WELCOME TO THE

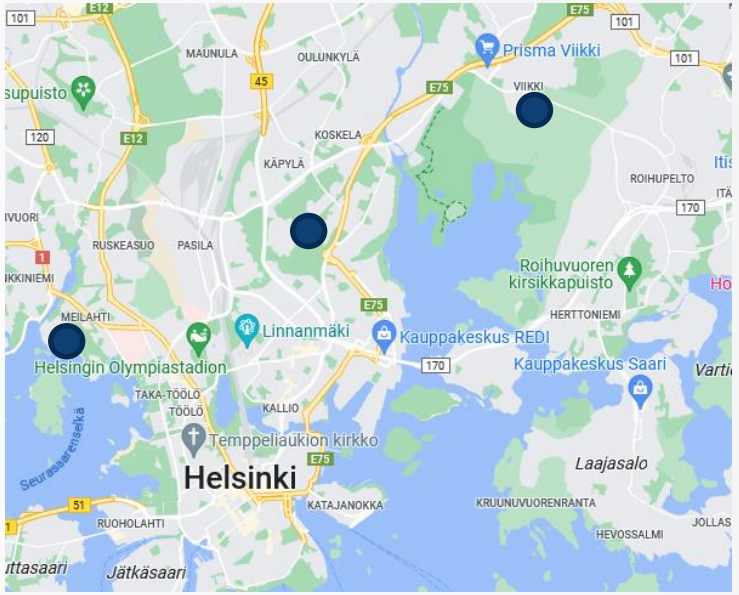
LIFE SCIENCE INFORMATICS (LSI) MASTER'S PROGRAMME

28.8.2025

MASTER'S PROGRAMME IN
LIFE SCIENCE INFORMATICS (LSI)

Life Sciences is one of the strategic research fields at the University of Helsinki. **The multidisciplinary LSI programme integrates research excellence in the Helsinki Institute of Life Sciences (HiLIFE)**. As a student, you will gain access to active research communities on three campuses: Kumpula, Viikki, and Meilahti.

The unique combination of study opportunities tailored from the offering of the three campuses provides an attractive educational profile in life sciences.



City Centre Campus

The multidisciplinary City Centre Campus in the very heart of Helsinki is the largest campus of the University of Helsinki. The City Centre...

Kumpula Campus

The Kumpula Campus, dedicated to research and teaching in the exact natural sciences, is perched on a verdant hill only four kilometres...

Viikki Campus

The Viikki Campus is a hub of teaching and research in the biosciences, agriculture and forestry, pharmacy, and veterinary medicine.

Meilahti Campus

Meilahti Campus is a campus where top-notch medical research, education and care meet.

KUMPULA CAMPUS

EXACTUM

•Department of Computer Science
•Department of Mathematics and Statistics
•Unicafe canteen

PHYSICUM

- Department of Geosciences and Geography
- Department of Physics
- Kumpula Campus Library
- Student Services

CHEMICUM

•Department of Chemistry
•Unicafe canteen

WHAT ARE LIFE SCIENCES? WHAT HAS INFORMATICS TO DO WITH THEM?

Life sciences are **fields of science studying life and organisms**

- From healthcare and medicine to agriculture and food-production
- One of the strategic fields of University of Helsinki

Life sciences and their application areas are producing enormous amounts of data and theoretical questions that cannot be analyzed without tailored methods from mathematics, statistics and computer sciences – **Life science informatics develops and studies computational methods to answer these questions**

At the core of LSI is also to understand the logical reasoning behind experimental sciences and be able to critically assess research-based information

WHY LIFE SIENCE INFORMATICS?

As a graduate of the Life Science Informatics programme you will:

- Have **first class knowledge and capabilities for a career in life science research and in expert duties** in the public and private sectors
- Have understanding of the regulatory and ethical aspects of scientific research
- Have excellent communication and interpersonal skills for employment in an international and interdisciplinary professional setting
- **Understand the principles of mathematical modelling, computational, probabilistic and statistical analysis of biological data, and be an expert in your specialisation area of the LSI programme**
- Understand the logical reasoning behind experimental sciences and be able to critically assess research-based information
- Have mastered scientific research, making systematic use of investigation or experimentation to discover new knowledge
- **Have good opportunities to continue your studies for a doctoral degree**

PROGRAMME STRUCTURE

Life Science Informatics Master´s programme 120 cr

Personal study plan

PSP / HOPS

Contact study track director when you start your studies.

