

MCB 295C    **Cell Signaling and Disease 2021**

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**25 years ago Mike Hall and colleagues discovered a novel kinase they named the Target of Rapamycin (TOR or mTOR). This kinase is now known to act as the master regulator of cell growth and metabolism in eukaryotes. Accordingly, defects in TOR function underlie many diseases including cancer, clinical depression, and diabetes. In this class students will learn about modern research in molecular and systems biology by walking through the major discoveries in the TOR signaling field--starting with basic research in yeast and moving to the study of disease and aging in humans. Each class period will focus on a new discovery and the experimental method(s) that were used to make that discovery. Students will practice interpreting real experimental data during class sessions and read and summarize a new paper in the TOR field as part of a group for their two assignments.**

Prerequisites. None

**GRADING:** Alternate grading will be used in this course (S, P, F). Students will be graded on two group presentations (100 points each) and the associated written assignments (100 points each), and their class participation (200 points). Assignments will be graded numerically for both clarity and content. Grades will be assigned as follows: S=80-100%; P=60-79%, F=0-59%

*Absence and Class Participation*

This class is designed so that students have a chance to discuss science and solve problems, rather than simply be told how or what to think. For this class structure to work it is critical that you participate in class, by asking questions and introducing your own views, even when you are not presenting. This means that you must read the papers **BEFORE** class (on the days indicated by a star) and come prepared with your questions and comments. If class is going well our discussion should expand beyond topics directly addressed in the papers we read. Class participation is worth 1/3 of your grade.

- **Classroom attendance:**

- If you feel sick, or may have been in contact with someone who is infectious, stay home. Except for seeking medical care, avoid contact with others and do not travel.
- Notify your instructor(s) if you will be missing a course meeting or an assignment deadline.

- Non-attendance for any reason does **not** guarantee an automatic extension of due date or rescheduling of examinations/assessments.
    - Please communicate and coordinate any request directly with your instructor.
  - If you must miss the equivalent of more than one week of class, you should contact the Dean of Students Office [DOS-deanofstudents@email.arizona.edu](mailto:DOS-deanofstudents@email.arizona.edu) to share documentation about the challenges you are facing.
  - Voluntary, free, and convenient [COVID-19 testing](#) is available for students on Main Campus.
  - If you test positive for COVID-19 and you are participating in on-campus activities, you must report your results to Campus Health. To learn more about the process for reporting a positive test, visit the [Case Notification Protocol](#).
  - COVID-19 vaccine is available for all students at [Campus Health](#).
  - Visit the [UArizona COVID-19](#) page for regular updates.
- **Academic advising:** If you have questions about your academic progress this semester, please reach out to your academic advisor (<https://advising.arizona.edu/advisors/major>). Contact the Advising Resource Center (<https://advising.arizona.edu/>) for all general advising questions and referral assistance. Call 520-626-8667 or email to [advising@.arizona.edu](mailto:advising@.arizona.edu)
  - **Life challenges:** If you are experiencing unexpected barriers to your success in your courses, please note the Dean of Students Office is a central support resource for all students and may be helpful. The [Dean of Students Office](#) can be reached at (520) 621-2057 or [DOS-deanofstudents@email.arizona.edu](mailto:DOS-deanofstudents@email.arizona.edu).
  - **Physical and mental-health challenges:** If you are facing physical or mental health challenges this semester, please note that Campus Health provides quality medical and mental health care. For medical appointments, call (520) 621-9202. For After Hours care, call (520) 570-7898. For the Counseling & Psych Services (CAPS) 24/7 hotline, call (520) 621-3334.
  - **Statement on compliance with COVID-19 mitigation guidelines:** As we enter the Fall semester, your and my health and safety remain the university's highest priority. To protect the health of everyone in this class, students are required to follow the university guidelines on COVID-19 mitigation. Please visit [www.covid19.arizona.edu](http://www.covid19.arizona.edu).

**POLICY ON REPORTS AND PRESENTATION:** Students not appearing for presentations (without an official excuse) will receive a 0 for their presentation. Written assignments are due in class on the day stated on the syllabus or they are late. Assignments handed in <24hr late are marked down by 10%, 24-48 hrs late are marked down by 20%, and greater than 48 hours late get a zero.

**ABSENCE POLICY:** All holidays or special events observed by organized religions will be honored for those students who show affiliation with that particular religion. Absences pre-approved by the UA Dean of Students (or Dean's designee) will be honored.

