The George Washington University  
Biochemistry Graduate Program  

New Technologies in Scientific Research (BIOC 6230)  
Spring Semester 2021  
January 12 - April 27, Tuesdays, Hours: Time 6-8 PM

Course Co-Directors: Dr. Manjari Dimri and Dr. Brett Shook  
Dr. Manjari Dimri    Dr. Brett Shook  
Ross Hall 205      Ross Hall 205  
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Email: mdimri@gwu.edu                  Email: brettshook@gwu.edu

Course Prerequisites:  
● BIOC 6221 or equivalent  
● BIOC 6222 - Biochemical Genetics and Medicine (enrollment co-requisite)

Course Purpose and Overview:  
The main purpose of this course is to introduce students to new technologies for conducting meaningful scientific inquiry and research. Over the past decade, new technologies have evolved and are now considered essential to investigative research. This course will deepen the students’ understanding of basic concepts of these newer technologies and provide knowledge necessary to apply these modern methods to solve research problems.

Course Learning Objectives:  
By the conclusion of this course, students should be able to:

1. Demonstrate advanced knowledge of the role of each technology in scientific research  
   Achievement of this objective is assessed via course requirements 1, 2 and 3.

2. Discuss the benefits and limitations of each technology with respect to its implementation.  
   Achievement of this objective is assessed via course requirements 1, 2 and 3.

3. Apply the concepts of these technologies to scientific research.  
   Achievement of this objective is assessed via course requirements 1, 2 and 3.

Technologies for above three course learning objectives include Mass Spectrometry, CRISPR, ChIP-Seq, RNA sequencing, Disease modeling using iPSCs, Imaging (confocal, live and intravital), Metabolomics, Flow cytometry, CyTOF, Cryogenic Electron microscopy, 3D-organoid cultures and 3D-Bioprinting.

Academic Preparation for Learning:  
Number of credits: 2 Credits

Credit Hour Policy: Over 15 weeks, students will spend 2 hours (100 minutes) per week in lecture. Homework, required readings and other out of class work is estimated at around 5 hours (300 minutes) per week (75 hours for the semester) and includes a final project due at the end of semester for which approximately 10 hours of independent work is assumed. Over the course of the semester, students will spend 26 hours in direct instructional time and 75 hours on independent learning.
Course Materials:

Required Texts and Readings: will be provided by instructors

Course Requirements: Assignments, Deadlines:

1. Class Participation (ongoing)  
   Grade (% of total): 10%
   Students are expected to complete all assigned pre work prior to each session so that all can engage in meaningful discussion and learning. On-time mandatory attendance is expected for all class sessions. Missed sessions will require additional assignments or be subject to a course grade reduction.

2. Quiz/Test  
   Twelve assessment Quiz are scheduled for Jan. 22, 29, Feb. 5, 12, 19, 26, March 5, 12, 26, April 2, 9, and 16. Each quiz accounts for 5% of total grade  
   Grade (% of total): 60%

3. Final Group Project (Due: April 16, 23)  
   Grade (% of total): 30%
   Students will work in groups to prepare a final project using at least four of the new technologies learnt during the semester. Final projects will be turned in as a 15 minute group presentation in class.

Missed Exam Policy  
To be eligible to schedule a make-up exam, you must have e-mailed or spoken with the course director prior to missing an exam or given timely notification that you were sick on the day of the exam.

Student Evaluation: will be based on
1. Graded quiz/tests (Quiz 1-12; 5% each, 60% of total)
2. In class participation and Attendance (10 % of total)
3. Final Project -(30 % of total)

Grading  
The grading scale will be as follows:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Required points</th>
<th>Grade</th>
<th>Required points</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>91-100</td>
<td>C+</td>
<td>75-78</td>
</tr>
<tr>
<td>A-</td>
<td>89-90</td>
<td>C</td>
<td>70-74</td>
</tr>
<tr>
<td>B+</td>
<td>86-88</td>
<td>C-</td>
<td>65-69</td>
</tr>
<tr>
<td>B</td>
<td>81-85</td>
<td>F</td>
<td>≤ 64</td>
</tr>
<tr>
<td>B-</td>
<td>79-80</td>
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Course Topics and Lecture Schedule:

