EDITORS' CHOICE

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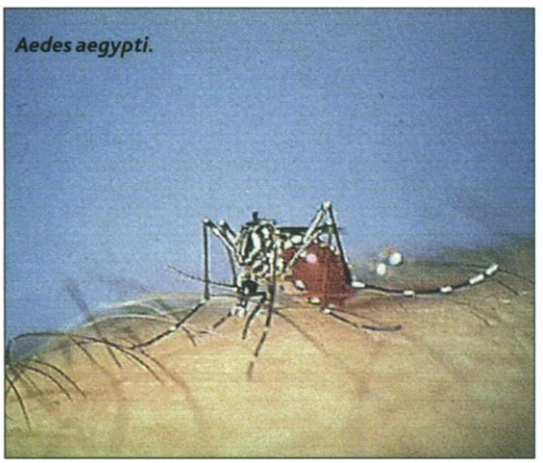


VIROLOGY

Virus, Vector, Vertebrate

The flaviviruses are responsible for many diseases of significance to humans. Gaunt *et al.* have used sequence data to construct phylogenetic trees to help define the complex interrelationships between the viruses, their hosts, and the diseases they cause.

The flaviviruses fall into three major clades: mosquito-borne, tick-borne, and those with no known vectors. Hence, it seems the *Aedes* spp. of mosquitoes are associated with the primate hemorrhagic diseases, including dengue and yellow fevers, which reflects the slightly fussy feeding habits of this mosquito genus. The *Culex* spp. group appears to have evolved later than the *Aedes* group and are indiscriminate feeders transmitting neurotrophic viruses, including West Nile fever and Japanese encephalitis among mammals and birds. In contrast, the tick-borne viruses do not divide into disease groups, but the shift to the universal vector *Ixodes* has hit economically important targets, as with louping ill virus in sheep.

It appears that the out-of-Africa notion also holds true for the flaviviruses, and it is probable that yellow fever and dengue crossed the Atlantic on slave ships. Gaunt *et al.* hope that this kind of analysis will offer a tool not just for tracing the history of these viruses, but for predicting and monitoring the emergence of new viral diseases. — CA

J. Gen. Virol. **82**, 1867 (2001).

ECOLOGY/EVOLUTION

How Many Species, Revisited

Despite three centuries of avid collecting, cataloguing, and classifying, large uncertainties have surrounded the total number of species of eukaryotic organisms on Earth. Recent estimates have ranged from as few as 3 million to over 30 million. Increasingly, estimates are homing in on values at the lower end of the spectrum. Most efforts consider insects, which constitute the vast majority of terrestrial metazoa.

Dolphin and Quicke focus on the parasitic wasp family Braconidae and use two models to extrapolate from the number of described species to the total. Their first method uses the rate of taxonomic description of new species, and the second uses biogeographic comparisons with other insect groups that are better described (such as butterflies). Both estimates produce similar results, indicating that the total number of species is likely to be 2.1 to 3.4 times the number of species so far described. Extended to insects as a whole, this would place an upper bound of around 3.4 million species. — AMS

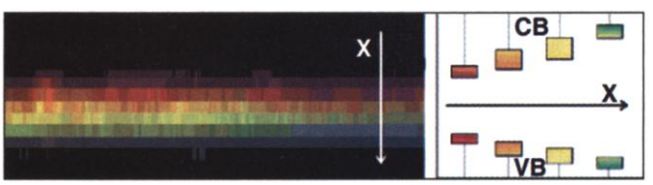
Biol. J. Linn. Soc. **73**, 279 (2001).

MATERIALS SCIENCE

Layered Films Make the Grade

Graded semiconductor films, in which the band gap changes through the thickness of film, have numerous potential applications in devices such as photodetectors, waveguides, and bipolar transistors, but their preparation often requires numerous advanced fabrication steps. Mamedov *et al.* show how layer-by-layer solution growth of colloidal nanoparticles, in which alternating layers of polyelectrolytes immobilize each layer, can be used to build up graded semiconductor films. In this case, they assembled CdTe particles in bilayer stacks, starting with nanoparticles emitting in the green and increasing in size to those emitting in the yellow, orange, and finally red (each color layer was typically five to ten bilayers thick). Although the gradation achieved is not as fine as that possible with vacuum epitaxy methods, the layers are still well below optical wavelengths, thus suggesting applications such as polarizability or refractive index tuning. — PDS

J. Am. Chem. Soc. 10.1021/ja015857q.



Confocal microscopy cross section of graded CdTe layers, with conductance and valence bands (CB and VB).

ARCHAEOLOGY

Climate and Farming

Agriculture evidently arose in several societies after the beginning of the Holocene, about 10,000 years ago, even though many earlier Pleistocene societies were quite sophisticated. Richerson *et al.* offer an overview of what is known of the development of agriculture in different societies and propose that sustainable agriculture was impossible during the Pleistocene but compulsory during the Holocene. They argue that the climate during the Pleistocene was incompatible with agriculture; globally, it was drier and dustier, and large shifts in climate were frequent enough to inhibit cultural evolution (from hunting-gathering to farming). In contrast, during the more stable, wet, and warmer climate of the Holocene, population pressure would create feedback that catalyzed the development of agriculture. They present numerical models to support their comparisons between the pace of cultural change and climate variation. — BH

Am. Antiq. **66**, 387 (2001).

