PowerPoint® Lecture Presentation for

Concepts of Genetics

Ninth Edition

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Chapter 1
Introduction to Genetics

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Chapter 1 Contents

1.1 Genetics Progressed From Mendel to DNA in Less Than a Century

Section 1.1

- In **mitosis**, chromosomes are copied and distributed so that the two resulting daughter cells each receive a **diploid** set.
- In **meiosis**, the gametes produced are **haploid**.
- Homologous chromosomes

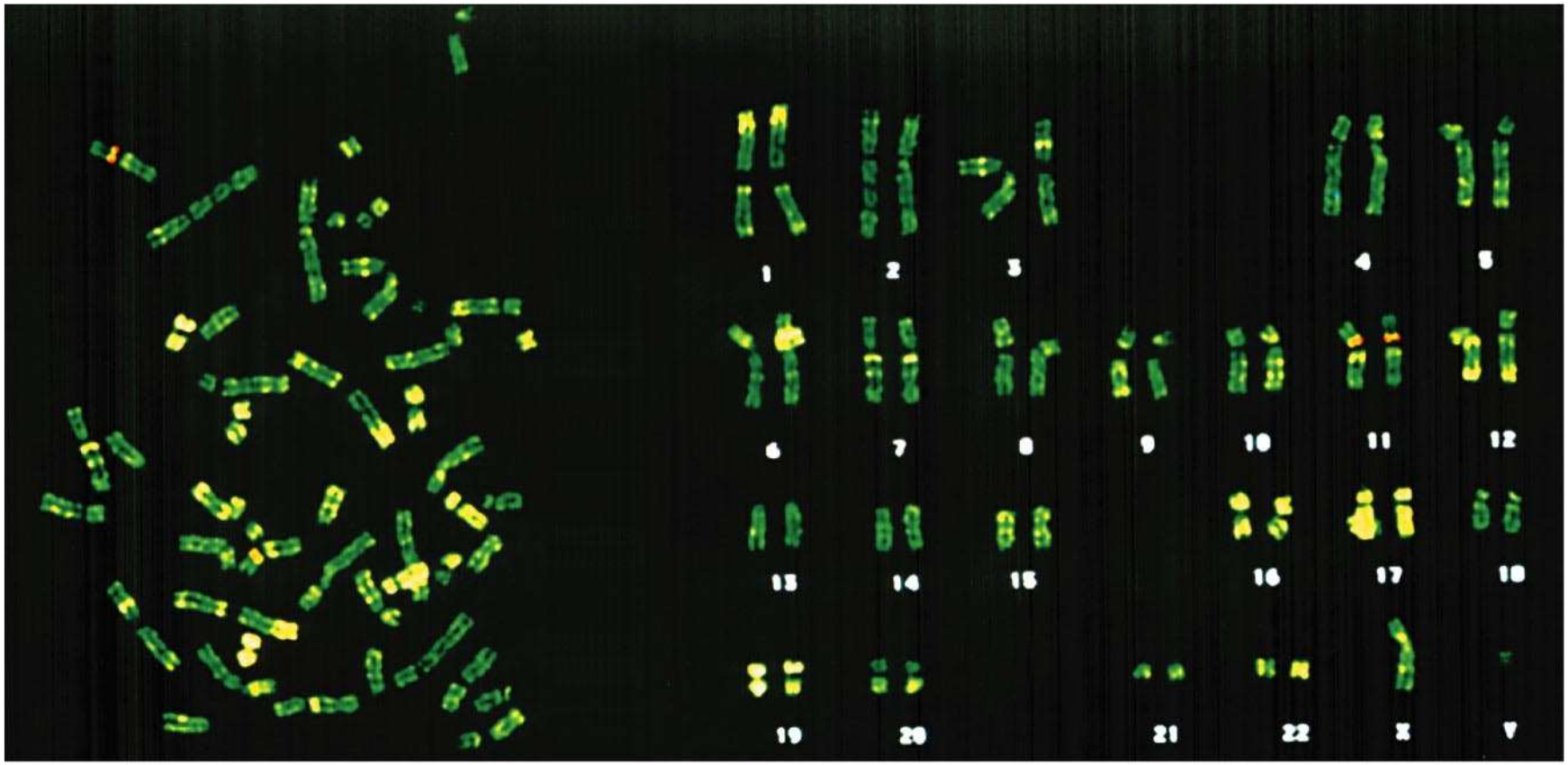

Figure 2.4

Section 1.1

- According to the chromosome theory of inheritance, inherited traits are controlled by genes residing on chromosomes.
- The genes are faithfully transmitted through gametes.
- This maintains genetic continuity from generation to generation.

