

PUBH 691: Bioinformatics and Personalized Medicine

Course Coordinator: Lan Guo, Ph.D., Assistant Professor
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Office Hours: Monday and Wednesday 3 – 4 PM, or by appointment.

Class Meeting Format

In class. 8:00 am – 9:15 am, Tuesday and Thursday, fall 2010, Room G252F HSC

Course Prerequisites

There are no prerequisites.

Course Resources:

Recommended Textbook: Bioinformatics Basics: Applications in Biological Science and Medicine. 2nd Edition. Edited by Lukas K. Buehler and Hooman H. Rashidi. Taylor & Francis Group.

All reading materials and course contents (in PowerPoint slides) will be available from the SOLE website.

Website linkages and download instructions for software and database toolsets will be covered in the course materials.

Additional course resources include websites and library. Relevant references will be provided in the course materials.

Course Description

This course will give an overview of the interdisciplinary approaches in molecular diagnosis and prognosis for personalized patient care. Recent advances in the knowledge of human genomics and proteomics, as well as bioinformatics, have revolutionized the ways in which researchers are able to identify human molecular disease signatures and to predict treatment response in an individual patient. Genome-wide association studies will guide hypothesis-driven experimentation and aid clinical decision-making.

The goal of this course is to describe methodologies in applying gene profiling for personalized therapy. To accommodate diverse academic backgrounds of students, this course will cover topics in latest advances in molecular biology, cell biology, pharmacology, high throughput microarrays, translational and pre-clinical research, and commonly used biostatistics techniques and bioinformatics tools. Students are expected to acquire the fundamental concepts and techniques for research design, data retrieval from public databases (i.e., GEO, NCBI, SEER, and ONCOMINE), as well as experimental analysis and interpretation. These skills will be crucial for future multidisciplinary research combining population approaches, bioinformatics analysis, biological experimental validation, and prospective clinical trials.

Course Objectives

1. Provide necessary background in experimental biology, systems biology, bioinformatics, biostatistics, epidemiology, population research, and environmental health sciences.
2. Introduce general methods used in quantitative gene expression and protein expression assays as well as bioinformatics analysis.

3. Describe research topics in solving critical issues in personalized therapy.

Public Health Competencies [referencing the Core Public Health Biology, Communication and Informatics, Biostatistics, Epidemiology, and Environmental Health Sciences Competencies for MPH Students identified by the Association of Schools of Public Health (ASPH)]
<http://www.asph.org/userfiles/version2.3.pdf>

1. Specify the role of the immune system, the biological and molecular basis of population health [ASPH Public Health Biology Competencies #1 and #4].
2. Describe how behavior alters human biology [ASPH Public Health Biology Competency #2].
3. Explain how genetics and genomics affect disease processes and public health policy and practice [ASPH Public Health Biology Competency #6].
4. Articulate how biological, chemical and physical agents affect human health [ASPH Public Health Biology Competency #7].
5. Apply biological principles to development and implementation of disease prevention, control, or management programs [ASPH Public Health Biology Competency #8].
6. Apply evidence-based biological and molecular concepts to inform public health laws, policies, and regulations [ASPH Public Health Biology Competency #9].
7. Integrate general biological and molecular concepts into public health [ASPH Public Health Biology Competency #10].
8. Describe how the public health information infrastructure is used to collect, process, maintain, and disseminate data [ASPH Communication and Informatics Competency #1].
9. Use information technology to access, evaluate, and interpret public health data [ASPH Communication and Informatics Competency #8].
10. Use informatics methods and resources as strategic tools to promote public health [ASPH Communication and Informatics Competency #9].
11. Apply basic informatics techniques with vital statistics and public health records in the description of public health characteristics and in public health research and evaluation [ASPH Biostatistics Competency #8].
12. Interpret results of statistical analyses found in public health studies [ASPH Biostatistics Competency #9].
13. Describe the direct and indirect human, ecological and safety effects of major environmental and occupational agents [ASPH Environmental Health Sciences Competency #1].
14. Describe genetic, physiologic and psychosocial factors that affect susceptibility to adverse health outcomes following exposure to environmental hazards [ASPH Environmental Health Sciences Competency #2].
15. Explain the general mechanisms of toxicity in eliciting a toxic response to various

environmental exposures [ASPH Environmental Health Sciences Competency #6].

16. To introduce systematic reviews with meta-analysis as an approach for summarizing associations between exposures and health outcomes [ASPH Epidemiology Competencies #6, #7, #9, and #10].

Course Requirements

- **Class attendance** is required.
- **Class participation** in class discussion and presentation is required. Students will be expected to have read all materials and be prepared to participate in presentation as a group.
- All take home exams must be typed in MS Word documents in English.

