Introduction

Neuroimmunology is an evolving interdisciplinary field that combines neuroscience, immunology, molecular and cell biology as well as neuropharmacology in an attempt to better understand the role of the immune system and its effects on the human brain. Building evidence suggests that immune responses to environmental and genetic challenges play an essential role in the development of many CNS pathologies including ischemic stroke, demyelination, degeneration, infections and trauma, drug addiction. This course will cover the role of the immune system in maintaining a healthy brain and the consequences of improper immunological challenges on brain health. Topics to be presented over the course of the semester include: history of neuroimmunology, structure function relationships between the nervous and immune system and the role of the immune system as it relates to brain function during neurological disorders. In addition, material will be presented that discusses the challenges related to the development of therapeutics for the treatment of neuroimmune disorders.

Objectives

This lecture course is designed for upper-level undergraduate and early graduate students and should have broad appeal to many USC students including early stage Master, Pre-Pharmacy, Pre-Medicine and other students in health and life sciences.

Upon successful completion of this course, you should be able to demonstrate a working knowledge of:

- The history, development and overall framework of the field of neuroimmunology.
- The basic mechanisms regarding interactions between the nervous and immune system.
- The importance of neuroglial cells in regards to maintaining a healthy brain.
- The role of inflammatory mediators including cytokines and chemokines and their role in the neuroimmune response.
- How environmental insults (for example; infections, drugs, alcohol) and/or genetic factors can lead to an altered immune response and participate in the development of neurological diseases.
- The existing and evolving experimental and pharmacological therapeutic strategies targeting neuroimmune mechanisms to treat neurological disorders.
Course Pre-requisites

Completion of a year of biological science coursework e.g., BISC 120/220 or CHEM 105A/B, etc. Optional but preferred - Principles of Immunology (BISC450L).

Assignments and Grading:

Grading will be based on 1 midterm examination, a 1 journal club presentation and the final examination.

- 5 quizzes at 6 points each: 30 pts (15%)
- 1 midterm exam: 60 pts (30%)
- 1 journal club presentation: 10 pts (5%)
- 1 final exam (partially cumulative): 100 pts (50%)
- **Total:** 200 pts

Attendance at all classes is expected and may be considered when assigning final grades. You can therefore increase the probability of getting a higher mark by being proactive in terms of asking (relevant) questions in class and/or contributing to discussions.

It is expected that the students read the assigned papers prior to the lecture and be prepared to discuss background, current understanding and gaps in knowledge for the topic in each lecture.

The midterm exam (60 points) will include 20 multiple choice questions (2 points each), 5 T/F questions (1 point each), 5 fill-in the blank questions (1 point each), and 1 short essay (10 points).

Students will be required to participate in a discussion of an assigned paper during a journal club (10 points).

The final exam (100 points) will consist of 40 multiple choice questions (2 points each), 5 fill-in the blank questions (1 points each) and one short essay (15 pts). The final exam will be cumulative, but will emphasize material covered after the midterm.

There are no make-up exams. If exceptional circumstances prevent you from attending an exam, your reason for missing it must be accompanied by a written statement from a third party (e.g. a note from a medical doctor).

Notes, books, calculators, electronic dictionaries, regular dictionaries, cell phones or any other aids are not allowed during exams.

Students will be asked to complete an anonymous critical evaluation of the course at its completion.

Course Readings

Required Readings

To be successful in this course you will be expected to read the assigned chapters from the textbooks listed below. Reading materials will be supplemented with a variety of source materials including articles from scientific journals and public websites. Supplemental reading assignments and additional handouts will be posted on [http://blackboard.usc.edu/](http://blackboard.usc.edu/). The information will be complemented with discussions involving students on real life situations.
• **Inflammatory Diseases of the Central Nervous System**  

• **Neural-Immune Interactions in Brain Function and Alcohol Related Disorders**  
  Changhai Cui, Lindsay Grandison and Antonio Noronha; ISBN:978-1-4614-4728-3  
  Chapters from this book will be available on Blackboard.

