BIOS-524/BIOS-594
Concepts in Biochemistry and Molecular Biology
Semester: Fall 2018
General Course Information

**DESCRIPTION OF GOALS AND PLANS**

This is a 5-credit-hour combination of two courses – BIOS-524 and BIOS-594. Students should register for BIOS-524 (CRN 12352; MWF, 3 credits) and BIOS-594 (CRN 29210; MW, 2 credits) courses (3 + 2 = 5 total credit-hours). Students will learn the following basic concepts in biochemistry and molecular biology:

<table>
<thead>
<tr>
<th>Part of the Course</th>
<th>Covered Topics</th>
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</table>
| **Module 1 (BIOS-524)**  
(Prof. Constance Jeffery) | • Structure and function of proteins;  
• Basic principles of enzyme action and enzyme kinetics;  
• Principles of basic experimental approaches in molecular biology and biochemistry research such as recombinant protein expression, standard protein purification, basic steps in X-ray crystallography and protein structure determination;  
• Critical reading and analysis of key publications in the field; |
| **Module 2 (BIOS-524)**  
(Prof. Brian Kay) | • Synthesis, structure and function of nucleic acids;  
• Principles of DNA cloning, DNA sequencing as well as other most common and most widely used techniques for manipulating DNA molecules;  
• Critical reading and analysis of key publications in the field; |
| **Module 3 (BIOS-594)**  
(Prof. Donald Morrison) | • Synthesis of RNA;  
• Regulated flow of genetic information;  
• Principles of DNA sequencing and gel blotting methods;  
• Critical reading and analysis of key publications in the field; |
| **Module 4 (BIOS-594)**  
(Prof. Yury Polikanov) | • Central dogma of molecular biology;  
• Structure, function and diversity of cellular RNA molecules;  
• Principles of RNA structure;  
• Genetic code;  
• Protein metabolism: synthesis, modification, targeting, degradation;  
• Principles of ribosome structure and function;  
• Critical reading and analysis of key publications in the field; |
CLASS TIME AND PLACE

9:00 – 10:30 AM on Mondays, Wednesdays, and Fridays at MBRB (building 919) conference room 4300.

INSTRUCTORS

<table>
<thead>
<tr>
<th>Instructor</th>
<th>E-Mail</th>
<th>Office Phone</th>
<th>Office Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. Constance Jeffery</td>
<td><a href="mailto:cjeffery@uic.edu">cjeffery@uic.edu</a></td>
<td>312-996-3168</td>
<td>MBRB-4252</td>
</tr>
<tr>
<td>Prof. Brian Kay</td>
<td><a href="mailto:bkay@uic.edu">bkay@uic.edu</a></td>
<td>312-355-0668</td>
<td>MBRB-4318</td>
</tr>
<tr>
<td>Prof. Donald Morrison</td>
<td><a href="mailto:damorris@uic.edu">damorris@uic.edu</a></td>
<td>312-996-6839</td>
<td>MBRB-4102</td>
</tr>
<tr>
<td>Prof. Yury Polikanov</td>
<td><a href="mailto:yuryp@uic.edu">yuryp@uic.edu</a></td>
<td>312-413-2408</td>
<td>MBRB-4170</td>
</tr>
</tbody>
</table>

* Lectures/discussions and professors’ offices are located on the 4th floor of the MBRB building at 900 South Ashland Avenue. Enter the door facing Marshfield Avenue, because the other doors are usually locked.

COURSE PHILOSOPHY

BIOS-524 combined with BIOS-594 comprise the molecular biology course foundation for graduate training in the Department of Biological Sciences. The goal of the course is to familiarize students with concepts and experimental approaches in a wide range of molecular biology research. Students are expected to achieve a high degree of competence in reading, understanding, evaluating, and applying the research literature. Students should complete the course with a working understanding of many topics in biochemistry and molecular biology, and should be able to apply this knowledge creatively and realistically to propose novel and plausible solutions to current problems in molecular biology research. Altogether this course is a mixture of lectures and discussions adjusted at the discretion of the instructors. When possible, current “hot topics” and approaches are incorporated into the material.

Questions or comments about this course should be directed to Don Morrison (coordinator for the course), or to individual instructors. Students are encouraged to come to the instructors with problems, comments, or suggestions they may have about the contents and/or style of the course.

