Annexe A: New/Revised Course Content in OBTL+ Format

Course Overview

The sections shown on this interface are based on the templates UG OBTL+ or PG OBTL+
If you are revising/duplicating an existing course and do not see the pre-filled contents you expect in the subsequent sections e.g. Course Aims, Intended Learning Outcomes etc. please refer to Data Transformation Status for more information.

Expected Implementation in Academic Year	AY2025/26
Semester/Trimester/Others (specify approx. Start/End date)	Semester 1
Course Author * Faculty proposing/revising the course	Asst Prof Kim Hie Lim
Course Author Email	HLKIM@ntu.edu.sg
Course Title	The Genome and Society
Course Code	ES3203
Academic Units	3
Contact Hours	39
Research Experience Components	Not Applicable

Course Requisites (if applicable)

Pre-requisites	N/A
Co-requisites	N/A
Pre-requisite to	N/A
Mutually exclusive to	N/A
Replacement course to	N/A
Remarks (if any)	

Course Aims

This course offers an introduction to genomics and human genetics, with a strong emphasis on their implications for individuals, society, and the environment. It is designed for students interested in understanding how genomics has transformed science and society since the completion of the Human Genome Project in 2010.

You should take this course if you are curious about:

The exponential growth of the genomics field—driven by advances in genome sequencing technology—and how it has reshaped various scientific disciplines and aspects of human life.

Genetic variation among individuals, and how these differences manifest in traits, disease susceptibility, and responses to pathogens. You will also explore how genomics is revolutionizing personalized medicine by enabling the diagnosis and treatment of diseases based on individual genomes.

The role of genomics in environmental science and sustainability, where it has emerged as a powerful tool for studying biodiversity, species conservation, and ecosystem health.

This course is especially relevant for students considering careers in public health, life sciences, medicine, insurance, risk assessment, environmental policy, and related fields. You will explore how genome sequencing technologies are reshaping social systems—such as decisions around marriage, pregnancy, and health insurance—through access to personal genetic information.

You will critically examine how genomic data intersects with identity, ancestry, politics, and policy-making. We will discuss current trends, including national initiatives to collect population-level genome and health data, and their implications for public health infrastructure, big data management, and economics.

Furthermore, the course highlights the importance of biodiversity and explores how genomics can inform policies for building a sustainable society. Ultimately, you will gain an understanding of how the accumulation of genomic data may influence your own health and life over the long term.

By the end of the course, you will:

- Gain foundational knowledge in genomics and its applications,
- Reflect on your personal values related to life technologies,
- Develop creative thinking around how to communicate complex scientific ideas to the public,
- Appreciate the significance of diversity—both within human populations and across nature.

You will also have the unique opportunity to hear directly from scientists who are actively working in the field, offering real-world perspectives and inspiration.

Course's Intended Learning Outcomes (ILOs)

Upon the successful completion of this course, you (student) would be able to:

ILO 1	Describe how the Genomics and related technology are useful to assess risks in your health.
ILO 2	Evaluate advantages and concerns on development of the life science technology and generating genome information.
ILO 3	Explain how life science technology change or impact human society.
ILO 4	Describe genetic differences between individuals and ethnicities and why it's importance to study them.
ILO 5	Explain the significance and role of genomics in biodiversity and environmental science.

Course Content

The course content covers: 1) Introductory Genomics and Human Genetics, 2) The process of generation and implications of genome data, and 3) Various impacts of the data or research using the data on human societies. Course readings and activities will include knowledge and theory as well as development of logical and critical thinking.

