

PUBH 8446, SECTION 001

Advanced Statistical Genetics and Genomics Spring 2022

COURSE & CONTACT INFORMATION

Credits: 3
Meeting Day(s): M/W
Meeting Time: 11:15-12:30
Meeting Place: Health Science Edu Ctr 4-107

Instructor: Baolin Wu, PhD
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Office Hours: via email/Zoom
Office Location: Mayo A442

COURSE DESCRIPTION

Statistical methods for analysis of genetic and genomic data including topics on multiple comparison and gene network modeling. Note this course is a continuation of PubH 7445 for PhD students in Biostatistics or Statistics.

COURSE PREREQUISITES

PubH 7445 Statistics for Human Genetics and Molecular Biology, Statistical theory at the level of Stat 8101-2, a college-level molecular genetics course is recommended, or permission by instructors.

COURSE GOALS & OBJECTIVES

After taking the course, the students are expected to understand the statistical challenges in genetics and genomics and important statistical methods developed for this field. The students should then be able to conduct independent reading and research in the future.

METHODS OF INSTRUCTION AND WORK EXPECTATIONS

Course Workload Expectations

The course will focus on several broad research topics over the semester. Each research topic will be presented in 4-6 week period in the rest of the semester (see class schedule). Students are expected to carefully read all the required readings, and are strongly encouraged to also read the optional readings.

Learning Community

School of Public Health courses ask students to discuss frameworks, theory, policy, and more, often in the context of past and current events and policy debates. Many of our courses also ask students to work in teams or discussion groups. We do not come to our courses with identical backgrounds and experiences and building on what we already know about collaborating, listening, and engaging is critical to successful professional, academic, and scientific engagement with topics.

In this course, students are expected to engage with each other in respectful and thoughtful ways.

In group work, this can mean:

- Setting expectations with your groups about communication and response time during the first week of the semester (or as soon as groups are assigned) and contacting the TA or instructor if scheduling problems cannot be overcome.
- Setting clear deadlines and holding yourself and each other accountable.
- Determining the roles group members need to fulfill to successfully complete the project on time.
- Developing a rapport prior to beginning the project (what prior experience are you bringing to the project, what are your strengths as they apply to the project, what do you like to work on?)

In group discussion, this can mean:

- Respecting the identities and experiences of your classmates.
- Avoid broad statements and generalizations. Group discussions are another form of academic communication and responses to instructor questions in a group discussion are evaluated. Apply the same rigor to crafting discussion posts as you would for a paper.
- Consider your tone and language, especially when communicating in text format, as the lack of other cues can lead to misinterpretation.

Like other work in the course, all student to student communication is covered by the Student Conduct Code (<https://z.umn.edu/studentconduct>).

COURSE TEXT & READINGS

No required textbooks. Materials will mainly be drawn from the literature. The readings are required (unless identified as optional). The readings have been carefully chosen from the field to represent very good and recent research papers.

The required and optional readings can be retrieved through the University of Minnesota's e-journals. If you have any difficulty accessing any readings, please contact the instructor.

COURSE OUTLINE/WEEKLY SCHEDULE

Week 1-4 Multiple hypothesis testing in high-dimensional biomedical data: signal detection and reproducible research

Week 5-11 Genome-wide association and sequencing studies: association test, interaction modeling, risk prediction and integrative modeling

Week 12-14 Post-GWAS integrative analysis

Readings to be distributed in the class.

SPH AND UNIVERSITY POLICIES & RESOURCES

The School of Public Health maintains up-to-date information about resources available to students, as well as formal course policies, on our website at www.sph.umn.edu/student-policies/. Students are expected to read and understand all policy information available at this link and are encouraged to make use of the resources available.

The University of Minnesota has official policies, including but not limited to the following:

- Grade definitions
- Scholastic dishonesty
- Makeup work for legitimate absences
- Student conduct code
- Sexual harassment, sexual assault, stalking and relationship violence
- Equity, diversity, equal employment opportunity, and affirmative action
- Disability services
- Academic freedom and responsibility

Resources available for students include:

- Confidential mental health services
- Disability accommodations
- Housing and financial instability resources
- Technology help
- Academic support

EVALUATION & GRADING

Course grade is based on course projects (one for each topic). A letter grade will be determined from the percentage of points each student receives. Please refer to the University's Uniform Grading Policy and Grading Rubric Resource at <https://z.umn.edu/gradingpolicy>

Grading Scale

The University uses plus and minus grading on a 4.000 cumulative grade point scale in accordance with the following, and you can expect the grade lines to be drawn as follows:

| % In Class | Grade | GPA |
|------------|-------|-------|
| 93 - 100% | A | 4.000 |
| 90 - 92% | A- | 3.667 |
| 87 - 89% | B+ | 3.333 |
| 83 - 86% | B | 3.000 |
| 80 - 82% | B- | 2.667 |
| 77 - 79% | C+ | 2.333 |
| 73 - 76% | C | 2.000 |
| 70 - 72% | C- | 1.667 |
| 67 - 69% | D+ | 1.333 |
| 63 - 66% | D | 1.000 |
| < 62% | F | |

- A = achievement that is outstanding relative to the level necessary to meet course requirements.
- B = achievement that is significantly above the level necessary to meet course requirements.
- C = achievement that meets the course requirements in every respect.
- D = achievement that is worthy of credit even though it fails to meet fully the course requirements.
- F = failure because work was either (1) completed but at a level of achievement that is not worthy of credit or (2) was not completed and there was no agreement between the instructor and the student that the student would be awarded an I (Incomplete).
- S = achievement that is satisfactory, which is equivalent to a C- or better
- N = achievement that is not satisfactory and signifies that the work was either 1) completed but at a level that is not worthy of credit, or 2) not completed and there was no agreement between the instructor and student that the student would receive an I (Incomplete).

