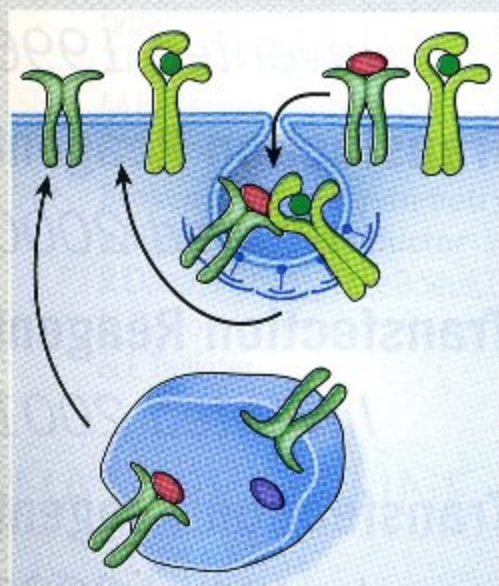


A cell is a self-organizing and self-replicating machine. The genome contains the instructions for building this highly complex machine, but how this information is accessed, read and interpreted depends on the cell type and its stage of development. Our understanding of how cellular organization and function are regulated in this way is now rapidly improving.



The integration of endocytosis and signalling allows spatiotemporal control of intracellular processes, p. 464.

BUILDING A CELL

REVIEWS

446 Towards building a chromosome segregation machine

K. Bloom & A. Joglekar

When a cell divides, it needs to replicate its DNA content, segregate the DNA so that the mother cell and daughter cell receive the same content, and package the DNA in a manner that retains information about the activity of genes. Although the general mechanisms of replication are well understood, those of segregation and packaging have puzzled researchers. It is clear that the strategies used by prokaryotes and eukaryotes to segregate replicated chromosomes differ markedly, but in all cases the segregation mechanism is driven by the physical properties of the DNA. And much can be learned about how DNA is organized in the cell by applying the principles of polymer physics.

457 Expansion of the eukaryotic proteome by alternative splicing

T. W. Nilsen & B. R. Graveley

One gene can encode more than one protein. Initially, this was thought unusual, but recent studies indicate that this is the case for almost all human genes that contain more than one exon. The process by which multiple functional proteins can be generated from a single gene is called alternative splicing. It involves the differential use of splice sites in the precursor messenger RNA, and thus the inclusion or exclusion of various exons in the mature mRNA. Researchers are now beginning to uncover the mechanisms of alternative splicing and the ways in which the choice of splice site are regulated.

464 The endocytic matrix

G. Scita & P. P. Di Fiore

Endocytosis was long thought of solely as a way for cells to internalize molecules from the extracellular fluid or plasma membrane. In the past decade, however, endocytosis has also been shown to be a master regulator of intracellular signalling, allowing signals to be resolved in space and time. Furthermore, many of the newly uncovered functions of the endocytic machinery — including exerting control over the cell cycle, mitosis and transcription — are not generally thought of as endocytic processes. These findings cannot be reconciled with the traditional view of endocytosis and indicate that endocytosis is integrated in the cell's master plan at a deeper level than previously thought, at the level of the 'endocytic matrix'.

