



Biology 5800 – An immune cell never forgets
Advanced Topics in Biochemistry and Cell Biology

Summer Semester, first half session, 2024
Tu/Th 9:30 am – 12:30 pm; JTB 320

Instructors:

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Office Hours:

Dr. Campos Acevedo: By appointment. Please contact me by email.

Dr. Nelson: Thursdays, 8:45-9:15 am (JTB 320). Or contact for additional time.

Zoom/IM/Canvas Conference Office Hours:

Contact by email to set up Zoom office hours.

Required Materials

We will use Canvas for this course. All required readings, prework, etc., will be posted on Canvas and available to students. Additionally, class expectations, scores, announcements, attendance tracking, and discussions will be available on Canvas.

Course Description

Vaccines play a crucial role in safeguarding the body against pathogenic diseases by inducing a durable memory within the body's immune system. This course will cover the vaccine development process and the mechanisms by which the immune system responds to vaccines for enduring immunity. Topics in this course will include vaccine design, vaccine efficacy, basic immunology, immune responses triggered by vaccines and pathogens, and the formation of immunological memory. The course will include a combination of assigned readings and homework, class discussions, team-based learning, and in-class activities. In addition to covering the course content, this course will integrate learning strategies for reading and interpreting scientific literature. **Key goals of this course include improving critical thinking skills, scientific literature comprehension, data interpretation, and conversing in an active learning environment.**

This is a 2-credit special topics course. The prerequisites for the course include a "C-" or better in (BIOL 2020 or BIOL 2021) AND (BIOL 3510 or CHEM 3510).

Course Outcomes

By the end of this course, you will be able to:

1. Demonstrate skill in reading scientific papers, including:
 - a. Communicating scientific findings effectively to your peers
 - b. Defining previously unfamiliar terms and methods encountered in scientific papers
 - c. Approaching each section of a paper with confidence
 - d. Reading and independently analyzing papers related to vaccine immunology
2. Demonstrate basic content knowledge in the following areas:
 - a. Immunology - Basic understanding of innate and adaptive immune memory and the host response to infection.
 - b. Vaccines - design and strategies, advances in vaccines, and barriers to success
 - c. Public Health - Economic impact and epidemiology of specific vaccines
3. Talk to peers and others about vaccine hesitancy in a respectful and thoughtful manner
4. Summarize how scientific discoveries fit into a larger framework of collective knowledge

Teaching and Learning Methods

This course is structured using a Team Based Learning (**TBL**) approach. Small TBL teams of students will be formed for the duration of the course. Students are assigned pre-reading and/or pre-work to be completed before class. Each class period starts with an in-class, closed-book, individual Readiness Assurance Test (**iRAT**) about the pre-reading. After this, students complete the same assessment with their team (group Readiness Assurance Test, or **gRAT**). After the readiness quizzes, most class time is spent reviewing the research article, discussing questions, applying strategies to read scientific literature with emphasis on specific sections, and participating in group application activities. Students will have many opportunities in class to practice presenting and getting feedback in preparation for the final assessment.

RAT = Readiness Assurance Test. These will be 5-10 multiple-choice questions. These questions test students' preparation and readiness for more in-depth and complex discussions. They are closed books, and no electronic resources are allowed.

- iRAT= individual RAT. These are completed individually.
- gRAT=group RAT. These are the same questions as the iRAT, but retaken as a TBL team.

Course Policies

- 1) Attendance, Participation & Punctuality: This course has expected attendance and participation, as reflected in the grading scheme. Attendance will be taken during each class period and worth 5% of the

final course grade. Additionally, in-class RATs are administered each class period (excluding the first and last class periods) and are worth a combined total of 50% of a student's grade. These quizzes must be taken in class and may not be made up if missed. The lowest iRAT/gRAT score pair will be dropped for each student.