PLANT SCIENCE

Efficient Fragrance

Floral scents generally consist of secondary metabolites such as terpenoid, phenylpropanoid, and benzenoid compounds, and as many as 700 varieties have been identified among numerous plant families. After visual cues have attracted bumblebees into their general vicinity, snapdragons utilize floral scent to entice them into landing.

CONTINUED ON PAGE 765

SOURCE: (TOP) IMAGE: CDC; (BOTTOM) MAMEDOV *ET AL., J. AM. CHEM. SOC.*, 10.1021/JA015857Q

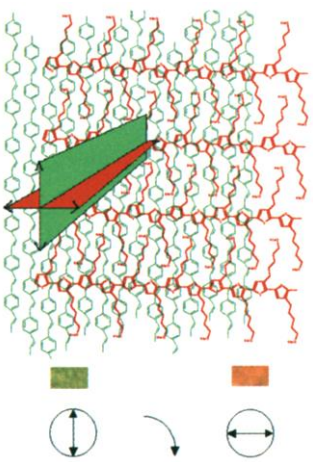
As described by Kolosova *et al.*, the scent emanates primarily from the tissues that the bumblebee would most likely approach while foraging for nectar. The enzyme *S*-adenosylmethionine:benzoic acid carboxyl methyltransferase (BAMT) catalyzes the final step in synthesis of the scent component methylbenzoate in snapdragons (*Antirrhinum majus*). Immunogold labeling indicated that BAMT is localized to inner epidermal cells; specialized scent glands, such as might be expected to sequester complex metabolites, were not found. The conical shape of the epidermal cells also contributes to efficient use of volatile metabolites by increasing the surface area from which the scent compounds may be emitted. — PJH

Plant Physiol. **126**, 956 (2001).

POLYMER SCIENCE

It's Not Easy Being Green

If light-emitting diodes (LEDs) made of conducting polymers are fabricated so that there is a large anisotropy in the polymer backbone orientation, either by chain rubbing or by stretching, the emitted light or electroluminescence of the device will often be polarized. At present, the wavelength of the polarized electroluminescence is determined primarily by the chemical structure of the polymer.



Red and green light emitted with orthogonal polarization.

Bolognesi *et al.* have succeeded in making an LED with a color output that can be adjusted. This device is made from two polymers, a green emitter [poly(*p*-phenylenevinylene) or PPV] and a red emitter {poly[3-(6-methoxyhexyl)thiophene] or P6OMe}, that are prepared as films with their backbones oriented orthogonally to each other. At low voltages (<7 volts), only P6OMe is excited, and a red emission is observed. As the voltage increases, the emission from PPV grows rapidly, and the color becomes orange-green. Because the orientation of the two materials is orthogonal, the emitted light has orthogonal polarization. Thus, the color can be changed by rotating a polarizing filter, allowing the color to be tuned from red to green. — MSL

Adv. Mater. **13**, 1072 (2001).

GEOCHEMISTRY

Abiotic Iron

Iron, an essential nutrient, can be fractionated isotopically by bacteria during its metabolic reduction from Fe(III) to Fe(II). Consequently, iron isotope fractionation may be useful as a tracer of early life or as a signature of biological activity in extreme environments, but theoretical arguments and recent empirical evidence have shown that iron isotopes can be fractionated by nonbiological processes.

Bullen *et al.* investigated the potential of abiotic chemical reactions to fractionate iron isotopes with samples from the field and the laboratory. During the oxidation of aqueous Fe(II) to Fe(III), abiotic processes form a precipitate of ferrihydrate, $Fe(II)(OH)_x$, with a $^{56}Fe/^{54}Fe$ nearly 1‰ higher than that of the coexisting disssolved Fe(III). This effect is comparable in magnitude to the fractionation observed in microbial systems and supports the argument that Fe isotopic fractionation in geological samples cannot be taken as an unequivocal indicator of biologic activity. — HJS

Geology **29**, 699 (2001).

BIOMEDICINE

Iron on the Brain

Patients with certain neurodegenerative disorders such as Parkinson's disease and dementia show excessive accumulation of iron in the brain. It has been postulated that these iron deposits damage neurons by inducing oxidative stress, but whether they are a cause or consequence of the disease process is unclear.

Curtis *et al.* report that the causative mutation in a family with adult-onset basal ganglia disease lies in a gene encoding a subunit of ferritin, a protein that functions in both storage and detoxification of iron. In a study of patients with Hallervorden-Spatz syndrome, an early-onset neurodegenerative disorder, Zhou *et al.* find that the culprit gene encodes pantothenate kinase (PANK), an essential regulatory enzyme in coenzyme A biosynthesis. The disease-associated mutations in PANK might alter iron levels in the brain indirectly through effects on cysteine levels. Further studies of these new disease genes will be needed to understand the role iron metabolism plays in neurodegeneration. — PAK

Nature Genet. 10.1038/ng571; 10.1038/ng572.

CREDITS: BOLOGNESI *ET AL.*, *ADV. MATER.* **13**, 1072 (2001)