GS02 1014 - Biological and Biophysical Principles of Molecular Imaging and Therapeutics
Lecture Days / Time / Location: MWF, 9:00-10:30 am, Location 3SCR4.3202b

Primary Textbooks:
- Lippincott's Illustrated Reviews - Biochemistry (4th ed.); Chapme, Harvey, Ferrier; Lippincott, Williams & Wilkins, 2008
- The Biology of Cancer (2nd Edition); Weinberg; Garland Science, 2013

GSBS Holidays: Martin Luther King Jr. Day (1/16), President's Day (1/20), Spring Break (3/13-3/17)

Grading: 4 exams (4 x 25%)

Lecture Contact: Steven Millward (smillward@mdanderson.org)

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<th>Session Section</th>
<th>Topic</th>
<th>Instructor</th>
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<td>Introduction</td>
<td>Course Goals &amp; Objectives</td>
<td>S. Millward</td>
<td>1.5</td>
<td>Mon.</td>
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I: Biomolecules
- Chemistry review; organic chemistry nomenclature
  Instructor: R. Howell
  Hours: 1.5
  Day: Wed.
  Date: 1/11 | 3SCR4.3202b |
- Organic chemistry nomenclature / bonding rules; Water (covalent vs hydrogen bonding, pH)
  Instructor: R. Howell
  Hours: 1.5
  Day: Fri.
  Date: 1/13 | 3SCR4.3202b |
- **NO CLASS**

II: Enzyme and Radiotracer Kinetics
- Thermodynamics and biochemical energetics
  Instructor: R. J. Stafford
  Hours: 1.5
  Day: Wed.
  Date: 1/25 | 3SCR4.3202a |
- Intro to enzymes, specificity
  Instructor: R. J. Stafford
  Hours: 1.5
  Day: Fri.
  Date: 1/27 | 3SCR4.3202b |
- **NO CLASS**

III: Cell Morphology
- The cell membrane; cellular components (membrane & non-membrane bound)
  Instructor: R. J. Stafford
  Hours: 1.5
  Day: Mon.
  Date: 2/6 | 3SCR4.3202b |

EXAM 1
- Physiological properties of cells, including diffusion
  Instructor: R. J. Stafford
  Hours: 1.5
  Day: Wed.
  Date: 2/8 | 3SCR4.3202b |

IV: Energy Conversion
- Principle energy sources; Anaerobic respiration: glycolysis, gluconeogenesis
  Instructor: S. Millward
  Hours: 1.5
  Day: Mon.
  Date: 2/13 | 3SCR4.3202b |
- Aerobic respiration - pyruvate oxidation, TCA cycle
  Instructor: N. Millward
  Hours: 1.5
  Day: Wed.
  Date: 2/15 | 3SCR3.43202b |
- Aerobic respiration - TCA cycle, oxidative phosphorylation, Glycogen metabolism
  Instructor: N. Millward
  Hours: 1.5
  Day: Fri.
  Date: 2/17 | 3SCR4.3202b |
- **NO CLASS**

V: Cellular Genetics
- DNA: Structure, synthesis, and repair
  Instructor: R. J. Stafford
  Hours: 1.5
  Day: Mon.
  Date: 2/27 | 3SCR4.3202b |
- RNA structure; DNA to RNA, Translation
  Instructor: R. J. Stafford
  Hours: 1.5
  Day: Wed.
  Date: 3/3 | 3SCR4.3202a |

EXAM 2
- | Hours: 1.5 |
- | Day: Fri. |
- | Date: 3/3 | 3SCR4.3202b |

VI: Signal Transduction
- Cellular signaling and Signal Transduction
  Instructor: V. Kundra
  Hours: 1.5
  Day: Mon.
  Date: 3/6 | 3SCR4.3202b |
- Receptors & receptor binding
  Instructor: V. Kundra
  Hours: 1.5
  Day: Wed.
  Date: 3/9 | 3SCR4.3202a |

EXAM BREAK

- Applications: Genetically Encoded Reporter Strategies
  Instructor: D. Pliwnica-Worms
  Hours: 1.5
  Day: Mon.
  Date: 3/20 | 3SCR4.3202b |

VII: Cell Division, Growth, & Death
- Cell growth: Phases of cell cycle, control of cell cycle, mitosis; Quiescence; Differentiation
  Instructor: R. J. Stafford
  Hours: 1.5
  Day: Wed.
  Date: 3/22 | 3SCR4.3202a |
- Stem cells
  Instructor: R. J. Stafford
  Hours: 1.5
  Day: Fri.
  Date: 3/24 | 3SCR4.3202b |
- **NO CLASS**

EXAM 3
- Cell Death: Apoptosis, Autophagy, and Necrosis
  Instructor: S. Millward
  Hours: 1.5
  Day: Mon.
  Date: 3/27 | 3SCR4.3202b |
- Applications: In vivo Optical Imaging
  Instructor: S. Gammon
  Hours: 1.5
  Day: Wed.
  Date: 3/29 | 3SCR4.3202a |

EXAM BREAK

VIII: From Cells to Tissues
- Cell junctions & extracellular matrix
  Instructor: R. J. Stafford
  Hours: 1.5
  Day: Mon.
  Date: 4/3 | 3SCR4.3202b |
- Extracellular Matrix II, Tumor-stroma concept
  Instructor: R. J. Stafford
  Hours: 1.5
  Day: Wed.
  Date: 4/5 | 3SCR4.3202a |

EXAM 4
- Applications: Magnetic Resonance Spectroscopy
  Instructor: P. Bhattacharya
  Hours: 1.5
  Day: Fri.
  Date: 4/7 | 3SCR4.3202b |

IX: Basics of Cancer Biology
- Tumor cell characteristics; transformation / carcinogenesis
  Instructor: R. J. Stafford
  Hours: 1.5
  Day: Mon.
  Date: 4/10 | 3SCR4.3202b |
- Oncogenes: Tumor Suppressors, Growth Factors, Signaling
  Instructor: S. Millward
  Hours: 1.5
  Day: Wed.
  Date: 4/12 | 3SCR4.3202a |
- Hypoxia, Angiogenesis, and inflammation
  Instructor: S. Millward
  Hours: 1.5
  Day: Fri.
  Date: 4/14 | 3SCR4.3202b |
- Invasion, Metastasis, and Replicative Immortality
  Instructor: S. Millward
  Hours: 1.5
  Day: Mon.
  Date: 4/17 | 3SCR4.3202b |

X: Applications
- Critical Analysis of Biomedical Imaging Literature
  Instructor: S. Millward
  Hours: 1.5
  Day: Fri.
  Date: 4/21 | 3SCR4.3202b |
- Review
  Instructor: S. Millward
  Hours: 1.5
  Day: Fri.
  Date: 4/28 | 3SCR4.3202b |

EXAM 4
- | Hours: 1.5 |
- | Day: Mon. |
- | Date: 5/1 | 3SCR4.3202b |

Faculty
Steve Millward, Ph.D. Assistant Professor, Cancer Systems Imaging - Course Coordinator
R. Jason Stafford, Ph.D. Associate Professor, Imaging Physics
Rebecca Howell, Ph.D. Assistant Professor, Radiation Physics
Vikas Kundra, M.D., Ph.D. Professor, Diagnostic Radiology / Cancer Systems Imaging
Niki Millward, Ph.D. Assistant Professor, Cancer Systems Imaging
Seth Gammon, Ph.D. Assistant Professor, Cancer Systems Imaging