- 2) Electronic Devices in Class: A laptop or tablet is required for in-class iRATs and gRATs, which will be given via Canvas. All assessments are closed to outside resources (notes, internet, other material). Students may not access any other resources during these assessments. For the remainder of the course, the use of devices to search/utilize outside sources is encouraged and will sometimes be necessary. **Note: please do not use devices or access materials that would distract yourself or others during class. This is a professional courtesy to your peers and instructors.**

Assignments

Weekly homeworks: The course is structured so that each week you will have the following tasks outside of class:

1. "Toolbox" creation: You and your TBL group will be responsible for an online working document to define terms and describe methods that come up in your pre-reading assignments. This toolbox will become a resource throughout the course and as you prepare for the final assessment. Its completion will be worth 5% of your final grade.
2. Weekly wrap-up question: After each Thursday session, you will answer a question on Canvas related to what you learned from the week. This assignment will be due each Friday by 11:59 pm and is expected to take up to 15 minutes. This will help you synthesize information from the week into a summary. Your wrap-up questions will be worth 5% of your final grade.

Group reflection assignment: Students reflect on the importance of teamwork considering the following points: communication, diversity of thought, responsibilities, conflict resolution, and respect. At the end of the second week of class, you will have a short assignment on Canvas in which you will be asked to reflect on how your TBL group is functioning. During week 3, we will have time in class for groups to review the comments anonymously and reflect on improvements that can be made. Completion of this assignment will be worth 5% of your final grade.

Model drawing assignments: During the semester, you will have two model-drawing assignments. The first will take place in class with your TBL group, and the second will be an individual assignment outside of class near the end of the course. For these assignments, you will depict the findings from an assigned reading as a drawn summary figure. These assignments are meant to help you

contextualize the literature articles you read and discover how new findings fit in with what is already known in this field of study. Each model will be worth 7.5% of your grade, for a total of 15%.

Final assessment: The final assessment will be an in-class oral exam on Thursday, June 20. For this assessment, you will work with your TBL group to prepare a presentation based on an assigned literature article, which will be given to you one week prior to the final. Following a rubric, each group member will be responsible for presenting in front of the class as part of a group presentation. The course is designed to prepare you for this assessment. The final assessment will be worth 15% of your grade.

Grading Policy (Evaluation Methods & Criteria)

Grades will be based on the following criteria:

Assessment	% of grade
Attendance/participation	5%
Group reflection assignment	5%
Weekly homeworks	10%
Model drawing assignments	15%
iRAT*	25%
gRAT*	25%
Final assessment	15%

*In recognition that life stressors and other unforeseen circumstances arise, the lowest iRAT/gRAT grade will be dropped for each student at the end of the course.

Evaluation Scheme

Letter Grade	Percentage	Letter grade	Percentage
A	94-100	C	73-75.9
A-	90-93.9	C-	70-72.9
B+	86-89.9	D+	67-69.9
B	82-85.9	D	64-66.9
B-	79-81.9	D-	60-63.9
C+	76-78.9	E	Below 60

Course Schedule

Date	Topic/Discussion	Reading
Week 1	Introduction	
Tu May 14	Introduction to the course; forming TBL groups; in-class activity	<ul style="list-style-type: none"> Syllabus

