## Special Problems in Plant Science

**Epigenome Explorer**

11:776:495 Fall Semester (yearly)

Credits by arrangement

Thursday: 8:30 AM - 11:30 AM

Waksman Institute of Microbiology, Busch Campus

Student Lab # WAK-019

## CONTACT INFORMATION

Instructor(s): Dr. Mark Zander

Office Location: Waksman Institute of Microbiology, 190 Frelinghuysen Road, Piscataway, NJ 08854

Phone: 848-445-4684

Email: mzander@waksman.rutgers.edu

Office Hours: by arrangement

## COURSE, WEBSITE RESOURCES AND MATERIALS

* Course website: Canvas
* Kumar, R., Das, S.P., Choudhury, B.U. et al. Advances in genomic tools for plant breeding: harnessing DNA molecular markers, genomic selection, and genome editing. Biol Res 57, 80 (2024). https://doi.org/10.1186/s40659-024-00562-6
* Aanchal Choudhary, Moonia Ammari, Hyuk Sung Yoon, Mark Zander, High-throughput capture of transcription factor-driven epigenome dynamics using PHILO ChIP-seq, *Nucleic Acids Research*, Volume 52, Issue 22, 11 December 2024, Page e105, https://doi.org/10.1093/nar/gkae1123
* Buenrostro, J., Giresi, P., Zaba, L. *et al.* Transposition of native chromatin for fast and sensitive epigenomic profiling of open chromatin, DNA-binding proteins and nucleosome position. *Nat Methods* **10**, 1213–1218 (2013). https://doi.org/10.1038/nmeth.2688
* Kaufmann K, Muiño JM, Østerås M, Farinelli L, Krajewski P, Angenent GC. Chromatin immunoprecipitation (ChIP) of plant transcription factors followed by sequencing (ChIP-SEQ) or hybridization to whole genome arrays (ChIP-CHIP). Nat Protoc. 2010 Mar;5(3):457-72. doi: 10.1038/nprot.2009.244. Epub 2010 Feb 18. PMID: 20203663.
* Landt SG, Marinov GK, Kundaje A, Kheradpour P, Pauli F, Batzoglou S, et al. ChIP-seq guidelines and practices of the ENCODE and modENCODE consortia. Genome Res. 2012 Sep;22(9):1813-31. doi: 10.1101/gr.136184.111. PMID: 22955991; PMCID: PMC3431496.
* Wang Y, Mostafa S, Zeng W, Jin B. Function and Mechanism of Jasmonic Acid in Plant Responses to Abiotic and Biotic Stresses. Int J Mol Sci. 2021 Aug 9;22(16):8568. doi: 10.3390/ijms22168568. PMID: 34445272; PMCID: PMC8395333.

## COURSE DESCRIPTION

Next-generation sequencing (NGS) has ushered in the era of genomics, enabling unprecedented advances across the life sciences. New genomic tools and plant genome assemblies are published almost daily, opening the door to a wide range of discoveries—from the identification of rare cell types and rapid detection of single nucleotide polymorphisms to the investigation of epigenetic reprogramming dynamics. This *Epigenome Explorer* course will introduce students to key genomic techniques now routinely applied across nearly all model organisms. The core toolset will include RNA-seq (RNA sequencing), ChIP-seq (Chromatin Immunoprecipitation Sequencing), and ATAC-seq (Assay for Transposase-Accessible Chromatin using sequencing). Through practical application of these methods to selected crop and medicinal plant species under biotic stress conditions, students will gain hands-on experience with each step of the workflow, including chromatin, RNA, and nuclei extraction, chromatin immunoprecipitation, sequencing library preparation, and comprehensive data analysis. The students will also learn about major advancements of this genetic core toolset.

## COURSE LEARNING GOALS (link to Plant Biology Undergraduate Program Goals: (http://plantbiology.rutgers.edu/undergrad/plantbiology/)

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

1. Develop a thorough understanding and competence in the complete experimental workflow of genomics, from sample preparation to data generation (addresses program goal 1, technical proficiency)

2. Understand the importance of studying plant-environment interactions (addresses program goal 2, context)

3. Summarize and present their findings to a scientific audience (addresses program goals 3, communication)

4. Critically analyze both publicly available and self-generated genomic datasets (addresses program goal 4, critical thinking)

## ASSIGNMENTS/RESPONSIBILITIES, GRADING & ASSESSMENT

Grading: Grades will be determined based on one in-class examinations and one presentation. Presentations will be carried out in groups of two students.

• Exam 1 = 50%

• Presentation 1 = 50%

Scale: 90-100% = A; 80-89 = B; 70-79 = C; 60-69 = D

Learning goals assessment: Specific questions on exams and in the presentation will be used to assess student knowledge of all course learning goals. The percentage score on these assessments will determine the level of mastery: >90% outstanding; 80-89% good; 70-70% satisfactory; <69% unsatisfactory.

## COURSE SCHEDULE



## FINAL EXAM/PAPER DATE AND TIME

The final exam is scheduled for normal class time.