TEXTBOOKS

Molecular Biology Principles and Practice
Authors: Cox, Doudna, and O’Donnell
Note: this is an excellent molecular biology reference that is worth having on your desk. This book provides a basic foundation in each area, and is used as a reference for students needing background on various topics. In general, lectures do not cover the material contained in the text, but assume that you have read and mastered that material, and go further, relying on journal publications for a majority of the information presented in class.
Lehninger's Principles of Biochemistry, Sixth edition
Authors: D. L. Nelson and M. M. Cox
Publisher: W. H. Freeman (www.whfreeman.com)
Other editions of the textbook contain most of the same information about biochemistry, however, there are some minor differences in the covered material and its presentation.

ADDITIONAL SOURCES
As you encounter methods that are new or unclear to you (and you will), two additional resources should be consulted freely: Current Protocols in Molecular Biology and Current Protocols in Protein Science (available online through UIC Electronic Journals at http://library.uic.edu/home/collections/journals/), and Molecular Cloning (Sambrook and Russell; Cold Spring Harbor Laboratory Press). These books give the details of, and explain the theoretical basis for most common methods used in molecular biology. Finally, for matters related to nucleic acid enzymology, especially the use of restriction enzymes, the reference section of the New England Biolabs Catalogue is a well-organized gold mine of information and explanation.

EXAMINATIONS AND GRADING
Grades for this course are assigned on the basis of four in-class exams as well as other grades from all the instructors. A maximum of 100 points can be earned for each part of the course. There is no cumulative final exam in this course. Examinations will take place during normal lecture periods as indicated on the syllabus.

ADVISORY WARNING
A tremendous amount of material is covered in this course. Therefore, a good knowledge and background in general chemistry, biology, biochemistry, molecular biology, and genetics is required. Students are highly encouraged to keep up with the reading and lectures because exams are comprehensive and test their command of the assigned literature, as well as their scientific creativity.
## COURSE MODULE 1 (PROF. JEFFERY):

<table>
<thead>
<tr>
<th>Week</th>
<th>Day</th>
<th>Date</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Monday</td>
<td>27-AUG-2018</td>
<td>Amino acids, 1°, 2°, 3° and 4° structure.</td>
</tr>
<tr>
<td>1</td>
<td>Wednesday</td>
<td>29-AUG-2018</td>
<td>Protein functions, Enzymes.</td>
</tr>
<tr>
<td>1</td>
<td>Friday</td>
<td>31-AUG-2018</td>
<td>Discussion of papers 1 and 2.</td>
</tr>
<tr>
<td>2</td>
<td>Monday</td>
<td>3-SEP-2018</td>
<td>Labor Day holiday. No classes.</td>
</tr>
<tr>
<td>2</td>
<td>Wednesday</td>
<td>5-SEP-2018</td>
<td>Transmembrane proteins.</td>
</tr>
<tr>
<td>2</td>
<td>Friday</td>
<td>7-SEP-2018</td>
<td>Discussion of papers 3 and 4.</td>
</tr>
<tr>
<td>3</td>
<td>Monday</td>
<td>10-SEP-2018</td>
<td>Reading.</td>
</tr>
<tr>
<td>3</td>
<td>Wednesday</td>
<td>12-SEP-2018</td>
<td>Macromolecular X-ray crystallography.</td>
</tr>
<tr>
<td>3</td>
<td>Friday</td>
<td>14-SEP-2018</td>
<td>Discussion of papers 5 and 6.</td>
</tr>
<tr>
<td>4</td>
<td>Monday</td>
<td>17-SEP-2018</td>
<td>Reading.</td>
</tr>
<tr>
<td>4</td>
<td>Wednesday</td>
<td>19-SEP-2018</td>
<td>Protein Purification.</td>
</tr>
<tr>
<td>4</td>
<td>Friday</td>
<td>21-SEP-2018</td>
<td>In Class Examination #1</td>
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## COURSE MODULE 2 (PROF. KAY):

<table>
<thead>
<tr>
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<th>Date</th>
<th>Topic</th>
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</thead>
<tbody>
<tr>
<td>5</td>
<td>Monday</td>
<td>24-SEP-2018</td>
<td>DNA &amp; RNA Structure.</td>
</tr>
<tr>
<td>5</td>
<td>Wednesday</td>
<td>26-SEP-2018</td>
<td>DNA analysis software.</td>
</tr>
<tr>
<td>5</td>
<td>Friday</td>
<td>28-SEP-2018</td>
<td>DNA sequencing, part I.</td>
</tr>
<tr>
<td>6</td>
<td>Monday</td>
<td>1-OCT-2018</td>
<td>DNA sequencing, part II.</td>
</tr>
<tr>
<td>6</td>
<td>Wednesday</td>
<td>3-OCT-2018</td>
<td>Genomes.</td>
</tr>
<tr>
<td>6</td>
<td>Friday</td>
<td>5-OCT-2018</td>
<td>DNA topology.</td>
</tr>
<tr>
<td>7</td>
<td>Monday</td>
<td>8-OCT-2018</td>
<td>Chromatin, part I.</td>
</tr>
<tr>
<td>7</td>
<td>Wednesday</td>
<td>10-OCT-2018</td>
<td>Chromatin, part II.</td>
</tr>
<tr>
<td>7</td>
<td>Friday</td>
<td>12-OCT-2018</td>
<td>Telomeres &amp; telomerase.</td>
</tr>
<tr>
<td>8</td>
<td>Wednesday</td>
<td>17-OCT-2018</td>
<td>Reading.</td>
</tr>
<tr>
<td>8</td>
<td>Friday</td>
<td>19-OCT-2018</td>
<td>In-Class Examination #2</td>
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## BIOS-594

