

USC School of Pharmacy

Spring 2021: RXRS 408: Arming the Immune System for Novel Therapies

Instructors: Liana Asatryan, Ph.D.
Research Assistant Professor
University of Southern California
E-mail: asatryan@usc.edu
Tel: (323) 442-1495
Office: PSC 500A; USC Mail Code: MCA-9121

Amanda M. Burkhardt, Ph.D.
Assistant Professor
University of Southern California
Email: aburkhar@usc.edu
Tel: TBD
Office: TBD

Other invited guest lecturers

Course Weight: 4 Units

Day/Time/Location: TUE/THU/9:30-10:50 am ONLINE via Zoom

Catalogue Description: *Principles of human immunological responses to maintain wellness and perturbation in disease. Focus on discovery, development and use of therapeutic strategies targeting immune mechanisms.*

Introduction

The immune system has the capacity to mount a counter attack in response to any antigenic intrusion. It has become clear that abnormal immune responses are key to the development of many common disorders not traditionally viewed as immunologic in nature, including autoimmune, genetic, neoplastic and neurodegenerative diseases. This integrative course will cover the critical role of the immune system in maintaining health, and the consequences of improper responses when pathogenic intrusion has occurred or upon pathogenic processes. Lectures will focus on immune responses to infections (bacterial, viral, fungal), immune disturbances that cause allergies, autoimmune disease and cancer. Additionally, this course will highlight the role of the immune system in development of neurological disorders. Part of the lectures of this course will be devoted to the immune-based treatment options and diagnostics including rapidly evolving immunotherapy and immunodiagnostics.

Objectives

This course is designed for upper-level undergraduate and early graduate students who are interested in understanding disease and therapeutics to manage these conditions. USC students who are pursuing a career in health or biological science majors, such as pharmacy or medical professions, would be most appropriate. In addition, this course would be of interest for early stage Master students in health/biological sciences.

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

1. The basic principles of human immunity and immune response, involvement of specific organs and cells in immune responses.
2. The types of immune responses, i.e. innate and adaptive, their molecular and genetic determinants, including cellular immunity and antibody synthesis.
3. The immune system receptors, signaling, the functions of cytokines, chemokines and antigen-antibody relationships.
4. The mechanisms and immunopathology of immunological-mediated human diseases including infections, allergic reaction, autoimmune diseases, immunodeficiency, disorders of the central nervous system.
5. The existing and evolving experimental and pharmacological therapeutic strategies targeting immune mechanisms.
6. The evolving diagnostic technologies including imaging and immune-based assays.

Grading:

2 midterm exams @ 40 pts each:	80 pts (40%)
Journal Club Debates 3@ 20 pts each	60 pts (30%)
<u>1 final exam</u>	<u>60 pts (30%)</u>
Total:	200 pts (100%)

Attendance at all classes is expected. Participation will include asking and answering questions and being actively involved in the discussion. It is expected that the students read the assigned papers prior to the lecture and be prepared to discuss background, current understanding, treatments, and gaps in knowledge for the topic in each lecture.

There will be two Midterm Exams, one Final Exam, and three Journal Club presentations that will account for all the points in this course.

Examinations

The questions for the exams will primarily be based on the lecture content, textbook readings and additional reading materials will be included as noted in class. The midterms and the final exam will include multiple choice, true/false questions, matching and short answer questions. Journal club and final test scores will be inputted into grading section of the Blackboard.

The Midterm Exams will be administered through Blackboard asynchronously. The exam will be available for a 5 hour window on each exam date. Once starting the exam, students will have

80 minutes to complete the exam before submitting it; students can only start the exam once and will need to complete it in one sitting within the 5 hour window.

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.

Journal Club Presentations

Students will participate in three journal club presentations throughout the semester. The Journal Club will be conducted in a debate-style format to facilitate scientific discussions and critical analysis of primary research articles related to content recently covered in class. Each presentation will include a Background Checker, Discussion Leader, Data Master and Devil's advocate role; students will sign up for a role for each presentation on Blackboard during the first week of classes. A full description of the assignment, including the specific tasks of each role, can be found in the Assignment Description under the Assignments tab on Blackboard. A grading rubric for this assignment can also be found under the Assignments tab.

