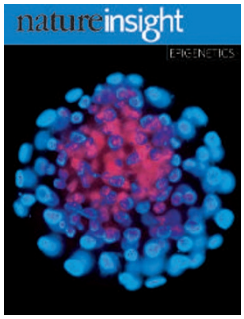

Cover illustration
Bovine blastocyst cells that give rise to different tissues show differential DNA methylation (pink). (Courtesy of F. Santos, W. Dean and W. Reik.)

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EPIGENETICS

Epigenetics is typically defined as the study of heritable changes in gene expression that are not due to changes in DNA sequence. Diverse biological properties can be affected by epigenetic mechanisms: for example, the morphology of flowers and eye colour in fruitflies.

Epigenetic changes are crucial for the development and differentiation of the various cell types in an organism, as well as for normal cellular processes such as X-chromosome inactivation in female mammals and silencing of mating-type loci in yeast. However, epigenetic states can become disrupted by environmental influences or during ageing, and the importance of epigenetic changes in the development of cancer and other diseases is increasingly being appreciated.

With the elucidation of a molecular basis for epigenetics, the field has flourished, even though the mechanisms of heritability are often obscure. Epigenetic processes can involve chemical modifications to DNA or to the proteins that are closely associated with DNA (the histones, which form the cores of chromatin packaging), and a prominent role for RNA is also emerging. Given this developing mechanistic understanding, the field is attracting investigators interested in diverse aspects of chromatin and chromosome biology.

In this Insight, we take a wide view of the epigenetics field, highlighting current topics of interest — from the influence of chromatin and chromosome organization on gene expression to the roles of epigenetic mechanisms in development and disease. And under this broad umbrella, the very definition of epigenetics is scrutinized. We hope that you enjoy these exciting reviews and thank the authors for their contributions.

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Alex Eccleston, Natalie DeWitt, Chris Gunter, Barbara Marte and Deepa Nath, Senior Editors

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