BIOL 3361/5361: MOLECULAR NEUROPHARMACOLOGY – FALL 2020

TEMPLE and COVID-19
Temple University’s motto is Perseverance Conquers, and we will meet the challenges of the COVID pandemic with flexibility and resilience. The university has made plans for multiple eventualities. Working together as a community to deliver a meaningful learning experience is a responsibility we all share: we’re in this together so we can be together.

Instructor
Eleni Anni, Ph.D.
Office: 352B BioLife Building
215-204-5764
Eleni.Anni@temple.edu

Class meetings
https://temple.zoom.us/j/97032382720
Monday/Wednesday/Friday 10:00-10:50 am
August 24 – December 11

Office hours (in Zoom)
Friday 2:00 pm - 5:00 pm by appointment

Technology specifications for this course
Limited resources are available for students who do not have the technology they need for class. Students with educational technology needs, including no computer or camera or insufficient Wifi-access, should submit a request outlining their needs using the Student Emergency Aid Fund (https://deanofstudents.temple.edu/news/student-emergency-aid-fund) form. The University will endeavor to meet needs, such as with a long-term loan of a laptop or Mifi device, a refurbished computer, or subsidized internet access.
Note that some software is available for free download on the ITS Academic Support page (https://its.temple.edu/tech-students). Other specialty software may be available for remote access through ITS.

Prerequisites
BIO3352: Systems Neuroscience or equivalent experience as determined by the instructor.

Textbook
“Molecular Neuropharmacology”
Nestler et al.,
Fourth Edition, 2020
McGraw-Hill, New York, NY
ISBN: 978-1260456905

The textbook will be available through electronic reserve of the Charles Library.
Power point slides with notes of each lecture and supplementary materials (scientific articles, reports, videos etc.) will be posted on Canvas.

Course Description
In this course we will examine how drugs interact with the nervous system. We will focus primarily on the cellular and molecular actions of drugs on synaptic transmission. In addition, we will discuss how natural toxins and venoms affect synaptic transmission in nature, as well as how they have been (and continue to be) used as research tools.

We will study the neural substrates of drug action and the sequence of events from the initial pharmacologic properties of drugs, binding to their molecular target(s), the resulting changes in the function of these target(s), the influence of these changes on biochemical networks in neurons, and in the circuit, including non-neuronal cells, and subsequent alterations in neuronal output.

Students will be able to appreciate the progress in the discovery of drugs (e.g., analgesics, antidepressants, hypnotics, narcotics, anticonvulsants, etc.) including legal and illegal recreational drugs (e.g., opiates, marijuana, cocaine), and how they are used to treat in the clinic major neural disorders (multiple sclerosis, myasthenia gravis, Alzheimer’s disease, Parkinson’s disease, addiction, schizophrenia, seizures, bipolar, etc.) as well as complex behaviors. Finally, we will learn about the process of drug approval (preclinical, clinical trials, drug monitoring, and the functions of FDA).

Course Objectives
Students taking this course will learn the fundamental principles for the translation of basic neuroscience into the discovery of therapeutic agents for various brain pathologies, the mechanisms of drug action from the cellular and molecular to the clinical level, and the regulatory processes involved.

Learning Outcomes
By the end of this course students should be able to:
- Describe the molecular mechanism of action of various drugs used for treatment of neurologic disorders and behaviors.
- Recognize the different types of neuronal and non-neuronal cells participating in drug action.
- Appreciate the diversity of drug targets in the different types of synaptic transmission: enzymes, transporters, ion channels and receptors.
- Explain the drug discovery process.
- Interpret and critique current high-impact research articles in the neuropharmacology field.
Course Requirements
The course requires engagement of students in class through group discussions, review sessions, presentations and peer-evaluations for active learning. Readings of assigned chapters and related material (articles, reports, videos, etc.) should be done before class meetings. Students may present in class primary scientific literature on current high-impact topics in the field for extra credit. *Graduate students are required to make a presentation in class.*

Students are encouraged to attend all classes in order to participate in class activities. Attendance will be taken at the beginning of the class and students will be marked tardy if not available within 5 min of class start. If circumstances prevent a student from attending a class, or joining the class on time, please notify the instructor in advance, if possible.

Attendance Protocol and Your Health
If you feel unwell, you should not come to campus, and you will not be penalized for your absence. Instructors are required to ensure that attendance is recorded for each in-person or synchronous class session. The primary reason for documentation of attendance is to facilitate contact tracing, so that if a student or instructor with whom you have had close contact tests positive for COVID-19, the university can contact you. Recording of attendance will also provide an opportunity for outreach from student services and/or academic support units to support students should they become ill. Faculty and students agree to act in good faith and work with mutual flexibility. The expectation is that students will be honest in representing class attendance.