474 Chromatin remodelling during development

L. Ho & G. R. Crabtree

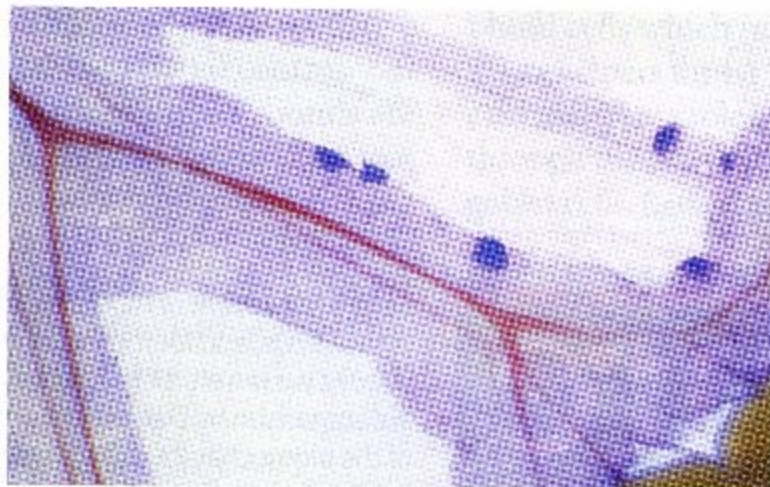
In the nucleus, DNA is wound around histone proteins to form nucleosomes, which are the basic units of chromatin. Chromatin is dynamic, and its structure and assembly are regulated by DNA methylation, histone modifications, and remodelling by ATP-dependent enzymes. New techniques for genome-wide analysis are markedly improving our knowledge of chromatin regulation and of the roles of the four classes of ATP-dependent chromatin-remodelling complex. There are many possible assemblages of each class of remodelling complex, and it is becoming clear that some assemblies are specific to certain cell types or certain developmental stages. Moreover, some seem to establish and maintain pluripotency in embryonic stem cells.

485 Cell mechanics and the cytoskeleton

D. A. Fletcher & R. D. Mullins

The cytoskeleton is not a fixed structure but a dynamic and adaptive network of filamentous polymers and regulatory proteins. The building blocks of the cytoskeleton have been extensively characterized, but progress is only now being made towards understanding the cytoskeleton as an integrated whole. It is becoming clear that the self-assembly of cytoskeletal polymers in response to environmental cues, such as physical forces, generates order within the cell over long distances and over short and long timescales, thus controlling the physical properties of the cell and its behaviour.

A newly recognized lymphocyte type (blue clusters) producing T_H2 cytokines, pp. 549, 436.



ARTICLES

- 495 Systemic signals regulate ageing and rejuvenation of blood stem cell niches**
S R Mayack, J L Shadrach, F S Kim & A J Wagers
- 501 Targeting Bcr-Abl by combining allosteric with ATP-binding-site inhibitors**
J Zhang, F J Adrián, W Jahnke, S W Cowan-Jacob, A G Li, R E Jacob, T Sim, J Powers, C Dierks, F Sun, G-R Guo, Q Ding, B Okram, Y Choi, A Wojciechowski, X Deng, G Liu, G Fendrich, A Strauss, N Vajpai, S Grzesiek, T Tuntland, Y Liu, B Bursulaya, M Azam, P W Manley, J R Engen, G Q Daley, M Warmuth & N S Gray
- 507 Structure of a bacterial homologue of vitamin K epoxide reductase**
W Li, S Schulman, R J Dutton, D Boyd, J Beckwith & T A Rapoport

LETTERS

- 513 A relativistic type Ibc supernova without a detected γ -ray burst**
A M Soderberg, S Chakraborti, G Pignata, R A Chevalier, P Chandra, A Ray, M H Wieringa, A Copete, V Chaplin, V Connaughton, S D Barthelmy, M F Bietenholz, N Chugai, M D Stritzinger, M Hamuy, C Fransson, O Fox, E M Levesque, J E Grindlay, P Challis, R J Foley, R P Kirshner, P A Milne & M A P Torres
- 516 A mildly relativistic radio jet from the otherwise normal type Ic supernova 2007gr**
Z Paragi, G B Taylor, C Kouveliotou, J Granot, E Ramirez-Ruiz, M Bietenholz, A J van der Horst, Y Pidopryhora, H J van Langevelde, M A Garrett, A Szomoru, M K Argo, S Bourke & B Paczyński
- 519 Broken rotational symmetry in the pseudogap phase of a high- T_c superconductor**
R Daou, J Chang, D LeBoeuf, O Cyr-Choinière, F Laliberté, N Doiron-Leyraud, B J Ramshaw, R Liang, D A Bonn, W N Hardy & L Taillefer

