

**Cover illustration**

3D reconstruction of a vitrified hepatocarcinoma cell from a cryo-electron tomograph. (Courtesy of A. Leis, B. Rockel, L. Andrees, A. Rigort and W. Baumeister, Max Planck Institute of Biochemistry.)

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BUILDING A CELL

The living cell is a self-organizing, self-replicating, environmentally responsive machine of staggering complexity. The instructions for this complexity are contained within the cell's genetic code, but how this information is accessed, read and interpreted is influenced by development and differentiation.

To divide, a cell needs to create a second set of its genetic material to donate to the daughter cell. The review by Bloom and Joglekar examines how duplicated chromosomes are divided accurately between mother and daughter cells and packaged by proteins, mainly histones, in the nucleus. This packaging regulates gene expression, and Ho and Crabtree discuss how this occurs during development and differentiation. In eukaryotes, protein-coding genes are transcribed into precursor messenger RNAs that contain non-coding regions. As described by Nilsen and Graveley, these non-coding regions must be removed before the RNA can be translated into protein, in a process known as alternative splicing.

The shape, movement and positioning of organelles within the cell depend on dynamic, polymeric cytoskeletal proteins. Fletcher and Mullins analyse the principles that allow these proteins to produce and respond to mechanical forces, as well as to establish order in the cytoplasm over long distances. In a process called endocytosis, portions of the cell membrane are internalized into the cytoplasm. This enables the cell to capture material from the extracellular environment and to respond to cues detected by externally oriented receptors. Scita and Di Fiore discuss the integral role of the endocytic system in the cell's signalling network.

This Insight offers a hint of the most exciting research on the regulation of cellular organization and function. As always, *Nature* retains sole responsibility for editorial content and peer review.

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