## ABSENCE POLICY

Students are expected to attend all classes; if you expect to miss one or two classes, please use the University absence reporting website <https://sims.rutgers.edu/ssra/> to indicate the date and reason for your absence. An email is automatically sent to me.

## ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

Please follow the procedures outlined at <https://ods.rutgers.edu/students/getting-registered>. Full policies and procedures are at <https://ods.rutgers.edu/>

**ACADEMIC INTEGRITY**

The university's policy on Academic Integrity is available at <https://academicintegrity.rutgers.edu/sites/default/files/pdfs/current.pdf>.

The principles of academic integrity require that a student:

* properly acknowledge and cite all use of the ideas, results, or words of others.
* properly acknowledge all contributors to a given piece of work.
* make sure that all work submitted as his or her own in a course or other academic activity is produced without the aid of impermissible materials or impermissible collaboration.
* obtain all data or results by ethical means and report them accurately without suppressing any results inconsistent with his or her interpretation or conclusions.
* treat all other students in an ethical manner, respecting their integrity and right to pursue their educational goals without interference. This requires that a student neither facilitate academic dishonesty by others nor obstruct their academic progress.
* uphold the canons of the ethical or professional code of the profession for which he or she is preparing.

Adherence to these principles is necessary in order to ensure that

* everyone is given proper credit for his or her ideas, words, results, and other scholarly accomplishments.
* all student work is fairly evaluated, and no student has an inappropriate advantage over others.
* the academic and ethical development of all students is fostered.
* the reputation of the University for integrity in its teaching, research, and scholarship is maintained and enhanced.

Failure to uphold these principles of academic integrity threatens both the reputation of the University and the value of the degrees awarded to its students. Every member of the University community therefore bears a responsibility for ensuring that the highest standards of academic integrity are upheld.

## STUDENT WELLNESS SERVICES

**Counseling, ADAP & Psychiatric Services (CAPS)**

(848) 932-7884 / 17 Senior Street, New Brunswick, NJ 08901/ [www.rhscaps.rutgers.edu/](http://www.rhscaps.rutgers.edu/)

CAPS is a university mental health support service that includes counseling, alcohol and other drug assistance, and psychiatric services staffed by a team of professionals within Rutgers Health services to support students’ efforts to succeed at Rutgers University. CAPS offers a variety of services that include individual therapy, group therapy and workshops, crisis intervention, referral to specialists in the community and consultation and collaboration with campus partners.

**Violence Prevention & Victim Assistance (VPVA)**

(848) 932-1181 / 3 Bartlett Street, New Brunswick, NJ 08901 / <https://vpva.rutgers.edu/>

The Office for Violence Prevention and Victim Assistance provides confidential crisis intervention, counseling, and advocacy for victims of sexual and relationship violence and stalking to students, staff, and faculty. To reach staff during office hours when the university is open or to reach an advocate after hours, call 848-932-1181.

**Disability Services**

(848) 445-6800 / Lucy Stone Hall, Suite A145, Livingston Campus, 54 Joyce Kilmer Avenue, Piscataway, NJ 08854 / <https://ods.rutgers.edu/>

Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: <https://ods.rutgers.edu/students/documentation-guidelines>. If the documentation supports your request for reasonable accommodations, your campus’s disability services office will provide you with a Letter of Accommodation. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form on the ODS web site at: https://webapps.rutgers.edu/student-ods/forms/registration.

**DoSomething** button through Rutgers Dean of Students office:

<http://health.rutgers.edu/do-something-to-help/>

**Wellness Coaching** through Rutgers HOPE:

<https://health.rutgers.edu/health-education-and-promotion/health-promotion-peer-education/wellness-coaching>

**Self-Help Apps** found on the Rutgers Student Health website:

<https://health.rutgers.edu/health-education-and-promotion/self-help/self-help-apps>

**NJ Hopeline** - (1-855-654-6735) **|** **National Suicide Hotline** - (1-800-273-8255)

## BASIC NEEDS RESOURCES

Any student who has difficulty affording groceries or accessing sufficient food, or who lacks a safe and stable place to live, is urged to contact the Rutgers Student Food Pantry and/or the Dean of Students (details below). Furthermore, please notify the professor if you are comfortable doing so, as they may be able to provide additional support.

**Rutgers Student Food Pantry**
848-932-5500 / College Ave Student Center, Room 115 (126 College Ave) / <http://ruoffcampus.rutgers.edu/food/>Check their website for hours and additional locations. The Rutgers Student Food Pantry is dedicated to helping all Rutgers students in need of food, no questions asked.  Students will be provided with groceries that typically last about one week.

**Dean of Students Office**
848-932-2300 / 88 College Avenue, New Brunswick, NJ 08901 / <https://deanofstudents.rutgers.edu/>
Mon-Fri, 8:30am-5:00pm
The Dean of Students Office at Rutgers University-New Brunswick provides solutions, services, and support to help students navigate Rutgers University. The Office serves as a student support network by providing advocacy, problem resolution, and critical incident intervention for those times when additional assistance is needed. Please call to schedule an appointment to meet with a representative from the Dean’s office.