1. **BIO 330 Cell Biology**

**Ferrum College**

**Program: Biology School: Natural Sciences and Mathematics**

1. **Instructor:** Instructor Name: Dr. Jinnie Garrett

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Office Hours: T 1:30-3:30, W 10:00-12:00

1. **Class Meeting Time: TR 9:30-10:50 Garber 305; Lab: M 1:00-4:00 Garber 200**
2. **Textbooks and Materials:**
	1. Alberts *et al* (2013) Essential Cell Biology 4th edition. Garland Science New York
	2. Lab Manual – Online
	3. Materials posted on Brightspace and referenced on course social media
3. **Catalog Course Description:**

An introduction to the fundamental unit of biological organization. Topics include cellular structure, membrane structure and function, cellular energetics, cell synthesis and growth and cellular genetics.

1. **Purpose/Rationale for this Course:**

The cell is the smallest unit of an organism that is classified as living, and is often called the building block of life. Thus, knowing the components of a cell and understanding how cells function is central to all biological sciences from molecular biology to ecology.

1. **Instructional Methodology and Use of Technology**

This course will be a lecture- and discussion-based course that will also include readings and student-led discussions of scientific articles. **The instructor will use the Angel Web site for the course and PowerPoint lectures and assignments will be available on the web site**. Practical work in the laboratory is designed to build a student’s competence and confidence in designing and completing experiments in cell biology.

1. **College and Course Outcomes**

**College-wide Student Learning Outcomes**

Students will learn about the molecular structure and multiple functions of cells. They will examine how cellular organelles contribute to the complex interplay of pathways that maintain cellular homeostasis. And distinguish how different cell types perform specialized functions within an organism. Laboratory work will illustrate and reinforce these principles and provide the student with the opportunity see the scientific method in action. They will gain hands on experience with the scientific process through several experiments and descriptive studies.

In this course, students will learn to:

1. Define key terms and concepts currently used in the study of cell biology.
2. Explain the structure/function relationships of each of the cellular organelles.
3. Demonstrate understanding of the importance of cell membranes and cell signaling in cell structure and function.
4. Consider the role of cell cycle control in the vital processes of growth, differentiation, aging, death and cancer.
5. Analyze and interpret experimental results using critical thinking skills and quantitative analysis, both in their own laboratory experiments and in published papers.
6. Apply the scientific method in the implementation and analysis of laboratory and published experiments .
7. Evaluate the ELSI (ethical, legal and social implications) of a controversial development in cell biology and communicate their conclusions to peers from diverse academic and socio-cultural backgrounds.

By successfully achieving these course goals students will meet the following college-wide and program student learning outcomes:

**College-wide Student Learning Outcomes**

* **Students will demonstrate an integrated knowledge in the liberal arts.**
	+ Course goal: Students will be able to design a thesis project that integrates knowledge from multiple subjects.
		- Instruction methodologies used will be lecture and peer feedback.
		- This goal will be assessed by faculty and peer evaluation of student poster presentations of their proposed thesis idea.

**College-wide Student Learning Outcomes**

* **Program Student Learning Outcomes**

**Students will demonstrate a depth of knowledge, capability and ethical reasoning in a chosen field.**

* **Biology graduates will demonstrate knowledge and understanding of fundamental biological principles and the evidence and reasoning that support them.**
* Course goals:
* Define key terms and concepts currently used in the study of cell biology.
* Explain the structure/function relationships of each of the cellular organelles.
* Demonstrate understanding of the importance of cell membranes and cell signaling in cell structure and function.
* Consider the role of cell cycle control in the vital processes of growth, differentiation, aging, death and cancer.
* Evaluate the ELSI (ethical, legal and social implications) of a controversial development in cell biology.
* Instructional strategies used to support this goal include lecture, assigned readings, quizzes and class interactive assignments.
* This goal will be assessed based on student success in multiple course assessments.

**Students will demonstrate competency in quantitative skills and reading, and information literacy, using available technology when appropriate.**

* **Biology graduates will use quantitative reasoning skills to sample, analyze, and interpret data for problem solving and to sample, analyze, and interpret numerical data.**
* Course Goal:
* Analyze and interpret experimental results using critical thinking skills and quantitative analysis, both in their own laboratory experiments and in published papers.
* Instructional strategies used to support this goal include laboratory exercises and class analytical exercises.
* This goal will be assessed by the results and conclusions sections of lab reports, and students’ performance on problem-based exercises.

