GENE 440 – Genetics Seminar

4:30-5:30 pm W
Skeen Hall Rm W129
Spring Semester, 2022

Instructor: Dr. Ian Ray Rm N342, Skeen Hall
Phone: 646-3819 email: iaray@nmsu.edu

Office Hours: M, 3:00-6:00 pm and by appointment.

Textbook: Assigned articles

Course Goals: To critically review and discuss scientific literature associated with the use of model microorganism, plant, or animal systems to solve problems in molecular, cellular, and developmental biology. Students will also organize, prepare, and deliver a presentation on a selected topic in the field of genetics, as described below.

Important Notice: My hope is that we will be able to meet in-person for the full semester. However, if events affiliated with the COVID-19 pandemic change, we may need to shift to online instruction. I have uploaded this course to CANVAS so we can switch seamlessly to online instruction via Zoom, if needed. All journal articles, handouts, slides & discussion questions for the course are available in CANVAS modules.

Presentation: Each student must develop a **10 to 15 minute Powerpoint® presentation** describing research which CLEARLY demonstrates that a specific candidate gene influences a unique phenotype/trait in a **MODEL organism** (e.g., yeast, mouse, humans, Zebrafish, Arabidopsis, etc.). For example, a gene influencing Alzheimer's disease in humans, or a cell surface receptor gene that influences flower development in plants, etc. The **Introduction (worth 10pts)** should briefly (~2 minutes) describe the trait, why it is important, and why the gene to be discussed was considered a potential candidate. The **Methods/ Experimental Approach (worth 10pts)** should briefly (~3 minutes) **list** the various techniques and approaches used to generate the experimental evidence that will be presented to the class. Note: You do not have to explain these methodologies in detail, as the class should have sufficient background knowledge about most of these techniques. However, a brief explanation of the type of information provided by each of the techniques (i.e., why it was useful or important) is certainly appropriate. **Results & Discussion (worth 40pts)** should comprise the bulk of your presentation (~9 minutes). It should provide the most convincing evidence (original data, figures, etc. from original research articles, not review articles) that demonstrates the candidate gene impacts the trait of interest. In this regard, demonstrating phenotypic impacts of knockout (via traditional homologous recombination repair or error-prone CRISPR-Cas9 nonhomologous end-joining repair), RNA interference, or transgenic complementation experiment results are recommended. Evidence must also be provided demonstrating that at least one other protein was identified which physically interacts with the candidate gene's protein (i.e., immuno-precipitation, yeast two-hybrid, FLIM/FRET, or other suitable assays). You are encouraged to include pertinent figures and data tables from the articles that you have reviewed, **just be sure to cite the source of each figure or table**. Be sure to mention where the gene is located in the organism's genome, the size of the gene and its gene products, and if known, where the candidate protein functions at the cellular/organism level (see attached pages). Given the presentation time limit, you will not be able to discuss everything about your candidate gene. So be sure to focus on the most important information/concepts. **Conclusions (worth 10pts)** should highlight the most important findings of your talk (~1 minute) and cite the papers that provided data for your presentation. **The following three components of your presentation will also be worth 7 points each** including: 1) visual appeal, 2) clarity/organization, 3) delivery volume and eye contact. **Meeting the time limit (worth 9 pts):** As a professional courtesy to other speakers, it is important not to exceed the allotted time limit. In this regard, you will be granted a ± 1 minute grace period, but will lose 5 points for each minute that your talk is over or under the 10 to 15 minute time limit. **A single page abstract summarizing your presentation is also required.** The abstract (1 inch page margins and 12pt font) should include your presentation title and your name at the top of the page (centered), followed by the abstract body (**200 words maximum, double spaced**). The abstract will be graded based on: informative title, grammar, and flow (10pts each) and content (70pts).

Grading: Class attendance and participation in weekly discussions of assigned journal articles will **each** comprise 20% of the course grade. The final presentation (worth 50% of the course grade) will be delivered to the class on April 27 or May 4 (I will need 3 volunteers for April 27). One **hardcopy abstract** that summarizes key features of your presentation (worth 10% of the course grade) will also be due May 4.

