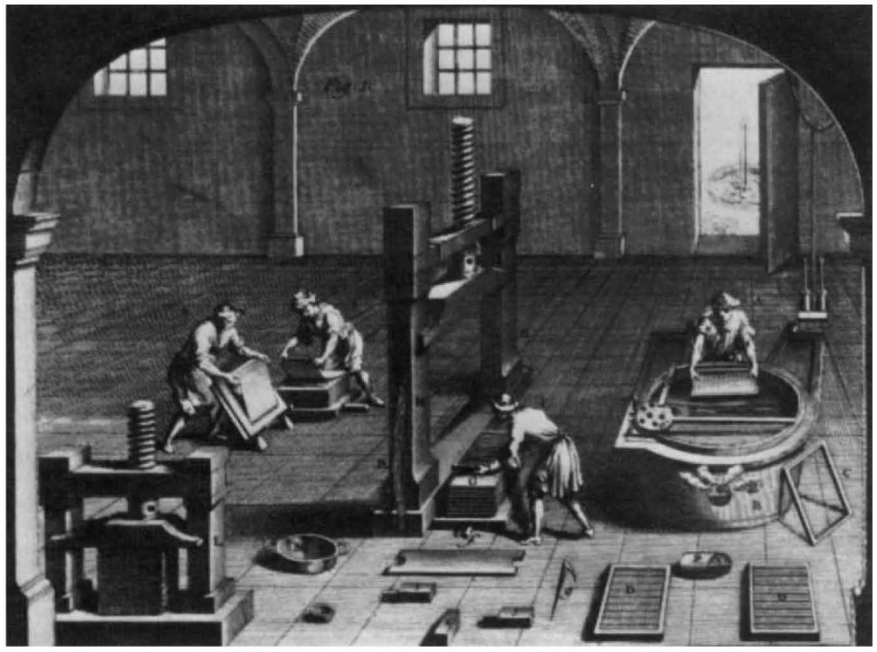
Yeast roll

David Wilkie

The Molecular and Cellular Biology of the Yeast *Saccharomyces*. Volume 1: Genome Dynamics, Protein Synthesis and Energetics. Edited by James R. Broach, John R. Pringle and Elizabeth R. Jones. *Cold Spring Harbor Laboratory Press: 1991. Pp. 826. $97 (hbk), $55 (pbk).*



Paper was invented in China at about the time of the birth of Christ, but it was not until the twelfth century that the art of papermaking reached Europe. There, unlike in Asia, papers were made almost exclusively from old cloth rags. As paper consumption increased with the development of printing, there were chronic shortages of rags. In 1666, the English Parliament passed a law forbidding the use of cotton and linen for burying the dead. This engraving of a French paper mill around 1761 is taken from *Recycled Papers: The Essential Guide* by Claudia G. Thompson. Published by MIT Press, price $40, £35.95 (hbk), $25, £22.50 (pbk).

THE yeast *Saccharomyces* has come of age as a model of the eukaryotic cell. Not only is there close correspondence with higher organisms in the genetic control of fundamental processes such as cell-cycle progression, messenger RNA processing and the biogenesis of membrane systems, particularly those of the mitochondrion, but the main gap of differentiation has been breached by genetic engineering: the genes that specify the biochemistry of a liver cell can be transferred and expressed in the yeast cell. It is fitting that we now have this updated reference source giving a detailed account of the recent advances in the molecular biology of the organism.

The work provides a comprehensive and extensive coverage. It is wide ranging, each of the 11 chapters having been compiled by investigators from laboratories specializing in a particular area. It is possible, however, to group the various contributions into three broad categories, the first of which can be listed under the heading of the nuclear genome. The 16 chromosomes are catalogued according to size as determined by chromosome separation by pulsed-field gel electrophoresis, and procedures for constructing restriction maps are clearly laid out. Attention is given to *cis*-acting sequences, their role in chromosome function and their use in making artificial chromosomes. The mechanisms of mitotic and meiotic recombination, for many years the subject of argument and discussion among geneticists, are thoroughly described, as are the associated procedures for the integration of transforming DNA. Mutagenesis comes under scrutiny in a chapter devoted to chromosome damage and repair mechanisms, including excision repair, photoreactivation and recombinational repair.

A suitable title for the second category of topics would be 'cytoplasmic inclusions'. A chapter on DNA plasmids deals mostly with the composition, expression and maintenance in the yeast cell of the 2-micron circle. RNA viruses, mainly those of the killer type, are treated in a separate chapter. Although the route of infectivity of these double-stranded RNA particles by cell-to-cell fusion distinguishes them from their animal counterparts, in other fundamental respects, such as replication and transcription processes, they are similar and form a model for the study of these viruses in higher organisms. Transposable elements are dealt with in a chapter on the family of Ty transposons, underlining their relatedness to one another and to those of other eukaryotes. Special reference is made to the organization and promoter activity of these 'long terminal repeats'. The chapter on cell membranes focuses on biophysical aspects of plasma and vacuolar membranes, giving an overview of transport systems followed by a detailed description of plasma membrane and vacuolar H^+–ATPases. Plasma-membrane permease systems and ion channels are also included in a treatise that is very much in the realms of the specialist but nonetheless timely — the function of membranes is a central problem in biology.

The biogenesis of mitochondria, described here in depth, is the epitome of cellular complexity, requiring the integration of genetic information from organelle and nucleus. Remarkably, the complement of genes in the mitochondrion and their products (inner-membrane proteins and elements of the translation machinery) are more or less the same for all mitochondrial systems. The bulk of the genetic information specifying mitochondrial components resides in the nucleus. How the translation products of the nuclear genes, formulated on cytoplasmic ribosomes, gain access to the organelle across its membranes is an intriguing problem ably dealt with in an erudite exposition of the possible mechanisms involved.

The third category of topics concerns biosynthetic systems. A chapter on the assembly of the yeast ribosome covers the processing of precursor RNAs, the proteins involved in constructing the subunits and the biogenesis of the mature ribosome with the involvement of the nucleolus. A final chapter on translational control stipulates the elements required for the initiation of protein synthesis and the components of the translation machinery.

The book concludes with an appendix of genetic and physical maps of *Saccharomyces cerevisiae* (although for the 'complete sequence of yeast chromosome III' one must read the 7 May issue of *Nature*).

The editors have put together a commendably detailed book. Extensive converage of this kind is a boon to all those working with *Saccharomyces* and might even encourage those with only fringe interests to convert to the organism.

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