Reading and References (if applicable)

Human Evolutionary Genetics, 2nd, Mark Jobling, Edward Hollox, Toomas Kivisild, Chris Tyler-Smith, 2013. ISBN 9780815341482

Genomics and Society: Ethical, Legal, Cultural and Socioeconomic Implications, Dhavendra Kumar and Ruth Chadwick, 2016. ISBN 9780127999210
https://www.sciencedirect.com.remotexs.ntu.edu.sg/book/9780124201958/genomics-and-society (NTU library accessible)

Genomic Citizenship: The molecularization of identity in the contemporary Middle East, Ian McGonigle, 2021. ISBN: 9780262542944 https://mitpress.mit.edu/books/genomic-citizenship (NTU library accessible)

Environmental DNA: For Biodiversity research and monitoring, Pierre Taberlet, et al., 2018. ISBN: 9780198767220
https://academic-oup-com.remotexs.ntu.edu.sg/book/32663 (NTU library accessible)

Planned Schedule

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
1	Introduction of Genomics and Human Genetics : what are gene and genome; what is genome sequencing technology; past and current genome projects; aims of genome projects	1, 2, 3, 4	Readings: Human Evolutionary Genetics, Chapter 2	In-person	Topic: What Genome Data would you generate? Discussion: what is your aim, samples, number of samples, benefits of data generation.
2	Power of sequencing data: Growing field of genomics and genomic project; human population structure and genetic difference between populations; Asian population genetics; genetic characteristics and health; what is microbiome; metagenome sequencing	1, 2, 3, 4, 5	Human Evolutionary Genetics, Chapter 3, 8 Environmental DNA, Chapter 1 The GenomeAsia 100K project enables genetic discoveries across Asia, Nature, 2019	In-person	Topic: One Health Discussion: what is the concept of One Health? What would be a role of One Health to improve the public health care? What could be a role of genomics in One Health?

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
3	Genetic difference in humans: Genetic variations; roles of the variations on genome functions; Mendelian inheritance; chromosome abnormalities	1, 2, 3, 4	Human Evolutionary Genetics, Chapter 10,11,14	In-person	Topic: Genome information will impact on your marriage? Discussion: Will you consider genetic test results from your partner? How this technology impact on human marriage?
4	Natural Selection; what is natural selection, what is the mechanism; types of natural selection; human adaptation to environment and pathogens	1, 2, 3, 4, 5	Human Evolutionary Genetics, Chapter 14	In-person	Topic: human natural selection Discussion: what would be strong selection pressure to different lifestyle of humans such as nomad, hunter-gatherers vs. urbanized modern humans; what could be the impact of global warming on human evolution?

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
5	Ethical and Legal requirements for human subject research: Ethical principles guiding human subject research; Importance of ethics in research; Informed consent; data. Handling and storage; regulations in Singapore	1, 2, 3, 4	Genomics and Society, Chapter 6, 7 Cheung et al, 2022	In-person	Topics: Ethics on human subject study Who owns your genetic data?; What would be public's concerns to provide their samples?; What efforts scientists should put on improving the public perception about human genetic studies or bio sample banking?
6	Genetic disease, test, and therapy: Why are humans sick?; what genetic test can tell you; genetic ancestry and disease; diagnosing a genetic disease; Precision medicine; gene therapy; rare or common disease; the current study and program for genetic disease	1, 2, 3, 4	Human Evolutionary Genetics, Chapter 16, 17 Genomics and Society, Chapter 2, 4	In-person	Topic: Genetic test and therapy Discussion: Should gene therapy be used for enhancement, not just disease?; Should parents be allowed to test their child for all genetic diseases?

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
7	Genetic disorder and their life: What are burden for patients who have rare genetic condition?; aspects from financial, psychosocial impact; limited information and expertise.	1, 2, 3, 4	Human Evolutionary Genetics, Chapter 12	In-person	Topic: Genetic disorder and social policy Discussion: What is medical insurance coverage for rare genetic disease in Singapore or any other countries?; what could be government' s role for the patients?

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
8	Human vs pathogens: Pandemic in history; evolution of pathogens; human immunity; emerging pathogen; development of medicine and vaccines; antibiotic resistance	1, 2, 3, 4	Human Evolutionary Genetics, Chapter 15	In-person	Topic: Pandemic Discussion: What key lessons from the COVID-19 pandemic?; In what ways does climate change influence the emergence and spread of infectious disease?; What are the impacts of antimicrobial resistance on societies?; How can genomics be used to track and understand the spread of antimicrobial resistance?
9	Environmental DNA: Sequencing environment; roles of microbiome in environment and human	1, 2, 3, 4, 5	Environmental DNA	In-person	Discussion: environmental pollution can change human genome? Interactions between humans and environment?

