

Division of Life Science
The Hong Kong University of Science and Technology

LIFS 4370 Human Genetics and Personalized Medicine

Fall semester, 2023-2024

Instructors: Dr. Ho Yi MAK (E-mail: hym@ust.hk) (course coordinator)
Dr. Tom CHEUNG (E-mail: tcheung@ust.hk)

Time and Venue: Tuesday & Thursday 16:30 - 17:50 Room 4620

Course Description

Credits: 3

Pre-requisite: LIFS 2210 or LIFS 3140

Many variations in the human population such as hair thickness, tolerance to milk in adults, high blood cholesterol and susceptibility to certain types of cancer can be determined by genetic factors. This course will cover the principles and up to date technologies for the discovery and analysis of human genetic variations. The application of basic scientific knowledge in a clinical setting will be discussed.

Intended Learning Outcomes

On successful completion of this course, students are expected to be able to:

1. Interpret the mode of inheritance of genetic traits and diseases based on family history and genomic data.
2. Explain and differentiate the technologies used for the diagnosis of diseases in a clinical laboratory setting.
3. Evaluate genetic data published in international journals and assess their relevance to specific human diseases.
4. Work as a member of a group to gather relevant information and devise strategies to solve a family medical mystery.
5. Present the findings of the group project in oral presentations.

Teaching approach

The primary delivery mode of the course will be lectures and small group discussions, supplemented with the use of videos. Basic concepts in genetics will be reviewed, followed by case studies of human genetic variations. Students are required to work in teams to apply their skills in database mining, literature review and analysis to solve a family medical mystery. The results will be summarized in a group oral presentation, in which peer participation will be expected.

Assessment scheme

Assessment Task	Percentage	Intended Learning Outcomes assessed
Final written exam	50%	1, 2, 3
Data mining assignment ^a	25%	1, 2, 3
Group project oral presentation ^b	10% (group)	3, 4, 5
	5% (individual)	3, 4, 5
Group project written report ^c	10% (individual)	2, 3, 4

- Each student will choose from a list of topics (available by October 17) and the assignment is due on December 20. The report should be no longer than 4 pages of text (12 pt font size, Times New Roman, single space, 1-inch page margins, inclusive of a reference list (maximum of 15 papers (APA format)) and 1 page of illustrations (e.g. screen shots of the NCBI Variation Viewer). Deviation from the format may be penalized.
- Groups of students will collaborate on the oral presentation. Students should form groups by September 19 and the assignment of the time of presentation will be drawn on the same day.
- The script of the group oral presentation should be submitted by December 6. Students are required to indicate the specific slides they are responsible for in the oral presentation. The script of each slide should be inserted in the note section of the PowerPoint file.

Assessment rubrics

Group project oral presentation

	Needs improvement	Good	Excellent
Summarizes phenotypes of the disease	Does not consult publicly available database or primary literature relevant to the disease.	Reviews publicly available database or primary literature relevant to the disease.	Reviews publicly available database or primary literature relevant to the disease and identifies potential gap in knowledge, e.g. prevalence in ethnic groups.
Summarizes variant level evidence	Does not consult publicly available database.	Reviews one or more publicly available database.	Reviews one or more publicly available database and shows clear logic in relating the disease with genetic variations.
Summarizes gene level evidence	Failure to relate gene function to the disease.	Correctly relate gene function to the disease.	Correctly relate gene function to the disease and explore additional genes that may cause the same disease.

Additional assessment rubrics will be discussed at the beginning of the course.

Student learning resources

Course material will be drawn from the primary literature and the following reference books.

“The Human Genome: A User’s Guide, 3rd edition” by Julia E. Richards and R. Scott Hawley

“Human Evolutionary Genetics, 2nd edition” by Jobling *et al*

Course schedule

Week	Date	Topic	Instructor
1	05-09-2023	Overview of human genetics	Mak
	07-09-2023	How mutations alter function I	Mak
2	12-09-2023	How mutations alter function II	Mak
	14-09-2023	Human population genetics I	Mak
3	19-09-2023	Human population genetics II	Mak
	21-09-2023	Mitochondrial defects	Mak
4	26-09-2023	Imprinting	Mak
	28-09-2023	Technologies for genetic variation discovery I	Cheung
5	03-10-2023	Technologies for genetic variation discovery II	Cheung
	05-10-2023	Prenatal genetic screening: at the bench	Cheung
6	10-10-2023	Case study I: unwanted reaction to specific food	Cheung
	12-10-2023	Case study I: unwanted reaction to specific food	Cheung
7	17-10-2023	Case study I: <i>group presentation</i>	Cheung
	19-10-2023	Case study II: failure to perceive the environment	Mak
8	24-10-2023	Case study II: failure to perceive the environment	Mak
	26-10-2023	Case study II: <i>group presentation</i>	Mak
9	31-10-2023	Case study III: human with too much or too little fat	Mak
	02-11-2023	Case study III: human with too much or too little fat	Mak
10	07-11-2023	Case study III: <i>group presentation</i>	Mak
	09-11-2023	Case study IV: susceptibility to cancer	Cheung
11	14-11-2023	Case study IV: susceptibility to cancer	Cheung
	16-11-2023	Case study IV: <i>group presentation</i>	Cheung
12	21-11-2023	Case study V: muscular dystrophy	Cheung
	23-11-2023	Case study V: muscular dystrophy	Cheung
13	28-11-2023	Case study V: <i>group presentation</i>	Cheung
	30-11-2023	Review session	Mak/Cheung