Bio 402/502 Advanced Cell Biology Fall, 2017

This course covers a wide range of topics in cell biology and cellular aspects of developmental biology. Emphasis is placed on the basic concepts and the experimental underpinnings that support these concepts. Students who successfully complete this course will acquire in depth understanding and advanced knowledge of a range of specialized areas in cell and developmental biology. They will further develop insight into the complexities of cell structure and function, the molecular events that mediate cellular processes, their dynamic properties in living cells and how this contributes to the functioning of the whole organism and its development.

Instructors: Professors Ron Berezney (Course Coordinator), berezney@buffalo.edu, Paul Cullen, pjcullen@buffalo.edu, and Steve Free, free@buffalo.edu. **Classes meet M,W,F 11:20 am –12:30 pm, Cooke 127B; EXAMS, 7 PM- 9 PM, Talbert 107**

Section I Cell Biology Methods; Biomembranes; Electron Transport & ATP Synthesis; Membrane Proteins; Cell Surface Receptors and Signal Transduction

Dr. Berezney (10 lectures, August 28th- September 20st)

Experimental Methods in Cell Biology	(Berezney: 4 lect, Aug. 28, 30, Sept 1, 6)
Membrane Structure and Dynamics	(Berezney: 1 lect, Sept 8)
Electron Transport and Oxidative Phosphorylation	(Berezney: 2 lect, Sept 11,13)
Cell Surface Receptors and Signal Transduction	(Berezney: 1 lect, Sept 15)
G-protein linked Cell-Surface Receptors	(Berezney: 1 lect, Sept 18)
Protein-kinase linked Cell-Surface Receptors	(Berezney: 1 lect, Sept 20)

Exam 1 (Proctor: Berezney, September 26th, 7-9 pm, TALBERT 107)

Section II Protein Secretion, Trafficking & Degradation; Signal Transduction; Cytoskeleton & Cell Motility; Extracellular Matrix & Cell-Cell Interactions

Dr. Cullen (12 lectures, September 22rd - October 18th)

Protein Delivery to the ER, Golgi, Exocytosis	(Cullen: 1 lect, Sept. 22)
Protein Glycosylation and unfolding	(Cullen: 1 lect, Sept. 25)
Golgi, Snares, COPs and Arfs	(Cullen: 1 lect, Sept. 27)
PI Signaling and Vesicle Identity	(Cullen: 1 lect, Sept. 29)
Protein Targeting: Peroxisome/Mitochondria	(Cullen: 1 lect, Oct. 2)
Cell Polarity - Actin Cytoskeleton	(Cullen: 1 lect, Oct. 4)
Cell Polarity - Microtubules	(Cullen: 1 lect, Oct. 6)
Origins of Cell Adhesion	(Cullen: 1 lect, Oct. 9)
Cell Adhesion Molecules, Integrins and Mucins and The Extracellular Matrix	(Cullen: 1 lect, Oct. 11)
Cell Polarity Regulation and Signal Transduction	(Cullen: 1 lect, Oct. 13)
Genomics Approaches to Cell Biology	(Cullen: 2 lect, Oct. 16,18)

Exam 2 (Proctor: Cullen, October, 24th, 7-9 pm, TALBERT 107)

Section III Developmental Systems in Cell Biology

Dr. Free (10 lectures, October 20th – November 10th)

Developmental strategies - maternal inheritance and regulative development	(Free: 1 lect, Oct. 20)
Early Drosophila development - pattern formation - maternal and gap genes	(Free: 1 lect, Oct. 23)
Research Literature Reading on early Drosophila development/Discussion	(Free: 1 lect, Oct. 25)
Drosophila development - cell/cell communications	(Free: 1 lect, Oct. 27)
Research Literature Reading on Drosophila development/Discussion	(Free: 1 lect, Oct. 30)
Justacrine Signaling	(Free: 1 lect, Nov 1)
Vertebrate Limb Development	(Free: 1 lect, Nov 3)
Vertebrate sex determination	(Free: 1 lect, Nov. 6)
Brain Development	(Free: 1 lect, Nov 8)
Apoptosis	(Free: 1 lect, Nov.10)

Exam 3 (Proctor: Free, November 14th, 7-9 pm, TALBERT 107)

Section IV Cell Nucleus and Genomic Function; Cell Cycle & the Regulation of Cell Proliferation

Dr. Berezney (10 lectures, November 13th- December 8th)