Recordings of the Zoom class sessions will be done by the instructor and uploaded to Canvas for the academic success of the class as a whole.
- Students may use the recordings as a study aid outside of class to review material.
- Students who have spotty internet service will be able to access the recording at times other than normal class times.

Students are not allowed to take audio or video recordings of class sessions, except in cases of an approved accommodation from the Office of Disability Resources (DRS).

Statement on recording and distribution of recordings of class sessions
Any recordings permitted in this class can only be used for the student’s personal educational use. Students are not permitted to copy, publish, or redistribute audio or video recordings of any portion of the class session to individuals who are not students in the course or academic program without the express permission of the faculty member and of any students who are recorded. Distribution without permission may be a violation of educational privacy law, known as *Family Educational Rights and Privacy Act* (FERPA) ([https://www2.ed.gov/policy/gen/guid/fpco/ferpa/index.html](https://www2.ed.gov/policy/gen/guid/fpco/ferpa/index.html)), as well as certain copyright laws. Any recordings made by the instructor or university of this course are the property of Temple University.
Quizzes and Exams
Quizzes and exams consist of a combination of short answers, multiple choice, true-false, and fill-in-the-blank questions. *Tests for graduate students include 20% additional questions.* Tests will be given on Canvas, and reviewed in class the following week. Grades for the course will be posted on the Canvas. Missed tests will NOT be rescheduled.

Final (letter) grade will be based on the following and calculated according to [http://www.temple.edu/registrar/students/academichistory/gpa.asp](http://www.temple.edu/registrar/students/academichistory/gpa.asp)

- **Quiz (5 min):** 7 points
  - 9/11, 9/25, 10/9, 11/6, 11/20: 35 points
- **Midterm exam (50 min):** 15 points
  - 10/23
- **Final exam (2 hours):** 28 points
  - 12/11 (8:00-10:00am)
- **Submitted (qualified) test questions:** 10 points
- **Discussion posts (weekly):** 12 points

Total: 100 points

- **Class presentation (optional):** 10 points

Remote proctoring statement
Zoom will be used to proctor exams and quizzes in this course. These tools verify your identity and record online actions and surroundings. It is your responsibility to have the necessary government or school issued ID, a laptop or desktop computer with a reliable internet connection, a webcam/built-in camera and microphone, and system requirements for using Zoom.

Expectations for Class Conduct
In order to maintain a safe and focused learning environment, we must all comply with the four public health pillars: wearing face coverings, maintaining physical distancing, washing our hands and monitoring our health.

It is also important to foster a respectful and productive learning environment that includes all students in our diverse community of learners. Our differences, some of which are outlined in the University's nondiscrimination statement, will add richness to this learning experience. Therefore, all opinions and experiences, no matter how different or controversial they may be perceived, must be respected in the tolerant spirit of academic discourse. Treat your classmates and instructor with respect in all communication, class activities, and meetings. You are encouraged to comment, question, or critique an idea but you are not to attack an individual. Please consider that sarcasm, humor and slang can be misconstrued in online interactions and generate unintended disruptions. Profanity should be avoided as should the use of all capital letters when composing responses in discussion threads, which can be construed as “shouting”
online. Remember to be careful with your own and others’ privacy. In general, have your behavior mirror how you would like to be treated by others.

**Course Policies**

Cell phones should be turned off during class meetings.

A number of surveys and studies suggest that cell phones use in class is a distraction for the user but also to other students. Data show that cell phones use in class results in decreased ability to paying attention, taking lower quality notes, retaining less information and doing worse on tests about the material (see e.g. Mayer and Moreno, 2010; Rosen et al., 2011; Kuznekoff & Titsworth, 2013).

**Student and Faculty Academic Rights and Responsibilities**

Freedom to teach and freedom to learn are inseparable facets of academic freedom. The policy can be accessed through the following link: [http://policies.temple.edu/PDF/99.pdf](http://policies.temple.edu/PDF/99.pdf)

**Academic Honesty and Plagiarism**

Any form of academic dishonesty — plagiarism and cheating — is as unacceptable in this course as it is across the University and throughout higher education. The policy can be accessed through the following link: [https://secretary.temple.edu/sites/secretary/files/policies/03.70.12.pdf](https://secretary.temple.edu/sites/secretary/files/policies/03.70.12.pdf)

**Disability Disclosure Statement**

Any student who has a need for accommodation based on the impact of a documented disability, including special accommodations for access to technology resources and electronic instructional material required for the course, should contact me privately to discuss the specific situation as soon as possible. You may also contact Disability Resources and Services (DRS) at 215-204-1280 in 100 Ritter Annex to learn more about the resources available to you. Reasonable accommodations for all students with documented disabilities will be provided by the DRS in coordination with the instructor. The policy can be accessed through the following link: [https://disabilityresources.temple.edu/](https://disabilityresources.temple.edu/)

**Technology Usage Policy**

Read Temple University’s Technology Usage policy which includes information on unauthorized access, disclosure of passwords, and sharing of accounts. The Temple University Technology Usage Policy can be accessed at [https://computerservices.temple.edu/technology-usage-policy](https://computerservices.temple.edu/technology-usage-policy)

**Resources**

Access class sessions in Zoom [https://temple.zoom.us](https://temple.zoom.us)

For Zoom support check [https://support.zoom.us/hc/en-us/categories/200101697](https://support.zoom.us/hc/en-us/categories/200101697)

Access your course materials at [canvas.temple.edu](http://canvas.temple.edu).