Course Schedule:

	DATE	TOPIC AND ASSIGNED READING
	Jan. 12	Characteristics of effective presentations
	19	Yeast two-hybrid system (Fields and Song 1989 & Sobhanifar 2003ab)
	26	**Involvement of the TRAP220 component of the TRAP/SMCC coactivator complex in embryonic development... (Ito et al. 2000). Also, handout overview of old stem cell HR knockout process**
	Feb. 2	No class – Dr. Ray at a conference.
	9	**The mediator complex functions as a coactivator for GATA-1 in erythropoiesis via subunit Med1/TRAP220 (Stumpf et al. 2006)**
	16	**The mediator complex functions as a coactivator for GATA-1 in erythropoiesis via subunit Med1/TRAP220 (Stumpf et al. 2006)**
►►		*****Notify Dr. Ray of the phenotype, gene, and organism that you will use for your final presentation.*****
	23	**Development and applications of CRISPR-Cas9 for genome engineering (Hsu et al. 2014)**
	Mar **2**	**Genome-scale CRISPR-Cas9 Knockout screening in human cells (Shalem et al. 2014)**
►►		*****Provide Dr. Ray with PDFs of **two key original research articles** that will be used for your final presentation. (NOTE: REVIEW ARTICLES NOT ACCEPTABLE).*****
►►	7-11	Spring Break
	16	**Sporopollenin biosynthetic enzymes interact and constitute a metabolon localized to the endoplasmic reticulum of tapetum cells (Lallemand et al. 2013).**
►►	17	Last day to withdraw from classes with a "W"
	23	Super-resolution imaging of fluorescently labeled, endogenous RNA Pol II in living cells with CRISPR/Cas9-mediated gene editing (Cho et al. 2016)
	30	Chromatin remodeling during glucocorticoid receptor regulated transactivation (Sections 1.1 to 2.1 only; King et al. 2012).
	April 6	CRISPR-based chromatin remodeling of the endogenous Oct4 or Sox2 locus enables reprogramming to pluripotency (Liu et al. 2018)
	13	In-class preview of draft presentations – break up into teams of two students, review your presentations, and provide constructive comments to each other.
	20	In-class review of final presentations and abstracts – break up into teams of two students, review abstracts and final presentations, and provide constructive comments to each other.
	27	Begin final presentations from 3 students (bring presentation on USB drive). ALL students must attend.
	May 4	Continue final presentations **(Skeen W129, 3:30-5:30pm**; bring presentation on a USB drive). All students must attend.

Above articles in bold provide a demonstration of the general type of information that you want to consider incorporating into your presentation (i.e., gene knockout, yeast 2-hybrid, co-immunoprecipitation, etc.).

*IMPORTANT: **All students will use the in-class PC computer & projector for the final presentation, so bring your presentation on a USB drive.** For students using Apple computers, be sure to check your presentation on the class computer/projector on April 20 to make sure that it will display properly (i.e. compatibility issues sometimes arise with Mac presentations). As a backup, email your presentation to yourself in case your USB drive file gets corrupted.*

Presentation Abstract: Students are encouraged to utilize the NMSU writing center (https://towc.nmsu.edu/), or contact Dr. Ray to get assistance with writing your abstract. I recommend that you pattern your abstract so that it is similar to those associated with the papers that we cover in class. However, do not simply cut and paste information from the papers that you use for your presentation. You must use your own words and summarize the key points of your specific presentation.

COVID-19 Expectations and the Crimson Commitment

You are expected to comply with all university requirements and expectations regarding mask-wearing, vaccination, and testing, or you should not enroll in in-person course sections. Please do not come to class if you are feeling sick; communicate with your instructor about making up any missed classes.

Mask requirements for all students

All students, regardless of vaccination status, must wear a mask while indoors on any NMSU system campus. Any changes to this guidance will be posted online at now.nmsu.edu/plan/key-updates-and-quick-reference.html. Students seeking an exception to the mask-wearing requirement should contact the Dean of Students Office at 575-646-1722.

