

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**
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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-1000 Biochemistry and Structural Biology Study Track

GMB-3000 Cell and Developmental Biology Study Track

GMB-2000 Genetics and Genomics Study Track

GMB-4000 Molecular and Analytical Health Biosciences Study Track

GMB-5000 Biology Subject Teacher Study Track

GMB-1000 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
- VIIKB-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-3000 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-202 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.

GMB-2000 Genetics and Genomics, Advanced Studies, 97 cr

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
- LSI31008 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
- LSI31007 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-4000 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 equivalent 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 analytics, 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

LSI31008 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-206 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-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, 5cr
DOCPOP-111 Essential clinical epidemiology, 3 cr
Mechanisms of Human Disease
(TMED-103 Cancer from Biology to Research,
TMED-202 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-5000 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-213C 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

PED100 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