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
10	Conservation genetics: What does endangered species means?; why we need to conserve them?; roles of natural history museum; roles of genetics for conservation	1, 2, 3, 4, 5	Readings: Davis, C.C., Knapp, S. Exploring biodiversity through museomics. Nat Rev Genet 26, 149–150 (2025). https://doi.org/10.1038/s41576-024-00801-2	In-person	Field trip to LKC museum
11	Biodiversity and ecosystem: What is biodiversity and why it is important; how to estimate biodiversity; roles of genomics in study biodiversity; human impacts on biodiversity; human and environment interaction	1, 2, 3, 4, 5	Hogg, C.J. Translating genomic advances into biodiversity conservation. Nat Rev Genet 25, 362–373 (2024). https://doi-org.remotexs.ntu.edu.sg/10.1038/s41576-023-00671-0	In-person	Topic: human impacts on environment and biodiversity Discussion: what are some logistical and environmental challenges that scientists face when studying biodiversity in tropical regions? Choose your favourite species and discuss why is studying the species critical for biodiversity?

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
12	What would be the future humans with this technology?: gene editing and human enhancement; human + technology integration; ethical, social, and evolutionary issues	1, 2, 3, 4, 5	Kun, Á. Is there still evolution in the human population?. BIOLOGIA FUTURA 73, 359–374 (2022). https://doi.org/10.1007/s42977-022-00146-z	In-person	Discussion: Would you want to edit your child's genome?; What kind of human do we want to become?; Could we lose genetic diversity?
13	Student presentation	1, 2, 3, 4, 5	N/A	In-person	Q&A

Learning and Teaching Approach

Approach	How does this approach support you in achieving the learning outcomes?
Lecture	Lectures will directly convey fundamental knowledge and key concepts (ILO 1-5) and will give a guide to raise issues and questions in the topic of each week. The instructor or guest lecturers will give an hour of lecture using lecture slides, video, or online materials. Q&A time will be given to students after the lecture.
Tutorial Activity	After the lecture with given reading materials, the instructor will present single or multiple issues or questions to solve in-class. Students will be randomly assigned into groups using the online tools and have separate sessions to discuss and search for addressing answers or solutions (ILO 1-5). Within a half hour, each team has to develop single slide to present their answers to the class. Each team will have a short presentation. This approach will help students to develop critical thinking and communication skills. The tutorial activity is a part of process for finding each student's topic of their Uessay project.
Quiz	Quiz is for assessing the students' understanding level of the basic knowledge of genetics covered during the lectures (ILO 1-5). Multiple choice questions or short answer questions regarding the principles of the basic genetics will be asked in the close book test. This approach will help students to obtain the basic concepts of genetic principle for further understanding various topics during the class.
Continuous Assessment	Every week students will learn different topic and have a group discussion during the tutorial. Students will be asked to summerise the topics and discussion and introduce one case study regarding the topic in a short report. This approach will help students to follow up the module every week and provide to opportunity think further about the topics and relate it to their real life (ILO 1-5).
Unessay Project	This course will bring a lot of issues and problems broadly about Genomics and Society. Students will select any topic/issue/problem to research by themselves and develop a unessay project. The project outcomes can be any type of contents, such as video, artwork, blog, webpages, survey research, podcast, policy proposal, business proposal, and so on. The process of this project will provide opportunities for student to explore social issues with rapidly advancing technology, think creatively and critically, develop idea for problem-solving and engaging with society and community. During the process, students can think what their future roles could be in society (ILO 1-5). Students will have a presentation of their outcomes of the project and will be asked to show their creativity and competency in the presentation (ILO 1-5).