**ACADEMIC CONDUCT:** Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See:

<http://deanofstudents.arizona.edu/codeofacademicintegrity>

<http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity>.

The University Libraries have some excellent tips for avoiding plagiarism, available at <http://www.library.arizona.edu/help/tutorials/plagiarism/index.html>.

*Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor's express written consent.* Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA e-mail to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may also constitute copyright infringement.

#### **UA NONDISCRIMINATION AND ANTI-HARASMENT POLICY**

The University is committed to creating and maintaining an environment free of discrimination; see <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>

**CHANGES:** Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.

## 295C Syllabus

### *Module I- Transcriptional Circuits and Kinetic Modeling*

- 1 Aug 24 (T) **Introduction**  
Brief overview of the class and an introduction to cell signaling and kinases. Get into groups.
- 2 Aug 31 (T) **Introduction to Genetics and the discovery of TOR**  
We will go over the first papers on TOR in class and key concepts in genetics.
- \*3 Sept 7 (T) **Biochemical Methods and the Discovery of TORC1/2**  
We will go over the discovery of the TOR complexes and key concepts in experimental biochemistry. *Read Loewith paper before class.* We will also discuss the structure of TORC1.
- \*4 Sept 14 (T) **Downstream signaling from TORC1 (i).** We will go over TORC1 dependent gene regulation and key concepts in genomics. *Read the Schrieber paper before class.*
- \*5 Sept 21 (T) **Downstream signaling from TORC1 (ii).** We will go over TORC1 dependent protein phosphorylation and key concepts in proteomics. *Read Loewith paper II before class.*
- 6 Sept 28 (T) **Presentation Prep and group work**, no official class session. Groups must pick one of the papers posted on D2L about TORC1 dependent transcription (2), autophagy, nucleotide metabolism, oxidative stress, or translation and present it in to the class in 15 min on Oct 5, 12 or 19<sup>th</sup>. All members of the group need to turn in a 3 page summary of the paper (written by them, not the group) by the start of class on the day of their presentation.
- 7 Oct 5 (T) **Mechanisms of Downstream signaling (i).** 15 min student group presentations. Transcription papers.
- 8 Oct 12 (T) **Mechanisms of Downstream signaling (ii).** 15 min student group presentations. Translation and nucleotide metabolism papers.
- 9 Oct 19 (T) **Mechanisms of Downstream signaling (iii).** 15 min student group presentations. Autophagy and oxidative stress papers

10. Oct 26 (T) **The all-powerful TORC1!** What happens when TORC1 is hyper- or hypo-activated. We will discuss the role of TORC1 in aging, death, depression, epilepsy and cancer.
- \*11 Nov 2 (T) **Upstream regulators and disease (i).** We will discuss the Role of hormones in TORC1 regulation via TSC1/2 and Rheb. *Read the Kun-Liang Guan (GuanTSC12) paper before class.*
- \*12 Nov 9 (T) **Upstream regulators and disease (ii).** We will discuss the role of nutrients (especially amino acids) in TORC1 regulation via the Rag proteins and the Ragulator. *Read Sabatini paper I before class.*
- \*13 Nov 16 (T) **Upstream regulators and disease (iii)** We will discuss the role of nutrients (especially amino acids) in TORC1 regulation via GATOR, a GAP for RagA. *Read Sabatini paper II before class.*
- 14 Nov 23 (T) **Upstream regulators and disease (iv).** Groups will present Papers on nutrient sensors. Sestrin, SAMTOR, Castor, SLC38a9, Sar1b, AMPK. All members of the group need to turn in a 3 page summary of the paper (written by them, not the group) by the start of class on the day of their presentation.
- 15 Nov 30 (T) **Upstream regulators and disease (v).** Groups will present Papers on nutrient sensors. Sestrin, SAMTOR, Castor, SLC38a9, Sar1b, AMPK. All members of the group need to turn in a 3 page summary of the paper (written by them, not the group) by the start of class on the day of their presentation.
- 16 Dec 7 (T) **Upstream regulators and disease (vi).** Groups will present Papers on nutrient sensors. Sestrin, SAMTOR, Castor, SLC38a9, Sar1b, AMPK. All members of the group need to turn in a 3 page summary of the paper (written by them, not the group) by the start of class on the day of their presentation.