**Students will think critically and solve problems through analysis, evaluation and inference.**

* Biology graduates will use and understand relevant methods, tools and techniques in all areas of biology.
* Course Goal:
* Apply the scientific method in the implementation and analysis of laboratory experiments.
* Instructional strategies used to support this goal include laboratory exercises and class analytical exercises.
* This goal will be assessed by student success on major laboratory reports and problem-based exercises.

**Students will demonstrate awareness of local, national and global issues using ethical reasoning in a chosen field.**

**Communicate with unity of purpose and coherent organization consistent with standard rules and recognized conventions using appropriate methodologies.**

* Biology graduates should understand the relevance of biology to concerns of society.
* Course Goal:
* Apply the ELSI (ethical, legal and social implications) of a controversial development in cell biology and communicate their conclusions to peers from diverse academic and socio-cultural backgrounds.
* Instructional strategies used to support this goal, collaborative research and academic exchange with students in a business course (Business, Government and Society) at Trinity Washington University.
* This goal will be assessed by student performance on the poster developed in collaboration with students from Trinity Washington Business program.
1. **Course Requirements/Assignments**
2. **Energy In = Reward Out!** Come to class and come prepared, having read the assigned materials. Quizzes may be given without advance notice and may occur at the beginning or end of class. In-class assignments and quizzes cannot be made up at a later date.
3. Assignments must be turned in on time. There will be a 10% deduction from your grade for every day your assignment is late
4. Turn off all cell phones, ipods, and any other electronic devices at the start of class. It is inconsiderate to your fellow classmates and professor, and disruptive to the learning environment, to have interruptions during class time. Repeat offenders will experience consequences including confiscation of devices, peer censure, or being asked to leave the class. Laptops and tablets will be allowed for taking notes **so long as they are used appropriately and are not disruptive to the class.**
5. Class absence may be excused by the instructor for documented illness or injury. Student requests to miss class for other reasons (job or grad school interview, family emergency etc) will be considered on a case-by-case basis. Timely requests, when possible, will be more likely to get a favorable response.

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| **Percentage of Grade** | **Due Date** | **Brief Description** |
| **20%** | **09/29, 11/05** | **Exams (2 x 10%)** |
| **20%** | **Throughout course** | **Class Participation**  |
| **30%** | **Throughout course** | **Lab Quizzes, Exercises and Reports. Detail TBA** |
| **5%** | **11/30** | **Model Organism paper and presentation** |
| **10%** | **TBA – late October** | **TWU** |
| **15%** | **12/10** | **Final Exam**  |

***Exams:*** *You will have three exams throughout the class. These will be based on lecture material, assigned readings, and class/homework assignments. Exams will be short answer, and/or problem-based. The Final Exam for the semester will be cumulative consisting of information from the entire semester but will emphasize material in the final third of the course.*

***Class Participation:*** *The class participation portion of your grade will include your attendance, participation in discussions, and completion of class assignments, for example KWL? and Just-in-Time ?s. You will also be required to engage in online discussions through Brightspace and social media (will be explained in class)*

***Lab Worksheets and Reports****: During the lab portion of the course there will be several one or two week laboratories for which you will complete the assigned data analysis/question worksheet. There will also be a major, multi-week experiment that you will complete with your fellow students. There will be major lab reports that you will write in the style of scientific journal articles to accompany each of these multi-week experiments. These will be further explained in class.*

***Model organism paper and presentation:****: Working in groups, you will be required to select a recent paper discussing a topic covered during the semester in which one of the ‘model organisms’ (yeast, Arabadopsis, C.elegans, Drosophila, zebrafish, mouse) is used as the experimental organism. You should prepare an overview of the research to present to the class during lab as an 8-10min oral presentation and also hand in a 2-page summary of your paper.*

1. **Evaluation and Grading Evaluation Scale A=90-100**

**B=80-89**

**C=70-79**

**D=60-69**

**F=0-59**

1. **Attendance Policy:**

Attendance will be taken at the start of every class. Two unexcused absences are allowed. Absence from lab will count as two unexcused absences. Do not miss lab, these cannot be rescheduled for you to make up. Excused absences are at my discretion, if you know there will be a conflict, please see me as soon as possible. It is the student’s responsibility to find out what they missed during their absence and to make up any missed work. College policy dictates that attendance is required at a minimum of three-fourths of all class meetings in order to receive credit in the course.