Vaccination and testing protocols

Students who are not NMSU employees (vax or test):

If you will be present on any NMSU campus at any time to fulfill program requirements or participate in activities:

- Be fully vaccinated – full vaccine series (one or two doses) plus 14 days – or submit results of an antigen or PCR test to VaxTrax on a weekly basis.
- Receive a booster within 4 weeks of eligibility (as defined by current FDA recommendation) or submit results of an antigen or PCR test to VaxTrax on a weekly basis.

If you will not be present on any NMSU campus, you are not required to follow the vax or test protocol, but we encourage you to become vaccinated as soon as possible.

Students who are NMSU employees (vax unless exempt):

If you are a student employee of NMSU (or would like to become one), whether teleworking or in person, you must:

- Be fully vaccinated – full vaccine series (one or two doses) plus 14 days – or obtain an approved and documented exemption.
- Receive the booster within 4 weeks of eligibility (as defined by current FDA recommendation) or submit results of an antigen or PCR test to VaxTrax on a weekly basis.

The Crimson Commitment

All students will acknowledge the Crimson Commitment at my.nmsu.edu.

The Crimson Commitment

I commit to myself and other Aggies, I will:

- Get vaccinated for COVID-19 or submit weekly COVID-19 test results if I am enrolled in any in-person or hybrid courses, student employee, or if I will be on campus for any reason
- Monitor myself for symptoms of COVID-19
- Report to the Aggie Health & Wellness Center or another medical professional if I have symptoms of COVID-19 or other communicable illness
- Wash my hands often with soap and water and/or use hand sanitizer
- Wear a mask and keep my distance as directed by the latest university guidance
- Stay home if I feel ill or have been around someone ill
- Report a positive case online at now.nmsu.edu and participate in contact tracing if called
- Keep up to date with the latest guidance from experts at NMSU, the NM Department of Health, and the CDC.

I will abide by these practices throughout the year:

- I will not use vaccine status or mask-wearing to discriminate against my classmates, instructors, or NMSU staff members in any way.
- I will follow instructions regarding seating in campus classrooms.
- I will speak to my instructor if I have concerns about social distancing or wearing a mask during class.
- If I am unable to attend an in-person class session due to symptoms of COVID-19 or another illness, I will communicate with my instructor ahead of time.

If I am unwilling to comply with COVID-safe practices:

- I will talk to my academic advisor about enrolling in online course sections, if available, or disenrolling from fall course work. (Disenrolling will impact financial aid, housing, etc.)

Stay informed about COVID-19 at NMSU

More information about the NMSU system's COVID-19 response can be found at now.nmsu.edu. In addition, updates are available to students and their families through many communication channels. Links to visit or subscribe are available at now.nmsu.edu/plan/communication-and-information-sharing.html.

