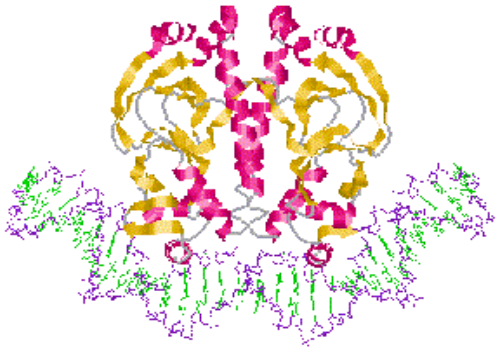
AQS 108 Genetics



Prof. Dr. İsmail AKYOL
Prof. Dr. M. Ali YILDIZ
Prof. Dr. M. Muhip ÖZKAN
Ankara Üniversitesi

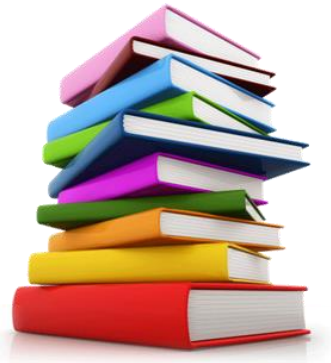
Outline of course

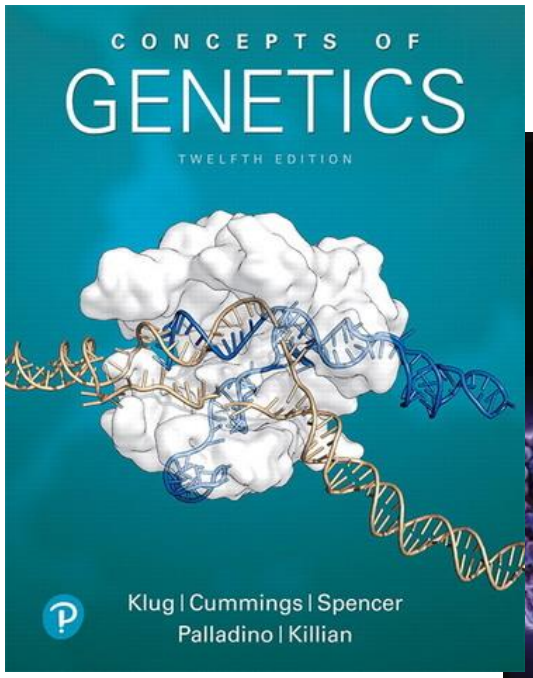
Week	Topics
1. Week	Introduction to Genetics
2. Week	Mitosis and Meiosis and their comparison.
3. Week	Mendelian Genetics
4. Week	Punnett Squares, Testcross, Monohybrid, dihybrid and trihybrid cross.
5. Week	Extensions of Mendelian Genetics
6. Week	Chromosome mapping and segregation of genes linked on the same chromosome
7. Week	Population and evolutionary genetics