Th May 16	Vaccine overview (history, basic principles)	<ul style="list-style-type: none"> • Pollard et al, Nature reviews. 2021. – <i>introduction and what is in a vaccine?</i> sections • <i>History of Vaccines</i> overview • “10 rules for reading a scientific paper”
Week 2	Immunology	
Tu May 21	Immune system overview (cell types/tissues, vaccine response)	<ul style="list-style-type: none"> • <i>The human immune system</i> excerpt from <i>History of Vaccines</i> • Pollard et al, Nature reviews. 2021 – <i>Vaccines induce antibodies through vaccines need T cell help</i> • Khan academy videos • Hammarlund et al, J. Virol 2010
Th May 23	Immune system principles for vaccination (memory, active/passive immunity, the immunocompromised)	<ul style="list-style-type: none"> • <i>ASM Understanding Immunological memory</i> • Pollard et al, Nature reviews. 2021 – <i>Immune memory and Immunodeficiency and vaccination</i> • Kaech et al, Nat. Immunol 2003
Week 3	Vaccine Principles + Design	
Tu May 28	Vaccine immunology I: Basic vaccine principles/ Types of vaccines	<ul style="list-style-type: none"> • Gillie et al, Nature reviews. 2022 – <i>Vaccine immunity in space and time</i> • Pfizer – understanding six types of vaccine technologies • Bao et al, Nature. 2020 – The pathogenicity of SARS-CoV-2 in hACE2 transgenic mice
Th May 30	Vaccine immunology II: Vaccine design/efficacy and stability	<ul style="list-style-type: none"> • Schoenmaker et al, Int J Pharm. 2021 – <i>mRNA-lipid nanoparticle COVID-19 vaccines: Structure and stability</i> • Zhang et al, npj vaccines. 2023 – Effect of mRNA-LNP components of two globally-marketed COVID-19 vaccines on efficacy and stability
Week 4	Vaccine Barriers + Advancements	
Tu June 4	Barriers to successful vaccine design (co-evolution of pathogens, emerging pathogens, complex antigens)	<ul style="list-style-type: none"> • Han et al, Nature reviews. 2023 – <i>Co-evolution of immunity and seasonal influenza viruses</i> • Sheppard et al, Nat Commun. 2023 – An Influenza A virus can evolve to use human ANP32E through altering polymerase dimerization.
Th June 6	Vaccine technology advancements (mRNA/DNA vaccines, bivalent vaccines, etc.)	<ul style="list-style-type: none"> • Wang et al, Signal Transduct Target Ther. 2023 – <i>Viral vectored vaccines: design, development, preventive and therapeutic applications in human diseases.</i> • Marcandalli et al, Cell. 2019 – Induction of Potent Neutralizing Antibody Responses by a Designed Protein Nanoparticle Vaccine for Respiratory Syncytial Virus.

Week 5	Population/Health Science Considerations	
Tu June 11	Vaccine efficacy, epidemiology, herd immunity, economic impact	<ul style="list-style-type: none"> • Pollard et al, Nature reviews. 2021 – <i>Herd immunity through schedule of vaccination</i> • Janse et al, Front Public Health. 2021 – Influencing Vaccine Development Timelines, Identification, Causal Analysis, and Prioritization of Key Barriers by KOLs in General and Covid-19 Vaccine R&D
Th June 13	Vaccine hesitancy/barriers to vaccination efforts, how to talk to vaccine-hesitant folks	<ul style="list-style-type: none"> • Pollard et al, Nature reviews. 2021 – <i>Safety and side effects of vaccines through The anti-vaccine movement</i> • Huang et al, J Clin Transl Sci. 2024 – Psychological reactance, misinformation, and distrust: A mixed methods analysis of COVID-19 vaccine uptake.
Week 6	Wrap-up + Final Day	
Tu June 18	Review, prep for final day, answer additional questions	TBD
Th June 20	Final assessment (in class)	Assigned on Thursday, June 13.

Note: This syllabus is meant to serve as an outline and guide for our course. Please note that we may modify it with reasonable notice to you. We may also modify the Course Schedule to accommodate the needs of our class. Any changes will be announced in class and posted on Canvas under Announcements.

