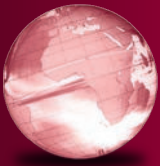


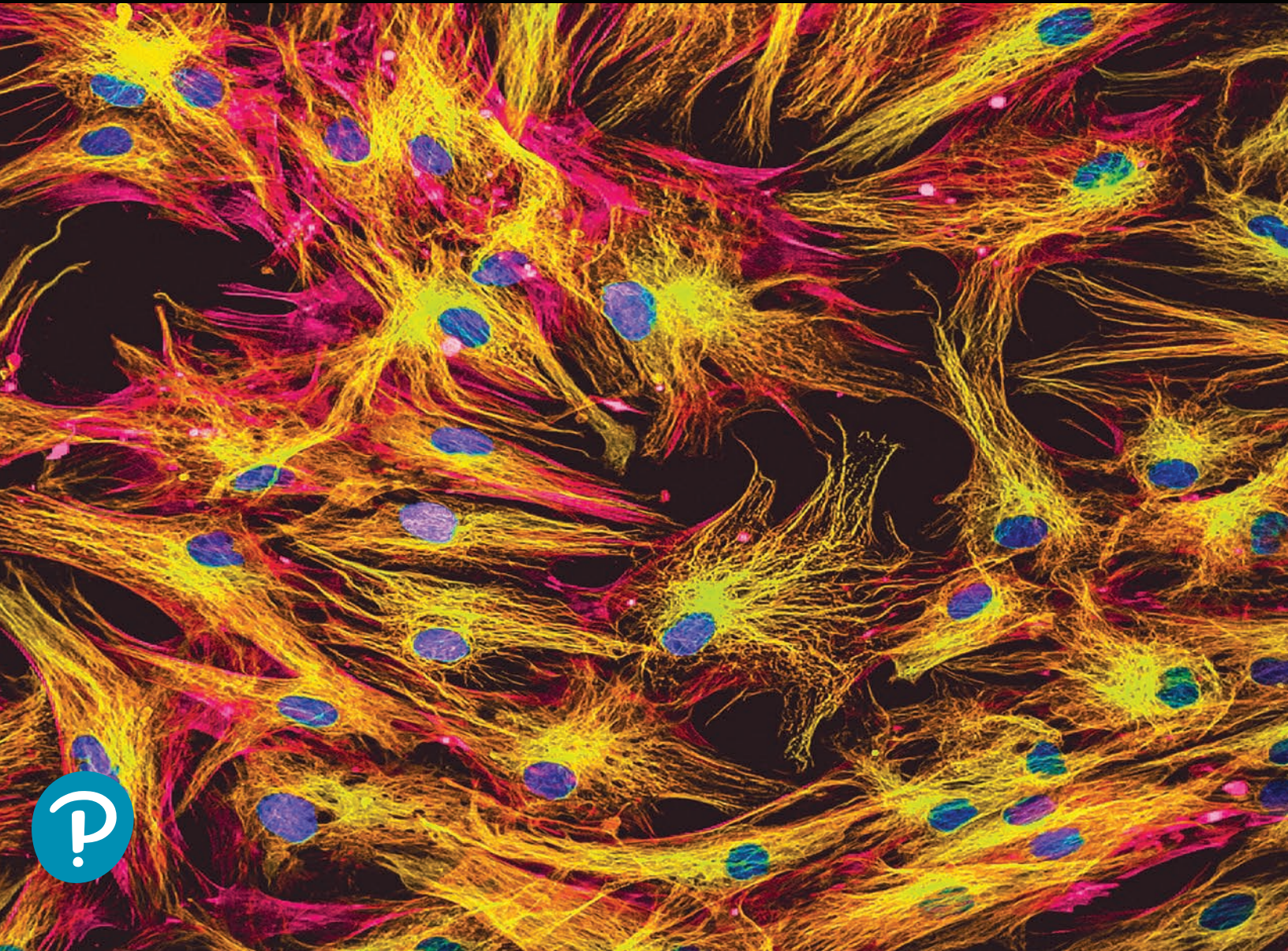