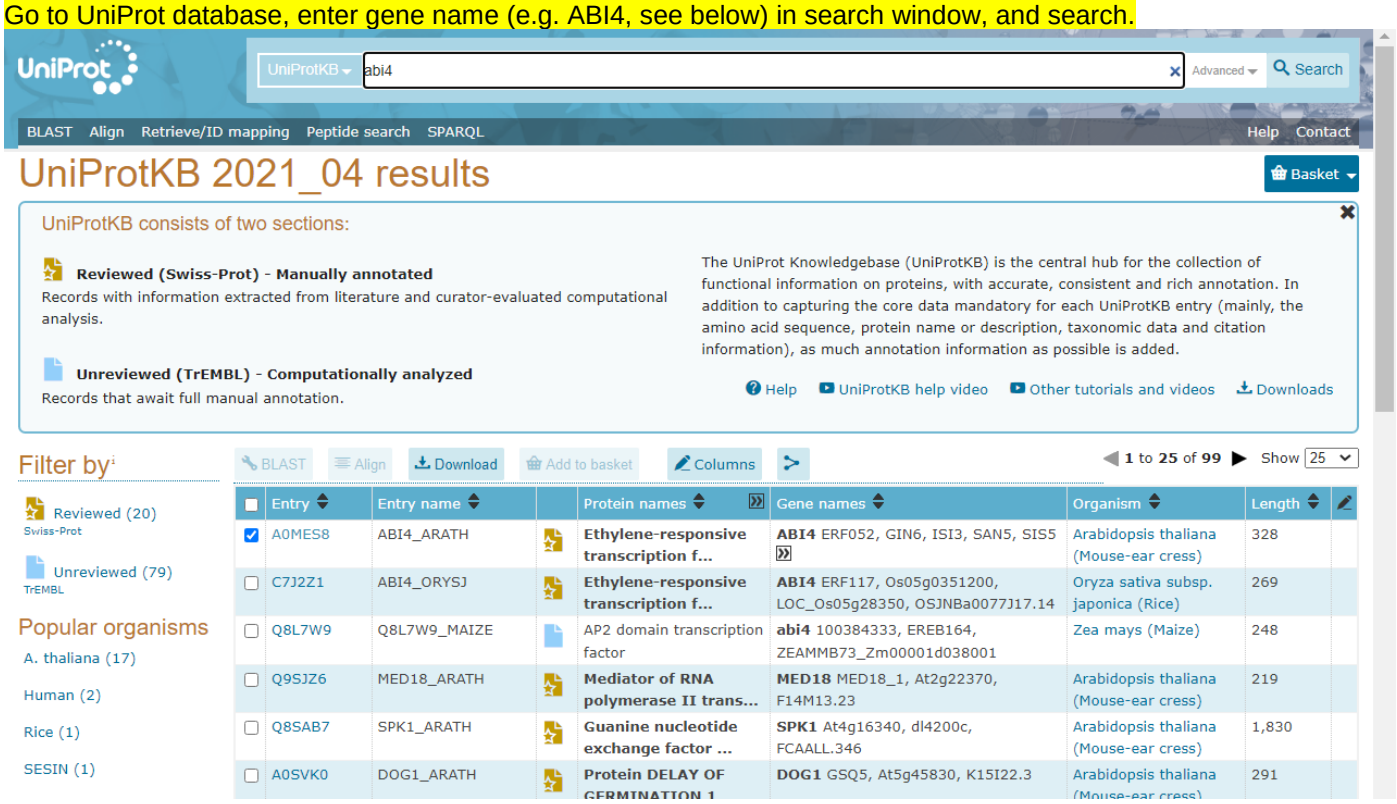
Discrimination and Disability Accommodation: Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act Amendments Act (ADA) covers issues relating to disability and accommodations. If a student has questions or needs an accommodation in the classroom (all medical information is treated confidentially), contact: Main Campus Student Accessibility Services (SAS) Corbett Center Student Union Room 208 Jesse Haas, Interim Director, 575-646-6840, sas@nmsu.edu.

New Mexico State University, in compliance with applicable laws and in furtherance of its commitment to fostering an environment that welcomes and embraces diversity, does not discriminate on the basis of age, ancestry, color, disability, gender identity, genetic information, national origin, race, religion, retaliation, serious medical condition, sex (including pregnancy), sexual orientation, spousal affiliation, or protected veteran status in its programs and activities, including employment, admissions, and educational programs and activities. Inquiries may be directed to Laura Castille, Executive Director, Title IX and Section 504 Coordinator, Office of Institutional Equity, P.O. Box 30001, E. 1130 University Avenue, Las Cruces, NM 88003; 575.646.3635; 575-646-7802 (TTY); equity@nmsu.edu. Title IX prohibits sex harassment, sexual assault, intimate partner violence, stalking and retaliation. For more information on discrimination or Title IX, or to file a complaint contact: Laura Castille, Executive Director and Title IX Coordinator Office of Institutional Equity (OIE) – O'Loughlin House, 1130 University Avenue Phone: (575) 646-3635 E-mail: equity@nmsu.edu Website: http://equity.nmsu.edu/.

