Bioinformatics

BSc(Bioinformatics)

HKU Med

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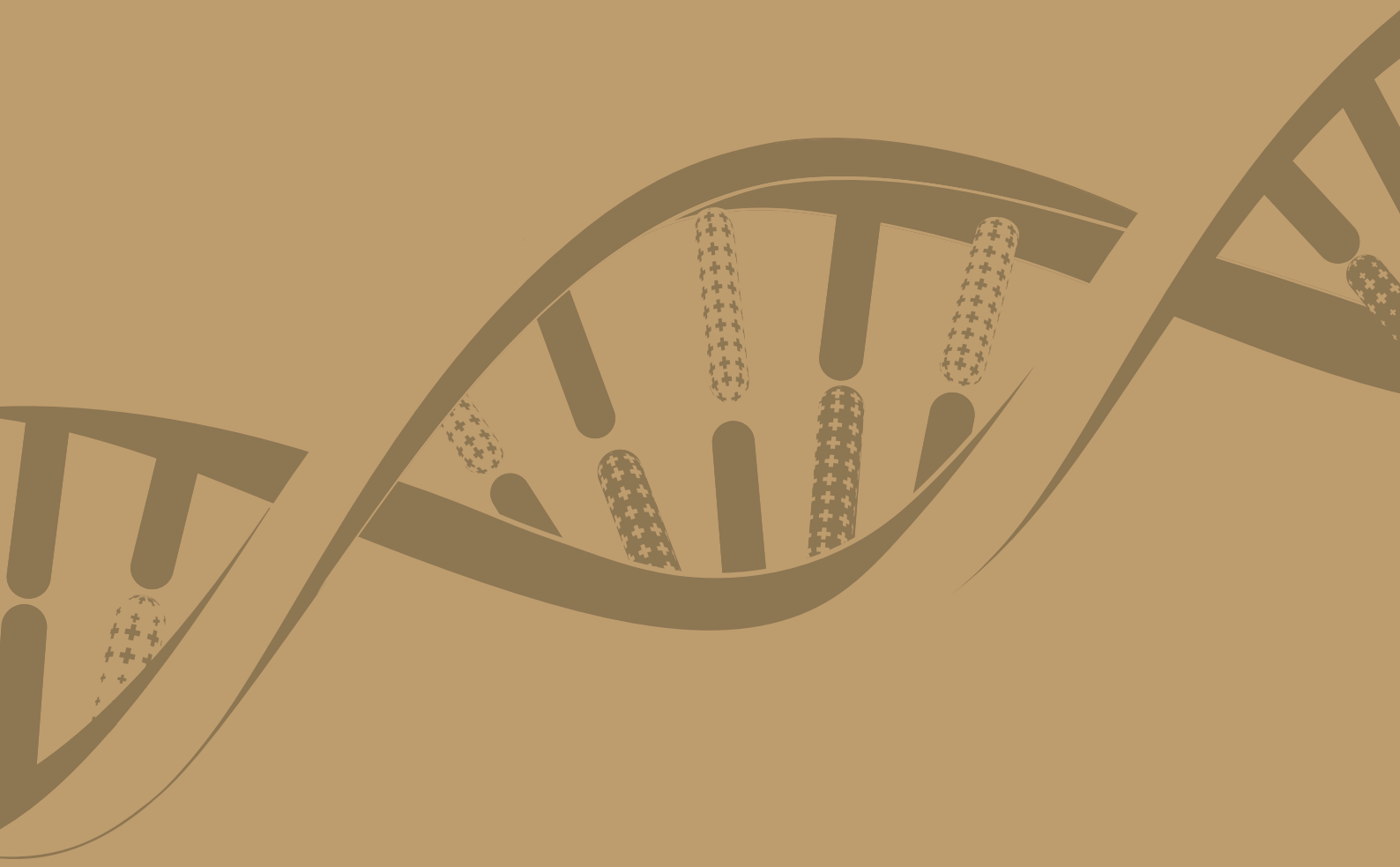
+ The Bioinformatics programme at HKUMed nurtures the next generation of global leaders in biomedical data science and digital healthcare technology, who are well equipped to excel in diverse career paths in the healthcare sector, public health services, innovative entrepreneurship, and research.