**Concepts in Biochemistry and Molecular Biology**

**Semester: Fall 2018 | Syllabus**

### COURSE MODULE 3 (PROF. MORRISON):

<table>
<thead>
<tr>
<th>Week</th>
<th>Day</th>
<th>Date</th>
<th>Topic</th>
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</thead>
<tbody>
<tr>
<td>9</td>
<td>Monday</td>
<td>22-OCT-2018</td>
<td>Transcription - Organization of Operons</td>
</tr>
<tr>
<td>9</td>
<td>Wednesday</td>
<td>24-OCT-2018</td>
<td>Transcription - Biochemistry of RNA synthesis</td>
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<tr>
<td>9</td>
<td>Friday</td>
<td>26-OCT-2018</td>
<td>Discussion of papers</td>
</tr>
<tr>
<td>10</td>
<td>Monday</td>
<td>29-OCT-2018</td>
<td>Regulation at initiation of transcription</td>
</tr>
<tr>
<td>10</td>
<td>Wednesday</td>
<td>31-OCT-2018</td>
<td>Transcription termination as a control point</td>
</tr>
<tr>
<td>10</td>
<td>Friday</td>
<td>2-NOV-2018</td>
<td>Discussion of papers</td>
</tr>
<tr>
<td>11</td>
<td>Monday</td>
<td>5-NOV-2018</td>
<td>Global regulation.</td>
</tr>
<tr>
<td>11</td>
<td>Wednesday</td>
<td>7-NOV-2018</td>
<td>Sigma factor cascades</td>
</tr>
<tr>
<td>11</td>
<td>Friday</td>
<td>9-NOV-2018</td>
<td>Discussion of papers</td>
</tr>
<tr>
<td>12</td>
<td>Monday</td>
<td>12-NOV-2018</td>
<td>Reading</td>
</tr>
<tr>
<td>12</td>
<td>Wednesday</td>
<td>14-NOV-2018</td>
<td>Reading</td>
</tr>
<tr>
<td>12</td>
<td>Friday</td>
<td>16-NOV-2018</td>
<td>In-Class Examination #3</td>
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### COURSE MODULE 4 (PROF. POLIKANOV):

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<th>Date</th>
<th>Topic</th>
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</thead>
<tbody>
<tr>
<td>13</td>
<td>Wednesday</td>
<td>21-NOV-2018</td>
<td>Intracellular RNA world.</td>
</tr>
<tr>
<td>13</td>
<td>Friday</td>
<td>23-NOV-2018</td>
<td>Thanksgiving holiday. No classes.</td>
</tr>
<tr>
<td>14</td>
<td>Wednesday</td>
<td>28-NOV-2018</td>
<td>Genetic code.</td>
</tr>
<tr>
<td>14</td>
<td>Friday</td>
<td>30-NOV-2018</td>
<td>Discussion of papers 1 and 2.</td>
</tr>
<tr>
<td>15</td>
<td>Monday</td>
<td>3-DEC-2018</td>
<td>Principles of ribosome structure.</td>
</tr>
<tr>
<td>15</td>
<td>Wednesday</td>
<td>5-DEC-2018</td>
<td>Principles of ribosome function.</td>
</tr>
<tr>
<td>15</td>
<td>Friday</td>
<td>7-DEC-2018</td>
<td>Discussion of papers 3 and 4.</td>
</tr>
<tr>
<td>16</td>
<td>Monday</td>
<td>10-DEC-2018</td>
<td>Reading.</td>
</tr>
<tr>
<td>16</td>
<td>Wednesday</td>
<td>12-DEC-2018</td>
<td>Reading.</td>
</tr>
<tr>
<td>16</td>
<td>Friday</td>
<td>14-DEC-2018</td>
<td>In-Class Examination #4</td>
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