Assessment Structure

Assessment Components (includes both continuous and summative assessment)

No.	Component	ILO	Related PLO or Accreditation	Weightage	Team/Individual	Rubrics	Level of Understanding
1	Continuous Assessment (CA): Test/Quiz(Quiz)	1, 4, 5		25	Individual	Analytic	Relational
2	Continuous Assessment (CA): Others(Continuous Assessment)	1, 2, 3, 4, 5	1, 2, 3, 4, 5, 6	40	Individual	Analytic	Extended Abstract
3	Continuous Assessment (CA): Project(Unessay project)	1, 2, 3, 4, 5		30	Individual	Holistic	Extended Abstract
4	Continuous Assessment (CA): Class Participation(Participation)	1, 2, 3, 4, 5		5	Individual	Holistic	Not Applicable

Description of Assessment Components (if applicable)

The Unessay project: you will decide any topic related to this module and develop your own research and produce outcomes from the research. It can be various types of outcomes, ex) website, blog, video, artwork, script of a play, portfolio, case study, presentation, research paper, and etc. You will make a short presentation to show your project outcomes in a classroom. You will submit your outcome along with a short writing to explain the topic, aim, motivation, and method of the project.

CA: You will submit a short report from their group discussion during tutorial every week. The report will be submitted individually and is a summary of the group discussion and a case study regarding the topic.

Formative Feedback

You will receive written feedback from me about your continuous assessment (short report) you will submit to the NTU blackboard. My feedback will be about your report, how well you identify the topic and issue and related case study. For quiz, you will receive the scores and marks in the blackboard, and I will upload the answer sheet at the same time. You will receive verbal feedback about your unessay project after your presentation in the class. You will also receive feedback from your peer.

NTU Graduate Attributes/Competency Mapping

This course intends to develop the following graduate attributes and competencies (maximum 5 most relevant)

Attributes/Competency	Level
Care for Society	Advanced
Creative Thinking	Advanced
Curiosity	Intermediate
Decision Making	Advanced
Global Perspective	Intermediate

Course Policy

Policy (Academic Integrity)

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values. As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the academic integrity website for more information. On the use of technological tools (such as Generative AI tools), different courses / assignments have different intended learning outcomes. Students should refer to the specific assignment instructions on their use and requirements and/or consult your instructors on how you can use these tools to help your learning. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Policy (General)

You are expected to complete all assigned readings, activities, assignments, attend all classes punctually and complete all scheduled assignments by due dates. You are expected to take responsibility to follow up with assignments and course related announcements. You are expected to participate in all project critiques, class discussions and activities.

Policy (Absenteeism)

In-class activities make up a significant portion of your course grade. Absence from class without a valid reason will affect your participation grade. Valid reasons include falling sick supported by a medical certificate and participation in NTU's approved activities supported by an excuse letter from the relevant bodies. There will be no make-up opportunities for in-class activities.

Policy (Others, if applicable)

Diversity and inclusion policy
Integrating a diverse set of experiences is important for a more comprehensive understanding of science.

It is our goal to create an inclusive and collaborative learning environment that supports a diversity of perspectives and learning experiences, and that honours your identities; including ethnicity, gender, socioeconomic status, sexual orientation, religion or ability.

To help accomplish this:

If you are neuroatypical or neurodiverse, have dyslexia or ADHD (for example), or have a social anxiety disorder or social phobia;
If you feel like your performance in the class is being impacted by your experiences outside of class;
If something was said in class (by anyone, including the instructor) that made you feel uncomfortable;
Please speak to your teaching team, our school pastoral officer Christina Tee Siew Khiaw or a peer or senior (either in-person or via email) about how we can help facilitate your learning experience.

As a participant in course discussions, you should also strive to honour the diversity of your classmates. You can do this by: using preferred pronouns and names; being respectful of others opinions and actively making sure all voices are being heard; and refraining from the use of derogatory or demeaning speech or actions.

All members of the class are expected to adhere to the NTU anti-harassment policy. if you witness something that goes against this or have any other concerns, please speak to your instructors or a faculty member.

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