University Policies

1. **The Americans with Disabilities Act.** The University of Utah seeks to provide equal access to its programs, services, and activities for people with disabilities. If you need accommodations in this class, reasonable prior notice must be given to the Center for Disability & Access, 162 Olpin Union Building, (801) 581-5020. CDS will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in an alternative format with prior notification to the Center for Disability & Access.
 - ***If in-class attendance is a necessary component of the course for pedagogical reasons (e.g., laboratories, studios, or artistic training), state it explicitly.***

Use this standard language: “Given the nature of this course, attendance is required and adjustments cannot be granted to allow non-attendance. However, if you need to seek an ADA accommodation to request an exception to this attendance policy due to a disability, please contact the Center for Disability and Access (CDA). CDA will work with us to determine what, if any, ADA accommodations are reasonable and appropriate

Basic Needs Student Support Statement. Success at The University of Utah includes learning about and using available resources. The [Basic Needs Collective](#) (BNC) is a coordinated resource referral hub. They educate about and connect students to campus and community resources to help them meet their basic needs. As a central location for resource referrals related to food, housing, health insurance, managing finances, legal services, mental health, etc., any student experiencing difficulty with basic needs is encouraged to contact them. Drop into their office located in the Union basement or schedule with them online for an in-person or virtual visit through their webpage: <https://basicneeds.utah.edu/>.

In compliance with ADA requirements, some students may need to record course content. Any recordings of course content are for personal use only, should not be shared, and should not be made publicly available. In addition, recordings should be destroyed at the conclusion of the course.

2. **University Safety Statement.** The University of Utah values the safety of all campus community members. To report suspicious activity or to request a courtesy escort, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit <https://safeu.utah.edu>
3. **Addressing Sexual Misconduct.** Title IX makes it clear that violence and harassment based on sex and gender (which includes sexual orientation and gender identity/expression) is a civil rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veteran’s status or genetic information. If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 383 South University Street, 801-581-8365, or the Office of the Dean of Students, 270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report

to the police, contact the Department of Public Safety, 801-585-2677(COPS).

- a. [recommended addendum] **Lauren's Promise:** Lauren's Promise is a vow that anyone – faculty, staff, students, parents, and community members – can take to indicate to others that they represent a safe haven for sharing incidents of sexual assault, domestic violence, or stalking. Anyone who makes Lauren's Promise vows to: 1.) listen to and believe those individuals who are being threatened or experiencing sexual assault, dating violence or stalking; 2.) represent a safe haven for sharing incidents of sexual assault, domestic violence, or stalking; and 3.) change campus culture that responds poorly to dating violence and stalking. By making Lauren's Promise, individuals are helping to change campus cultures that respond poorly to dating violence and stalking throughout the nation.

4. Academic Misconduct Statement. It is expected that students adhere to University of Utah policies regarding academic honesty, including but not limited to refraining from cheating, plagiarizing, misrepresenting one's work, and/or inappropriately collaborating. This includes the use of generative artificial intelligence (AI) tools without citation, documentation, or authorization. Students are expected to adhere to the prescribed professional and ethical standards of the profession/discipline for which they are preparing. Any student who engages in academic dishonesty or who violates the professional and ethical standards for their profession/discipline may be subject to academic sanctions as per the University of Utah's Student Code:
<https://regulations.utah.edu/academics/6-410.php>

5. Diversity Statement . I stand in support of compassion, dignity, value-of-life, equity, inclusion and justice for all individuals regardless of color, race/ethnicity, sexual orientation, religion, language, socioeconomic status, ability, gender, gender identity or expression, immigration status, or any type of marginalization. I stand in support of making our society more inclusive, just, and equitable for all individuals. I stand against individual and systemic racism in all its various forms.

6. Undocumented Student Support Statement. Immigration is a complex phenomenon with broad impact—those who are directly affected by it, as well as those who are indirectly affected by their relationships with family members, friends, and loved ones. If your immigration status presents obstacles to engaging in specific activities or fulfilling specific course criteria, confidential arrangements may be requested from the

Dream Center. Arrangements with the Dream Center will not jeopardize your student status, your financial aid, or any other part of your residence. The Dream Center offers a wide range of resources to support undocumented students (with and without DACA) as well as students from mixed-status families. To learn more, please contact the Dream Center at 801.213.3697 or visit dream.utah.edu.