Programme Aims and Objectives

Bioinformatics cover a wide range of high impact biomedical big data applications, including genomics, precision medicine, single-cell analysis, multi-omic systems biology, digital health technology, mobile health, artificial intelligence (AI) analysis of medical imaging data, electronic health record analysis, and global health & epidemiology.

Programme Overview

The design of this BSc(Bioinformatics) curriculum recognises the wide spectrum of personal interest and diversity in career aspiration of a modern bioinformatics practitioner, ranging from biomedical researchers who are skilled at performing analysis with bioinformatics tools (bioinformatics users), to computational biologists who can perform large-scale data analyses to solve biological questions (bioinformatics scientists), to software developers who build innovative computational or statistical tools for biomedical applications (bioinformatics engineers).

Data science is now central to modern biomedical research and healthcare innovation. Our BSc in Bioinformatics programme provides essential training for future leaders in this cutting-edge discipline.

This programme is centred around a series of anchoring courses across the four-year curriculum. These anchoring courses enable vertical and horizontal integration of various courses from diverse disciplines across different year levels. The flexible design of the curriculum allows students to take a multitude of disciplinary elective courses in biomedical sciences, statistics, computer science, and biomedical engineering. The programme focuses on essential statistical data analysis skills, key algorithms for biomedical informatics, and fundamental concepts in modern genomic and health technology.

Students are required to complete 240 credits of courses in the four-year curriculum, of which 96 credits are major courses, 36 credits are Common Core courses, and 18 credits are Language Enhancement courses. The remaining 90 credits are for minors and electives.

Core Courses for Bioinformatics Major

The core courses are divided into anchoring, foundation, project and disciplinary elective courses.

Anchoring Courses

Three anchoring courses are the centre-piece of the programme. It is expected that one anchoring course is taken at each of Year 1, 2 and 3/4 of the programme. These courses adopt a case-based problem solving approach to support interdisciplinary integration of subject-specific content at each year level (horizontal integration), and provide a consistent backbone for the curriculum across different years levels (vertical integration). Students are required to complete the following anchoring courses:

- Introduction to Biomedical Data Science
- Artificial Intelligence in Medicine
- Big Data in Biomedical Informatics

Foundation Courses

These courses, mostly to be taken in Year 1 and 2 of the programme, focus on concepts and practical skills in fundamental topics in bioinformatics, such as biochemistry, mathematics, statistics, and computer programming. Students are required to complete the following foundation courses:

- Perspectives in Biochemistry
- Computer Programming
- University Mathematics II
- Multivariable Calculus and Linear Algebra
- Probability and Statistics I
- Probability and Statistics II

Project: Capstone Experience

Each student is required to carry out an in-depth year-long research project in a specialised field of bioinformatics under the guidance of a supervisor who will provide continuous assessment on the student's performance.

Disciplinary 'Data Science Laboratory' Courses

Taking an experiential learning approach, two innovative 'Data Science Laboratory' courses are offered to allow students to acquire hands-on computer programming and data analysis skills, and reinforce the underlying principles of mathematical, statistical, and algorithmic concepts through tailored dry-lab practical classes in genomics and digital health.