| Evaluation/Grading Policy | Evaluation/Grading Policy Description |
|--|---|
| Scholastic Dishonesty, Plagiarism, Cheating, etc. | <p>You are expected to do your own academic work and cite sources as necessary. Failing to do so is scholastic dishonesty. Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering, forging, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis (As defined in the Student Conduct Code). For additional information, please see https://z.umn.edu/dishonesty</p> <p>The Office for Student Conduct and Academic Integrity has compiled a useful list of Frequently Asked Questions pertaining to scholastic dishonesty: https://z.umn.edu/integrity.</p> <p>If you have additional questions, please clarify with your instructor. Your instructor can respond to your specific questions regarding what would constitute scholastic dishonesty in the context of a particular class-e.g., whether collaboration on assignments is permitted, requirements and methods for citing sources, if electronic aids are permitted or prohibited during an exam.</p> <p>Indiana University offers a clear description of plagiarism and an online quiz to check your understanding (http://z.umn.edu/iuplagiarism).</p> |
| Late Assignments | <p>Not accepted unless pre-arranged with the instructor.</p> |
| Attendance Requirements | <p>Required unless pre-arranged with the instructor.</p> |
| Extra Credit | <p>none</p> |

CEPH COMPETENCIES

| Competency | Learning Objectives | Assessment Strategies |
|--|--|-----------------------|
| Analyze quantitative genetic data using appropriate biostatistical models and computer software. | <p>General outcomes</p> <ul style="list-style-type: none"> • Conduct statistical analysis of large-scale genetic data using software, create tables, interpret results, and write summary report <p>Signal detection</p> <ul style="list-style-type: none"> • Employ appropriate statistical models to extract signals from the large-amount of features <p>Hypothesis Testing</p> <ul style="list-style-type: none"> • Identify proper tests and statistics to conduct the hypothesis tests, and carry out the tests via their chosen software. <p>Computation</p> <ul style="list-style-type: none"> • Write computational programs and deliver usable software package for research use | Course projects |
| Interpret results of data analysis for public health research, policy or practice. | <p>Descriptive and Graphical Summaries</p> <ul style="list-style-type: none"> • Interpret analysis results from statistical models | Course projects |

COVID-19, Face-Covering Requirement, Symptoms, Vaccination, and Boosters

The University requires all students and employees to be vaccinated or have a valid exemption; more information is at [safe-campus website](#). On January 5, 2022 President Gabel announced an update on COVID-19 and campus operations which strongly encourages all community members to get a booster as soon as they are eligible. For information about getting a booster and how to schedule an appointment, please refer to [the University's Get the Vax 2.0 initiative](#).

Stay at home if you experience any signs of illness or have a positive COVID-19 test result, and consult with your healthcare provider about an appropriate course of action. Absences related to illness, including COVID-19 symptoms, for yourself or your dependents, are [excused absences](#) and I will work with you to find the best course of action for missed work and course content. I will follow these same protocols and will let you know if the delivery of this course has to be temporarily changed as the result of my own circumstances.

See below for additional details:

People who are not vaccinated are at high risk for getting and spreading SARS-CoV-2, the virus that causes COVID-19. New variants such as Omicron spread more easily and quickly which may lead to more cases of COVID-19 among college students this semester. Increases in the number of COVID-19 cases are straining healthcare resources.

The best defenses against contracting COVID-19 and spreading it to others are vaccination, masking, and taking measures to isolate when symptomatic or COVID-19 positive.

When indoors on campus, students, faculty, staff and guests are currently [required to wear a face covering \(mask\)](#). You must wear your mask so that it covers both your nose and mouth. This will help protect all members of the community, and especially those who are immunocompromised and/or who are caretakers of others (e.g., young children) who are not yet vaccinated. Even though vaccinations are highly protective and required for all students and employees, breakthrough infections do occur; therefore, indoor masking continues to be one of our most important tools for ensuring sustained in-person learning. With the high transmissibility of the recent variants it is strongly recommended that you use an enhanced mask— a surgical mask either alone or in combination with a cloth mask, or an N95, KN95, AirPop or similar mask. Surgical masks are widely available throughout campus, and you can get free high-quality masks by following the instructions at <https://www.uhs.umn.edu/university-health-and-safety-mask-support-program>.

Both the Center for Disease Control ([CDC](#)) and Minnesota Department of Health ([MDH](#)) recommend that we stay home and get tested if we are experiencing [COVID-19 symptoms](#), even if we're already fully vaccinated. I commit to doing my part to keep you and your peers safe by doing this, and I expect that you will too. If you experience [COVID-19 symptoms](#) or symptoms of any potentially infectious respiratory or other illness, you should stay home or in your residence hall room and not come to class or to campus. Consult your healthcare provider about an appropriate course of action, and refer to the [M-test program](#) for COVID-19 testing resources. If you test positive for COVID-19 here are the guidelines for [what to do](#).

The above policies and guidelines are subject to change because the University regularly updates [pandemic guidelines](#) in response to guidance from health professionals and in relation to the prevalence of the virus and its variants in our community. Any changes in COVID-19 policy will be indicated in email messages from the Administration and these syllabus details will be modified as needed.