Section 1.1

- Mutations produce alleles of a gene.
- They are the source of genetic variation.
- SNP sickle cell Beta globin CTC to CAC
- mRNA GAG to GUG amino acid shifts
- Glu to Valine
- Genotype to phenotype

Section 1.1

- DNA, not protein, is the carrier of genetic information.

1.2 Discovery of the Double Helix Launched the Era of Molecular Genetics

Section 1.2

- DNA is an antiparallel, double-stranded helix made up of the nucleotides A, C, G, and T.
- The sugar in its nucleotides is deoxyribose.
- These nucleotides form A–T and G–C base pairs across the helix (**Figure 1.8**).

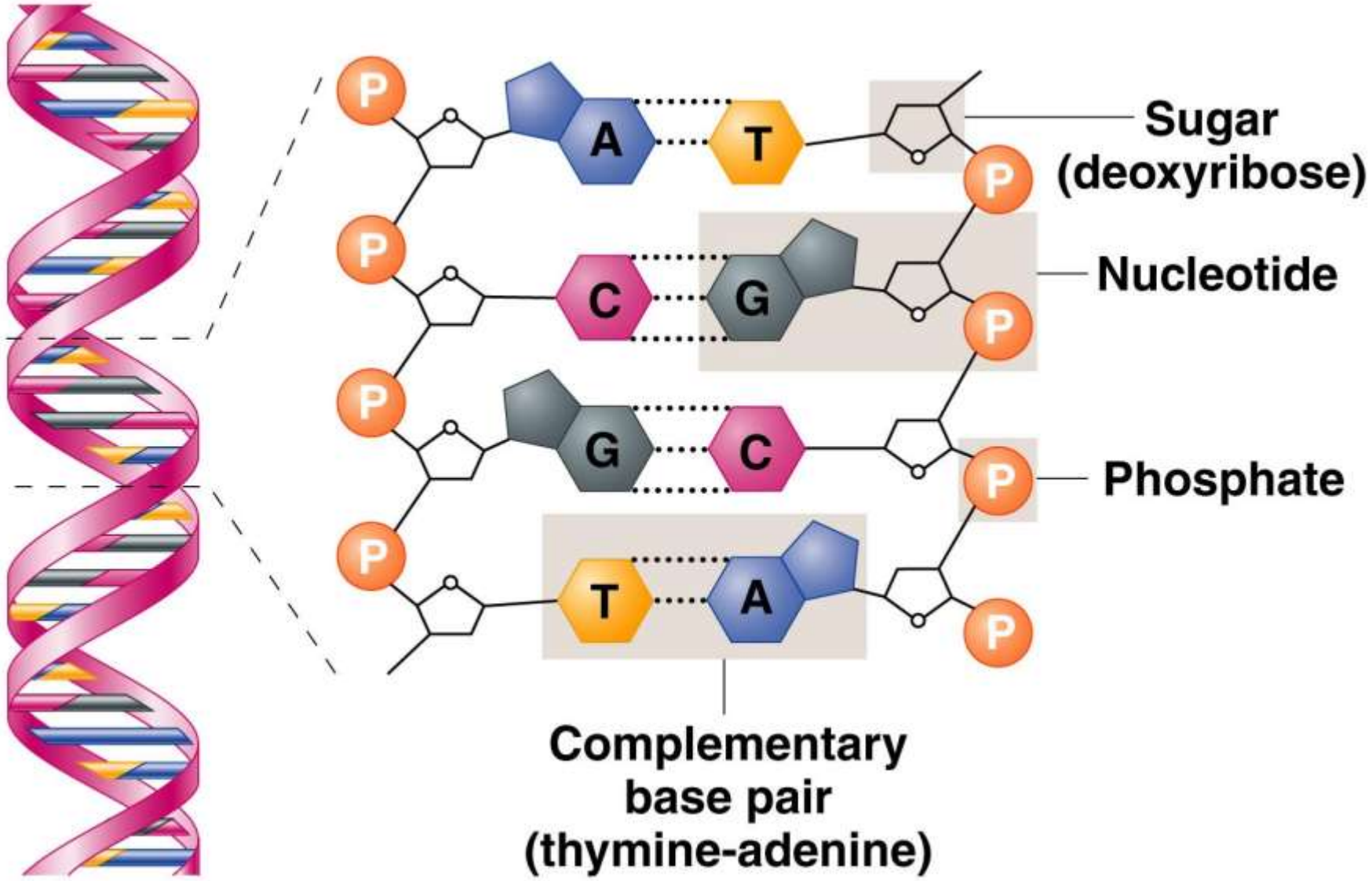

Figure 1.8

Section 1.2

- RNA is similar to DNA, except that:
  - it is usually single-stranded
  - it has U in place of T
  - the sugar in RNA nucleotides is ribose instead of deoxyribose

Section 1.2

- DNA is transcribed to RNA, which is translated into protein (**Figure 1.9**).
- This is known as the central dogma of genetics.

