

The human genome of three billion letters has been sequenced. So have the genomes of thousands of other organisms. With unprecedented resolution, modern technologies are allowing us to peek into the world of genes, biomolecules, and cells - and flooding us with data of immense complexity that we are just barely beginning to understand. A huge gap separates our knowledge of the components of a cell and what is known from our observations of its physiology. The authors have written this graduate textbook to explore what has been done to close this gap of understanding between the realms of molecules and biological processes. They have gathered together illustrative mechanisms and models of gene regulatory networks, DNA replication, the cell cycle, cell death, differentiation, cell senescence, and the abnormal state of cancer cells. The mechanisms are biomolecular in detail, and the models are mathematical in nature. The interdisciplinary presentation will be of interest to both biologists and mathematicians, and every discipline in between.

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Cover image: An electron tomogram of a complete yeast cell. It shows the plasma membrane, microtubules and light vacuoles (green), nucleus, dark vacuoles and dark vesicles (gold), mitochondria and large dark vesicles (blue) and light vesicles (pink). © Johanna Höög, EMBL Heidelberg.

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