***MCDB S 205 Cell Biology*** Summer 2022

**Joseph S. Wolenski Ph.D.**

Two textbooks are recommended.

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|  | 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:9781319365028https://www.macmillanlearning.com/college/us/product/Molecular-Cell-Biology/p/1319208525W.H. Freeman and Company. |
| https://images-na.ssl-images-amazon.com/images/I/51QZq0MRViL._SX388_BO1,204,203,200_.jpg | Supplemental Text: Pollard, Earnshaw Lippincott-Schwartz and Johnson (3rd Edition). This is an excellent textbook that covers all the essential topics. ISBN: 9780323341264 |

Session B M-F 1 - 2:30 PM.

Instructor: Joseph S. Wolenski Ph.D. Joseph.Wolenski@yale.edu YSB C112 Teaching Assistant:

Grading

Exam I 30%

Exam II 30%

Quiz I 10%

Quiz II 10%

Presentation 10%

Class participation 10%

 **Week 1**

Lecture/Date Topics covered and new methodologies

**1 M. 07/04 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. 07/05 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. 07/06 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. 07/07 Chapter 4. Culturing and Visualizing Cells**

 Tissue culture, FACS, 3D culture matrices. GFP and fluorescence microscopy, spinning disk, laser scanning confocal microscopy, 2P excitation and Lightsheet microscopy, superresolution.

**5 F. 07/08 The Cell Biology Coronaviruses.**

 Therapeutic strategies for COVID-19.

**Week 2**

**6 M. 07/11 Chapter 5. Fundamental Molecular Genetic Mechanisms.**

Properties of DNA and RNA**.** DNA cloning, Knock outs, recombination.

**7 T. 07/12 Quiz I 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

**8 W. 07/13 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

**9 Th. 07/14 Chapter 8. Transcriptional Control of Gene Expression**

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

.**10 F. 07/15** **Chapter 9. Post-Transcriptional Gene Control**

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

**Week 3**

**11 M. 07/18 Chapter 10 Biomembrane Structure**

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

**12 T. 07/19 Chapter 11 Transmembrane Transport of Ions and Small Molecules**

 **W. 07/20 EXAM I 30% of final grade**

**13 Th. 07/21 Chapter 12 Cellular Energetics**

Glycolysis, Electron transport chain, Proton-motive force.

**14 F. 07/22 Chapter 13. Moving Proteins into Membranes and Organelles.**

 Ribosomes and the Signal Recognition Particle

 **Week 4**

**15 M. 07/25 Chapter 14. Vesicular Traffic, Secretion, and Endocytosis.**

 Rab proteins and their role in vesicle fusion with target membranes

**16 T. 07/26**  **Chapter 15. Receptors, Hormones and Cell Signaling**

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

**17 W 07/27** **Chapter 16. Growth Factor and Cytokine Signaling Pathways That Control Gene Expression**

 Role of Receptor Tyrosine Kinases (RTKs) in growth and proliferation

**18 Th. 07/28 Quiz II. Ch. 17. Cell Organization and Movement, I: Microfilaments**

 Actin dynamics, role of nucleotides, actin binding proteins.

**19 F. 07/29 Chapter 18.** **Cell Organization and Movement, II: Microtubules**

 Microtubule polymerization, role of nucleotides. Kinesin, dynein and flagella.

**Week 5**

**20 M. 08/01 Chapter 20. Integrating Cells into Tissues**.

 Functions of the extracellular matrix and cell adhesion molecules. Mechanotransduction and signaling.

**21 T. 08/02 Chapter 21. Responding to the Cellular Environment.**

 Glucose regulation and role of Tug.

**22** **W. 08/03 Chapter 22. Stem Cells, Cell Asymmetry and Regulated Cell Death.**

**23 Th. 08/04 Chapter 25 Cancer.**

 **F. 08/05 Exam II 30% of final grade: noncumulative**