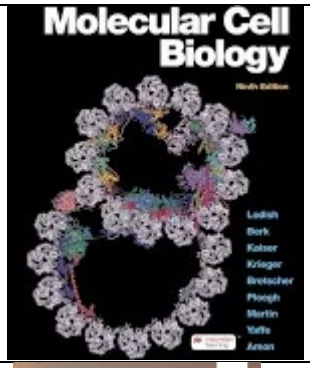
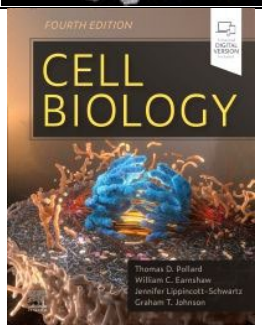
MCDB S 205 Cell Biology
Summer 2025 *Session A*
May 26 to June 27 YSB C105
Joseph S. Wolenski Ph.D.

Two textbooks are recommended.

	Textbook: *Molecular Cell Biology Ninth Edition* Lodish, Berk, Kaiser, Krieger, Bretscher, Ploegh, Martin, Yaffe, Amon Paperback: ISBN-13: 978-1-319-20852-3. E-book: ISBN:9781319365028 https://www.macmillanlearning.com/college/us/product/Molecular-Cell-Biology/p/1319208525 W.H. Freeman and Company.
	Textbook: Pollard, Earnshaw, Lippincott-Schwartz and Johnson (4th Edition). This is an excellent textbook that covers all the essential topics. ISBN: 9780443106149

Session A M-F 1 - 2:30 PM.
Instructor: Joseph S. Wolenski Ph.D. Joseph.Wolenski@yale.edu YSB C112

<u>Grading</u>

Quiz 1	10%
Quiz 2	10%
Quiz 3	10%
Quiz 4	10%
Final Quiz: Cumulative	20%
Presentations (2)	25%
Class participation	15%

Week 1

Lecture/Date Topics covered and new methodologies

1 M. 05/26 Chapter 1 Evolution: Molecules, Genes, Cells and Organisms
Cell Theory. What is alive: viruses, bacteria. Eubacteria and archaea. RNA world. Model organisms *Chlamydomonas reinhardtii* (for study of flagella, chloroplast formation, photosynthesis, and phototaxis) and *Plasmodium falciparum* (novel organelles and a complex life cycle).

2 T. 05/27 Chapter 2 Chemical Foundations: Thermodynamics and Kinetics
Atomic structure, chemical bonds, chemical interactions in cell biology, equilibrium and steady state reactions. Mass spectrometry

3 W. 05/28 Chapter 3 Protein Structure and Function, Kinetics
Helices, beta sheet, protein folding, intrinsically disordered proteins. Chaperone-guided folding and updated chaperone structures. Phosphoproteomics

4 Th. 05/29 Chapter 4. Culturing and Visualizing Cells
Tissue culture, FACS, 3D culture matrices. GFP and fluorescence microscopy,

5 F. 05/30 QUIZ 1 Chapter 4. Visualizing cells.
Spinning disk, laser scanning confocal microscopy, 2P excitation and Lightsheet microscopy, superresolution microscopy, STED and MINFLUX.

Week 2

6 M. 06/02 Chapter 5. Fundamental Molecular Genetic Mechanisms.
Properties of DNA and RNA**.** DNA cloning, Knock outs, recombination.
Student Job talk 1.

7 T. 06/03 Chapter 6. Molecular Genetic Techniques.
Phenotype, GOF, LOF mutations, PCR**,** Molecular genetic therapeutic Strategies for Duchenne Muscular Dystrophy. CRISPR/Cas9 system in bacteria and its application in genomic editing
Student Job talk 2.

8 W. 06/04 Chapter 7. Genes, Chromatin, and Chromosomes
What is a gene? Transcriptional units. Protein coding genes, functional RNA, transposons, satellite DNA and intergenic regions of the genome
Student job talk 3.

9 Th. 06/05 Chapter 8. Transcriptional Control of Gene Expression

Heterochromatin and euchromatin, RNA polymerase, chromatin remodeling, transcription factors, histone modifications

Student job talk 4.

10 F. 06/06 QUIZ II. RNA polymerase regulation.

Week 3

11 M. 06/09 Chapter 9. Post-Transcriptional Gene Control

RNA processing pathways, RNA binding proteins, mRNA degradation pathways and RNA surveillance in the cytoplasm Nuclear bodies

Student Job talk 5.

12 T. 06/10 Chapter 10 Biomembrane Structure

Fluid mosaic model, Types of phospholipids, lipid rafts, synthesis and role of cholesterol in cardiovascular disease

Student Job talk 6.

13 W. 06/11 Chapter 11 Transmembrane Transport of Ions and Small Molecules

Student Job talk 7.

14 Th. 06/12 Chapter 12 Cellular Energetics

Glycolysis, Electron transport chain, Proton-motive force.

15 F. 06/13 Quiz III Chapter 13. Moving Proteins into Membranes and Organelles.

Ribosomes and the Signal Recognition Particle

Week 4

16 M. 06/16 Chapter 14. Vesicular Traffic, Secretion, and Endocytosis.

Rab proteins and their role in vesicle fusion with target membranes

Student Job talk 1b.

17 T. 06/17 Chapter 15. Receptors, Hormones and Cell Signaling

Human G protein-coupled receptors (GPCRs) of pharmaceutical importance

Student Job talk 2b

18 W 06/18 Chapter 16. Growth Factor and Cytokine Signaling Pathways That Control Gene Expression

Role of Receptor Tyrosine Kinases (RTKs) in growth and proliferation
Student Job talk 3b

19 Th. 06/19 Ch. 17. Cell Organization and Movement, I: Microfilaments
Actin dynamics, role of nucleotides, actin binding proteins.
Student Job talk 4b

20 F. 06/20 Quiz III Chapter 18. Cell Organization and Movement, II: Microtubules
Microtubule polymerization, role of nucleotides. Kinesin, dynein and flagella.

Week 5

21 M. 06/23 Cell motility: Chapters 17, 18. Mechanoenzymes, force generation and cell motility.
Student Job talk 5b

22 T. 06/24 Chapter 20. Integrating Cells into Tissues.
Functions of the extracellular matrix and cell adhesion molecules.
Mechanotransduction and signaling.
Student Job talk 6b

23 W. 06/25 Chapter 25. Cancer
Student Job talk 7b

24 Th. 06/26 Alzheimer's disease. Cell biology and therapeutic strategies

25 F. 06/27 Final quiz 20%. Cumulative.