

likelihood of the emergence of dispersal barriers. But a negative relationship is also plausible: A wider distribution might be facilitated by biological characters, such as good dispersibility or wide ecological tolerance, that would tend to depress speciation.

Using fossil and extant molluscs, Jablonski and Roy find evidence in support of a negative relationship between speciation rate and distribution. Cretaceous gastropods from the Atlantic Coastal Plain of what is now eastern North America show a significant inverse relationship between species production rates over 35 million years and geographical range; 13 clades of living bivalves and gastropods distributed globally show no relation between species richness and range. This result suggests that the factors that lead to wide distribution also tend to dampen speciation rates, at least in marine molluscs. — AMS

Proc. R. Soc. London Ser. B 10.1098/rspb.2002.2243 (2003).

BIOCHEMISTRY

Laissez-faire Versus Keynesian

How enzymes lower the activation energy of reactions has almost as many answers as there are enzyme structures. Hur and Bruice use molecular dynamics simulations to compare and contrast a pair of intramolecular rearrangements: chalcone to (*S*)-flavanone and chorismate to prephenate. Both enzymes (chalcone isomerase and chorismate mutase) achieve comparable rate enhancements, decreasing the energy barrier from about 25 kcal/mol for the aqueous reaction to about 15 kcal/mol. However, the former relies on actively abetting nucleophilic attack by an enolate, whereas the latter merely watches after capturing the rare chorismate conformer in which the Claisen rearrangement is already primed and ready to go. — GJC

J. Am. Chem. Soc. 10.1021/ja0293047 (2003).

APPLIED PHYSICS

Integrating Color Displays

Electroluminescence occurs when carriers are injected into wide band-gap semiconductors such as gallium nitride (GaN) and excite light-emitting centers. The wavelength of the emitted light can be controlled with rare earth dopants, and thus there is considerable effort being made toward developing these materials for large-area flat-panel displays. Wang *et al.* introduce a processing route involving several steps of deposition and patterning in which

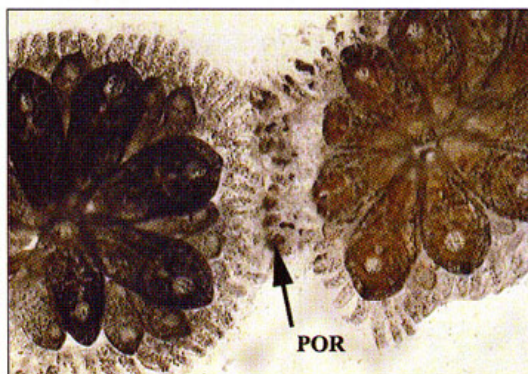
a lift-off technique is used, with liquid glass as the sacrificial layer at each step. Their process is compatible with the high-temperature growth of the GaN layers and conventional wet-processing techniques. They demonstrate the fabrication of laterally patterned red-, green-, and blue-emitting regions on a single substrate. — ISO

Appl. Phys. Lett. 82, 502 (2003).

IMMUNOLOGY

An Early Sign of Adaptive Immunity

The urochordates represent an early step in the evolutionary lineage of vertebrates. Urochordate larvae develop a notochord and nervous system, chordate features that are then lost in the adult phase of the organism, as observed in the



The point of rejection between two colonies (central zooids surrounded by vascular ampullae).

sessile, and sometimes colonial, sea squirt. Khalturin *et al.* show that the adults may share other features with higher vertebrates.

On physical contact, two *Botryllus* colonies either fuse into one or reject each other in a process determined by a single, highly polymorphic genetic locus reminiscent of the vertebrate major histocompatibility (MHC) locus. By screening for changes in gene expression during the process of acceptance or rejection, they identified a gene, *BsCD94-1*, that encodes a membrane protein similar to the CD94 class of natural killer (NK) receptors. This protein is found on the surface of a group of granulocyte-like *Botryllus* blood cells. In mammals, NK lymphocytes distinguish between normal cells (self) and foreign cells (nonself). Thus, rejection of incompatible transplants in vertebrates may function via a process with evolutionary roots in sea squirts. — PJH

Proc. Natl. Acad. Sci. U.S.A. 100, 622 (2003).