EDITORS' CHOICE

edited by Gilbert Chin

GENETICS

Making Sense of Sequence

A series of articles describe the results of the *Drosophila* Genome Annotation Assessment Project (www.fruitfly.org/GASP/), a collaboration of 12 research groups formed to evaluate computational tools currently available for the analysis of genome sequence. All of these groups were examining the same sequence, 2.9 Mb centered on the *Adh* gene of *Drosophila*. This region has been studied extensively for 20 years and is known to include genes of varying complexity, including one with 30 exons and some that were located within the introns of other genes. The groups used computer programs to develop predictions based on ab initio gene identification, promoter recognition, EST and cDNA alignment, protein similarity, repetitive sequence identification, and gene function.

Stormo describes the basic principles of genome annotation; Reese *et al*. present an overview of how the project was designed and how results were evaluated; and Ashburner presents a summary of the findings, from the expected to the surprising. — BJ

Genome Res. **10** (2000).

GEOLOGY

A Large Asteroid, a Major Extinction?

Asteroid impacts are now recognized as having shaped Earth's history. Early impacts likely formed the moon, modified the composition of Earth's crust and mantle, and influenced the formation of its atmosphere and life; more recently, impact of a 10-kilometer diameter asteroid at the end of the Cretaceous (65 million years ago) may have led to a mass extinction that altered the course of evolution. It has been difficult to identify large impacts on Earth—and thus to reconstruct this important history—because many of the diagnostic rocks are weathered and altered, and craters, such as that at Chicxulub, are rapidly buried.

Mory *et al*. suggest that a large impact structure (120 km in diameter) lies buried in Western Australia. The crater is covered by Lower Jurassic and younger sediments but retains a diagnostic geophysical signature. Drill cores into the structure returned heavily shocked minerals and rocks, and Permian fossils. Precise dating has not yet been achieved, but the age range between Permian and Lower Jurassic encompasses two major extinctions, and the size of this crater places it, after Chicxulub, as the second largest impact identified in the Phanerozoic. — BH

Earth Planet. Sci. Lett. **177**, 119 (2000).

The Trapezium cluster in Orion

SOURCE: JOHN BALLY, DAVE DEVINE, AND RALPH SUTHERLAND.

ASTRONOMY

Free-floating Planets in Orion

Extrasolar planets and brown dwarfs have been discovered with increasing frequency around young stars, yet still more discoveries will be needed to understand conditions under which a star or a planet will form from the collapse of a molecular cloud or other processes. Evolutionary diagrams of star formation track the change in color, luminosity, and mass of a star from its youth to old age, but there are so few substellar objects that such diagrams are poorly defined.

Lucas and Roche completed a deep infrared photometric survey over a small area of the Trapezium cluster in the Orion nebula with the UKIRT telescope on Mauna Kea, Hawaii. They identified over 500 sources that could be plotted on an evolutionary diagram, and about 30% of these sources were brown dwarfs, while 13 sources were planets. Such a large population of substellar sources has not been observed previously in Orion and provides vital parameters for deriving evolutionary tracks. The planets are called free-floating because they appear isolated from other stars; however, these planets are assumed to have formed by cloud core fragmentation and collapse, the same process that accounts for star and brown dwarf formation. One unusual break in the substellar object track is the lack of planets of less than 8×10^3 solar masses, which the authors attribute to local O stars with strong stellar winds that disperse the collapsing core gases before the smaller planets have formed. — LR

http://arXiv.org/abs/astro-ph/?0003061.

MOLECULAR BIOLOGY

Translational Trickery and Polyamines

Polyamines are essential for the proliferation of eukaryotic cells. Their intracellular concentrations are regulated through the cell cycle and largely determined by the level of ornithine decarboxylase (ODC), the rate-limiting synthetic enzyme.

Pyronnet *et al*. show that mammalian ODC messenger RNA contains a cap-independent internal ribosome entry site that functions exclusively at the G_2/M phase of the cell cycle, a time when most protein synthesis is inhibited, thereby ensuring production of the polyamines needed for mitosis.

Ivanov *et al*. investigate a polyamine-enhanced ribosomal frameshifting event that occurs during translation of the mRNA for antizyme 1, a protein that targets ODC for degradation. They show that this programmed frameshifting is conserved from fission yeast to mammals, suggesting that it plays a fundamental role in cell physiology. In a separate study in mice, Ivanov *et al*. find a new antizyme paralog that is selectively expressed in testis germ cells, suggesting an involvement of this regulatory system in spermatogenesis. — PAK

Mol. Cell **5**, 607 (2000); *EMBO J.* **19**, 1907 (2000); *Proc. Natl. Acad. Sci. U.S.A.* **97**, 4808 (2000).

