NEUROSCIENCE
Making Memories

During learning, in a process termed long-term potentiation (LTP) or long-term facilitation, synapses are specifically modified by a process that involves transcription. Because the synapse itself is at a distance from the neuronal cell nucleus—separated by the elongated axon or dendrite—the neuron must possess mechanisms to transmit synthetically activated second messengers and transcription factors to its nucleus. Thomson et al. now dissect aspects of this pathway in *Aplysia* sensory neurons and in mouse hippocampal neurons. In both cases importins (proteins involved in active nuclear import in many cell types) appear to be involved. In both types of neurons, importins were found localized along axons and dendrites and in synaptic compartments. Stimuli that triggered long-lasting facilitation in *Aplysia* triggered translocation of importin to the nucleus. Similarly, in hippocampal neurons synaptic receptor activation promoted nuclear accumulation of importin. The changes in importin distribution were not observed when only short-term synaptic changes were induced (changes that are known not to involve changes in transcription). It remains to be demonstrated which memory-related substrates may be associated with the translocating importins, but a role for the classical nuclear import pathway in generating long-lasting memories seems likely. — SMH


CLIMATE SCIENCE
Twinned Thinning

The response of the West Antarctic Ice Sheet (WAIS) to global warming is of great concern because, if it were to melt completely, it is large enough to raise sea level by approximately 7 m. Such massive melting is unlikely to occur soon; nevertheless, there is still the potential for a marked increase in the rate of sea level rise due to accelerated ice loss. The great majority of the ice mass lost presently from the WAIS flows to the sea as ice streams, of which that of Pine Island Glacier is the most important. The Pine Island Glacier, and the adjoining ice shelves of Pine Island Bay, have thinned significantly over the past 3 decades. In two related papers, the extents, causes, and effects of these changes are examined. Shepherd et al. use satellite data altimetry to document how ice shelves in that region have thinned, and they attribute the thinning to melting cased by the action of ocean currents that are 0.5°C warmer than freezing on average. The pattern of shelf thinning mirrors that of their grounded tributaries, suggesting that Antarctic ice is more sensitive to changing climates than previously thought. Payne et al. test the hypothesis that these changes are triggered by the adjoining ocean, using a numerical ice-flow model to simulate its effects on the dynamics of the Pine Island Glacier. They confirm the idea that recent increases in local ocean temperature are the cause of the observed thinning and find that the thinning of coastal ice shelves is transmitted rapidly to the grounded ice streams above, revealing a tight coupling between the ice sheet interior and surrounding ocean. — HJS


CHEMISTRY
Maintaining Chains

Coupling reactions of organic molecules on surfaces can proceed at modest temperatures. McCarty and Weiss have used low-temperature scanning tunneling microscopy (STM) to observe molecules aligning into chains before such reactions can proceed. At room temperature, diiodobenzene dissociates on the atomically flat Cu(111) surface to create mobile phenylene radicals that can be pinned at defect sites. Images taken at 77 kelvin show that the phenylene species align in noncovalently bonded chains—the STM tip could be used to pull a phenylene monomer out of...
on the surface, where they would return to their original length by recruiting more monomer units. — PDS


ECOLOGY/EVOLUTION

Eats Roots or Shoots

Recently, plant ecologists have increasingly focused on the role of soil organisms in determining plant community processes. Below-ground herbivores, such as worms, tend to promote plant diversity when they feed on dominant plant species. However, van Ruijven et al. show that the combined effects of above- and below-ground herbivores cannot be predicted from their separate effects. Different combinations of invertebrate herbivores (nematodes and wireworms below ground, and grasshoppers above ground) were added to experimental species-rich grassland plant communities. When added separately, the nematodes and wireworms had positive effects on diversity, whereas the grasshoppers had neutral effects. When added together, however, the combined effect on diversity was negative. The different feeding preferences of the two groups of herbivores appeared to alter the competitive interactions among the plant species within the communities, eventually producing the nonadditive effects observed. Differential distributions of above- and below-ground herbivores may well contribute to locally heterogeneous diversity levels. — AMS


BIOTECHNOLOGY

Library Science

Bacteria are everywhere and can eat just about anything, including such unappetizing fare as petroleum sludge. Therefore, they must possess the enzymes (and the genes encoding the enzymes) that catabolize hydrocarbons. In the past, the challenge has been to identify and cultivate the desired species; advances in technology have made it feasible to bypass cultivation and to browse for specific genes (enzyme activities) in metagenome (expression) libraries. Uchiyama et al. take the next step in devising a method of sorting the library contents on the basis of substrate specificity and then searching for genes of interest. Their approach succeeds because bacteria rely on gene regulatory networks (and even riboswitches) that, in many cases, are induced or repressed by small molecules—either the substrate itself or chemically related compounds. Starting with a metagenome library made from petroleum-contaminated groundwater, they end up with a P450 enzyme that catalyzes hydroxylation (which makes hydrocarbons more polar and amenable to catabolism) of 4-hydroxybenzoate. — GJC


HIGHLIGHTED IN SCIENCE’S SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

Yeast use partially overlapping kinase modules to specify discrete cellular responses. For example, the upstream kinases in the mitogen-activated protein kinase (MAPK) cascade, Ste11 and Ste7, are both activated during mating response signaling and during filamentous growth signaling. The MAPK Kss1 then triggers the filamentous growth transcriptional cascade and the MAPK Fus3 triggers the mating response genes. In the absence of Fus3, pheromone signaling stimulates Kss1 and filamentous growth gene expression, suggesting that Fus3 has a role in suppressing filamentous growth responses during pheromone signaling. Chou et al. and Bao et al. now report that Fus3 triggers the degradation of a transcription factor required for filamentous growth, Tec1, to maintain signaling specificity through the shared MAPK pathways. The abundance of Tec1 decreased after mating stimulated by pheromone and this destabilization required Fus3 but not Kss1. Tec1 Thr273 was phosphorylated by Fus3. Degradation was mediated by a SCF ubiquitin ligase complex. Thus, selective degradation of a transcriptional regulator represents a mechanism for generating specificity during intracellular signaling. — NG

Making Memories

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Science 307 (5707), 182.
DOI: 10.1126/science.307.5707.182b