

USC Mann

Alfred E. Mann School of Pharmacy
and Pharmaceutical Sciences

Spring 2023: RXRS 408: Arming the Immune System for Novel Therapies

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Course Weight: 4 Units

Day/Time/Location: TUE/THU/9:30-10:50 am CPA/DMC 157

Instructor Office Hours: See announcements on Blackboard for time/location of each instructor's office hours

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 neurological 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), immunodeficiencies, 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 Breakdown:

2 midterm exams @ 30 pts each:	60 pts (37.5%)
Immediate Feedback Assessments 2@ 20 pts each	40 pts (25%)
Case Study Group Activity	20 pts (12.5%)
Final exam	40 pts (25%)
<hr/> Total:	<hr/> 160 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, two Immediate Feedback Assessments (IFATs) and one Case Study Group presentation 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. Scores for all exams and activities will be inputted into the Blackboard Gradebook.

The Midterm exams (2, worth 30 points/each or cumulative 37.5% of the total grade) and the Final exam (worth 40 points with 25% of the total grade) will be a combination of Multiple choice, Multiple answer, Matching, True/False, Short Answer questions and will be administered in class through Blackboard. To complete these activities, electronic equipment with internet access is required.

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.

Immediate Feedback Assessments (IFATs)

Students will participate in two (2) Immediate Feedback Assessments (IFATs) this semester. The IFATs will facilitate and assess the critical analysis of primary research articles related to content recently covered in class. A full description of the IFAT can be found on Blackboard under the Assignments tab. Each IFAT is worth 20 points each, for a cumulative 40 points, or 25% of the total course grade.

Group Case Study Activity

Students will be placed in groups of two (2) and assigned a case study to work on. There are 2-3 days assigned for case study presentations scattered throughout the semester. A full description of this activity and a grading rubric will be posted on Blackboard under the Assignments Tab. This activity is worth 20 points, or 12.5% of the total course grade.

Course evaluation

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

Please note, below is the grading scale breakdown. However, this scale is not set in stone and may slightly shift up or down based on overall scores.

Grading Scale

93% to 100%: A	79% to 81%: B-	65% to 67%: D+
90% to 92%: A-	76% to 78%: C+	62% to 64%: D
87% to 89%: B+	71% to 75%: C	55% to 61%: D-
82% to 86%: B	68% to 70%: C-	0% to 54%: F

Required Readings and Supplementary Materials

Course Readings

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

Recommended Reading

- 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
Tue Jan 10	Introduction to the Immune System Brief introduction to the history of Immunology; development of immunological concepts. Reading Material: Parham Chapter 1	Burkhardt
Thu Jan 12	Innate Immunity I Cells of the innate immune system, physical barriers, pattern recognition receptors, cytokines, chemokines. Reading Material: Parham Chapters 2 & 3	Burkhardt
Tue Jan 17	Innate Immunity II Innate immune recognition of pathogens, mechanisms of killing, complement system Reading Material: Parham Chapters 2 & 3	Burkhardt
Thu Jan 19	Adaptive Immunity I Humoral Immunity – B-lymphocyte development, antibody production Reading Material: Parham Chapters 4 & 6	Burkhardt
Tue Jan 24	Adaptive Immunity II B cell mediated immunity Cellular immunity – T lymphocyte development Reading Material: Parham Chapter 9	Burkhardt
Thu Jan 26	Adaptive Immunity III Cellular Immunity – T lymphocyte development Reading Material: Parham Chapter 7	Burkhardt
Tue Jan 31	Antigen Recognition by T cells MHC restriction; concept of immunological tolerance and how it occurs; central and peripheral tolerance. Reading Material: Parham Chapters 5 & 7	Burkhardt
Thu Feb 2	Antigen Recognition by T cells (continued) MHC restriction; concept of immunological tolerance and how it occurs; central and peripheral tolerance. Reading Material: Parham Chapters 5 & 7	Burkhardt
Tue Feb 7	Case Study Activity – Student Presentations	Students
Thu Feb 9	Midterm #1 – In class Implemented on Blackboard, need to bring in mobile devices	Students
Tue Feb 14	Adaptive Immunity IV Roles of T cells in the immune system Reading Material: Parham Chapter 8	Burkhardt