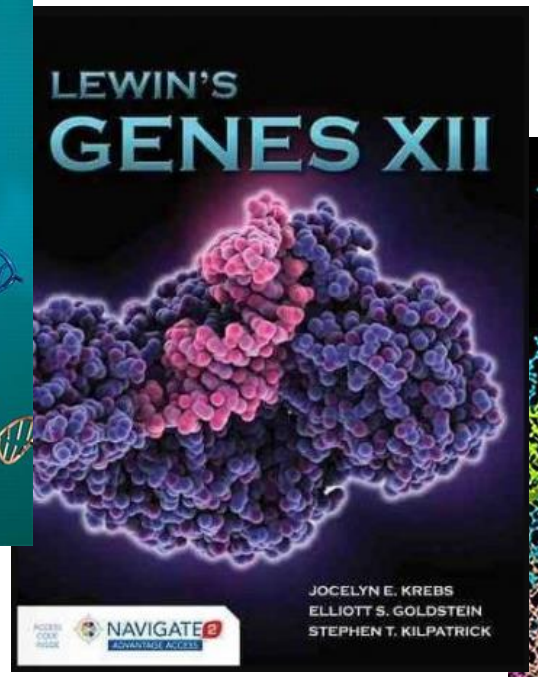
Outline of course

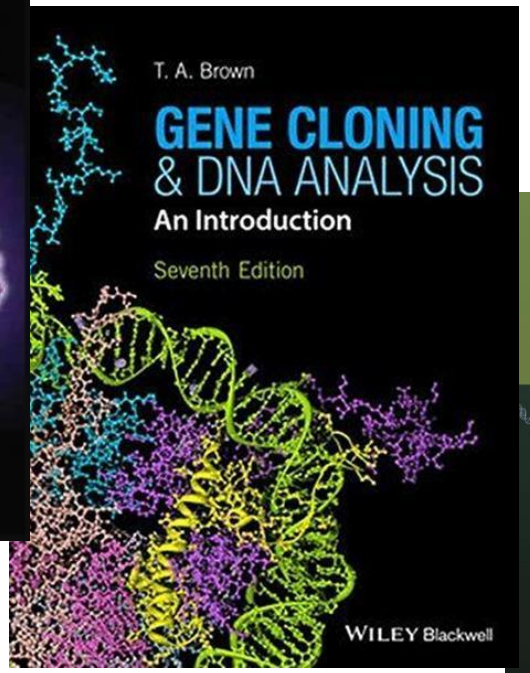
Week	Topics
8. Week	DNA structure, replication and recombination
9. Week	The genetic code and transcription
10. Week	Differences between prokaryotes and eukaryotes transcription
11. Week	Translation and proteins
12. Week	Diverse role of proteins
13. Week	Gene mutation, DNA repair and transposition
14. Week	Introduction to Recombinant DNA technology

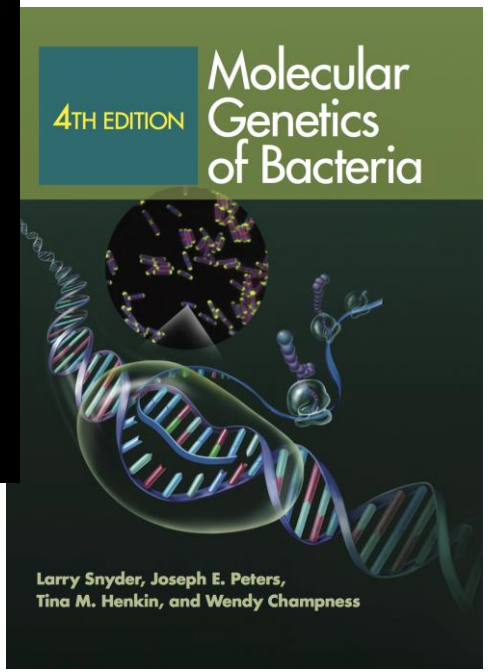
Recommended Books

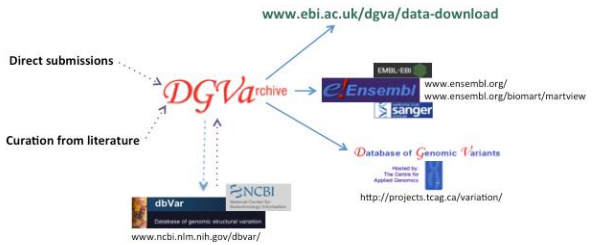








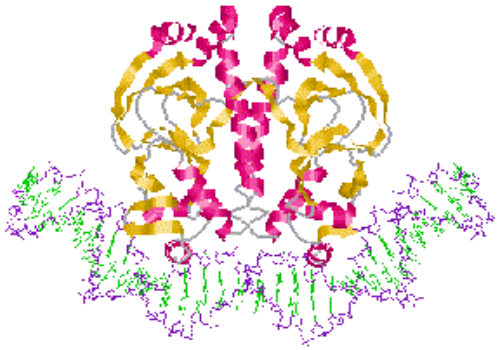




Recommended Books

- William S. Klug , Michael R. Cummings, Charlotte A. Spencer, Michael A. Palladino , Darrell J. Killian (2019) Concepts of Genetics, Pearson Education, Inc.
- Jocelyn E. Krebs, Elliott S. Goldstein, Stephen T. Kilpatrick (2018) Lewin's Genes XII, Jones & Bartlett Learning; 12 Edition
- T. A. Brown (2016) Gene Cloning and DNA Analysis: An Introduction, Wiley-Blackwell, 7 Edition
- Larry Snyder and Wendy Champness (2007) Molecular Genetics of Bacteria, AMS Press; 4 Edition