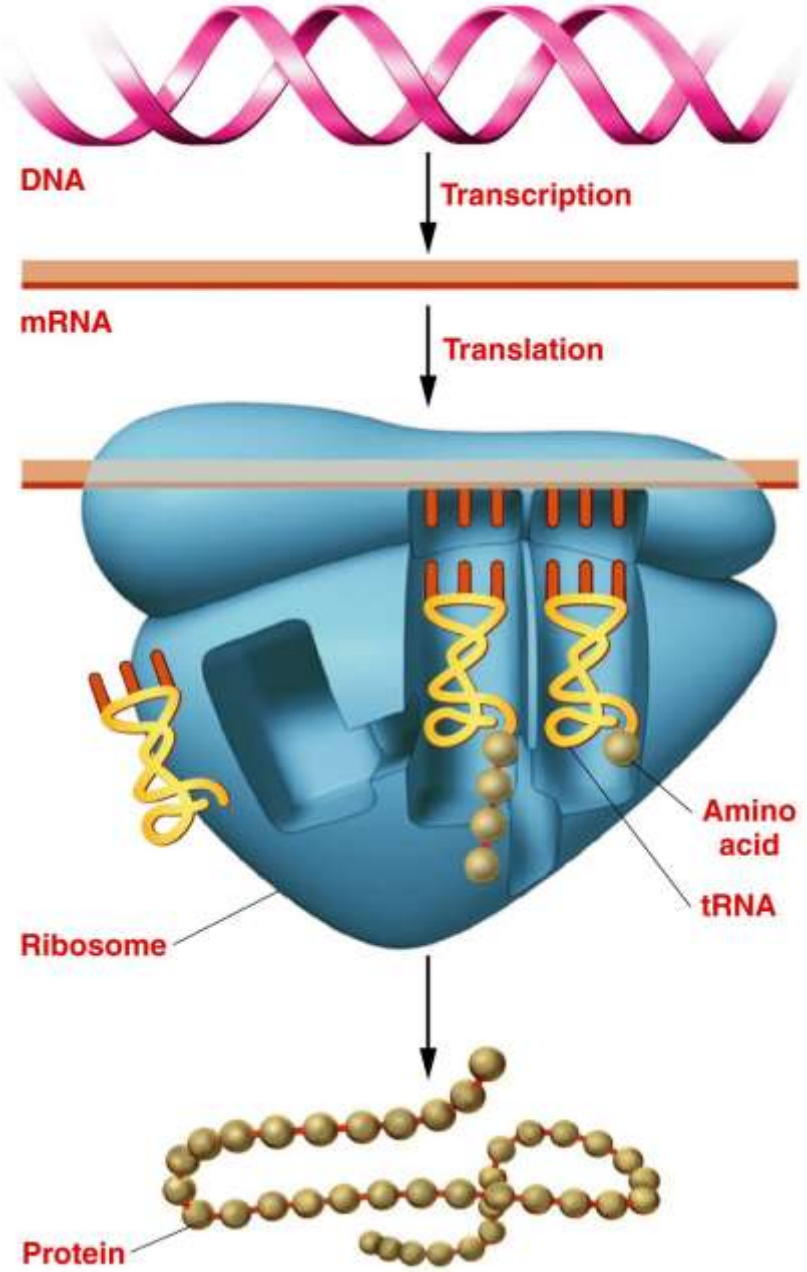

Figure 1.9

Section 1.2

- The genetic code consists of triplet nucleotides present in mRNA.
- Each triplet encodes for insertion of a specific amino acid into a growing protein chain.

Section 1.2

- Once a protein is made, its action or location in a cell plays a role in producing a phenotype.

1.3 Development of Recombinant DNA Technology Began the Era of Cloning

Section 1.3

- Restriction enzymes have allowed the advent of recombinant DNA and cloning (**Figure 1.14**).

