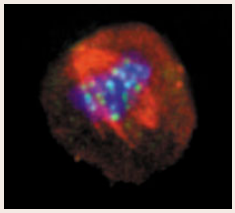
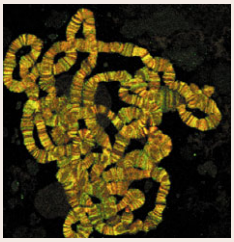
In this issue

by Jane Bradbury



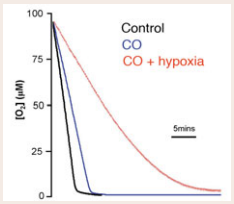
Spindles in flux

The formation and maintenance of a bipolar spindle in dividing eukaryotic cells involves multiple proteins that affect microtubule dynamics. The steady-state length of the metaphase spindle depends on the 'microtubule flux' – a phenomenon in which tubulin subunits are simultaneously added at the plus ends and removed at the minus ends of microtubules. Joseph Laycock, Matthew Savoian and David Glover have investigated which proteins regulate this flux in *Drosophila*. On p. 2354, they report that Orbit, a highly conserved protein that stabilizes microtubules, interacts antagonistically with the kinesin-like microtubule depolymerase Klp10A to regulate spindle length, bipolarity and function. They find that knocking down Orbit alone by RNAi causes spindles to collapse and results in formation of monopolar spindles, mitotic arrest and apoptosis. Co-depletion of Orbit and Klp10A (but not other *Drosophila* microtubule depolymerases), however, rescues spindle bipolarity and the cells divide normally after extended periods in mitosis. Because these two proteins normally act antagonistically to drive microtubule flux, the authors conclude that microtubule flux in flies must therefore be dispensable for bipolar spindle formation and function.



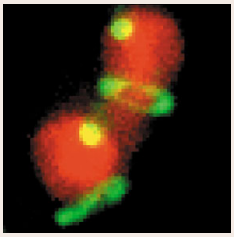
Chromatin regulators band together

Within the polytene chromosomes of *Drosophila*, chromatin is organized into band and interband regions. These have different higher-order structures, which are thought to control expression of the genes in these regions. What establishes and maintains the differences in chromatin organization is unclear. Kristen Johansen and colleagues now report that an interband-specific complex that contains the chromodomain protein Chromator and the tandem kinase JIL-1 regulates the structure of *Drosophila* polytene chromosomes (see p. 2332). The authors use two new hypomorphic alleles to show that impaired Chromator function causes disorganization and misalignment of band/interband regions – this is similar but not identical to what is seen in *JIL-1* mutant flies. Johansen and colleagues also show that Chromator and JIL-1 co-localize at polytene interband regions, that the two proteins interact directly through their C-terminal domains, and that this interaction is biologically significant – *Drosophila* that lack both proteins have reduced viability during development. The authors thus conclude that Chromator and JIL-1 interact in a multiprotein interband-specific complex that can establish and/or maintain global chromatin structure.



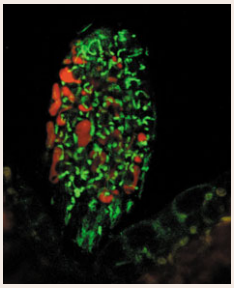
Haem-oxygenase and CO: regulators for respiration

The effects of carbon monoxide (CO) on whole organisms are well known – too much can cause unconsciousness or death. Its effects on individual cells are much less clear, but on p. 2291 Salvador Moncada and colleagues fill in some of the blanks. They report that endogenously produced CO, like nitric oxide (NO), inhibits cellular respiration by interacting with mitochondrial cytochrome c oxidase – particularly during hypoxia. Endogenous NO regulates cellular oxygen consumption in many physiological and pathophysiological situations. The authors now show that endogenously produced CO also inhibits cellular respiration in human kidney cells. This effect, they report, is enhanced under hypoxic conditions. Furthermore, haemoxygenase – the enzyme that makes CO – can operate at much lower oxygen concentrations than NO synthase. Consequently, suggest the authors, although endogenously produced NO and CO might both contribute to inhibition of cellular respiration, endogenously produced CO might be largely responsible for this in hypoxic tissues – for example, after a stroke or in ischaemic heart disease.



MORNing parasite break

Toxoplasma gondii, like other Apicomplexan parasites, divides by internal budding: two daughter cells form as buds within the mother cell on a cytoskeletal scaffold, acquire a set of organelles and then emerge. How the cytoskeleton and various endomembranes interact during this process is poorly understood. Now, Marc-Jan Gubbels, Boris Striepen and co-authors report that the MORN-repeat protein MORN1 is a dynamic component of the division apparatus that could play a role (see p. 2236). MORN (for membrane occupation and recognition nexus) motifs are found in proteins that help organize membranous and cytoskeletal structures. The authors show that, in dividing *T. gondii*, MORN1 localizes to the centrocone, which organizes the mitotic spindle, and to a ring structure at both ends of the barrel-shaped inner membrane complex (IMC), which delineates the forming daughters. Strikingly, the posterior ring moves along the IMC during mitosis and division and contracts during the final stage of budding. The authors suggest that MORN1 links specific membrane regions of *T. gondii* to its cytoskeleton during the division process and that microtubular growth moves the MORN1-associated ring.



Cell walls out of WAK

Plant cell walls contain cellulose fibres embedded in a pectin gel and several protein-carbohydrate polymer complexes. Previous work indicated that these complexes are assembled at the cell wall, but on p. 2282 Bruce Kohorn and co-authors report that the crosslinking of carbohydrate polymers to a protein called wall-associated kinase 1 (WAK1) begins in a cytoplasmic compartment in *Arabidopsis*. The authors investigated the biosynthesis of WAK1, which binds to pectin through an extracellular domain, by expressing a WAK1-GFP fusion protein in plant cells regenerating their cell walls. They found that WAK1-GFP accumulates in a cytoplasmic compartment that contains pectin and Golgi markers; WAK1 then migrates very slowly to the cell wall. The authors show that the migration requires cellulose synthesis but the crosslinking of WAK1 into a detergent-insoluble complex, which occurs in the cytoplasm, is independent of cellulose synthesis. The authors conclude that WAK1 crosslinking, which is likely to be essential for its roles in cell elongation and sugar metabolism, occurs deep within the cell rather than at the plasma membrane as previously thought.

Development in press

Axon guidance gets per-Plexin

During development, neurons are guided by multiple guidance molecules and their receptors, but how developing neurons integrate these different guidance cues to form neural circuits is unclear. In a paper published in *Development*, Alex Kolodkin and co-workers have examined the roles of plexins – receptors for the semaphorin guidance cues – in the developing *Drosophila* nervous system. They report important new insights into how the multiple components of the system interact by showing that the two fly plexins (PlexA and PlexB) have distinct and overlapping functions in central and peripheral axon pathfinding. Their observation that PlexA and PlexB physically associate in vivo and can use common downstream signalling pathways provides an explanation for their overlapping functions. By contrast, their discovery that PlexB is a receptor for the secreted semaphorin Sema-2a whereas PlexA is a receptor for the transmembrane semaphorin Sema-1a indicates that the distinct roles of the two plexins could be mediated by interactions with different semaphorins. Their findings thus reveal one way in which complex neuronal guidance patterns can be determined at different molecular levels.

Ayoob, J. C., Terman, J. R. and Kolodkin, A. L. (2006). *Drosophila* Plexin B is a Sema-2a receptor required for axon guidance. *Development* **133**, 2125-2135.