GMB Curriculum 2020-2023

Faculty of Biological and Environmental Sciences

Master’s programme in Genetic and Molecular Biosciences

In this Master’s programme you can specialize according to your interests in:

- biochemistry and structural biology
- genetics and genomics
- cellular and developmental biology
- molecular and analytical health biosciences

Upon completing the Master’s programme in Genetics and Molecular Biosciences:

- You will have in-depth knowledge of genetics and molecular biosciences and of the experimental methods used in these research fields.
- You will understand the characteristics and functions of genes and biomolecules at the cellular, tissue and organism levels.
- You will be able to analyze scientific knowledge critically and communicate it to a range of audiences.
- You will have the ability to produce new scientific information about the properties of genes, biomolecules and cells by means of experimental studies.
- You will be able to take advantage of existing research data and biological databases.
- You will be familiar with good scientific practice and be able to implement it in your own work.
- You be capable of independent project management and problem solving, as well as for maintaining and developing your own expertise.
- You will have experience with working in multi-disciplinary and multicultural communities.

The language of instruction, and of the study materials, is English in all compulsory courses as well as in most optional courses. You can write all exams, reports and your Master’s thesis in English. If you are fluent in Finnish or Swedish you may instead use these languages.

Degree structures

Master’s Programme in Genetics and Molecular Biosciences

Advanced Studies of the study tracks

GMB-100 Biochemistry and Structural Biology Study Track
GMB-300 Cell and Developmental Biology Study Track
GMB-200 Genetics and Genomics Study Track
GMB-400 Molecular and Analytical Health Biosciences Study Track
GMB-500 Biology Subject Teacher Study Track
GMB-100 Biochemistry and Structural Biology Study Track, Advanced Studies, 97cr

**Compulsory courses 57 cr**
GMB-015 Principles of genetics and molecular biosciences, 10 cr  
GMB-010 Master's Thesis, 30 cr  
GMB-009 MSc thesis seminar, 2 cr  
VIKKB-001 Master's Maturity Test BY, 0 cr  
GMB-006 Book exam, 5 cr  
GMB-008 Research project in biochemistry/structural biology, 10 cr

**Optional courses of the track:** Choose 15 - 35 cr of the following
GMB-101 Enzymes, 5 cr  
GMB-102 Membrane biology and biochemistry, 5 cr  
GMB-103 Advanced molecular biology techniques, 5 cr  
GMB-105 Introduction to structural biology and biophysics, 5 cr  
GMB-106 Protein Structure, Function and Folding, 5 cr  
GMB-107 Chemical Biology, 5 cr  
GMB-301 Advanced cell biology, 5 cr

**Elective courses of the track:** Choose 5 - 25 cr of the following
GMB-108 Advanced intensive course in Protein Characterization and Crystallization, 3 cr  
GMB-104 Molecular Biology Laboratory course, 5 cr  
PROV-604 Modeling protein-ligand complexes (MPLC), 5 cr  
one of the following  
KEM342 Molecular modelling, 5 cr or  
PROV-211 Introduction to molecular modelling for life science students, 5 cr  
PBIO-121 Plant Biochemistry and Cell Biology, 5 cr  
MMB-503 Production of recombinant proteins - lab course, 5 cr  
MMB-118 Metabolic engineering - lab course, 5 cr  
PROV-709 Introduction to spectroscopy, 5 cr  
PROV-606 Mass spectrometry in bioanalysis, 5 cr  
NEU-561 Principles of bioscience omics, 10 cr  
NEU-415 Creative Scientific Thinking, 5 cr  
LSI32001 Introduction to applied bioinformatics, 5 cr  
LSI31002 Modeling and analysis in bioinformatics, 5 cr  
KEK228 Bioinorganic chemistry, 5 cr  
BSCH2001 Organic Chemistry 2, 5 cr  
GMB-005 Research project, 10 cr  
GMB-007 Elective Book exam, 5 cr  
GMB-003A Internship, 5 cr  
GMB-003B Internship, 5 cr  
993734 Academic Writing for Students in Master's Degree Programmes 1 (CEFR C1), 2 cr  
Or other courses suitable for the study track according to the personal study plan.