NEUROSCIENCE

Synapses Under Construction

Presynaptic terminals are tiny, complicated portions of neurons and are located far from the cell body, often at the very end of long processes. Neuronal communication occurs when transmitters are released from the presynaptic terminal and bind to receptors on the surface of the postsynaptic neuron. But

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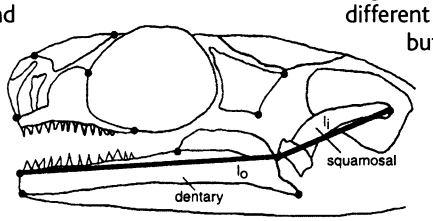
how does the cell construct these distant structures? Ahmari *et al.* address this question by real-time imaging of hippocampal neurons in culture. By tagging the synaptic protein VAMP with green fluorescent protein, these authors could see that large assemblies of membranes, vesicles, and synaptic proteins were carried together in discrete packets down the axon and into the processes. As a synapse formed, these packets were diverted and localized. The preloaded vesicles then matured and were able to begin releasing transmitter within hours. Thus, partial fabrication of synaptic components in the cell body enables the cell to form synapses where needed, quickly and efficiently. — KK

Nature Neurosci. **3**, 445 (2000).



Biomechanical specialization relieves competitive pressure

PHYSICS

Not as Far to Go, But Longer to Get There

Shrinking the size of devices has been the method of choice in microelectronics (it has led to improvements in on-chip device densities with a commensurate increase in speed) and is a trend that is likely to continue. Fischetti and Laux, however, call into question the perceived improvements in device performance as dimensions become smaller. Their device modeling study shows that for transistors with conduction channels shorter than 40 nanometers and an oxide layer less than 2.5 nm, the close proximity of the conduction channel to the heavily doped source and drain contact regions is detrimental to electron transport in the channel; this effectively slows electron motion and leads to an overall reduction in device performance. — ISO

Appl. Phys. Lett. **76**, 2277 (2000).

EVOLUTIONARY ECOLOGY

A Tale of Two Salamanders

Evolutionary ecologists have theorized that two closely related animal species may be almost indistinguishable when they occupy different geographical areas, but show increased morphological or behavioral divergence in areas where their distributions overlap (sympatry). This phenomenon, called character displacement, is explained as a result of increased competitive pressure between sympatric species: competition tends to drive them to exploit different kinds of prey. Despite its theoretical appeal, however, character displacement has been demonstrated unequivocally in relatively few instances.

In a study of sympatric North American salamanders of the genus *Plethodon*, Adams and Rohlf apply new morphometric techniques to show how the jaw morphology and mechanics (the ratio of squamosal length to dentary length is proportional to closing force and inversely proportional to closing speed) of two salamander species have diverged in sympatry to allow capture of arthropod prey of different size and agility. Their results provide a solid example of character displacement and strengthen the case for the role it plays in the coexistence of species. — AMS

Proc. Natl. Acad. Sci. U.S.A. **97**, 4106 (2000).

HIGHLIGHTED IN *SCIENCE*'S SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

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Sog Blocks Gbb, Supersog Blocks Gbb and Dpp

Two members of the bone morphogenetic protein (BMP) family of growth factors in *Drosophila* are encoded by the genes *decapentaplegic* (*dpp*) and *glass-bottom boat* (*gbb*). Yu *et al.* studied the effects of *short gastrulation* (*sog*) on wing development in adult flies and found that Sog abrogates signaling by the Gbb protein and not signaling by Dpp. Truncated forms of Sog, called Supersog, were observed in embryonic and pupal cells but not larval cells, suggesting that Sog is processed in vivo in a developmentally regulated manner. Expression of Supersog led to inhibition of both Dpp signaling and Gbb signaling. Although the metalloproteinase Tolloid (Tld) has been shown to degrade Sog to an inactive form, Yu *et al.* present evidence that Sog is proteolytically processed into Supersog by a complex of Tld and the Twisted Gastrulation (Tsg) protein. That is, whereas Tld alone degrades Sog, the subsequent expression of Tsg appears to modify Tld proteolytic activity, leading to the formation of Supersog. This may establish the gradient required to regulate Dpp activity and subsequent differentiation of the dorsal region. — JN

Development **127**, 2143 (2000).