Course Syllabus

Date	Topics	Lecturer
Aug. 24, 26	Transcription factors and their binding sites	Tom Elliott
Aug. 31, Sep 2	DNA copy number variation, transcriptome and eQTL	Yao Li
Sep. 7, 9	Protein biomarkers and signal pathway: validation in clinical studies	Linda Vona-Davis
Sep. 14, 16	DNA, RNA and Chromatin; applications of microRNA and siRNA in therapy	Alexey Ivanov
Sep. 21, 23	Pathology for public health	Barbara Ducatman
Sep. 28, 30	Meta-analysis: Overview and Application	Juhua Luo
Oct. 5, 7	SNP; gene environment interactions	Berran Yucesoy
Oct. 12, 14	Assessment of biomarkers in clinical trials	Ramin Altaha
Oct. 19, 21	Pharmacogenomic Aspects of Inter-Patient Drug Variability	Bill Petros
Oct. 26, 28	Biomarkers for risk assessment of environmental exposures	Stephanie Frisbee
Nov. 4	Workshop: Bioinformatics databases (at HSC Library computer lab)	Lan Guo
Nov. 9	Computational methods for microarray data analysis	Lan Guo
Nov. 11	Workshop: Machine learning software WEKA (at HSC Library computer lab)	Lan Guo
Nov. 16, 18	Gene expression-based models for personalized therapy	Lan Guo
Nov. 30 Dec. 2	Population databases and applications in health outcome research	Suresh Madhavan

Important Dates/Time:

- Oct. 1: Take home exam 1 assigned, covering lectures from August 24 to Sep 30
 Oct. 8: Take home exam 1 due by 9AM ET
 Dec. 3: Take home exam 2 assigned, covering lectures from Oct 5 to Dec 2
 Dec. 10: Take home exam 2 due by 9AM ET

Grading

Presentation: Every student will be scored for each class presentation in a scale of 10 points.

Participation: More than one unexcused absence will result in a 5 point reduction for each missed class.

Take home exams: Each take home exam is scored in a scale of 100 points.

30% take home 1
30% take home 2
30% presentation
10% class participation

100-90% A
89-80% B
79-70% C
69-60% D
< 60% F

Late Work and Make-up Exams

Make-up assignments are permitted only with consent of the instructor. In the case of unforeseen circumstances, such as an officially scheduled trip on WVU business, arrangements for a make-up need to be made at least one week prior to the scheduled lecture. Any make-up assignment will be completed as close to the original assignment deadline as possible.

A grade of "I" (incomplete) is given only when the instructor believes that the course work is unavoidably incomplete. Any student receiving an incomplete must contact the faculty member who issued the incomplete to discuss its removal.

Social Justice

WVU is committed to social justice. The instructor of this course concurs with this commitment and expects to maintain a positive learning environment based on open communication, mutual respect, and nondiscrimination. WVU does not discriminate on the basis of race, sex, age, disability, veteran status, religion, sexual orientation, color, or national origin. Any suggestion as to how to further a positive and open environment will be appreciated and given serious consideration.

Disability

If you have a disability and anticipate needing any type of accommodation in order to participate in this class, please inform the instructor and make appropriate arrangements with Disability Services (293-6700).

Academic Integrity/Dishonesty

West Virginia University expects that every member of its academic community shares the historic and traditional commitment to honesty, integrity, and the search for truth. Academic dishonesty is defined to include, but is not limited to, any of the following:

- 1. Plagiarism:** To take and pass off as one's own the ideas, writings, artistic products, etc., of someone else; for example, submitting, without appropriate acknowledgment, a report, notebook, speech, outline, theme, thesis, dissertation, or other written, visual, or oral material that has been knowingly obtained or copied in whole or in part, from the work of others, whether such source is published, including (but not limited to) another individual's academic composition, compilation, or other product, or commercially prepared paper.
- 2. Cheating** and dishonest practices in connection with examinations, papers, and projects, including but not limited to:

- a. Obtaining help from another student during examinations.
- b. Knowingly giving help to another student during examinations, taking an examination or doing academic work for another student, or providing one's own work for another student to copy and submit as his/her own.
- c. The unauthorized use of notes, books, or other sources of information during examinations.
- d. Obtaining without authorization, an examination or any part thereof.

3. Forgery, misrepresentation, or fraud:

- a. Forging or altering, or causing to be altered, the record of any grade in a grade book or other educational record.
- b. Use of University documents or instruments of identification with intent to defraud.
- c. Presenting false data or intentionally misrepresenting one's records for admission, registration, or withdrawal from the University or from a University course.
- d. Knowingly presenting false data or intentionally misrepresenting one's records for personal gain.
- e. Knowingly and unethically furnishing the results of research projects or experiments.
- f. Knowingly furnishing false statements in a University academic proceeding.

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