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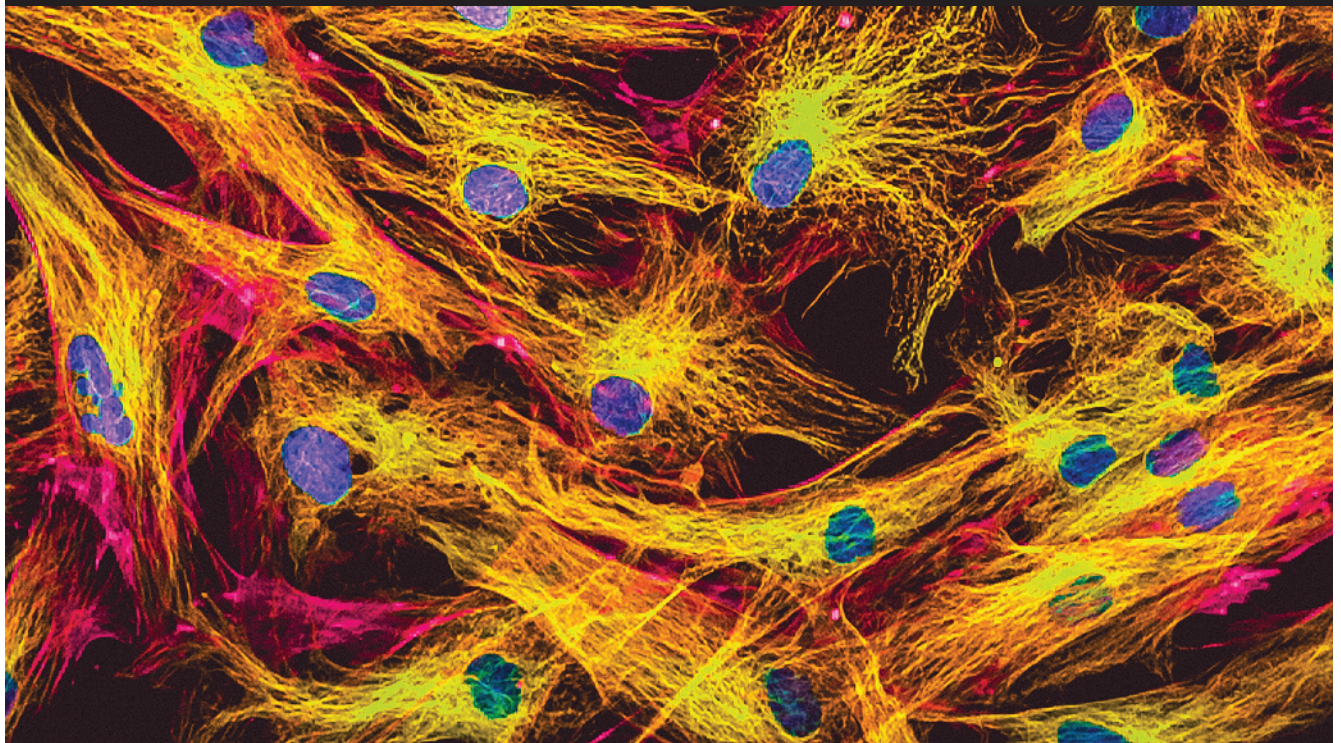