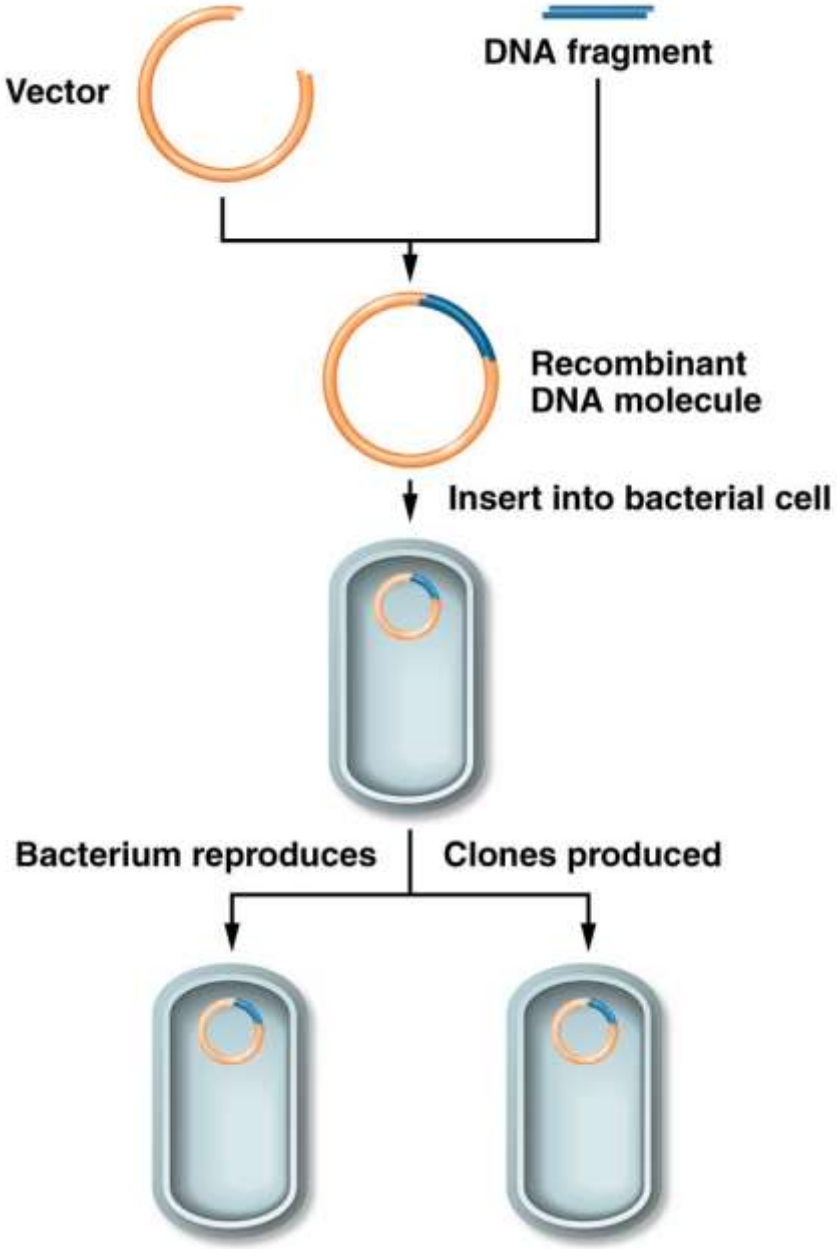

Figure 1.14

1.4 The Impact of Biotechnology Is Continually Expanding

Section 1.4

- Biotechnology has been used for the genetic modification of crop plants for:
  - increased herbicide, insect, and viral resistance
  - nutritional enhancement
- Some genetically altered traits in crop plants are shown in **Table 1.1**.

TABLE 1.1

Some Genetically Altered Traits in Crop Plants

Herbicide Resistance	
Corn, soybeans, rice, cotton, sugarbeets, canola	
Insect Resistance	
Corn, cotton, potato	
Virus Resistance	
Potato, yellow squash, papaya	
Nutritional Enhancement	
Golden rice	
Altered Oil Content	
Soybeans, canola	
Delayed Ripening	
Tomato	

Section 1.4

- Gene therapy and genetic testing are important parts of medicine.
- The molecular basis for hundreds of genetic disorders is known (**Figure 1.17**).

