

GS02-1063: Fundamental Anatomy, Physiology, and Biology for Medical Physicists

Syllabus, Fall Semester 2023
Lectures: MWF 8:00 – 9:00 am
FCT14.5059

Course coordinator

A. Kyle Jones, Ph.D.

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Other lecturers as listed on the schedule.

Office hours

Contact kyle.jones@mdanderson.org to make an appointment.

GSBS important dates

August 28, 2023: Classes start

September 4, 2023: Labor Day holiday

November 23-24, 2023: Thanksgiving Holiday

December 8, 2023: Last day of classes

Grades

Final grades will be based on the following weighting:

Exams (75%), assignments, quizzes, presentations, and participation (25%)

Exams (75%)

Each exam will be weighted equally.

Assignments, quizzes, presentations, and participation (25%)

A variety of activities other than formal exams will be used to engage students and assess class progress. Of course, you must be present to participate.

Grading scale

A: 86.7 – 100

B: 73.3 – 86.6

C: 60 – 73.2

F: < 60

Textbooks

Required:

Basic Clinical Radiobiology (5th ed.), Michael Joiner and Albert van der Kogel. CRC Press (2018) ISBN 9781444179637

Highly recommended:

Molecular Biology of the Cell (7th ed.), Bruce Alberts et al. Garland Science (2022) ISBN 0393884821

The Biology of Cancer (2nd ed.), Robert A. Weinberg. Garland Science (2013) ISBN 9780815342205

You might find these useful:

Lehninger Principles of Biochemistry (8th ed.), David L. Nelson, Michael M. Cox (2021) ISBN 1319228003

Lippincott Illustrated Reviews: Biochemistry (8th ed.), Abali et al. Lippincott, Williams, & Wilkins (2021) ISBN 9960717313

It should be noted that our knowledge of the subjects covered by these textbooks, for the most part, does not evolve at such a rate that past editions become obsolete within a year. Thus, an edition within 1 or 2 of the current one should suffice.

Online resources:

www.openstax.org

<https://www.ncbi.nlm.nih.gov/books/>

Earlier editions of Molecular Biology of the Cell are available from NCBI bookshelf, and maybe others.

<https://www.imaios.com/en/e-Anatomy>

(must be connected to MD Anderson network to access e-Anatomy for free)

Learning objectives:

1. Review basic biochemistry, cellular physiology, and cellular biology to form a foundation for understanding the application of these principles to medical physics.
2. Apply these basic principles to understand the effects of radiation on the cell.
3. Discuss how cells interact with other cells and the extracellular matrix and how such interactions lead to the formation of tissues.
4. Define the language of anatomy.
5. Examine the response of tissues to radiation.

Date	Lecture Title	Lecturer(s)	Exception?
8/28/2023	Welcome and introduction	Jones	Recorded
8/30/2023	Review of basic biochemistry	Walker	
9/1/2023	Biomolecules	Walker	
9/4/2023	HOLIDAY – NO CLASS	HOLIDAY	
9/6/2023	The eukaryotic cell I	Jones	Recorded
9/8/2023	The eukaryotic cell II	Jones	Recorded
9/11/2023	DNA and the genome	Taylor	
9/13/2023	Protein synthesis	Taylor	
9/15/2023	Thermodynamics and bioenergetics	Walker	
9/18/2023	Enzymes and kinetics	Walker	
9/20/2023	Cellular energetics and glycolysis	S Millward	
9/22/2023	Aerobic respiration and anaerobic glycolysis	NZ Millward	
9/25/2023	Non-carbohydrate metabolism	S Millward	
9/27/2023	Regulation and dysregulation of metabolism	NZ Millward	
9/29/2023	Imaging metabolism	NZ Millward	
10/2/2023	EXAM 1		
10/4/2023	The cell cycle and mitosis	Jones	
10/6/2023	DNA maintenance and repair (with specific mention of radiation)	Taylor	
10/9/2023	Immunology and the immune system I	Jones	
10/11/2023	Immunology and the immune system II	Jones	
10/13/2023	Cell death: Apoptosis, autophagy, and necroptosis (with specific mention of radiation)	S Millward	
10/16/2023	Cancer biology I	Walker	
10/18/2023	Cell-cell and cell-substratum interactions	Farach-Carson	
10/20/2023	Cell interactions with extracellular matrix	Farach-Carson	
10/23/2023	Cell communications in complex tissues	Farach-Carson	
10/25/2023	Controls of cell fate and decision making	Farach-Carson	
10/27/2023	Cell and matrix responses to stress: wound healing	Farach-Carson	
10/30/2023	Cancer biology II (incl. stem cells)	Farach-Carson	
11/1/2023	Systems approach to modeling cancer	Karacosta	
11/3/2023	EXAM 2		
11/6/2023	Introduction to radiobiology and significance of radiotherapy for cancer treatment	Schueler	
11/8/2023	Target theory and cell survival curves	Schueler	
11/10/2023	Dose-response relationships in radiotherapy	Schueler	
11/13/2023	LET and RBE	Sawakuchi	
11/15/2023	Response of tumors to radiation	Howell	
11/17/2023	Fractionation: the linear quadratic approach	Howell	
11/20/2023	The linear quadratic approach in clinical practice	Howell	
11/21/2023	Modified fractionation	Howell	T 8-9
11/22/2023	NO CLASS		

11/24/2023	HOLIDAY - NO CLASS	NO CLASS	
11/27/2023	Response of normal tissues to radiation	Fuller	
11/29/2023	Pathogenesis of normal tissue side effects	Fuller	
12/1/2023	Treatment and retreatment tolerance of normal tissues	Fuller	
12/4/2023	The dose rate effect	Schueler	
12/6/2023	The oxygen effect and therapeutic approaches to tumor hypoxia	Schueler	
12/8/2023	FLASH radiotherapy	Schueler	
TBD	FINAL EXAM	9 am to noon	