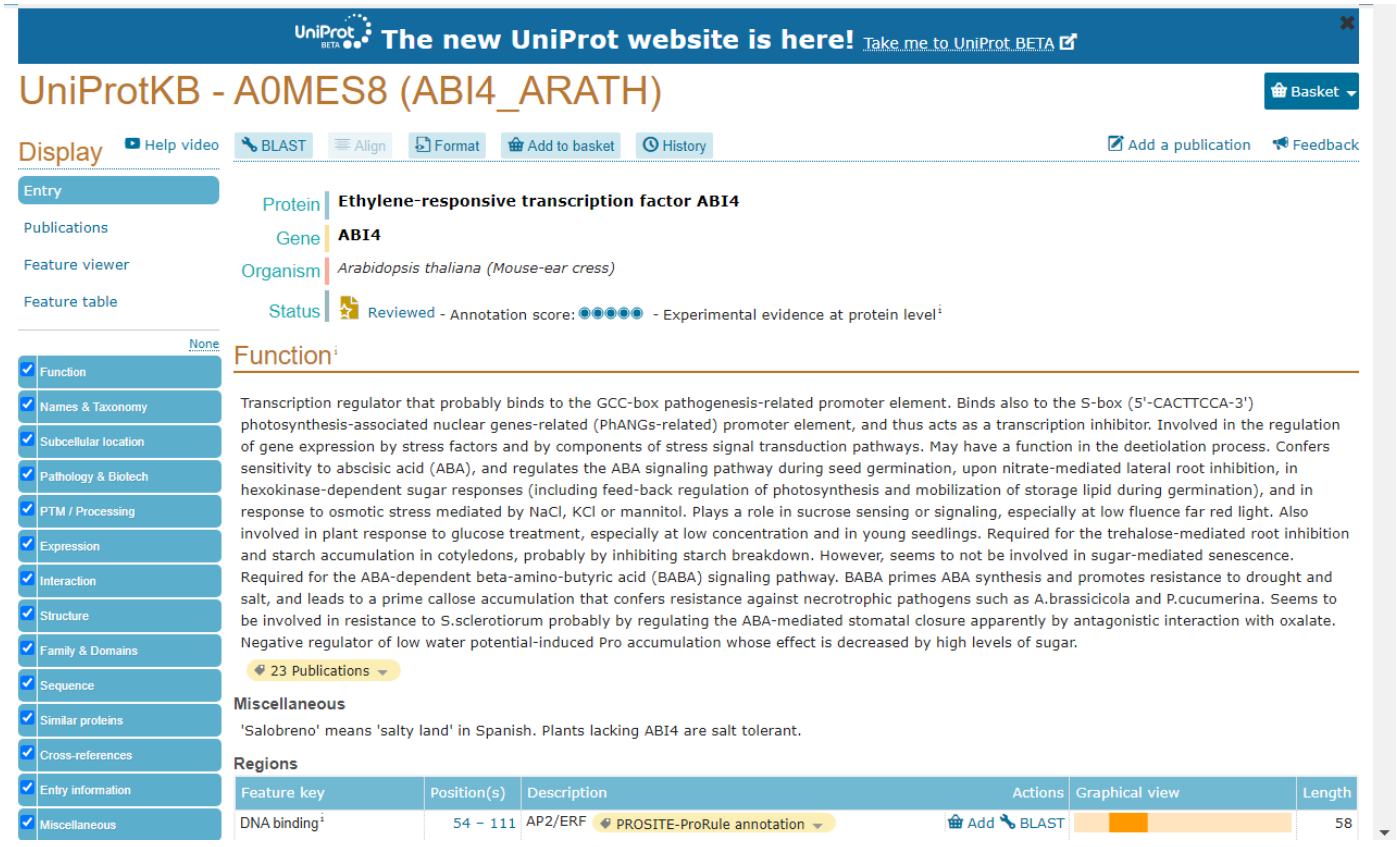
See next two pages for a quick overview about how to locate a gene of interest in a genome.

Overview on how to quickly locate a gene of interest in a genome:

Go to UniProt database, enter gene name (e.g. ABI4, see below) in search window, and search.