1. **Academic Integrity:**

In all instances, policies identified in the Ferrum College Catalog and the Ferrum College Student and Faculty Handbooks regarding the Honor System shall be followed. Students are expected to display academic integrity at all times and in all circumstances.

1. **Disability Services:**

As directed by Ferrum College’s policy, any student with a disability who qualifies for and seeks academic accommodations (such as testing or other services) must work through the Office for Academic Disability Services. The office is located the Academic Resources Center 110 and the Director may be reached at 365-4262 or nbeach@ferrum.edu . Please remember that accommodations cannot be granted retroactively; they must be requested in a timely manner before the accommodation is needed.

**Tentative Lecture and Discussion Syllabus**

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| Wk | Date | Topic | Reading  |
| 1 | 09/01 | The unity and diversity of cells | 1,  |
|  | 09/03 | Techniques and technologies | 1, 2 |
| 2 | 09/08 | Macromolecules, enzymes and proteins | 3, 4 |
|  | 09/10 | Macromolecules, nucleic acids | 5 |
| 3 | 09/15 | Membrane structure | 11 |
|  | 09/17 | Membrane transport | 12 |
| 4 | 09/22 | Membrane transport 2 | 12 |
|  | 09/24 | Discussion and Exam Review |  |
| 5 | 09/29 | Exam 1 |  |
|  | 10/01 | Cell components. 1. Nucleus | 5, 15 |
| 6 | 10/06 | 2. Mitochondria | 14, 15 |
|  | 10/08 | 3. Chloroplasts | 14, 15 |
| 7 | 10/13 | 4. Secretory pathway | 15 |
|  | 10/15 | FALL BREAK  |  |
| 8 | 10/20 | Project with TW | TBA |
|  | 10/22 | Project with TW | TBA |
| 9 | 10/27 | Cell/cell communication | 16 |
|  | 10/29 | Cont. | 16 |
| 10 | 11/03 | Discussion and Exam Review |  |
|  | 11/05 | Exam 2 |  |
| 11 | 11/10 | Cytoskeleton | 17 |
|  | 11/12 | JMG at conference: Cell Division lecture TBA | 18 |
| 12 | 11/17 | Cell Cycle Control | 18, 19 |
|  | 11/19 | Cell aging and death |  |
|  | 11/21-11/29 | THANKSGIVING BREAK |  |
| 13 | 12/01 | Stem cells & Cancer | 20 |
|  | 12/03 | Stem cells & Cancer | 20 |
| 14 | 12/08 | Review for Final |  |
|  | 12/11 | 10:30am-12:30pm | Final Exam |

**Bio330 Lab Syllabus**

This sequence of labs involves a series of introductory experiments to familiarize you with some common techniques in cell and molecular biology and then a 5-week project in which you will analyze the protein localization signals in a mitochondrial protein using fusion constructs in yeast.

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| Lab Number | Date | Topic |
| 1 | 08/31 | Introduction. |
| 2 | 09/7 | Overview of techniques: Accuracy and sterile technique |
| 3 | 09/14 | Bradford protein assay |
| 4 | 09/21 | Tyrosinase enzyme activity assay – Purification  |
| 5 | 09/28 | Tyrosinase enzyme activity assay – Kinetics |
| 6 | 10/05 | Microscopy and use of hemocytometer |
| 7 | 10/12 | Cell fractionation |
| 8 | 10/19 | Plasmid purification  |
| 9 | 10/26 | Plasmid analysis and yeast transformation |
| 10 | 11/02 | Protein localization in yeast 1 (cell fractionation) |
| 11 | 11/09 | Protein localization in yeast 2 (fraction analysis) |
| 12 | 11/16 | Protein localization in yeast 3 (Western blotting) |
|  | 11/23 | No Lab: Thanksgiving Break 11/22-11/30 |
| 13 | 11/30 | Student presentations |