**Other studies 2 cr**
GMB-004 Personal Study Plan (PSP), 0 cr  
993735 Academic Writing for Students in Master's Degree Programmes 2 (CEFR C1), 2 cr

**Elective studies 21 cr**
Free-choice studies supporting the development of the skills and competencies of the student.
GMB-300 Cell and Developmental Biology Study Track, Advanced Studies, 103 cr

**Compulsory courses (72 cr)**
- GMB-015 Principles of genetics and molecular biosciences, 10 cr
- GMB-010 Master's Thesis, 30 cr
- GMB-009 MSc thesis seminar, 2 cr
- VIIKB-001 Master's Maturity Test BY, 0 cr
- GMB-301 Advanced cell biology, 5 cr
- GMB-302 Methods in cell biology, 5 cr
- GMB-304 Methods in functional genetics and development, 5 cr
- GMB-305 Stem cells and organogenesis, 5 cr
- GMB-306 Seminar in cell and developmental biology, 5 cr
- GMB-006 Book exam, 5 cr

**Optional courses of the study track (Choose 31 cr)**
- GMB-007 Elective Book exam, 5 cr
- GMB-005 Research project, 10 cr
- GMB-309 Drosophila genetics, 5 cr
- GMB-203 RNA seq data analysis, 5 cr
- GMB-207 New experimental approaches in genomics, 5 cr
- GMB-202 Essentials of gene regulation & epigenetics, 5 cr
- NEU-231 Regeneration and aging, 5 cr
- NEU-561 Principles of bioscience omics, 10 cr
- NEU-207 Regulatory networks in metabolism, 5 cr
- NEU-203 Systems Physiology, 5 cr
- NEU-204 Integrative Physiology, 5 cr
- NEU-415 Creative Scientific Thinking, 5 cr
- MMB-116 Cell biology of viral infection, 5 cr
- NEU-531 Developmental Neuroscience, 5 cr
- NEU-522 Pre-clinical models of neurological diseases and emerging therapies, 5 cr
- ILS-111 Imaging technologies in biological sciences, 2 cr
- ILS-108 Evo-devo of vertebrate systems, 5 cr
- ILS-110 Growth factors and their receptors, 3 cr
- PBIO-121 Plant Biochemistry and Cell Biology, 5 cr
- TMED-103 Cancer from biology to research, 5 cr
- TMED-203 Regenerative Medicine from Bench to Bedside, 5 cr
- GMB-003A Internship period 1, 5 cr
- GMB-003B Internship period 2, 5 cr
- 993734 Academic Writing for Students in Master's Degree Programmes 1 (CEFR C1), 2 cr
- or other courses suitable for the study track offered by GMB or other Master’s or PhD programmes (according to the personal study plan)

**Other studies 2 cr**
- GMB-004 Personal Study Plan (PSP), 0 cr
- 993735 Academic Writing for Students in Master's Degree Programmes 2 (CEFR C1), 2 cr

**Elective studies 15 cr**
Free-choice studies supporting the development of the skills and competencies of the student.
Compulsory courses (67 cr)
GMB-015 Principles of genetics and molecular biosciences, 10 cr
GMB-010 Master’s Thesis, 30 cr
GMB-009 MSc thesis seminar, 2 cr
VIIKB-001 Master’s Maturity Test BY, 0 cr
GMB-006 Book exam, 5 cr
GMB-201 Genomes and cytogenetics, 5 cr
GMB-202 Essentials of gene regulation & epigenetics, 5 cr
GMB-204 Population genetics and genomics, 5 cr
LSIXXXX Elements of bioinformatics, 5 cr

Optional courses of the track. Choose 10 cr of the following
GMB-205 Evolutionary genomic data analysis, 5 cr
GMB-207 New experimental approaches in genomics, 5 cr
GMB-203 RNA-seq data analysis, 5 cr
LSI-34002 Genome-wide association studies, 5 cr
AGRI-321 Quantitative genetics, 5 cr