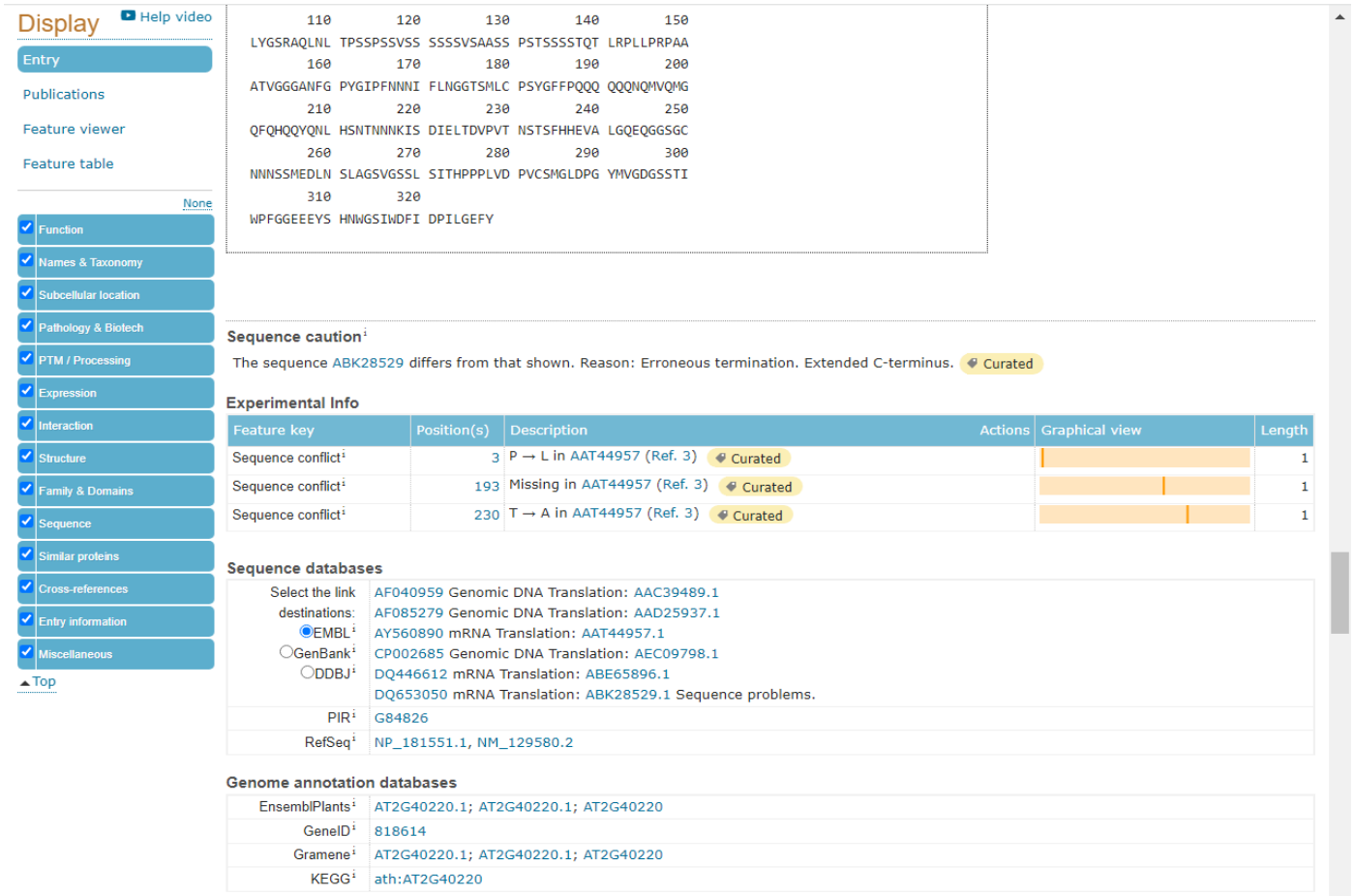


Identify “entry” link in correct organism (see above) & select it to see more information about this gene (see below).



When the window refreshes, look at the tabs on the left side and select “sequence” tab.

After selecting the “sequence” tab, scroll down the new page until you see “Genome annotation databases”, select “GeneID” link (e.g., 818614 below).



This takes you to the NCBI GENES database. Note Genomic context window below with genome position information. Hover the cursor over the mRNA transcript ID link (NM_129580.2 below) for more information.