Introduction to Genetics



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Outline of course today

- Genetics has a rich and interesting
- Genetics progressed from mendel to DNA
- Discovery of the double helix launched
- Development of recombinant DNA
- The impact of biotechnology is continually
- Genomics, proteomics, and bioinformatics
- We live in the age of genetics

Genetics has a rich and interesting

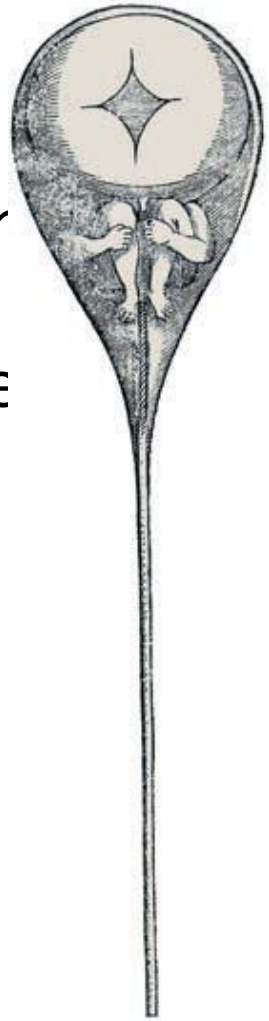
- Genetics in the twenty-first century is built on a rich tradition of discovery and experimentation stretching from the ancient world through the nineteenth century to the present day.
- Transmission genetics is the general process by which traits controlled by genes are transmitted through gametes from generation to generation.
- Mutant strains can be used in genetic crosses to map the location and distance between genes on chromosomes.
- The Watson–Crick model of DNA structure explains how genetic information is stored and expressed. This discovery is the foundation of molecular genetics.

