

<<基础分子生物学>>

图书基本信息

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前言

The fast pace of modern molecular biology research is driven by intellectual curiosity and major challenges in medicine, agriculture, and industry. No discipline in biology has ever experienced the explosion in growth and popularity that molecular biology is now undergoing. There is intense public interest in the Human Genome Project and genetic engineering, due in part to fascination with how our own genes influence our lives. With this fast pace of discovery, it has been difficult to find a suitable, up-to-date textbook for a course in molecular biology. Other textbooks in the field flail into two categories: they are either too advanced, comprehensive, and overwhelmingly detailed, with enough material to fill an entire year or more of lectures, or they are too basic, superficial, and less experimental in their approach. It is possible to piece together literature for a molecular biology course by assigning readings from a variety of sources. However, some students are poorly prepared to learn material strictly from lectures and selected readings in texts and the primary literature that do not match exactly the content of the course. At the other end, instructors may find it difficult to decide what topics are the most important to include in a course and what to exclude when presented with an extensive array of choices. This textbook aims to fill this perceived gap in the market. The intent is to keep the text to a manageable size while covering the essentials of molecular biology. Selection of topics to include or omit reflects my view of molecular biology and it is possible that some particular favorite topic may not be covered to the desired extent. Students often complain when an instructor teaches "straight from the textbook," so adding favorite examples is encouraged to allow instructors to enrich their course by bringing to it their own enthusiasm and insight. Approach A central theme of the textbook is the continuum of biological understanding, starting with basic properties of genes and genomes, RNA and protein structure and function, and extending to the complex, hierarchical interactions fundamental to living organisms. A comprehensive picture of the many ways molecular biology is being applied to the analysis of complex systems is developed, including advances that reveal fundamental features of gene regulation during cell growth and differentiation, and in response to a changing environment, as well as developments that are more related to commercial and medical applications. Recent advances in technology, the process and thrill of discovery, and ethical considerations in molecular biology research are emphasized. The text highlights the process of discovery - the observations, the questions, the experimental designs to test models, the results and conclusions - not just presenting the "facts." At the same time the language of molecular biology is emphasized, and a foundation is built that is based in fact. It is not feasible to examine every brick in the foundation and still have time to view the entire structure. However, as often as possible real examples of data are shown, e.g. actual results of an EMSA, Western blot, or RNA splicing assay. Experiments are selected either because they are classics in the field or because they illustrate a particular approach frequently used by molecular biologists to answer a diversity of questions.

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内容概要

The beginnings of molecular biology , The structure of DNA ,Genome organization : from nucleotides to chromatin, The versatility of RNA, From gene to protein, DNA replication and telomere maintenance, DNA repair and recombination, Recombinant DNA technology and molecular cloning。

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 - Creativity in approach leads to the one gene-one enzyme hypothesis
 - The importance of technological advances: the Hershey-Chase experiment
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Bacteriophages

Mammalian DNA Viruses

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tRNA structure : important insights into RNA structural motifs

Common tertiary structure motifs in RNA

4.4 Kinetics of RNA folding

4.5 RNA is involved in a wide range of cellular processes

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Tetrahymena groUP I intron ribozyme

RNase P ribozyme

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6.5 Semidiscontinuous DNA replication

Leading strand synthesis is continuous

Lagging strand synthesis is discontinuous

6.6 Nuclear DNA replication in eukaryotic cells

Replication factories

Histone removal at the origins of replication

Prereplication complex formation at the origins of replication

Replication Licensing: DNA only replicates once per cell cycle

Duplex unwinding at replication forks

RNA priming of Leading strand and Lagging strand DNA synthesis

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Maturation of nascent DNA strands

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Focus box 6.2 The naming of genes involved in DNA replication

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6.8 Rolling circle replication

6.9 Tetomere maintenance: the role of tetomerase in DNA replication, aging, and cancer

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Solution to the end replication problem

Maintenance of telomeres by telomerase

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Telomerase, aging, and cancer

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Cellular response to DNA damage

7.4 Lesion bypass

7.5 Direct reversal of DNA damage

7.6 Repair of single base changes and structural distortions by removal of DNA damage

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Other subviral pathogens Other subviral pathogens include satellite RNAs and virusoids. Viroids replicate autonomously by using host-encoded RNA polymerase. In contrast, satellite RNAs multiply only in the presence of a helper virus that provides the appropriate RNA-dependent RNA polymerase. Some of the larger satellite RNAs may encode a protein. Satellite RNAs are found in plants (e.g. satellite tobacco necrosis virus) and animals. A well known human satellite RNA is hepatitis delta virus (HDV) . HDV is a small single-stranded RNA satellite of hepatitis B virus. A virusoid is an RNA molecule that does not encode any proteins and depends on a helper virus for replication and capsid formation. Virusoids occur in association with viruses causing plant diseases such as velvet tobacco mottle and subterranean clover mottle. They are sometimes regarded as a subtype of satellite RNA. The virusoid genome resembles a viroid and consists of circular, single-stranded RNA with self-cleaving activity (see Section 4.7) .

Chapter summary The genomes of most organisms are made of DNA; certain viruses and subviral pathogens have RNA genomes. Eukaryotic DNA combines with basic protein molecules called histones to form structures known as nucleosomes. Each nucleosome contains four pairs of core histones (H2A, H2B, H3, and H4) in a wedge-shaped disk, around which is wrapped 146 bp of DNA. The linker histone H1 is bound to DNA between the core histone octamers, where the DNA enters and exits the nucleosome. The first order of chromatin folding is represented by a string of nucleosomes. This 10 nm nucleosome fiber is further folded into a 30 nm fiber in a zig-zag ribbon structure, which is then folded into loop domains, and finally the metaphase chromosome. Each chromosome is composed of one linear, double-stranded DNA molecule. Bacterial chromosomal DNA exists as one double-stranded, circular DNA molecule organized into a condensed structure called a nucleoid. Plasmids are self-replicating small, double-stranded, circular or linear DNA molecules carried by bacteria, some fungi, and some higher plants. Plasmids are important tools for recombinant DNA technology. Bacteriophages and mammalian DNA viruses have DNA genomes that occur in a variety of forms, ranging from double-stranded to single-stranded DNA and linear to circular forms. Viruses either package their genomes with their own basic proteins, or use host cell histones. Both mitochondria and chloroplasts contain their own genetic information. The small, double-stranded DNA genomes are usually, but not always, circular and there are multiple copies per organelle. Organelle genomes are maternally inherited.

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