Thu Feb 16	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	Burkhardt
Tue Feb 21	IFAT #1 - In class Implemented on Blackboard, need to bring in mobile devices	Students
Thu Feb 23	Immunological Memory & Vaccines Immunological memory, vaccine technologies, vaccine-preventable disease. Reading Material: Parham Chapter 11	Burkhardt
Tue Feb 28	Cooperation Between The Innate and Adaptive Immune Systems How innate and adaptive immune systems interact; NK cells Reading Material: Parham Chapters 3 & 12	Burkhardt
Thu Mar 2	Failure of Defenses Therapeutic Modalities for Bacterial and Viral Infections Immune based therapies for bacterial and viral infections Reading Material: Parham 13; other material will be posted on Blackboard	Asatryan
Tue Mar 7	Primary Immunodeficiencies Common variable immunodeficiency, severe combined immune deficiency, virally induced immunodeficiencies. Reading Material: Parham Chapter 13	Burkhardt
Thu Mar 9	Secondary Immunodeficiencies Drug, environmental, age, illness induced immunodeficiencies Reading Material: Parham Chapter 13	Burkhardt
SPRING BREAK Mar 13-17		
Tue Mar 21	Case Study Activity – Student Presentations	Students
Thu Mar 23	Midterm #2 – In class Implemented on Blackboard, need to bring in mobile devices	Students
Tue Mar 28	Allergic Reactions and Their Treatment Modalities Overview of the immune system functioning during hypersensitivity reactions, asthma and chronic obstructive pulmonary disease. Treatment options - antihistamines, immunosuppressants. Reading Material: Parham Chapter 14	Burkhardt
Thu Mar 30	Transplantation Immunological basis of transplantation, organ rejection, transplant therapeutics	Burkhardt

	Reading Material: Parham Chapter 15	
Tue Apr 4	Autoimmune Diseases and Their Treatments Mechanisms of autoimmunity, overview of autoimmune diseases, e.g. rheumatoid arthritis, inflammatory bowel syndrome, psoriasis; their treatments Reading Material: Parham Chapter 16	Asatryan
Thu Apr 6	Oncogenesis and Tumor Proliferation, Cellular Immunotherapies for Cancer Overview of cancer mechanisms and treatment options Reading Material: Parham Chapter 17; other material will be posted on Blackboard	Zhang Invited lecturer
Tue Apr 11	IFAT #2 - In class Implemented on Blackboard, need to bring in mobile devices	Students
Thu Apr 13	<u>Neuro-immunity</u> Immune Processes in the Central Nervous System (CNS) Interactions between nervous and immune systems. Reading Material on the subject matter will be posted on Blackboard	Asatryan
Tue Apr 18	Cellular basis of neuroinflammation Role of glial cells – microglia, astrocytes, oligodendrocytes Reading Material on the subject matter will be posted on Blackboard	Asatryan
Thu Apr 20	Disorders of Nervous System Caused by Infections Neuroinflammatory processes during infections of nervous system; therapeutic modalities Readings on the subject matter will be posted on Blackboard	Asatryan
Tue Apr 25	CNS Autoimmune Demyelinating Disorders Immune-based mechanisms of CNS autoimmune disorders with the focus on Multiple Sclerosis; therapeutic modalities Readings on the subject matter will be posted on Blackboard	Asatryan
Thu Apr 27	Open day for Case Study Activity – Student Presentations	Students
Tue May 9 8:00-10:00am	Final Examination – In Class Implemented on Blackboard, need to bring in mobile devices	Students

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 your webcam on during the entire class, do your 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

Course Content Distribution and Synchronous Session Recordings Policies

USC has policies that prohibit recording and distribution of any synchronous and asynchronous course content outside of the learning environment.

Recording a university class without the express permission of the instructor and announcement to the class, or unless conducted pursuant to an Office of Student

Accessibility Services (OSAS) accommodation. Recording can inhibit free discussion in the future, and thus infringe on the academic freedom of other students as well as the instructor. ([Living our Unifying Values: The USC Student Handbook](#), page 13).

