of re-identification from

financial data sets was high: Four spatiotemporal observations, (of the shop and the day the transaction took place) were enough to re-identify 90% of the individuals. Knowing the approximate price of a transaction increased the likelihood of re-identification. — BJ

Science, this issue p. 536

ATMOSPHERIC DYNAMICS

Because the rain falls and the wind blows

Global warming is expected to intensify the hydrological cycle, but it might also make the atmosphere less energetic. Laliberté *et al.* modeled the atmosphere as a classical heat engine in order to evaluate how much energy it contains and how much work it can do (see the Perspective by Pauluis). They then used a global climate model to project how that might change as climate warms. Although the hydrological cycle may increase in intensity, it does so at the expense of its ability to do work, such as powering large-scale atmospheric circulation or fueling more very intense storms. — HJS

Science, this issue p. 540; see also p. 475

INFLAMMATION

Preventing sepsis in type 1 diabetics

Patients with type 1 diabetes have chronic systemic inflammation and are more prone to developing sepsis. Filgueiras *et al.* found that mice that are a model for type 1 diabetes had higher amounts of leukotriene B₄, a proinflammatory lipid, and of 5-lipoxygenase, the enzyme that produces leukotriene B₄. Model mice treated with an inhibitor of 5-lipoxygenase survived sepsis and had decreased markers of inflammation. Thus, targeting 5-lipoxygenase to prevent the production of leukotriene B₄ could potentially decrease the susceptibility of diabetic patients to sepsis. — WW

Sci. Signal. **8**, ra10 (2015).

IN OTHER JOURNALS

Edited by **Kristen Mueller** and **Jesse Smith**



The Fraser River in British Columbia, Canada

ECOLOGY

Healthy rivers need diversity, too

Savvy financial investors know that a diverse portfolio generates stability due to a balance of ups and downs across investments. A similar hypothesis posits that larger river systems offer similar stability to their ecosystems. Moore *et al.* tested this hypothesis in one of the few remaining free-flowing river systems in North America, the Fraser River watershed. They found that larger watersheds were more stable in terms of water temperature and flow, and produced salmon more consistently. This shows that greater biological diversity can buffer ecosystems against environmental variability and may enhance long-term stability. — SNV

Ecol. Soc. Am. 10.1890/14-0326.1 (2014).

CLIMATE CHANGE

Another cause of climate change is developing

The continuing increase in greenhouse gas concentrations is not the only thing driving global warming; changing land use, such as the conversion of forests to farmland, is adding to the

problem, too. Because increasing population and rising affluence will require more land be farmed in order to supply food to the world, our climate will experience even more disruption in the coming decades. Ward *et al.* calculate the climate forcing due to land use and land cover change and find that it is contributing nearly

half as much as anthropogenic greenhouse gas emissions, and that could grow in the future. Their work shows how important land policy will be in efforts to minimize continued climate warming. — HJS

Atmos. Chem. Phys. 10.5194/acp-14-12701-2014 (2014).

CANCER BIOLOGY

Engineering cancer cell metastasis

Cancer cell metastasis is not random. Breast cancer, for example, tends to metastasize to bone. To explore what underlies this selectivity, Jeon *et al.* took an engineering approach: They built in vitro microfluidic models that allowed them to compare how different tissue microenvironments affect the ability of breast cancer cells to exit blood vessels (extravasate) and enter surrounding tissue. They found that a bone-mimicking microenvironment was particularly potent in inducing extravasation. Adding a protein called adenosine to the system, which binds to breast cancer cells, reduced their extravasation, suggesting that this model might be a valuable way to screen for drugs that block metastasis. — PAK

Proc. Natl. Acad. Sci. U.S.A. 112, 214 (2015).

AGING

The downside of living a longer life

Over the years, scientists have identified many factors that increase longevity in animal models. But do these interventions also let animals stay healthy longer, giving them an extended "healthspan"? To find out, Bansal *et al.* measured a range of physiological parameters over the lifetime of worms with mutations that extended their lifespans. The effect of these mutations on healthspan was variable. In fact, control worms had the greatest healthspan when calculated as a percentage of total lifespan. Extending the period of ill health

of an increasingly aged human population could be devastating, suggesting that researchers should focus on optimizing healthspan rather than lifespan. — LBR

Proc. Natl. Acad. Sci. U.S.A. 10.1073/pnas.1412192112 (2015).

SOLID-STATE PHYSICS

Engineering a copper oxide look-alike

Many discoveries of spectacular material properties are serendipitous. Scientists can make the discovery process more predictable if they design materials from the "bottom up" to behave in a certain way. Disa *et al.* fabricated heterostructures consisting of alternating layers of LaTiO_3 , LaNiO_3 , and LaAlO_3 , with the aim of making a material in which the top two valence orbitals are filled

with electrons to very different degrees. This property can lead to exotic effects and may be useful for making high temperature copper oxide superconductors. The authors used x-ray absorption spectroscopy to verify the properties of the heterostructure. Their theoretical calculations showed that replacing LaAlO_3 with a different material can lead to further improvements. — JS

Phys. Rev. Lett. 10.1103/PhysRevLett.114.026801 (2015).

ORGANIC CHEMISTRY

Olefins from seed oils at industrial scales

Linear-chain olefins with terminal double bonds (linear α -olefins, or LAOs) are essential building blocks for both commodity

products, such as lubricants and thermoplastics, and fine chemicals and drugs. Many fatty acids derived from seed oils have a linear tail containing a

central double bond, and exchanging this tail with ethylene (ethenolysis) would provide a renewable source of LAOs. However,

most catalysts for this reaction deactivate after thousands of reaction cycles (turnovers) and require unacceptable amounts of catalyst. Marx *et al.* now report a ruthenium ethenolysis catalyst bearing a cyclic alkyl amino carbene ligand that achieves more than 100,000 turnovers at a catalyst loading of only three parts per million. — PDS

Angew. Chem. Int. Ed. 10.1002/anie.201410797 (2014).



Pea aphids require the bacterium *Buchnera* to develop and reproduce

SYMBIOSIS

What's mine is yours, and what's yours is mine

Many invertebrates harbor symbiotic bacteria. Because these relationships have evolved over millions of years, dissecting whether a particular feature of an organism results from the host's or the symbiont's genes is a challenge. Moran and Yun discovered how to manipulate an obligatory symbiosis between a bacterium and its aphid host. They did this by exploiting a natural mutation in the bacteria that causes them to die at high temperatures. They then replaced the dead bacteria by injecting heat-tolerant bacteria. Evidence of success came when not just the symbionts but also the recipient aphids developed a striking tolerance to high temperatures. — CA

Proc. Natl. Acad. Sci. U.S.A. 10.1073/pnas.1420037112 (2015).