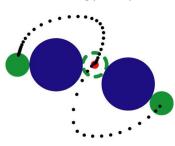
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NEUROSCIENCE

Making a plan of action

Were the brain to rely completely on sensory feedback to direct movement during activities like reaching, primate arms would move infuriatingly slowly. Grant Mulliken *et al.* investigated



Example trajectories for obstacle (blue circles) task.

how a region of the brain develops a representation of arm movement that overcomes the long sensory feedback delays. The posterior parietal cortex (PPC) area of the brain serves as a functional bridge between the areas that sense input, like visual cues, and those that direct motor function. Because sensory input alone is generally too slow for the PPC to

develop an estimate of the state of the hand during movement, the authors investigated whether downstream motor movement information is harnessed by the PPC to anticipate the next state of a movement. They measured the activity of neurons in the PPC while monkeys operated a joystick to move a cursor toward a target. The neural activity showed that the PPC develops a forward-state representation of action, with neurons encoding an estimate of the current direction of the cursor, as well as its future direction. Because the PPC develops a continuously updated forward representation of action for goal-directed movement, it would be an attractive region for the development of neural prosthetics, the authors say. — T.H.D.

"Forward estimation of movement state in posterior parietal cortex" by Grant H. Mulliken, Sam Musallam, and Richard A. Andersen (see pages 8170–8177)

MEDICAL SCIENCES

Starvation enhances chemotherapy

One popular approach to chemotherapy involves targeting the unique characteristics of cancer cells. Researchers have turned this idea upside down and used their knowledge of antiaging and stress-resistance systems to develop a differential stress resistance

method to make the organism, but not the cancer cells, resistant to chemotherapy. Lizzia Raffaghello *et al.* examined the response of normal and cancer cells to chemotherapy after the cells were

starved of blood or glucose. The authors found that yeast cells with antiaging genetic alterations, but without the *Ras2*^{val19} cancer gene ortholog, were 1,000 times better protected than those with the gene. They also found that normal glial cells were protected by starvation, whereas six cancerous brain cell lines remained susceptible to hydrogen peroxide or cyclophosphamide. Star-



Normally fed mice were moribund after high-dose chemotherapy.

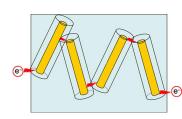
vation did not block the toxicity of the drug etoposide to cancer cells that were injected into mice, but it provided remarkable protection to the mice. The mice, which had been starved for 2 days, showed no signs of toxicity to high doses of the chemotherapy drug and gained back the weight they had lost. The authors say they are making progress on methods and drugs to obtain the same anticancer effect with normal feeding. — P.D.

"Starvation-dependent differential stress resistance protects normal but not cancer cells against high-dose chemotherapy" by Lizzia Raffaghello, Changhan Lee, Fernando M. Safdie, Min Wei, Federica Madia, Giovanna Bianchi, and Valter D. Longo (see pages 8215–8220)

APPLIED PHYSICAL SCIENCES

Nanocomposite materials

Carbon nanotubes have unusual electrical and thermodynamic properties that make them potentially useful in a number of applications, including electronics and optics. The formation of nanocomposite materials—mixed nanotubes with polymers—plays a key role in utilizing these properties. Andriy Kyrylyuk and Paul van der Schoot conducted a theoretical investigation of the interactions that occur as nanotubes load onto matrix materials during the fluid stage of nanocomposite construction. The authors show that the host matrix induces interactions between the nanotubes and the matrix material during the loading process. These interactions, and the connections between the



Carbon nanotubes forming an electrically conducting network.

materials, mediate the amount of nanotubes necessary to form a complete network. Properties of the final material, including conductivity, are sensitive to the degree of connectedness, the presence of small quantities of longer nanotubes, and the weak attractive interactions between

the two substances, according to the authors. Certain qualities, such as the flexibility of the nanotubes, however, have a fairly weak impact overall. The authors say their findings should aid in the design of nanotube-based composite materials for a variety of industries. — F.A.

"Continuum percolation of carbon nanotubes in polymeric and colloidal media" by Andriy V. Kyrylyuk and Paul van der Schoot (see pages 8221–8226)

BIOPHYSICS

Do the twist

Nicotinic acetylcholine receptors (nAChRs) are models for the greater class of ligand-gated ion channels. But despite years of investigation and modeling, researchers have yet to determine exactly how ligand binding snaps the channels open. Myunggi Yi et al. conducted molecular dynamics simulations in explicit

solvent to compare the behavior of nAChR alone and bound to the antagonist cobratoxin. The authors based their initial model on an x-ray structure of acetylcholinebinding protein (AChBP), a homolog of the nAChR ligand-binding domain. AChBP consists of five identical subunits bound in a ring that, in nAChR, helps activate a transmembrane ion channel. Compared with the



Model of toxin-bound α 7 ligandbinding domain.

cobratoxin-bound pentamer in which all five subunits remained relatively rigid, in unbound nAChR the authors consistently observed a single subunit wandering outward from the others, flexing both internally and relative to the rest of the protein over the simulation period. If all subunits behaved similarly in the full structure of nAChR, the authors say, the ligand-binding domain would twist like a pepper grinder oppositely to the ion channel. They suggest that individual subunits of nAChR continually sample open and closed conformations until ligand binding locks them open; and more than one subunit must twist to trigger channel opening. — K.M.

"Spontaneous conformational change and toxin binding in α 7 acetylcholine receptor: Insight into channel activation and inhibition" by Myunggi Yi, Harianto Tjong, and Huan-Xiang Zhou (see pages 8280 - 8285)