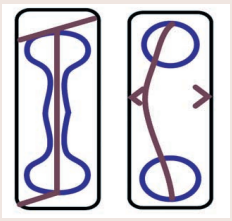
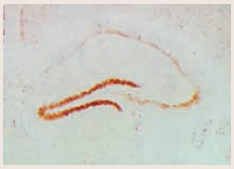
In this issue

by Jane Bradbury



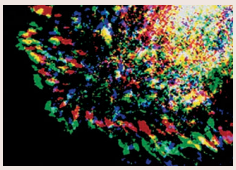
Microtubule arrays unbundled

The microtubule cytoskeleton in eukaryotic cells is a dynamic structure that undergoes characteristic rearrangements during the cell cycle. In interphase, microtubule bundles that extend from the centrosomes to the cell tips help to maintain cell polarity in many cell types. At the transition to mitosis, these bundles are replaced by a dynamic nuclear array that ensures accurate chromosome segregation. On p. 4891, Zacheus Cande and co-workers use time-lapse video microscopy and kymographic analysis to investigate how individual microtubules behave in budding yeast. They show that although microtubules within interphase bundles grow and shrink at similar rates, these processes are not coordinated within bundles; each microtubule acts autonomously. The researchers also describe the behaviour of individual nuclear microtubules during mitosis. Overall, their detailed analysis of microtubule behaviour challenges some previously accepted theories of how microtubule-associated proteins and motor proteins interact with microtubule arrays and provides the groundwork for a better understanding of the organisation and regulation of microtubule arrays throughout the cell cycle.



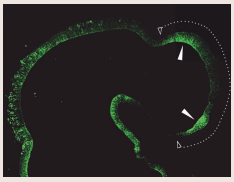
Remodel chromatin for neuronal responses

Many neurotransmitters and neuromodulators induce gene expression changes in neurons. Transcription factors clearly play a part in this, but chromatin remodelling may also be important. Paolo Sassone-Corsi and colleagues have therefore looked for signs of chromatin remodelling in the transcriptional response of hippocampal neurons to multiple stimuli (see p. 4905). Post-transcriptional modifications of conserved residues in the N-terminal tails of histones cause conformational changes in chromatin, which in turn activate or silence genes. When the researchers treated mice systemically with agonists for dopaminergic, acetylcholine or kainate glutamate receptors, histone H3 was rapidly and transiently phosphorylated at Ser10 in different subfields of the hippocampus. Concurrently, the mitogen-activated protein kinase signalling pathway was activated in the same areas and transcription of immediate-early response genes was induced. A causal link between these three events remains to be proven but, say the researchers, the plasticity of chromatin modifications may be an ideal way to facilitate neuronal responses to a range of stimuli.



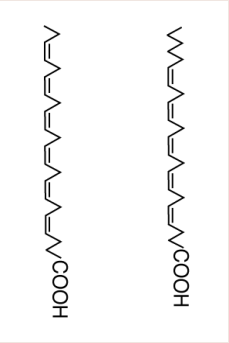
The matrix adhered

Focal contacts (FCs) mediate adhesion between many types of cell and the extracellular matrix. Within these contacts, integrins on the cell surface link extracellular matrix ligands to cytoskeletal elements, typically actin-containing microfilaments. Now, on p. 4977, Daisuke Tsuruta and Jonathan Jones provide data that indicate for the first time that the vimentin intermediate filament cytoskeleton regulates FC size and stabilises cell-matrix adhesions in some endothelial cells. By using fluorescently labelled fusion proteins, the researchers show that at least 50% of integrin-β3-containing FCs are associated with vimentin intermediate filaments in live cells. Particularly large FCs assembled when endothelial cells were subjected to shear stress in a flow chamber, and these structures, which were less dynamic than those in unstressed cells, were associated with thick vimentin bundles. Conversely, when the researchers used RNA interference to reduce vimentin expression, smaller FCs formed and the cells became less adherent to the substratum.



A fateful change in cell-cycle length

Neuroepithelial cells are the progenitors for all the neurons in the mammalian central nervous system. At the onset of neurogenesis, the G1 phase of the cell cycle in neuroepithelial cells lengthens, but is this a cause or an effect of neurogenesis? To find out, Federico Calegari and Wieland Huttner treated 9.5-day mouse embryos in culture with olomoucine, an inhibitor of cyclin-dependent kinases that lengthens the G1 phase of the cell cycle (see p. 4947). In these cultures, TIS21, a marker for neuroepithelial cells that have switched from proliferative to neuron-generating divisions, was expressed prematurely and neurons were made earlier than expected. Because the only observable effect of olomoucine in these cultures was a lengthening of the cell cycle by about two hours, the researchers conclude that this change is sufficient to induce neuroepithelial cell differentiation. They therefore propose a model whereby cell-cycle length can be linked to the effects of cell-fate determinants.



Greasing the way to neuro-transmission

Although the membranes of neuronal cells contain precisely controlled amounts of long-chain polyunsaturated fatty acids (LC-PUFAs) and defects in LC-PUFA metabolism are associated with some human neuronal pathologies, exactly how LC-PUFAs are involved in neuronal function is unknown. On p. 4965, Giovanni Lesa et al. remedy this by showing that in *C. elegans* LC-PUFAs are essential for efficient neurotransmission. In *C. elegans*, a single Δ6-desaturase enzyme, encoded by *fat3*, is essential for LC-PUFA synthesis. *fat3* mutant worms have movement and egg-laying defects indicative of neuronal impairment. These defects are functional rather than developmental since treating adult mutant worms with LC-PUFAs rescues the phenotype. Because *fat3* mutants release very low amounts of neurotransmitters and have fewer synaptic vesicles than do wild-type worms, the researchers conclude that there are insufficient synaptic vesicles to support normal neurotransmission in these mutants. Additional experiments are now needed to reveal how a LC-PUFA deficit affects synaptic vesicle numbers.

Development in press

Giving flies a leg up

The ability to generate distinct ventral and dorsal structures is critical during embryogenesis. Reporting in *Development*, Estella et al. shed new light on how this morphological distinction is achieved. In *Drosophila*, legs and antennae develop from the ventral imaginal discs, and Estella and co-workers report that the product of a single gene, *buttonhead* (*btd*), can trigger the entire genetic network needed for leg and antennal development. RNAi-mediated downregulation of *btd*, which encodes a zinc-finger transcription factor, together with a related transcription factor, *Sp1*, resulted in formation of underdeveloped legs and antennae. Conversely, when the authors ectopically expressed *btd* in dorsal imaginal discs, the normal products of these discs – eyes, wings and halteres – were replaced by antennae and legs. This transformation involved the de novo activation of the Engrailed-Hedgehog-Wingless-Decapentaplegic cascade responsible for the growth and patterning of ventral imaginal discs.

Estella, C., Rieckhof, G., Calleja, M. and Morata, G. The role of *buttonhead* and *Sp1* in the development of the ventral imaginal discs of *Drosophila*. *Development* **130**, 5929-5941.