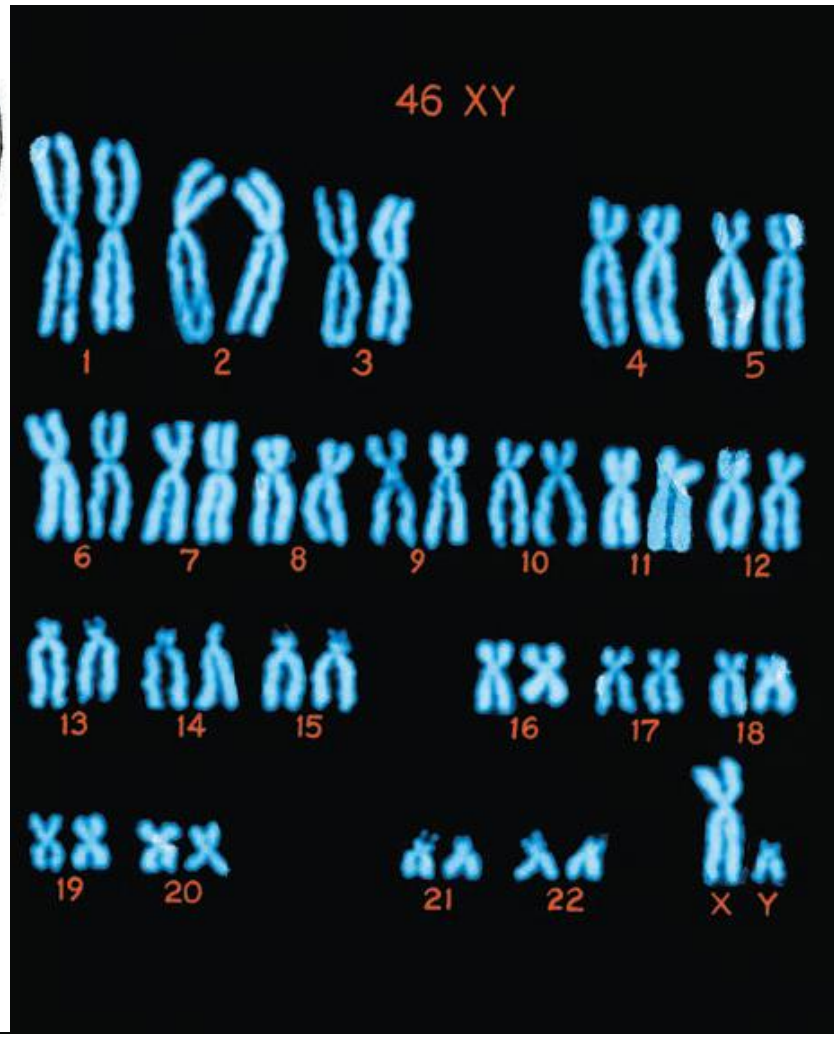
Genetics has a rich and interesting

- Recombinant DNA technology revolutionized genetics, was the foundation for the Human Genome Project, and has generated new fields that combine genetics with information technology.
- Biotechnology provides genetically modified organisms and their products that are used across a wide range of fields including agriculture, medicine, and industry.
- Model organisms used in genetics research are now utilized in combination with recombinant DNA technology and genomics to study human diseases.
- Genetic technology is developing faster than the policies, laws, and conventions that govern its use.

Genetics progressed from Mendel to DNA

- The theory of epigenesis directly conflicted with the theory of **preformation**, which stated that the fertilized egg contains a complete miniature adult, called a **homunculus** (Figure).
- Depiction of the homunculus, a sperm containing a miniature adult, perfect in proportion and fully formed.





Discovery of the double helix launched

- Once it was accepted that DNA carries genetic information, efforts were focused on deciphering the structure of the DNA molecule and the mechanism by which information stored in it produces a phenotype.

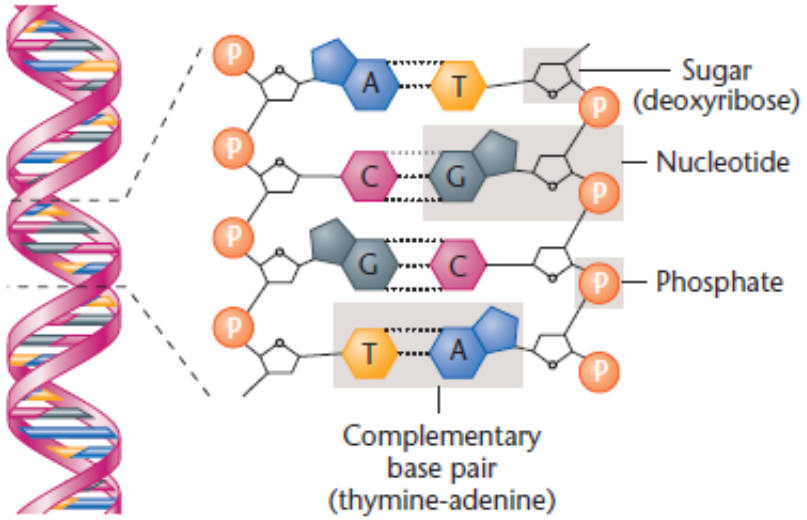


FIGURE 1.7 Summary of the structure of DNA, illustrating the arrangement of the double helix (on the left) and the chemical components making up each strand (on the right). The dotted lines on the right represent weak chemical bonds, called hydrogen bonds, which hold together the two strands of the DNA helix.

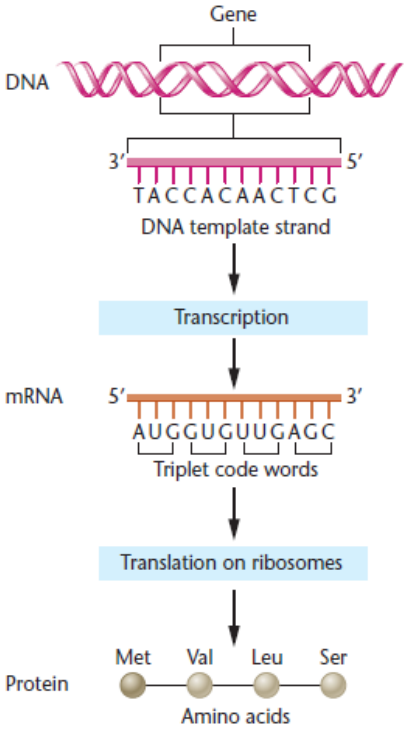


FIGURE 1.8 Gene expression consists of transcription of DNA into mRNA (top) and the translation (center) of mRNA (with the help of a ribosome) into a protein (bottom).