The Cell Nucleus and its Genome	(Berezney: 1 lect, Nov. 13)
Nuclear Envelope, NPC, Nucleolus and Nuclear Matrix	(Berezney: 1 lect, Nov. 15)
Replication/Transcription/Splicing in the Nucleus	(Berezney: 2 lect, Nov. 17, 20)
Nuclear Import/Export and Targeting	(Berezney: 2 lect, Nov. 27, 29)
Cell Cycle and the Regulation of Cell Proliferation	(Berezney: 4 lect, Dec. 1,4,6,8)

Exam 4 (Proctor: Berezney, Tuesday, December 12th, 3:30 – 5:30 pm – NSC 228)

Textbook and Assignments:
Molecular Biology of the Cell (Alberts et al., 5th or 6th edition, Garland Science, 2008 (15)
Reference Reading: Cell & Molecular Biology (Karp, 5th, 6th, or 7th edition, John Wiley, 2008/10/12).
Reading assignments will be from Alberts and/or Karp and/or additional readings provided by your instructor. Alberts is generally more comprehensive and cover cellular aspects of developmental biology for Section III of the course. Karp is often superior in writing style and simplicity of explanations. **Copies of Karp (6th edition) and one copy of Alberts (5th edition) are on reserve in the Undergraduate Library.** The instructor for each section of the course will provide a detailed list of reading and other assignments prior to the beginning of their lectures. Each instructor will determine which of these assignments, power point lecture slides (optional) and other information on the course will be available on the **UB Learns site.**

Course Evaluation: Grading will be based on four written in-class exams. **Each of the 4 exams will count 25% of the final grade which will be based on the total points earned on the four exams.** The first 3 exams will be in **107 TALBERT HALL from 7-9 PM** on the designated dates. The last exam **(Exam 4)** will be held during the scheduled time and room assigned for final exams as stated above **(NSC 228)**. The exams will be composed of questions with short answers as well as possibly questions with longer answers. Each instructor will devise and grade his own exam and provide information to the students as to the exam format. Graduate and undergraduate students will take the same exam and be evaluated separately.

ADVISE

Take good notes. Students need to fully understand the lectures, e.g., the power point slides.

Read and re-read the textbook assignments and other texts as necessary to fully understand the topics and to correlate with the lectures and power point slides.

ASAP read Chapters 2 & 3 of Karp or Alberts (also basic information on DNA/RNA in other chapters) to review basic biochemistry. If you detect significant deficiencies, see Dr. B.

COURSE OUTCOME OBJECTIVES AND ASSESSMENT

This class is designed to meet specific learning objectives for students in Bio 402 and Bio 502 which are based on the overall Program Outcomes of the Department of Biological Sciences. The specific objectives of this course along with the related overall program learning outcome of our Department are listed in the table below. Assessment of reaching these objectives is determined by grades on four written exams – one for each section of the course. These objectives are achieved if at least 70% of Bio 402 students obtain at least 55% of the total exam points and at least 70% of Bio 502 students obtain at least 70% of the total exam points.

	Program Learning Outcome	Specific Outcome objectives	Assessment Instrument
1	Provide breadth of knowledge of basic principles and concepts	Master a wide range of basic concepts in cell and cellular developmental biology. Develop an appreciation of the intricacies of cell structure and function, their dynamic properties in living cells and how this contributes to the functioning of the whole organism and its development.	Exams 1,2,3,4
2	Provide depth within specialized areas	Students will acquire in depth understanding and advanced knowledge of a range of specialized areas in cell and developmental biology and obtain a detailed understanding of how cellular processes are mediated by hierarchical levels of organization from molecules to whole cells to cell-cell interactions.	Exams 1,2,3,4
3	Provide an understanding of experimental design and	Experimental **underpinnings of** selected topics in cell biology are developed in depth. Major molecular and cellular techniques and methods used to study cell organization and function are	Exams 1,2,3,4

	methodology	covered.	
4	Develop approaches for integration of information	Examples are presented that integrate information from molecular events to cellular structures to cellular functions.	Exams 1,2,3,4
5	Encourage critical thinking and hypothesis building	Emphasis is placed on critical thinking of how specific experimental findings support basic concepts as well as considering alternative interpretations of the findings. Quantitative analysis skills will be developed by studying examples of quantitative approaches used to analyze cell structure and function and the strengths and weaknesses of these approaches.	Exams 1,2,3,4
6	Provide contemporary information	Exposure to recent findings in the topics studied and the application of modern interdisciplinary approaches to cell biology such as bioinformatics and computer image analysis of microscopic studies.	Exams 1,2,3,4