7. **Drop/Withdrawal Policies.** Students may drop a course within the first two weeks of a given semester without any penalties. Students may officially withdraw (W) from a class or all classes after the drop deadline through the midpoint of a course. A “W” grade is recorded on the transcript and appropriate tuition/fees are assessed. The grade “W” is not used in calculating the student's GPA. For deadlines to withdraw from full-term, first, and second session classes, see the U's Academic Calendar.
8. Other important information:
 - a. Student Code: <http://regulations.utah.edu/academics/6-400.php>
 - b. Accommodation Policy (see Section Q):
<http://regulations.utah.edu/academics/6-100.php>
9. **Student Mental Health Resources**
 - *If you need help dealing with burnout, anxiety, depression, isolation, and loneliness, or other mental health issues please, reach out. Here are some [campus mental health resources](#), including free counseling, trainings and other support.*
 - *Consider participating in a [Mental Health First Aid](#) or other [wellness-themed](#) training provided by our Center for Student Wellness and sharing these opportunities with your peers, teaching assistants and department colleagues*
10. **Diverse Supports for Students.** Your success at the University of Utah is important to all of us here! If you feel like you need extra support in academics, overcoming personal difficulties, or finding community, the U is here for you.

Student Support Services (TRIO)

TRIO federal programs are targeted to serve and assist low-income individuals, first-generation college students, and individuals with disabilities.

Student Support Services (SSS) is a TRIO program for current or incoming undergraduate university students who are seeking their bachelor's

degree and need academic assistance and other services to be successful at the University of Utah.

For more information about what support they provide, a list of ongoing events, and links to other resources, view their website or contact:

Student Support Services (TRIO)

801-581-7188

trio.utah.edu

Room 2075

1901 E. S. Campus Dr.

Salt Lake City, UT 84112

American Indian Students

The AIRC works to increase American Indian student visibility and success on campus by advocating for and providing student centered programs and tools to enhance academic success, cultural events to promote personal well-being, and a supportive “home-away-from-home” space for students to grow and develop leadership skills.

For more information about what support they provide, a list of ongoing events, and links to other resources, view their website or contact:

American Indian Resource Center

801-581-7019

diversity.utah.edu/centers/airc

Fort Douglas Building 622

1925 De Trobriand St.

Salt Lake City, UT 84113

Black Students

Using a pan-African lens, the Black Cultural Center seeks to counteract persistent campus-wide and global anti-blackness. The Black Cultural Center works to holistically enrich, educate, and advocate for students, faculty, and staff through Black centered programming, culturally affirming educational initiatives, and retention strategies.

For more information about what support they provide, a list of ongoing events, and links to other resources, view their website or contact:

Black Cultural Center

801-213-1441

diversity.utah.edu/centers/bcc

Fort Douglas Building 603
95 Fort Douglas Blvd.
Salt Lake City, UT 84113

Students with Children

Our mission is to support and coordinate information, program development and services that enhance family resources as well as the availability, affordability and quality of child care for University students, faculty and staff.

For more information about what support they provide, a list of ongoing events, and links to other resources, view their website or contact:

Center for Childcare & Family Resources

801-585-5897

childcare.utah.edu

408 Union Building
200 S. Central Campus Dr.
Salt Lake City, UT 84112

Students with Disabilities

The Center for Disability & Access is dedicated to serving students with disabilities by providing the opportunity for success and equal access at the University of Utah. They also strive to create an inclusive, safe, and respectful environment.

For more information about what support they provide and links to other resources, view their website or contact:

Center for Disability & Access

801-581-5020

disability.utah.edu

162 Union Building
200 S. Central Campus Dr.
Salt Lake City, UT 84112

Students across Intersectional Identities and Experiences

The Center for Equity & Student Belonging (CESB) creates community and advocates for academic success and belonging for students across intersectional identities and experiences among our African, African

American, Black, Native, Indigenous, American Indian, Asian, Asian American, Latinx, Chicanx, Pacific Islander, Multiracial, LGBTQ+, Neurodiverse and Disabled students of color.