Course evaluation

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

Please note, below is the "Approximate" grading scale breakdown. However, this scale is not set in stone and may slightly shift up or down based on overall scores. There are no pluses (+) or minuses (-) assigned to grades in this course.

Percent	Letter Grade
90-100%	A
80-89%	B
70-79%	C
60-69%	D
Below 60%	F

Required Readings and Supplementary Materials

Course Readings

Primary didactic materials will be posted at each lecture on Blackboard (www.blackboard.usc.edu).

Required/Recommended Readings

- The Immune System, 4th Edition. Peter Parham. ISBN: 978-0-393-53334-7

- Supplemental information for those seeking clarification or additional reading will include textbook sections or manuscripts from the scientific literature that will be posted on Blackboard. Faculty in the course may be contacted at any time for clarification of any issues or information.

Course Schedule

Date	Subject	Lecturer
<p>Tue Jan 19</p> <p>9:30 -10:50am</p>	<p>Introduction to the Immune System</p> <p>Brief introduction to the history of Immunology; development of immunological concepts.</p> <p>Reading Material:</p> <p>Parham Chapter 1</p>	<p>Burkhardt</p>
<p>Thur Jan 21</p> <p>9:30 -10:50am</p>	<p>Innate Immunity I</p> <p>Cells of the innate immune system, physical barriers, pattern recognition receptors, cytokines, chemokines.</p> <p>Reading Material:</p> <p>Parham Chapter 2 & 3</p>	<p>Burkhardt</p>
<p>Tue Jan 26</p> <p>9:30 -10:50am</p>	<p>Innate Immunity II</p> <p>Finish innate immune recognition of pathogens, mechanisms of killing, complement system</p> <p>Reading Material:</p> <p>Parham Chapter 2 & 3</p>	<p>Burkhardt</p>
<p>Thur Jan 28</p> <p>9:30 -10:50am</p>	<p>Adaptive Immunity I</p> <p>Humoral Immunity – B-lymphocyte development, antibody production</p> <p>Reading Material:</p> <p>Parham Chapter 6 & 9</p>	<p>Burkhardt</p>
<p>Tue Feb 2</p> <p>9:30 -10:50am</p>	<p>Adaptive Immunity II</p> <p>Cellular immunity – T lymphocyte development</p> <p>Reading Material:</p> <p>Parham Chapter 4 & 7</p>	<p>Burkhardt</p>
<p>Thur Feb 4</p> <p>9:30 -10:50am</p>	<p>Antigen Recognition by T cells</p> <p>MHC restriction; concept of immunological tolerance and how it occurs; central and peripheral tolerance.</p> <p>Reading Material:</p> <p>Parham Chapter 4 & 7</p>	<p>Burkhardt</p>
<p>Tue Feb 9</p> <p>9:30 -10:50am</p>	<p>Adaptive Immunity III</p> <p>Roles of T cells in the immune system</p> <p>Reading Material:</p> <p>Parham Chapter 8</p>	<p>Burkhardt</p>

<p>Thur Feb 11 9:30 -10:50am</p>	<p>Cooperation Between The Innate and Adaptive Immune System How innate and adaptive immune systems interact; NK cells Reading Material: Parham Chapter 3 & 12</p>	<p>Burkhardt</p>
<p>Tue Feb 16 9:30 -10:50am</p>	<p>Midterm #1 -- Asynchronous (3p-8p PST) Journal Club Debate #1 Roles and manuscript TBD</p>	<p>Asatryan & Burkhardt</p>
<p>Thur Feb 18 9:30-10:50am</p>	<p>Therapeutic Modules Mucosal Immune Responses How the mucosal immune system differs from the peripheral immune system, how it balances normal microbiome and responses to pathogenic microorganisms Reading Material: Parham Chapter 10</p>	<p>Burkhardt</p>
<p>Tue Feb 23 9:30 -10:50am</p>	<p>Therapeutic Modalities for Bacterial and Viral Infections Immune based therapies for bacterial infections Reading Material Readings on the subject matter will be posted on Blackboard</p>	<p>Phan Invited lecturer</p>
<p>Thur Feb 25 9:30 -10:50am</p>	<p>Immunodeficiency: Genetic and Acquired Common variable immunodeficiency, severe combined immune deficiency, drug induced immunodeficiency. Virally induced immunodeficiencies. Reading Material Parham Chapter 13</p>	<p>Burkhardt</p>
<p>Tue Mar 2 9:30 -10:50am</p>	<p>Allergic Reactions Overview of the immune system functioning during hypersensitivity reactions, asthma and chronic obstructive pulmonary disease Reading Material Parham Chapter 14</p>	<p>Burkhardt</p>
<p>Thur Mar 4 9:30 -10:50am</p>	<p>Therapeutic Treatments for Allergies Antihistamines, immunosuppressants Reading Material Readings on the subject matter will be posted on Blackboard</p>	<p>Burkhardt</p>
<p>Tue Mar 9 9:30 -10:50am</p>	<p>Transplantation Immunological basis of transplantation, organ rejection, transplant therapeutics</p>	<p>Burkhardt</p>