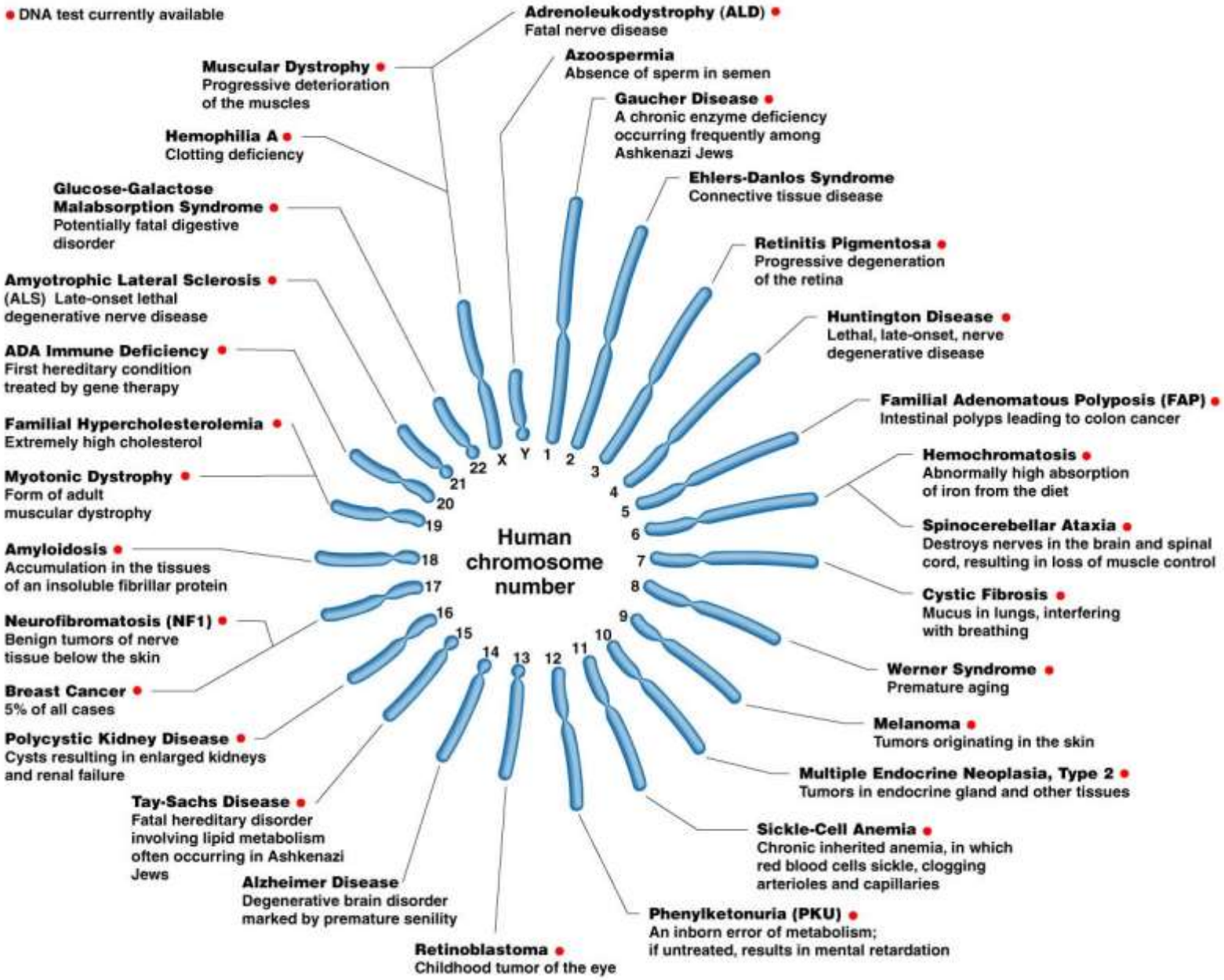

Figure 1.17

1.5 Genomics, Proteomics, and Bioinformatics are New and Expanding Fields

Section 1.5

- **Genomics** analyzes genome sequences to study the structure, function, and evolution of genes and genomes.

Section 1.5

- All life has a common origin, and genes with similar functions in different organisms are similar in structure and DNA sequence.

1.6 Genetic Studies Rely on the Use of Model Organisms

Section 1.6

- Model organisms for genetic study meet these criteria:
  - easy to grow
  - short life cycle
  - produce many offspring

Section 1.6

- Recombinant DNA technology and the ability to transfer genes across species has made it possible to develop models of human diseases (**Table 1.2**).

TABLE 1.2

Model Organisms Used to Study Human Diseases

Organism	Human Diseases
E. coli	Colon cancer and other cancers
S. cerevisiae	Cancer, Werner syndrome
D. melanogaster	Disorders of the nervous system, Cancer
C. elegans	Diabetes
D. rerio	Cardiovascular disease
M. musculus	Lesch–Nyhan disease, cystic fibrosis, fragile-X syndrome, and many other diseases

1.7 We Live in the Age of Genetics

Section 1.7

- Genetics is the core of biology.
- It is the method of choice for understanding the functions and malfunctions of a biological system.