- 523 Cleaving carbon-carbon bonds by inserting tungsten into unstrained aromatic rings**
A Sattler & G Parkin **See N&V p. 435**
- 527 Ensemble reconstruction constraints on the global carbon cycle sensitivity to climate**
D C Frank, J Esper, C C Raible, U Büntgen, V Trouet, B Stocker & F Joos **See N&V p. 438**
- 531 Foot strike patterns and collision forces in habitually barefoot versus shod runners**
D E Lieberman, M Venkadesan, W A Werbel, A I Daoud, S D'Andrea, I S Davis, R O Mang'Eni & Y Pitsiladis **See N&V p. 433**
- 536 Chimpanzee and human Y chromosomes are remarkably divergent in structure and gene content**
J F Hughes, H Skaletsky, T Pyntikova, T A Graves, S K M van Daalen, P J Minx, R S Fulton, S D McGrath, D P Locke, C Friedman, B J Trask, E R Mardis, W C Warren, S Repping, S Rozen, R K Wilson & D C Page
- 540 Innate production of T_H2 cytokines by adipose tissue-associated c-Kit⁺ Sca-1⁺ lymphoid cells**
K Moro, T Yamada, M Tanabe, T Takeuchi, T Ikawa, H Kawamoto, J-i Furusawa, M Ohtani, H Fujii & S Koyasu **See N&V p. 434**
- 545 Interaction between Ras^{V12} and scribbled clones induces tumour growth and invasion**
M Wu, J C Pastor-Pareja & T Xu
- 549 Hsp70 stabilizes lysosomes and reverts Niemann-Pick disease-associated lysosomal pathology**
T Kirkegaard, A G Roth, N H T Petersen, A K Mahalka, O D Olsen, I Moilanen, A Zylicz, J Knudsen, K Sandhoff, C Arenz, P K J Kinnunen, J Nylandsted & M Jäättelä **See N&V p. 436**
- 554 A role for the elongator complex in zygotic paternal genome demethylation**
Y Okada, K Yamagata, K Hong, T Wakayama & Y Zhang
- 559 Microbial production of fatty-acid-derived fuels and chemicals from plant biomass**
E J Steen, Y Kang, G Bokinsky, Z Hu, A Schirmer, A McClure, S B del Cardayre & J D Keasling **See News p. 409**
- 563 DNMT1 maintains progenitor function in self-renewing somatic tissue**
G L Sen, J A Reuter, D E Webster, L Zhu & P A Khavari
- 568 Self versus non-self discrimination during CRISPR RNA-directed immunity**
L A Marraffini & E J Sontheimer

NATURE ONLINE

ADVANCE ONLINE PUBLICATION

PUBLISHED ON 22 JANUARY 2010

Genome-wide erasure of DNA methylation in mouse primordial germ cells is affected by AID deficiency
C Popp, W Dean, S Feng, S J Cokus, S Andrews, M Pellegrini, S E Jacobsen & W Reik **doi:10.1038/nature08829**

PUBLISHED ON 24 JANUARY 2010

Animal cryptochromes mediate magnetoreception by an unconventional photochemical mechanism
R J Geiger, L E Foley, A Casselman & S M Reppert **doi:10.1038/nature08719**

A bony connection signals laryngeal echolocation in bats
N Veselka, D D McErlain, DW Holdsworth, J L Eger, R K Chhem, M J Mason, K L Brain, P A Faure & M B Fenton **doi:10.1038/nature08737**

PUBLISHED ON 27 JANUARY 2010

Fossilized melanosomes and the colour of Cretaceous dinosaurs and birds
F Zhang, S L Kearns, P J Orr, M J Benton, Z Zhou, D Johnson, X Xu & X Wang **doi:10.1038/nature08740**

The cells and peripheral representation of sodium taste in mice
J Chandrasekar, C Kuhn, Y Oka, D A Yarmolinsky, E Hummler, N J P Ryba & C S Zuker **doi:10.1038/nature08783**

Direct conversion of fibroblasts to functional neurons by defined factors
T Vierbuchen, A Ostermeier, Z P Pang, Y Kokubu, T C Südhof & M Wernig **doi:10.1038/nature08797**

THIS WEEK ONLINE

This week's cover story — on the biomechanics of barefoot running — features on the Nature Video Channel, where previous clips and material from other NPG journals can be accessed:

www.youtube.com/NatureVideoChannel

On the podcast, regulars include Headlines and News. Plus background on AOP papers on the colour of dinosaur feathers, and the conversion of fibroblasts to nerve cells without going via pluripotency.

www.nature.com/podcast