Distribution or use of notes, recordings, exams, or other intellectual property, based on university classes or lectures without the express permission of the instructor for purposes other than individual or group study. This includes but is not limited to providing materials for distribution by services publishing course materials. This restriction on unauthorized use also applies to all information, which had been distributed to students or in any way had been displayed for use in relationship to the class, whether obtained in class, via email, on the internet, or via any other media. ([Living our Unifying Values: The USC Student Handbook](#), page 13).

Academic Integrity

The University of Southern California is foremost a learning community committed to fostering successful scholars and researchers dedicated to the pursuit of knowledge and the transmission of ideas. Academic misconduct is in contrast to the university's mission to educate students through a broad array of first-rank academic, professional, and extracurricular programs and includes any act of dishonesty in the submission of academic work (either in draft or final form).

This course will follow the expectations for academic integrity as stated in the [USC Student Handbook](#). All students are expected to submit assignments that are original work and prepared specifically for the course/section in this academic term. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s). Students suspected of engaging in academic misconduct will be reported to the Office of Academic Integrity.

Other violations of academic misconduct include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see the [student handbook](#) or the [Office of Academic Integrity's website](#), and university policies on [Research and Scholarship Misconduct](#).

Statement on Academic Conduct and Support Systems

Academic Integrity:

The University of Southern California is a learning community committed to developing successful scholars and researchers dedicated to the pursuit of knowledge and the dissemination of ideas. Academic misconduct, which includes any act of dishonesty in the production or submission of academic work, comprises the integrity of the person who commits the act and can impugn the perceived integrity of the entire university community. It stands in opposition to the university's mission to research, educate, and contribute productively to our community and the world.

All students are expected to submit assignments that represent their own original work, and that have been prepared specifically for the course or section for which they have been submitted. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s).

Other violations of academic integrity include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), collusion, knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university. All incidences of academic misconduct will be reported to the Office of Academic Integrity and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see [the student handbook](#) or the [Office of Academic Integrity's website](#), and university policies on [Research and Scholarship Misconduct](#).

Please ask your instructor if you are unsure what constitutes unauthorized assistance on an exam or assignment, or what information requires citation and/or attribution.

Students and Disability Accommodations:

USC welcomes students with disabilities into all of the University's educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at

osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu.

Support Systems:

[Counseling and Mental Health](#) - (213) 740-9355 – 24/7 on call

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

[988 Suicide and Crisis Lifeline](#) - 988 for both calls and text messages – 24/7 on call

The 988 Suicide and Crisis Lifeline (formerly known as the National Suicide Prevention Lifeline) provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week, across the United States. The Lifeline is comprised of a national network of over 200 local crisis centers, combining custom local care and resources with national standards and best practices. The new, shorter phone number makes it easier for people to remember and access mental health crisis services (though the previous 1 (800) 273-8255 number will continue to function indefinitely) and represents a continued commitment to those in crisis.

[Relationship and Sexual Violence Prevention Services \(RSVP\)](#) - (213) 740-9355(WELL) – 24/7 on call

Free and confidential therapy services, workshops, and training for situations related to gender- and power-based harm (including sexual assault, intimate partner violence, and stalking).

[Office for Equity, Equal Opportunity, and Title IX \(EEO-TIX\)](#) - (213) 740-5086

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

[Reporting Incidents of Bias or Harassment](#) - (213) 740-5086 or (213) 821-8298

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

[The Office of Student Accessibility Services \(OSAS\)](#) - (213) 740-0776

OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

[USC Campus Support and Intervention](#) - (213) 740-0411

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

[Diversity, Equity and Inclusion](#) - (213) 740-2101

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

[USC Emergency](#) - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call
Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

[USC Department of Public Safety](#) - UPC: (213) 740-6000, HSC: (323) 442-1200 – 24/7 on call
Non-emergency assistance or information.

[Office of the Ombuds](#) - (213) 821-9556 (UPC) / (323-442-0382 (HSC)
A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

[Occupational Therapy Faculty Practice](#) - (323) 442-2850 or otfp@med.usc.edu
Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.