NEUROSCIENCE

Predicting Memories

In the human brain, the medial temporal lobe is implicated in memory formation. The precise contribution of its different structures to memory formation, however, has been the subject of much controversy. Strange et al. optimized functional magnetic resonance imaging for the scanning of the medial temporal lobe during a verbal encoding task. The activation strength of the left perirhinal cortex and the left hippocampal body during the task was significantly greater for words that the person subsequently remembered versus those that were forgotten, confirming earlier electrophysiological data obtained from patients with temporal lobe epilepsy. In the right anterior hippocampal, bilateral parahippocampal, and posterior fusiform gyrus regions, activation was observed that predicted subsequent memory for the initial two words of a list but not for later words. This phenomenon, the primacy effect, has been attributed to greater rehearsal or to the relative distinctiveness of initial items. These findings support a role for anterior hippocampal, parahippocampal, and posterior fusiform activation in the processing of novelty and distinctiveness. — PRS


POLYMER SCIENCE

Just Add Water

In polymer and biological gels, water affects both the mechanical properties of the gel and the ordering of the macromolecules, which in turn affect properties such as solute diffusion. For a series of block copolymers, Miyazaki et al. show that the water can also cause a localized phase transition. The authors reacted n-alkyl acrylate, which is hydrophobic, with acrylic acid, which is hydrophilic, to form a block copolymer. In the dry state, the alkyl segments formed a disordered bilayered structure. The addition of even a small amount of water caused the alkyl segments to crystallize and increased the melting point of the copolymer. It is possible that the water preferentially hydrates the acryllic acid segments, which lowers the glass transition temperature of the copolymer and raises the mobility of the alkyl segments. Thus, when water was first added to the copolymer, the mechanical strength of the gel increased, although above 5% water content, the strength decreased, which is typical of most hydrogels when additional water is added. — MSL

Langmuir 10.1021/la010922v.

CHEMISTRY

Toward IP3 Biosensors

Many cellular functions are regulated by the second messenger D-myoinositol-1,4,5-trisphosphate (IP3), which helps regulate intracellular Ca2+ concentrations. The concentration of small ionic species such as Ca2+ can be mapped in cells by using fluorescent sensors, but IP3 must be assayed with ex situ methods such as high-performance liquid chromatography. Morii et al. report on progress toward an IP3 biosensor based on binding by the pleckstrin homology (PH) domain of rat phospholipase C d (PLCd). They mutated three amino acids (Arg56, Val58, and Asn106) to cysteine and then labeled these sites with one of four thiol-reactive dyes. Several of the labeled PH domains showed large changes in fluorescence in response to micromolar solutions of IP3. The labeled PH domains also showed greater selectivity for IP3 as compared with other inositolts. — PDS

J. Am. Chem. Soc. 10.1021/ja016824d.

BIOCHEMISTRY

New Kid on the Block

Cyclophilin was first identified as the cellular target of the immunosuppressive drug cyclosporin; it also possesses a prolyl isomerase activity and binds proline-containing peptides. However, the in vivo function of this family of proteins remains unclear: Are they needed to flip the prolyl peptide bonds, or do they serve as chaperones that stabilize particular protein conformations? Attempts to untangle these putative roles have been stymied by the inability to disable one activity without disrupting the other. Horowitz et al. examined the catalytic and structural participation of the cyclophilin

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USA-CyP in the splicing of pre-messenger RNA (pre-mRNA). USA-CyP binds to the human splicing factors hPrp4 and hPrp18. hPrp4 is required for assembly of the spliceosome complex that mediates the first half-reaction (separating the 5’ end of the intron from the pre-mRNA), and hPrp18 is required during the second half-reaction (removing the intron and joining exons). These structural interactions differ from those of cyclophilins and HIV capsid proteins, in that binding occurs at a site distinct from the catalytic center. Thus cyclophilin can be added to the list of choreographers who direct the sequential rearrangements of RNA and protein that occur during pre-mRNA splicing. — GJC

EMBO J. 21, 470 (2002).

PALEONTOLOGY

Beached Jelly Bellies

Scyphozoan medusae or jellyfish are pelagic organisms that tend to congregate in near-shore, shallow water environments for reproduction, hunting, or during stormy weather. During the ebb of tides, large groups can be stranded. When a medusa realizes it is stuck in the sand, it turns belly-up and pumps its bell to try to escape, but this response only aggravates the sticky situation by filling the medusa with sand. The deceased medusa leaves a mound of sand and decomposing internal organs surrounded by concentric concave rings where it tried to repeatedly pump to flee.

Now, Hagadorn et al. have found rare and unusual traces of several strandings of large medusae from the late Cambrian, exquisitely preserved in coarse-grained sandstone beds in Wisconsin. The concentric concave rings surrounding sandy mounds, which in some cases show possible traces of internal organs, are commonly preserved on rippled bedding planes. Together, these features suggest a shallow lagoon environment, possibly a sandy barrier island, where frequent tropical storms may have caused the multiple strandings. Thus, these ancient sands provide a rare glimpse of rarely preserved soft-bodied life in Cambrian seas. — LR

Geology 30, 147 (2002).

Choreographers who direct the sequential rearrangements of RNA and protein that occur during pre-mRNA splicing.

Imprints of ancient jellyfish in sandstone beds.