Elective courses of the study track. Choose 20 cr of the following
GMB-005 Research project, 10 cr
GMB-208 Human and cancer genetics, 5 cr
GMB-209 Practical training in human genetics, 5 cr
GMB-210 Environmental epigenetics, 2 cr
GMB-205 Evolutionary genomic data analysis, 5 cr
GMB-206 Gene mapping, 5 cr
GMB-207 New experimental approaches in genomics, 5 cr
GMB-203 RNA-seq data analysis, 5 cr
LSI-34002 Genome-wide association studies, 5 cr
AGRI-321 Quantitative genetics, 5 cr
GMB-304 Methods in functional genetics and development, 5 cr
GMB-309 Drosophila genetics, 5 cr
GMB-103 Advanced molecular biology techniques, 5 cr
LSI31003 Machine learning in Molecular Biology, 5 cr
LSIXXXX Algorithms in Genome Analysis, 5 cr
NEU-415 Creative Scientific Thinking, 5 cr
GMB-003A Internship period 1, 5 cr
GMB-003B Internship period 2, 5 cr
993734 Academic Writing for Students in Master's Degree Programmes 1 (CEFR C1), 2 cr
or other courses suitable for the study track offered by GMB or other Master’s or PhD
programmes (according to the personal study plan)

Other studies 2 cr
GMB-004 Personal Study Plan (PSP), 0 cr
993735 Academic Writing for Students in Master's Degree Programmes 2 (CEFR C1), 2 cr

Elective studies 21 cr
Free-choice studies supporting the development of the skills and competencies of the student.
GMB-400 Molecular and Analytical Health Biosciences Study Track, Advanced Studies, 103 cr

Compulsory courses (70 cr)
GMB-015 Principles of genetics and molecular biosciences, 10 cr
GMB-010 Master's Thesis, 30 cr
GMB-009 MSc thesis seminar, 2 cr
VIIKB-001 Master's Maturity Test BY, 0 cr
GMB-006 Book exam, 5 cr
TMED-907 Laboratory Medicine and Molecular Diagnostics, 3 cr
GMB-401 Integrative health biosciences, 5 cr
NEU-561 Principles of bioscience omics, 10 cr

Physiology
Choose 5 cr of the following, or equalent course or book exam 5 cr
   NEU-203: Systems Physiology, 5 cr
   BIO-203: Human physiology, 5 cr

Optional courses of the study track (20 cr)

Alternative courses in analysis. Choose at least 10 cr of the following:

* Bioanalytical methods and quality control*
  KEM358 Quality assurance in analyics, 5 cr
  PROV-709 Introduction to spectroscopy, 5 cr
  PROV-606 Mass spectrometry in bioanalysis, 5 cr
* Statistics and bioinformatic analysis*
  GMB-203 RNA-seq data analysis, 5 cr
  LSIXXXX Elements of bioinformatics, 5 cr
  TMED-915 Introduction to Bioinformatics, 5 cr
  LSI32001 Introduction to applied bioinformatics, 5 cr
  LSI31002 Modeling and analysis in bioinformatics, 5 cr
  LSI31003 Machine learning in Molecular Biology, 5 cr
* Advanced analysis*
  GMB-205 Evolutionary genomic data analysis, 5 cr
  NEU-604 Functional lipidomics seminar, 5 - 10 cr
  ILS-203 Next generation genomics workshop, 4 cr
  TMED-913 Clinical metabolomics, 5 cr
  TMED-912 Introduction to clinical proteomics, 3 cr
  TMED-914 Translational methods 9-15 cr (TMED-910 Genome profiling and Personalized Medicine, TMED-911 Clinical Proteomics and Metabolomics, TMED-917 Introduction to Systems Biology)

Alternative theoretical courses. Choose at least 10 cr of the following:

