EDITORS' CHOICE

edited by Gilbert Chin

PHYSICS

Stirring a Condensate with a Laser

An object can move through a superfluid without resistance provided that its speed is below a critical value; higher speeds result in the formation of vortices, which are small volumes of normal fluid and superfluid that rotate and dissipate energy. Although the dynamics of these vortices are considered to be crucial in understanding superfluidity, the strong and complex interactions of the superfluid, dissipative forces, and surface effects in most superfluids (such as liquid helium) all combine to obscure observations.

Chevy *et al.* and Onofrio *et al.* have studied superfluid motion in a dilute gas of atoms forming a Bose-Einstein condensate (BEC), which they stirred using laser beams. Their results—the determination of the onset of dissipation and the measurement of angular momentum as the stirring rate neared the critical value—combined with the weak interactions between the particles in a dilute gas, suggest that the BEC may be an ideal system for studying superfluidity. — ISO

Phys. Rev. Lett. **85**, 2223 (2000); *Phys. Rev. Lett.* **85**, 2228 (2000).

CHEMISTRY

Grignard Reactions in Water

Synthetic chemists cut their teeth on the Grignard reaction, which allows carbon-carbon bonds to be formed. However, the reactive organomagnesium species is seemingly willful—it forms readily only in dry solvents and can revert to its starting material if it reacts first with water. Li and Wang now show that for one particular case, the addition of a phenyl group to an aldehyde, a Grignard-like reaction actually can occur in water and in air. Trimethyl and tributylphenyltin species add to aldehydes to yield the corresponding alcohols in the presence of a rhodium catalyst, which the authors suggest can insert into the bond between the tin atom and the phenyl carbon atom. — PDS

J. Am. Chem. Soc., in press.

GEOLOGY

Midcontinent Mineralization

Continental collisions do much more than just build mountains. As a consequence of the increased topography, large amounts of crustal fluid, which includes petroleum and metal-rich brines, are expelled thousands of kilometers underground toward continental interiors. These flows apparently were responsible for producing the Mississippi Valley–type zinc and lead sulfide ore deposits after the expelled fluids cooled and rose toward the surface. Previous dating of the ores had suggested that most of the fluids were supplied by formation of the Appalachian and Oachita Mountains about 250 million years ago (Ma) after the last collision of Europe and Africa with North America.

Mississippi valley–type zinc ore.

Coveney *et al.* provide additional dates and analysis of fluids from several major ore bodies that show a more complicated and much longer history. Although formation of the major ores is still coeval with formation of the Appalachian Mountains, some of the ores are younger and may be associated with fluid flow driven from the Laramide Orogeny in the Rocky Mountains, which occurred about 60 Ma. — BH

Geology **28**, 795 (2000).

PSYCHIATRY

Biogenic Amines and ADHD

The widespread treatment of children who show signs of attention deficit hyperactivity disorder (ADHD) with Ritalin (methylphenidate) has contributed to arguments about overmedication. The controversy surrounding ADHD treatment contrasts with its standing as a psychiatric disorder whose genetic basis is understood better than that of many psychiatric diseases.

The efficacious treatment of ADHD patients with methylphenidate, a drug that inhibits dopamine uptake, is satisfyingly consistent with multiple reports of the association of ADHD with an allele of the dopamine D4 receptor gene. This allele, characterized by a 48–base pair repeat in exon 3 that likely affects the function of the receptor, is shown to be significantly increased in ADHD patients and their parents by Holmes *et al.*, although a previously demonstrated association between ADHD and the DAT1 dopamine transporter is

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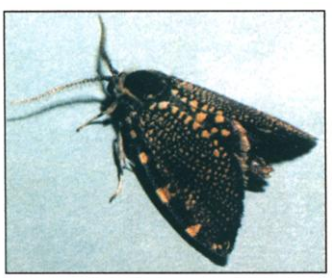
EVOLUTION

Conflict Leads to Speciation

The role of sexual selection, in the form of mate choice by females, in animal speciation is well established. Arnqvist *et al.* now show that post-mating sexual conflict also plays a part, at least in insects. Conflict occurs when females mate with multiple males (polyandry), giving rise to sperm competition or 'cryptic' female choice. Under these conditions the evolutionary interests of males and females can differ, leading to antagonistic coevolution between the reproductive physiologies of the two sexes. This, in turn, might lead to rapid reproductive isolation between allopatric populations and hence a higher rate of speciation.



Moths from the polyandrous family *Noctuidae* (right), and from the monadrous family *Psychidae* (above).