Becker's

10th Edition  
Global Edition

# WORLD OF THE CELL



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# Becker's World of the Cell, Global Edition

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Cell Walls Are Synthesized in Several Discrete Stages

Plasmodesmata Permit Direct Cell-Cell Communication Through the Cell Wall

## **Summary of Key Points**

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Human Connections: The Costly Effects of Weak Adhesion

Key Technique: Building an ECM from Scratch

# **Chapter 16. The Structural Basis of Cellular Information: DNA, Chromosomes, and the Nucleus**

## **16.1 Chemical Nature of the Genetic Material**

The Discovery of DNA Led to Conflicting Proposals Concerning the Chemical Nature of Genes

Avery, MacLeod, and McCarty Showed That DNA Is the Genetic Material of Bacteria

Hershey and Chase Showed That DNA Is the Genetic Material of Viruses

RNA Is the Genetic Material in Some Viruses

## **16.2 DNA Structure**

Chargaff's Rules Reveal That  $A = T$  and  $G = C$

Watson and Crick Discovered That DNA Is a Double Helix

DNA Can Be Interconverted Between Relaxed and Supercoiled Forms

The Two Strands of a DNA Double Helix Can Be Denatured and Renatured

## **16.3 DNA Packaging**

Bacteria Package DNA in Bacterial Chromosomes and Plasmids

Eukaryotes Package DNA in Chromatin and Chromosomes

Nucleosomes Are the Basic Unit of Chromatin Structure

A Histone Octamer Forms the Nucleosome Core

Nucleosomes Are Packed Together to Form Chromatin Fibers and Chromosomes

Changes in Histones and Chromatin Remodeling Proteins Can Alter Chromatin Packing



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Some Heterochromatin Plays a Structural Role in Chromosomes  
Chromosomes Can Be Identified by Unique Banding Patterns  
Eukaryotic Chromosomes Contain Large Amounts of Repeated DNA Sequences  
Eukaryotes Package Some of Their DNA in Mitochondria and Chloroplasts

## **16.4 The Nucleus**

A Double-Membrane Nuclear Envelope Surrounds the Nucleus  
Molecules Enter and Exit the Nucleus Through Nuclear Pores  
The Nucleus Is Mechanically Integrated with the Rest of the Cell  
Chromatin Is Located Within the Nucleus in a Nonrandom Fashion  
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DNA Synthesis Occurs During S Phase  
DNA Replication Is Semiconservative  
DNA Replication Is Usually Bidirectional  
Replication Initiates at Specialized DNA Elements  
DNA Polymerases Catalyze the Elongation of DNA Chains  
DNA Is Synthesized as Discontinuous Segments That Are Joined Together by DNA Ligase  
In Bacteria, Proofreading Is Performed by the 3'5' Exonuclease Activity of DNA Polymerase  
RNA Primers Initiate DNA Replication  
The DNA Double Helix Must Be Locally Unwound During Replication  
DNA Unwinding and DNA Synthesis Are Coordinated on Both Strands via the Replisome  
Eukaryotes Disassemble and Reassemble Nucleosomes as Replication Proceeds  
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Eukaryotes Also Have DNA-Only Transposons

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Human Connections: Children of The Moon

Key Technique: CRISPR/Cas9 Genome Editing

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### **18.1 The Directional Flow of Genetic Information**

Transcription and Translation Involve Many of the Same Components in Prokaryotes and Eukaryotes

Where Transcription and Translation Occur Differs in Prokaryotes and Eukaryotes

In Some Cases RNA Is Reversed Transcribed into DNA

### **18.2 Mechanisms of Transcription**

Transcription Involves Four Stages: RNA Polymerase Binding, Initiation, Elongation, and Termination

Bacterial Transcription Involves Factor Binding, Initiation, Elongation, and Termination

Transcription in Eukaryotic Cells Has Additional Complexity Compared with Prokaryotes

RNA Polymerases I, II, and III Carry Out Transcription in the Eukaryotic Nucleus

Three Classes of Promoters Are Found in Eukaryotic Nuclear Genes, One for Each Type of RNA Polymerase

General Transcription Factors Are Involved in the Transcription of All Nuclear Genes

Elongation, Termination, and RNA Cleavage Are Involved in Completing Eukaryotic RNA Synthesis

### **18.3 RNA Processing and Turnover**

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Ribosomal RNA Processing Involves Cleavage of Multiple rRNAs from a Common Precursor

Transfer RNA Processing Involves Removal, Addition, and Chemical Modification of Nucleotides

Messenger RNA Processing in Eukaryotes Involves Capping, Addition of Poly(A), and Removal of Introns

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The Genetic Code Is Degenerate and Nonoverlapping

Messenger RNA Guides the Synthesis of Polypeptide Chains

The Codon Dictionary Was Established Using Synthetic RNA Polymers and Triplets

Of the 64 Possible Codons in Messenger RNA, 61 Encode Amino Acids

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Transfer RNA Molecules Bring Amino Acids to the Ribosome

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Most mRNAs Are Read by Many Ribosomes Simultaneously

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Studies of Mutant Bacteria Revealed How the lac Operon Is Organized

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The lac Operon Is an Example of the Dual Control of Gene Expression

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Sigma Factors Determine Which Sets of Genes Can Be Expressed

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Riboswitches Allow Transcription and Translation to Be Controlled by Small-Molecule Interactions with RNA

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