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topics</th>
<th>Assignments</th>
<th>Lecturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>January 12</td>
<td>Mass Spectrometry</td>
<td>None</td>
<td>Dr. Huadong Pei</td>
</tr>
<tr>
<td>2.</td>
<td>January 19</td>
<td>Cryogenic Electron Microscopy</td>
<td>QUIZ 1 (mass spectrometry)</td>
<td>Dr. Anastas Popratiloff</td>
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<tr>
<td>Week</td>
<td>Date</td>
<td>Topic</td>
<td>Quiz</td>
<td>Instructor</td>
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<td>3</td>
<td>January 26</td>
<td>CRISPR</td>
<td>QUIZ 2 (cryo-EM)</td>
<td>Dr. Ed Seto</td>
</tr>
<tr>
<td>4</td>
<td>February 2</td>
<td>Modeling Human Disease using iPSCs</td>
<td>QUIZ 3 (CRISPR)</td>
<td>Dr. Valerie Hu</td>
</tr>
<tr>
<td>5</td>
<td>February 9</td>
<td>Metabolomics (Seahorse Tech)</td>
<td>QUIZ 4 (Modeling dis-iPSCs)</td>
<td>Dr. Jiyoungh Lee</td>
</tr>
<tr>
<td>6</td>
<td>February 16</td>
<td>Imaging (confocal, live cell and Intravital imaging)</td>
<td>QUIZ 5 (metabolomics)</td>
<td>Dr. Jiyoungh Lee</td>
</tr>
<tr>
<td>7</td>
<td>February 23</td>
<td>Flow cytometry</td>
<td>QUIZ 6 (Imaging)</td>
<td>Dr. Brett Shook</td>
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<tr>
<td>8</td>
<td>March 2</td>
<td>CyTOF (mass cytometry)</td>
<td>QUIZ 7 (Flow cytometry)</td>
<td>Dr. Brett Shook</td>
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<tr>
<td>9</td>
<td>March 9</td>
<td>RNA-sequencing</td>
<td>QUIZ 8 (mass cytometry)</td>
<td>Dr. Xiaowen Zhang</td>
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<tr>
<td></td>
<td>XXXX</td>
<td>SPRING BREAK - NO CLASS</td>
<td>XXXX</td>
<td>XXXXXXXXXX</td>
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<tr>
<td>10</td>
<td>March 23</td>
<td>ChIP-sequencing</td>
<td>QUIZ 9 (RNA seq)</td>
<td>Dr. Ray-Chang Wu</td>
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<tr>
<td>11</td>
<td>March 30</td>
<td>3D organoid cultures</td>
<td>QUIZ 10 (ChIP seq)</td>
<td>Dr. Manjari Dimri</td>
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<tr>
<td>12</td>
<td>April 6</td>
<td>3D Bioprinting</td>
<td>QUIZ 11 (3D organoids)</td>
<td>Dr. Grace Zhang</td>
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<tr>
<td>13</td>
<td>April 13</td>
<td>Final project reviews/feedback</td>
<td>QUIZ 12 (3D-bioprinting)</td>
<td>Drs. Manjari Dimri and Brett Shook</td>
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<tr>
<td>14</td>
<td>April 20</td>
<td>None</td>
<td>Final Group Project</td>
<td>Drs. Brett Shook and Manjari Dimri</td>
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<tr>
<td>15</td>
<td>April 27</td>
<td>None</td>
<td>Final Group Project</td>
<td>Drs. Manjari Dimri and Brett Shook</td>
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**University Policies:**

**University policy on observance of religious holidays:**
In accordance with University policy, students should notify faculty during the first week of the semester of their intention to be absent from class on their day(s) of religious observance.

Students should notify faculty during the first week of the semester of their intention to be absent from class on their day(s) of religious observance. Faculty should extend to these students the courtesy of absence without penalty on such occasions, including permission to make up examinations. Faculty who intend to observe a religious holiday should arrange at the beginning of the semester to reschedule missed classes or to make other provisions for their course-related activities. For details and policy, see: students.gwu.edu/accommodations-religious-holidays.

**GWU Code of Academic Integrity:**
Academic dishonesty is defined as cheating of any kind, including misrepresenting one's own work, taking credit for the work of others without crediting them and without appropriate
authorization, and the fabrication of information. For details and complete code, see: studentconduct.gwu.edu/code-academic-integrity

Safety and security
In the case of an emergency, if at all possible, the class should shelter in place. If the building that the class is in is affected, follow the evacuation procedures for the building. After evacuation, seek shelter at a predetermined rendezvous location.

Adverse Weather/Class cancellation
The instructor will follow the recommendations of the GWU in the event of severe weather or other threats. Students should call the university hotline at 202-994-5050 or check online at www.gwumc.edu. The course director will adjust the class schedule in the event of cancelled classes.

Support for students outside the classroom:

Disability Support Services (DSS)
Any student who may need an accommodation based on the potential impact of a disability should contact the Disability Support Services office at 202-994-8250 in the Rome Hall, Suite 102, to establish eligibility and to coordinate reasonable accommodations. For additional information see: disabilitysupport.gwu.edu/

Mental Health Services 202-994-5300
The University's Mental Health Services offers 24/7 assistance and referral to address students' personal, social, career, and study skills problems. Services for students include: crisis and emergency mental health consultations confidential assessment, counseling services (individual and small group), and referrals. For additional information see: counselingcenter.gwu.edu/