For more information about what support they provide, a list of ongoing events, and links to other resources, view their website or contact:

Center for Equity and Student Belonging (CESB)

801-581-8151

diversity.utah.edu/centers/CESB/

235 Union Building

200 S. Central Campus Dr.

Salt Lake City, UT 84112

English as a Second/Additional Language (ESL) Students

If you are an English language learner, there are several resources on campus available to help you develop your English writing and language skills. Feel free to contact:

Writing Center

801-587-9122

writingcenter.utah.edu

2701 Marriott Library

295 S 1500 E

Salt Lake City, UT 84112

English Language Institute

801-581-4600

continue.utah.edu/eli

540 Arapeen Dr.

Salt Lake City, UT 84108

Undocumented Students

Immigration is a complex phenomenon with broad impact—those who are directly affected by it, as well as those who are indirectly affected by their relationships with family members, friends, and loved ones. If your immigration status presents obstacles that prevent you from engaging in specific activities or fulfilling specific course criteria, confidential arrangements may be requested from the Dream Center.

Arrangements with the Dream Center will not jeopardize your student status, your financial aid, or any other part of your residence. The Dream

Center offers a wide range of resources to support undocumented students (with and without DACA) as well as students from mixed-status families.

For more information about what support they provide and links to other resources, view their website or contact:

Dream Center

801-581-3470

dream.utah.edu

1120 Annex (Wing B)
1901 E. S. Campus Dr.
Salt Lake City, UT 84112

LGBTQ+ Students

The LGBTQ+ Resource Center acts in accountability with the campus community by identifying the needs of people with a queer range of [a]gender and [a]sexual experiences and responding with university-wide services.

For more information about what support they provide, a list of ongoing events, and links to other resources, view their website or contact:

LGBTQ+ Resource Center

801-587-7973

lgbt.utah.edu (Links to an external site.)

409 Union Building
200 S. Central Campus Dr.
Salt Lake City, UT 84112

Veterans & Military Students

The mission of the Veterans Support Center is to improve and enhance the individual and academic success of veterans, service members, and their family members who attend the university; to help them receive the benefits they earned; and to serve as a liaison between the student veteran community and the university.

For more information about what support they provide, a list of ongoing events, and links to other resources, view their website or contact:

Veterans Support Center

801-587-7722

veteranscenter.utah.edu (Links to an external site.)

418 Union Building
200 S. Central Campus Dr.
Salt Lake City, UT 84112

Women

The Women's Resource Center (WRC) at the University of Utah serves as the central resource for educational and support services for women. Honoring the complexities of women's identities, the WRC facilitates choices and changes through programs, counseling, and training grounded in a commitment to advance social justice and equality.

For more information about what support they provide, a list of ongoing events, and links to other resources, view their website or contact:

Women's Resource Center

801-581-8030
womenscenter.utah.edu
411 Union Building
200 S. Central Campus Dr.
Salt Lake City, UT 84112

Food Pantry

The University of Utah food pantry provides non-perishable, nourishing food for our students, their families, faculty, and staff.

For more information about what support they provide and links to other resources, view their website:

Feed U Pantry

feedufoodpantry@gmail.com
union.utah.edu/resources-spaces/feed-u-pantry/hours-about-us/

Union Building (Pantry is located on the basement level)
200 S. Central Campus Dr.
Salt Lake City, UT 84112

Tutoring

The Learning Center offers free services to currently-enrolled University of Utah students.

For more information about what support they provide and links to other resources, view their website.

Learning Center

801-581-5153

learningcenter.utah.edu

1705 J. Willard Marriott Library

295 S. 1500 E

Salt Lake City, UT 84112

Other Student Groups at the U

To learn more about some of the other resource groups available at the U, check out:

getinvolved.utah.edu/

studentsuccess.utah.edu/resources/student-support