**Recommended Readings**

• **Neuroimmunity: A New Science that Will Revolutionize how We Keep Our Brains Healthy and Young**  
## Course Outline

<table>
<thead>
<tr>
<th>Week &amp; Date</th>
<th>Topic</th>
<th>Subtopics to be Included</th>
<th>Assigned and Supplemental Reading</th>
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<tbody>
<tr>
<td><strong>Introduction and Background</strong></td>
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<tr>
<td>Week 1</td>
<td>Aug 23</td>
<td>Introducing Neuroimmunology as an evolving discipline</td>
<td>Schwartz/London Chapter 1 Additional readings will be posted on Blackboard.</td>
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<tr>
<td>Week 2</td>
<td>Aug 30</td>
<td>General overview of nervous and immune system interactions; brain as an immune active organ</td>
<td>Cui/Grandison/Noronha Chapters 1-3 Additional readings will be posted on Blackboard.</td>
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<tr>
<td>Week 3-4</td>
<td>Sept 6, 13</td>
<td><strong>Quiz 1</strong> Neuroinflammation - cellular basis</td>
<td>Kilpatrick/Ransohoff/Wesselingh, Chapter 1 Cui/Grandison/Noronha Chapters 1-3</td>
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<tr>
<td>Week 5</td>
<td>Sept 20</td>
<td><strong>Quiz 2</strong> Neuroinflammation – molecular basis role in the development of CNS pathologies</td>
<td>Kilpatrick/Ransohoff/Wesselingh, Chapter 2 Additional readings will be posted on Blackboard.</td>
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<tr>
<td>Week 6</td>
<td>Sept 27</td>
<td>Journal Club</td>
<td>Students to read the assigned paper for in class discussion</td>
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<td><strong>Inflammatory Diseases of the Nervous System; Existing and Potential Therapeutics</strong></td>
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<td>Week 7</td>
<td>Oct 4</td>
<td>Autoimmunity and demyelinating disorders</td>
<td>Kilpatrick/Ransohoff/Wesselingh, Chapter 5,6</td>
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<td>Week 8</td>
<td>Oct 11</td>
<td>Ischemia-reperfusion, stroke</td>
<td><strong>In Class Midterm 1</strong> Reading material on the subject matter will be posted on Blackboard.</td>
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<td>Week 9</td>
<td>Oct 18</td>
<td><strong>Quiz 3</strong> Disorders of the nervous system caused by infections</td>
<td>Kilpatrick/Ransohoff/Wesselingh, Chapters 10-12</td>
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<tr>
<td>Week 10</td>
<td>Oct 25</td>
<td>Disorders of the nervous system caused by trauma</td>
<td>Kilpatrick/Ransohoff/Wesselingh, Chapters 14</td>
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<td>Week 11</td>
<td>Nov 1</td>
<td>Neurodegenerative disorders</td>
<td>Reading material on the subject matter will be posted on Blackboard.</td>
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<td>Week 12</td>
<td>Nov 8</td>
<td><strong>Quiz 4</strong> Drug- and alcohol-use brain disorders</td>
<td>Cui/Grandison/Noronha, Chapters 8,10,18</td>
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<td>Week 13  Nov 15</td>
<td>Gut microbiome, immune and nervous system connection</td>
<td>Overview on the recently evolving hot area of interaction between gut microflora, immune system and brain. Role in behavior and CNS disorders.</td>
<td>Reading material on the subject matter will be posted on Blackboard.</td>
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<tr>
<td>Week 14  Nov 22</td>
<td>No class</td>
<td>Thanksgiving/University Holiday</td>
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**Final Exam**  
**Dec 11**  8:00 – 10:00 am; VKC – 257
Statement on Academic Conduct and Support Systems

Academic Conduct
Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Section 11, Behavior Violating University Standards https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the Office of Equity and Diversity http://equity.usc.edu or to the Department of Public Safety http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us. This is important for the safety of the whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. The Center for Women and Men http://www.usc.edu/student-affairs/cwm/ provides 24/7 confidential support, and the sexual assault resource center webpage http://sarc.usc.edu describes reporting options and other resources.

Support Systems
A number of USC’s schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the American Language Institute http://dornsife.usc.edu/ali, which sponsors courses and workshops specifically for international graduate students. The Office of Disability Services and Programs http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, USC Emergency Information http://emergency.usc.edu will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.

Emergency Preparedness/Course Continuity:
In case of emergency, and travel to campus is difficult, USC executive leadership will announce an electronic way for instructors to teach students in their residence halls or homes using a combination of Blackboard, teleconferencing, and other technologies. Instructors should be prepared to assign students a "Plan B" project that can be completed at a distance. For additional information about maintaining your classes in an emergency please access: http://cst.usc.edu/services/emergencyprep.html