Development of recombinant DNA

- The era of recombinant DNA began in the early 1970s, when researchers discovered **restriction enzymes.**
- Large amounts of cloned DNA fragments can be isolated from these bacterial host cells.
- Soon after, researchers discovered ways to insert the DNA fragments produced by the action of restriction enzymes into **vectors.**
- When transferred into bacterial cells, thousands of copies, or **clones**, of the combined vector and DNA fragments are produced during bacterial reproduction.

The impact of biotechnology is continually

FIGURE Dolly, a Finn Dorset sheep cloned from the genetic material of an adult mammary cell, shown next to her first-born lamb, Bonnie.

Genomics, proteomics, and bioinformatics

- The use of recombinant DNA technology to create genomic libraries prompted scientists to consider sequencing all the clones in a library to derive the nucleotide sequence of an organism’s genome.
- This sequence information would be used to identify each gene in the genome and establish its function.
- The Human Genome Project began in 1990 as an international effort to sequence the human genome.
- By 2003, the publicly funded Human Genome Project and a private, industry-funded genome project completed sequencing of the gene-containing portion of the genome.

We live in the age of genetics

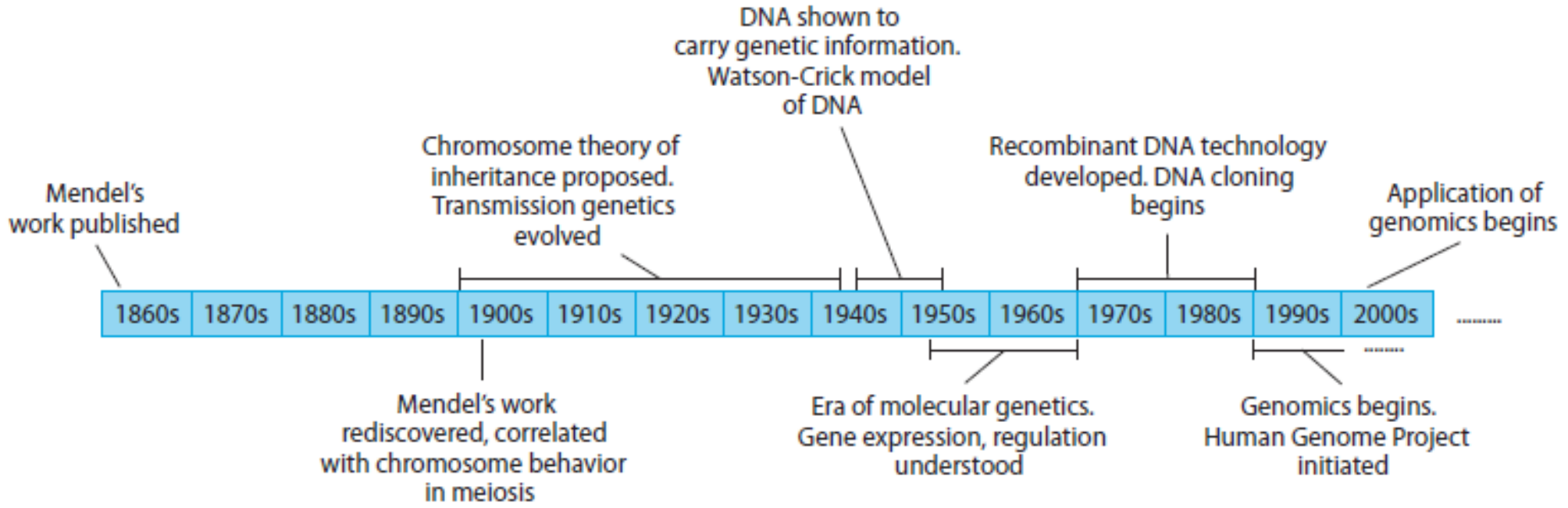


FIGURE 1.15 A timeline showing the development of genetics from Gregor Mendel's work on pea plants to the current era of genomics and its many applications in research, medicine, and society. Having a sense of the history of discovery in genetics should provide you with a useful framework as you proceed through this textbook.