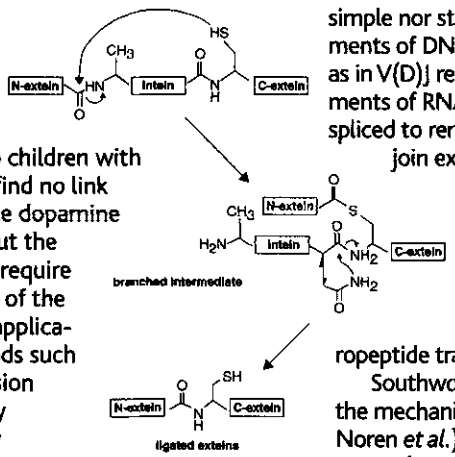
To test this idea, Arnqvist *et al.* performed a meta-analysis using published literature, reference databases, and the World Wide Web, covering insects in five different orders. They compared polyandrous groups with other groups in which females mate only once, and found that speciation rates, as measured by species richness in clades of known phylogeny, was up to four times higher where sexual conflict was present. This estimate does not include extinction rates, which might be expected to be higher in groups with sexual conflict; thus, the true effect of sexual conflict may turn out to be even greater. — AMS

Proc. Natl. Acad. Sci. U.S.A. **97**, 10460 (2000).

SOURCE: (TOP) COVENEY *ET AL.*, *GEOLOGY* 28, 795 (2000); (BOTTOM TWO) COURTESY OF DON HERBISON-EVANS, MACLEAY MUSEUM, UNIVERSITY OF SYDNEY.

not replicated. But as this part of the story solidifies, McCracken *et al.* find an association of ADHD with a different allele of the dopamine D4 receptor that has a repeat element in the 5′ transcription initiation site, Quist *et al.* find that the serotonin 2A receptor allele Tyr^{452} is preferentially transmitted to children with ADHD, and Barr *et al.* find no link between ADHD and the dopamine D5 receptor. Sorting out the true associations may require functional assessment of the candidate alleles and application of imaging methods such as single photon emission computed tomography (SPECT), as pursued by Dahlstrom *et al.*, which can determine the availability of neurotransmitter receptors in the living brain — KK

Mol. Psychiatry **5**, 523; 531; 537; 546; 514 (2000).



An alternative way to join exteins.

BIOCHEMISTRY

Forming New Ties Directly

The process through which a gene is transformed into a protein is neither simple nor straightforward. Segments of DNA can be rearranged, as in V(D)J recombination, and segments of RNA transcripts can be spliced to remove introns and to join exons. Proteins, too, can be modified, for instance, to cut away a membrane-targeting signal sequence or to snip out shorter pieces for use as neuropeptide transmitters.

Southworth *et al.* have studied the mechanisms (summarized by Noren *et al.*) by which protein segments (inteins) can be removed and the remaining pieces (exteins) spliced together. The canonical pathway relies on the reactivity of polar, nucleophilic side chains at the N-termini of both the intein and the downstream extein. They now demonstrate the existence of an alternative pathway in which an internal cysteine attacks directly an upstream peptide bond to form a branched intermediate, which then collapses through intramolecular cyclization and an S→N shift into the linear product and the disposable intein. — GJC

EMBO J. **19**, 5019 (2000); *Angew Chem. Int. Ed.* **39**, 450 (2000).

MOLECULAR BIOLOGY

First Step to Commitment

In eukaryotic transcription, a molecular machine consisting of RNA polymerase II together with a set of basal transcription factors acts at all promoters. The factors TFIIE and TFIIH are involved in facilitating transitions from a preinitiation complex to an open complex that links together the first few ribonucleotides and then to a stable elongation complex (containing a 15-nucleotide RNA) that allows subsequent synthesis of the full length transcript. But what happens to RNA polymerase II itself during these transitions?

Kugel and Goodrich have used a minimal in vitro transcription system, which does not require TFIIE or TFIIH, to measure rate constants for discrete steps of single rounds of transcription. They find that a transition occurs after initiation that commits RNA polymerase II to releasing the promoter and forming the elongation complex. This transition, termed escape commitment, is rapid and is complete after synthesis of the first four nucleotides of the transcript; TFIIH serves to enhance escape commitment. The authors present a kinetic model for transcription that comprises five steps: preinitiation complex formation, initiation, escape commitment, promoter escape, and transcript elongation. — VV

J. Biol. Chem., in press.

ATMOSPHERIC CHEMISTRY

Predicting Partners

Classic association species are formed from two radical species held together by weak covalent bonding. One such species found in the atmosphere is peroxyacetyl nitrate, which is very stable and thus can transport otherwise reactive radicals over long distances. Aloisio and Francisco have performed ab initio calculations of two representatives of a different class of association species, namely cyclic complexes of a radical and a molecule held together by strong hydrogen bonding. The authors find that both hydroperoxy–formic acid and hydroperoxy–acetic acid approach the stability of peroxyacetyl nitrate. These complexes are rare examples of systems whose hydrogen-bond strength is of the magnitude of weak, covalently bonded systems. These complexes also may be of importance in the atmosphere, particularly in colder regions of the troposphere where they may act as precursors to organic aerosols. — JU

J. Am. Chem. Soc., in press.

CREDITS: NOREN *ET AL.*, *ANGEW CHEM. INT. ED.* **39**, 450 (2000).