	Reading material Parham Chapter 15	
Thur Mar 11 9:30 -10:50am	Autoimmune Diseases Mechanisms of autoimmunity, overview of autoimmune diseases, e.g. rheumatoid arthritis, inflammatory bowel syndrome, psoriasis. Reading Material Parham Chapter 16	Asatryan
Tue Mar 16 9:30 -10:50am	Therapeutic Treatments of Autoimmune Disease Antibody therapeutics for rheumatoid arthritis, inflammatory bowel syndrome, psoriasis Reading Material Readings on the subject matter will be posted on Blackboard	Asatryan
Thur Mar 18 9:30 -10:50am	Midterm #2 -- Asynchronous (3p-8p PST) Journal Club Debate #2 Roles and manuscript TBD	Asatryan & Burkhardt
Tue Mar 23 9:30 -10:50am	University Wellness Day -- No Class	
Thur Mar 25 9:30 -10:50am	Immunogenomics Overview of modern computational methods to study T and B cell receptors. Reading Material Readings on the subject matter will be posted on Blackboard	Mangul Invited lecturer
Tue Mar 30 9:30 -10:50am	Oncogenesis and Tumor Proliferation Overview of cancer mechanisms Reading Material Parham Chapter 17	Zhang Invited lecturer
Thur Apr 1 9:30 -10:50am	Cellular Immunotherapies for Cancer Immunotherapeutic options for patients with cancer, CAR-T cells Reading Material Parham Chapter 17 Readings on the subject matter will be posted on Blackboard	Zhang Invited lecturer
Tue Apr 6 9:30 -10:50am	Vaccines and Immunological Memory Immunological memory, vaccine technologies, vaccine-preventable disease.	Burkhardt

	Reading Material Parham Chapter 11	
Thur Apr 8 9:30 -10:50am	Journal Club Debate #3 Roles and manuscript TBD	Asatryan & Burkhardt
Tue Apr 13 9:30 -10:50am	Immune Processes in the Central Nervous System (CNS) Interactions between nervous and immune systems. Cellular basis of neuroinflammation – role of glial cells Reading Material: Pertinent reading material on the subject matter will be posted on Blackboard.	
Thur Apr 15 9:30 -10:50am	Disorders of Nervous System Caused by Infections Neuroinflammatory processes during infections of nervous system; therapeutic modalities Reading Material: Pertinent reading material on the subject matter will be posted on Blackboard.	Asatryan
Thur Apr 20 9:30 -10:50am	CNS Autoimmune Demyelinating Disorders Immune-based mechanisms of CNS autoimmune disorders with the focus on Multiple Sclerosis; therapeutic modalities Reading Material: Pertinent reading material on the subject matter will be posted on Blackboard.	Asatryan
Thur Apr 22 9:30 -10:50am	University Wellness Day -- No Class	
Tue Apr 27 9:30 -10:50am	Therapeutic Modalities of Stroke and Neurodegenerative disorders Anti-inflammatory therapeutic modalities for stroke, Alzheimer’s disease, Parkinson’s Disease Reading Material: Pertinent reading material on the subject matter will be posted on Blackboard.	Asatryan
Thur Apr 29 9:30 -10:50am	Neuroinflammation as a Potential Therapeutic Target Classes of drugs targeting neuroinflammation. Immunotherapy for CNS disorders. Reading Material: Pertinent reading material on the subject matter will be posted on Blackboard.	Asatryan
	USC Study Days: May 1-4	

Tue May 11 8:00-10:00am	Final Examination	
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Class Policies Regarding Class Discussions and Etiquette

An overview of the class policies and how they relate to the discussions and interactions that will occur in this class can be found below. We expect each student to review, understand and adhere to these policies.

