RESEARCH HIGHLIGHTS

Birds of a feather

PLoS Biol. **7,** e1000132 (2009)

The size of flighted birds is limited by the demands of feather maintenance.

Sievert Rohwer at the University of Washington in Seattle and his colleagues studied 43 species of bird, assessing size, the length of flight feathers and timing of moulting cycles.

Flight-feather length is proportional, they say, to body mass raised to the one-third power, so that feather length roughly doubles with a tenfold increase in a bird's weight. But feather growth rate is proportional to body mass raised only to the one-sixth power. The trade-offs in time and energy required to replace long feathers therefore limit maximum bird size.

For a longer story on this research, see http://tinyurl.com/l3ge9b.

AFLO/NATUREPL.COM

ASTRONOMY

Honing the Hubble constant

Astrophys. J. **699,** 539–563 (2009)

Astronomers have measured the Universe's current rate of expansion to within 5% — twice as a precisely as before. Adam Riess of the Space Telescope Science Institute in Baltimore, Maryland, and his team used the Hubble Space Telescope to refine previous estimates of the Hubble constant, which relates the speed at which galaxies race apart to their distances from each other. They found the constant to be 74.2 kilometres per second per million parsecs.

Because true cosmic yardsticks are hard to find, astronomers chain together different observations to get the great distances needed to determine the constant. The researchers eliminated some sources of error using observations of 240 stars called cepheids, which provided precise distance measurements for seven galaxies. The new measurements are consistent with observations that the Universe is full of dark energy, a repulsive force that is accelerating the Universe's expansion — and changing the Hubble constant slightly with time.

NEUROBIOLOGY

Sweet memories

BMC Biol. **7,** 30 (2009)

Honeybees have helped scientists to sniff out a trigger of long-term memory formation. Calcium has been linked to this type of memory for more than a decade, but only recently have researchers directly manipulated it in the honeybee (*Apis mellifera*) to show that it can activate the formation of such memories.

Jean-Christophe Sandoz and his colleagues at the University of Toulouse in France tested honeybees' memories by first training them to extend their probosces for a sugary reward when presented with a specific odour. They then exposed the bees to the same odour three days later to see whether the bees remembered it. Injecting the bees with a chemical that decreased calcium availability impaired the insects' ability to remember. Conversely, injecting chemicals that increased calcium levels improved their long-term memory.

CHEMISTRY

The tiniest acid drop

Science **324,** 1545–1548 (2009)

The smallest drop of acid it is possible to make has been spotted within superfluid helium nanodrops cooled to below 1 kelvin.

Martina Havenith of Ruhr University Bochum in Germany and her colleagues observed the reaction between one molecule of hydrochloric acid and four of water using infrared laser spectroscopy. Using *ab initio* simulations, they found that the dissociation into H^+ and Cl^- occurs in a stepwise manner (pictured, left). A novel mechanism, which the authors term 'aggregation-induced dissociation', explains how this can happen even at such ultralow temperatures.

Such dissociations are key in chemistry, with relevance to processes ranging from reactions in polar clouds to spontaneous synthesis in space, the authors say.

AAAS

NANOTECHNOLOGY

Mass spec goes mechanical

Nature Nanotechnol. doi:10.1038/nnano.2009.152 (2009)

Mass spectrometry analyses molecules on the basis of the mass-to-charge ratios of their ionic fragments. The method can be difficult to use for substances that are hard to ionize or only available in minute amounts. Michael Roukes and his colleagues at the California Institute of Technology in Pasadena now demonstrate a nanoelectromechanical device that can directly measure the mass of individual molecules.

Inside the device, a tiny suspended beam vibrates at high frequency and acts as a sensor. The authors blasted the device first with gold nanoparticles, and later with bovine serum albumin.

When molecules stick to the sensor's surface, they drastically lower its vibrational frequency. By measuring the change, the mass of individual molecules can be established, the authors say, and this could potentially be done without the use of ionization.

ATMOSPHERIC SCIENCE

Rain on physics

Geophys. Res. Lett. doi:10.1029/2008GL037111 (2009)

By observing approximately 64,000 raindrops, researchers have determined that some can fall by as much as an order of magnitude faster than their terminal velocity — the limit at which the downwards force of gravity equals the upwards force of drag.

Fernando García-García at the National Autonomous University of Mexico in Mexico City and his colleagues show that when large