For Canvas support email [support@instructure.com](mailto:support@instructure.com) 24/7 or call the Student Hotline 1-844-683-6439 or the Student Live Chat [https://cases.canvaslms.com/liveagentchat?chattype=student](https://cases.canvaslms.com/liveagentchat?chattype=student)

Access databases, books, journals and more at [http://library.temple.edu](http://library.temple.edu)
Obtain 24/7 technology assistance at the Information Technology Services Help Desk (https://its.temple.edu/technical-support).

For academic support check the Student Success Center (studentsuccess.temple.edu) services, such as the Writing Center, the Peer Assisted Study Sessions (PASS) program, Academic Coaching, STEM tutoring, the Conversation Partners program, and more. Services are offered exclusively online this semester. Students can make same day appointments, and the cap on the number of tutoring sessions students can access per week is raised. More information is available by calling 215-204-0702, or by visiting the “Front Desk” Zoom room via the Meeting ID at 929-916-654.

Additional resources
Tuttleman Counseling Services: https://counseling.temple.edu/access-services

CST Professional Development Services including resume review, LinkedIn profile, interview practice, internships, full-time and temporary jobs, summer jobs, volunteering opportunities and more: https://cst.temple.edu/virtualprodevservices

Career Center: https://www.temple.edu/life-at-temple/students/careers-and-internships/career-center
<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
<th>Reading</th>
<th>Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8/24 - 8/28</td>
<td>Fundamentals of neuropharmacology: Principles</td>
<td>Chapter 1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>8/31 - 9/4</td>
<td>Fundamentals of neuropharmacology: Cellular targets</td>
<td>Chapter 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Workshop on literature search</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>9/9 - 9/11</td>
<td>Fundamentals of neuropharmacology: Synaptic targets</td>
<td>Chapters 3-4</td>
<td>Quiz 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Signaling targets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>9/14 - 9/18</td>
<td>Neurotransmitter pathway targets: Excitatory and inhibitory amino acids</td>
<td>Chapter 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Controlled substances</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>9/21 - 9/25</td>
<td>Neurotransmitter pathway targets: Monoamines, acetylcholine and orexin</td>
<td>Chapter 6</td>
<td>Quiz 2</td>
</tr>
<tr>
<td>6</td>
<td>9/28 - 10/2</td>
<td>Neurotransmitter pathway targets: Neuropeptides</td>
<td>Chapter 7</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>FDA drug approval</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>10/5 - 10/9</td>
<td>Neurotransmitter pathway targets: Atypical neurotransmitters</td>
<td>Chapter 8</td>
<td>Quiz 3</td>
</tr>
<tr>
<td>8</td>
<td>10/12 - 10/16</td>
<td>Neuropharmacology: Autonomic nervous system targets</td>
<td>Chapter 9</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Clinical trials: Phases</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>10/19 - 10/23</td>
<td>Neuropharmacology: Neuroendocrine system targets</td>
<td>Chapter 10</td>
<td>Midterm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>exam</td>
</tr>
<tr>
<td>10</td>
<td>10/26 - 10/30</td>
<td>Neuroinflammation drugs: Multiple sclerosis, Myasthenia gravis</td>
<td>Chapter 12</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Clinical trials: Design</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>11/2 - 11/6</td>
<td>Neurodegeneration drugs: Alzheimer’s and Parkinson’s disease</td>
<td>Chapter 18</td>
<td>Quiz 4</td>
</tr>
<tr>
<td>12</td>
<td>11/9 - 11/13</td>
<td>Addictive disorders drugs: Pain Alcoholism, Nicotine and Opioid addiction</td>
<td>Chapters 11, 16</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>11/16 - 11/20</td>
<td>Mood and Emotion drugs Bipolar disorder and Schizophrenia drugs</td>
<td>Chapters 15, 17</td>
<td>Quiz 5</td>
</tr>
<tr>
<td>14</td>
<td>11/23 - 11/27</td>
<td>FALL BREAK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>11/30 - 12/4</td>
<td>Sleep and arousal drugs</td>
<td>Chapters 13, 19</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Seizure disorders drugs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>12/7 - 12/11</td>
<td>Stroke and Migraine drugs</td>
<td>Chapter 20</td>
<td>Final exam</td>
</tr>
</tbody>
</table>