Students are required to complete one or both of the following courses:

- Genome Sequencing and Analysis
- Digital Health

Disciplinary Elective Courses

A wide range of specialised courses in bioinformatics, biomedical sciences, statistics and computer science can be chosen to fulfil the disciplinary elective courses. Students are required to take three to four courses from over 20 courses. Some example bioinformatics courses include:

- Structural Bioinformatics
- Biomedical Software Systems
- Global Health Informatics
- Biomedical Image Informatics

Minor Options and Electives

Students can plan their study with the remaining 90 credits in various manners. They may opt to take a minor and/or electives offered within the BSc(Bioinformatics) curriculum or offered in other curricula. The minor options offered in the BSc(Bioinformatics) curriculum include:

Minor in Digital Health

Example courses:

- Artificial Intelligence in Medicine
- Digital Health
- Biomedical Signals Processing and Modelling in Biomedical Applications

Minor in Biomedical Data Science

Example courses:

- Sequence Bioinformatics
- Global Health Informatics
- Statistical Machine Learning

Modes of Learning

Students will be exposed to a wide range of learning experiences, varying with courses they are enrolled in. These experiences include traditional lectures, data science laboratory practicals, problem-based learning tutorials, web-based learning, as well as research projects.

Internship Opportunities

BSc(Bioinformatics) students are provided with ample opportunities to gain work experience in the industry as well as local and international research laboratories relating to bioinformatics and health data science. An internship can be taken as a credit-bearing course during the semester, or as a non-credit bearing experience during the summer break. The workplace learning experience will enable students to apply knowledge gained during their studies in real work environments.

Curriculum Structure

YEAR 1	YEAR 2	YEAR 3	YEAR 4
Anchoring courses (18 credits) BIOF1001 Introduction to Biomedical Data Science	BIOF2001 Artificial Intelligence in Medicine	BIOF3001 Big Data in Biomedical Informatics	**Capstone course (12 credits)** BIOF4001 Final Year Project
Foundation courses (36 credits) BIOC1600 Perspectives in Biochemistry COMP117 Computer Programming MATH1013 University Mathematics II	MATH2014 Multivariable Calculus and Linear Algebra STATS2601 Probability & Statistics I STAT2602 Probability & Statistics II	**Disciplinary 'Data Science Lab' courses (6 or 12 credits)** BIOF3002 Genome Sequencing and Data Analysis BIOF3003 Digital Health	
Common Core (36 credits) **Language (18 credits)**	**Disciplinary elective courses (Choose any 3 or 4) (18 or 24 credits)** **Biomedical Sciences** BIOC2600 Basic Biochemistry BIOC 3605 Sequence Bioinformatics BBMS2003 Human Genetics BBMS2007 Essential Molecular Biology BBMS3008 Essential Proteomics BBMS3009 Genome Science BBMS4004 Public Health Genetics	**Computer Science** COMP2113 Programming Technologies COMP2119 Introduction to Data Structures and Algorithms COMP3314 Machine Learning COMP3317 Computer Vision COMP3353 Bioinformatics **Statistics** STAT3600 Linear Statistical Analysis STAT3612 Statistical Machine Learning STAT4602 Multivariate Data Analysis STAT4609 Big Data Analytics	**Bioinformatics specialty courses** BIOF3004 Bioinformatics Internship BIOF3005 Structural Bioinformatics BIOF3006 Biomedical Software Systems BIOF4002 Global Health Informatics BIOF4003 Biomedical Image Informatics
Other electives (90 credits) Students should ideally minor in Biomedical Data Science, Digital Health, Statistics, Computer Science, or one or more of the Biomedical Sciences minors. Selection of other electives from across the university is also possible.			

Professional Recognition and Career Prospects

BSc(Bioinformatics) graduates will be equipped with practical and transferable skills applicable to a rapidly maturing interdisciplinary field that is of high demand in research, hospital and industry, both locally and internationally. There is a strong growing demand for biotechnology and big data expertise in local/internationally research centres, as well as growing demand in the hospital and healthcare sector in analysis of clinical and public health data.

Some examples of tasks that graduates would be able to do include:

- Interpreting genetic testing results from patients and reporting findings to help clinicians to make treatment decisions.
- Identify patterns in epidemic outbreak-based electronic records of passengers on public transport in order to guide pandemic prevention strategies.
- Predicting how novel compounds interact with proteins to help identify new targeted therapies for diseases.

For more information
on admissions

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