Respect

- Listen actively and attentively
- No name calling or other character attacks
- Always use a respectful tone
- Be aware of the fact that tone of voice and body language are powerful communicators. Some postures or facial expressions can silence, intimidate, or hurt your classmates (e.g. crossed arms, eye rolls). Other postures or facial expressions can show you are listening respectfully (e.g. making eye contact, staying quiet, nodding).

Constructiveness

- If you wish to challenge something that has been said, challenge the idea not the individual sharing it
- Ask for clarification if you are confused
- Commit to learning, not debating

Inclusivity

- Try not to silence yourself out of concern for what others will think about what you say
- Try not to let your question (or answer) run on. Give others the chance to speak, too.
- Do not remain silent. Make sure to contribute to the discussion
- Take responsibility for the quality of the discussion

Online learning Etiquette

- If it is not possible to have you webcam on during the entire class, do you best to have it on when speaking
- Turn off your microphone when not speaking
- If you need to step away from your computer during class (e.g. get a drink of water, use the bathroom, attend to a family member/pet) please do so quietly and without disturbing your classmates. Return to the class when you can.
- Be aware the contents of conversations typed into the chat box, even private conversations, are visible by the instructors

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 Part B, Section 11, “Behavior Violating University Standards” policy.usc.edu/scampus-part-b. 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>.

Support Systems:

Student Counseling Services (SCS) – (213) 740-7711 – 24/7 on call

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. engemannshc.usc.edu/counseling

National Suicide Prevention Lifeline – 1 (800) 273-8255

Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. www.suicidepreventionlifeline.org

Relationship and Sexual Violence Prevention Services (RSVP) – (213) 740-4900 – 24/7 on call

Free and confidential therapy services, workshops, and training for situations related to gender-based harm. engemannshc.usc.edu/rsvp

Sexual Assault Resource Center

For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: sarc.usc.edu

Office of Equity and Diversity (OED)/Title IX Compliance – (213) 740-5086

Works with faculty, staff, visitors, applicants, and students around issues of protected class. equity.usc.edu

Bias Assessment Response and Support

Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. studentaffairs.usc.edu/bias-assessment-response-support

The Office of Disability Services and Programs

Provides certification for students with disabilities and helps arrange relevant accommodations. dsp.usc.edu

Student Support and Advocacy – (213) 821-4710

Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. studentaffairs.usc.edu/ssa

Diversity at USC

Information on events, programs and training, the Diversity Task Force (including representatives for each school), chronology, participation, and various resources for students. diversity.usc.edu

USC Emergency Information

Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible. emergency.usc.edu
USC Department of Public Safety – UPC: (213) 740-4321 – HSC: (323) 442-1000 – 24-hour

Additional Policies

Policy on Cell Phones, Pagers and Devices During ALL Classroom Activity

All cell phones, pagers, MP3 players or devices for communication **MUST** be turned off or vibrate mode during lectures, case conferences. Failure to comply will result in 5% deduction of the entire number of points accrued. In addition, no MP3 or electronic devices are allowed during examination. Devices are only permitted when written authorization by BOTH coordinators.

Extra Credits

There will be no extra credits that will be given for this course. This includes additional efforts that may improve the profession of pharmacy. Although these activities are encouraged, your participation in these activities improves the participants, professional.

Statement for Students with Disabilities

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. Website and contact information for DSP: http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html, (213) 740-0776 (Phone), (213) 740-6948 (TDD only), (213) 740-8216 (FAX) ability@usc.edu.

Statement on Academic Integrity

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. *SCampus*, the Student Guidebook, (www.usc.edu/scampus or <http://scampus.usc.edu>) contains the University Student Conduct Code (see University Governance, Section 11.00), while the recommended sanctions are located in Appendix A.

Emergency Preparedness/Course Continuity in a Crisis

In case of a declared emergency if travel to campus is not feasible, 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.