* Genetics and molecular biosciences*
  GMB-201 Genomes and cytogenetics, 5 cr
  GMB-202 Essentials of gene regulation & epigenetics, 5 cr
  GMB-208 Human and cancer genetics, 5 cr
  GMB-206 Gene mapping, 5 cr
  GMB-302 Methods in cell biology, 5 cr
  GMB-305 Stem cells and organogenesis, 5 cr
  GMB-103 Advanced molecular biology techniques, 5 cr
  GMB-107 Chemical Biology, 5 cr
* Health biosciences*
  NEU-207 Regulatory Networks in Metabolism, 5 cr
  NEU-251 Molecular nutrition, 5 cr
  NEU-231 Mechanisms of Regeneration and Aging, 5 cr
NEU-521 Basic Mechanisms of Nervous System Diseases, 5 cr
NEU-101 Cellular Physiology, 5 cr
NEU-204 Integrative Physiology, 5 cr
PROV-710 Nanomedicines for Biomedical Applications, 5 cr
DOCPOP-111 Essential clinical epidemiology, 3 cr
Mechanisms of Human Disease
(TMED-103 Cancer from Biology to Research,
TMED-203 Regenerative Medicine from Bench to Bedside,
TMED-303 Metabolic Disorders from Aetiology to Therapy, TMED-403 Psychobiology of Stress)

Immuno- and infection biology
MOLE-701 Immunobiology, 2 - 3 cr
MOLE-702 Book exam in Immunobiology, 3 cr
PROV-407 Advanced immunobiology, 5 cr
TMED-503 Infection Biology, 5 cr
MOLE-703 Infectious diseases and infection immunology, 5 cr

Human nutrition
HNFB-112 Ravitsemusfysiologia, 5 cr
HNFB-211 Nutritional physiology, 5 cr
HNFB-221 Nutrition and Society, 5 cr

Elective courses of the study track, Choose 13 cr
GMB-005 Research project, 10 cr
GMB-003A Internship period 1, 5 cr
GMB-003B Internship period 2, 5 cr
NEU-415 Creative Scientific Thinking, 5 cr
993734 Academic Writing for Students in Master's Degree Programmes 1 (CEFR C1), 2 cr
or other courses suitable for the study track offered by GMB or other Master’s or PhD programmes (according to the personal study plan)

Other studies 2 cr
GMB-004 Personal Study Plan (PSP), 0 cr
993735 Academic Writing for Students in Master's Degree Programmes 2 (CEFR C1), 2 cr

Choose 0 - 15 cr. (The remaining part of 120 cr)

Career orientation and professional skills training

GMB-003A Internship period 1, 5 cp
GMB-003B Internship period 2, 5 cp
VIIKB-005 Demanding participation in administrative bodies and student organisations, 2 - 5 cr
VIIKB-002 Tutoring BY, 5 cr
GMB-020 Project work and career planning, 5 cr
or other work life orientation studies.

Mobility window
Master's Programme in Genetics and Molecular Biosciences for Subject Teachers

GMB-500 Biology Subject Teacher Study Track, Advanced Studies, 60 cr

Compulsory courses
- GMB-010 Master's Thesis, 30 cr
- GMB-009 MSc thesis seminar, 2 cr
- VIIKB-001 Master's Maturity Test BY, 0 cr
- GMB-015 Principles of genetics and molecular biosciences, 10 cr
- GMB-006 Book exam, 5 cr
- MOLE-213A Gene technology lectures, 2 cr
- MOLE-213B Gene technology practical work, 5 cr
- GMB-004 Personal Study Plan (PSP), 0 cr
- 993735 Academic Writing for Students in Master's Degree Programmes 2 (CEFR C1), 2 cr

Optional courses of the track 4 cr

PED100r Education, pedagogical studies for teachers 60 cr

Career orientation and professional skills training
- GMB-003A Internship period 1, 5 cr
- GMB-003B Internship period 2, 5 cr
- VIIKB-005 Demanding participation in administrative bodies and student organisations, 2 - 5 cr
- VIIKB-002 Tutoring BY, 5 cr
- GMB-020 Project work and career planning, 5 cr or other work life orientation studies

Mobility window