Advanced studies 85 – 120 cr

Introductory courses from study tracks, at least 15 cr

Study track specific courses 35 – 75 cr

- Study tracks give a set of courses.
- In addition:
  - courses from other study tracks
  - advanced courses from other programmes.
- The content of studies will be agreed in personal study plans (PSP / HOPS).

Master´s thesis 30 cr
Master´s thesis seminar 5 cr

Other studies 0 – 35 cr

- Courses and/or modules from other disciplines (other programmes). The courses and modules can be bachelor level ones.
- Bachelor´s level courses in mathematics, statistics, computer science as agreed in personal study plan. Requirements of these courses depend on the content of BSc-degree studies.

STUDY TRACKS

We have 4 study tracks

- Bioinformatics and systems medicine
- Biomathematics
- Biostatistics
- Ecological informatics
  NOTE! Ecological Informatics and Biomathematics are merged into one new study track Mathematical and statistical ecology starting from 1.8.2026.

https://www.helsinki.fi/en/degree-programmes/life-science-informatics-masters-programme/studying

BIOINFORMATICS AND SYSTEMS MEDICINE

Life Science Informatics Master’s Programme

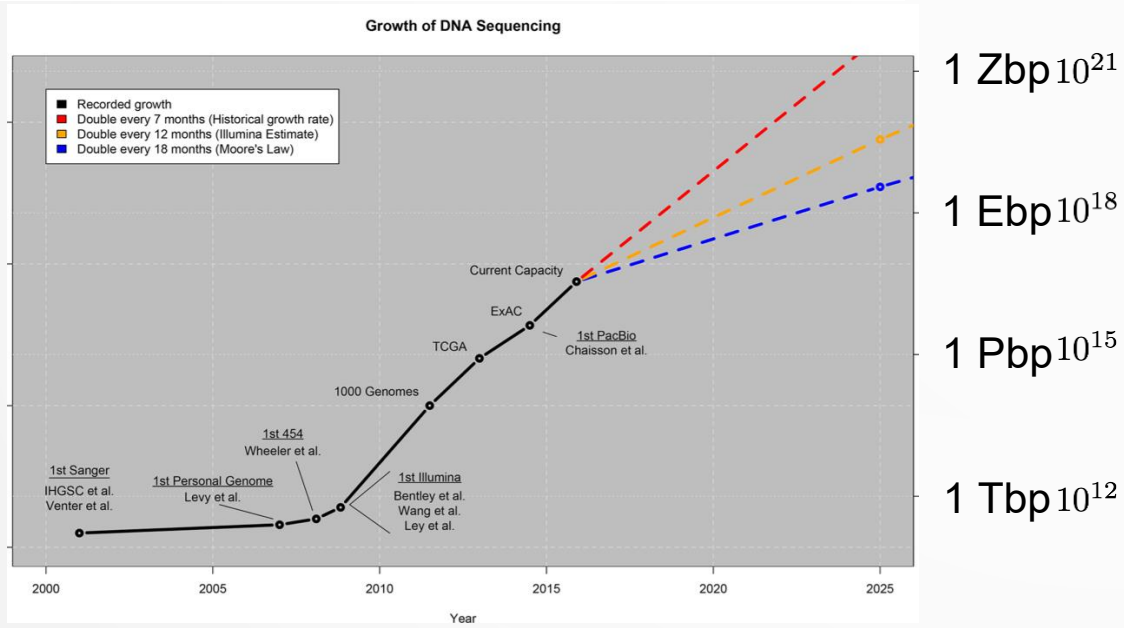
BIOINFORMATICS AND SYSTEMS MEDICINE STUDY TRACK

Worldwide sequencing capacity per year

PERSPECTIVE

Big Data: Astronomical or Genomical?

Zachary D. Stephens[1], Skylar Y. Lee[1], Faraz Faghri[2], Roy H. Campbell[2], Chengxiang Zhai[3], Miles J. Efron[4], Ravishankar Iyer[1], Michael C. Schatz[5]*, Saurabh Sinha[3]*, Gene E. Robinson[6]*



1 Zbp 10^{21}

1 Ebp 10^{18}

1 Pbp 10^{15}

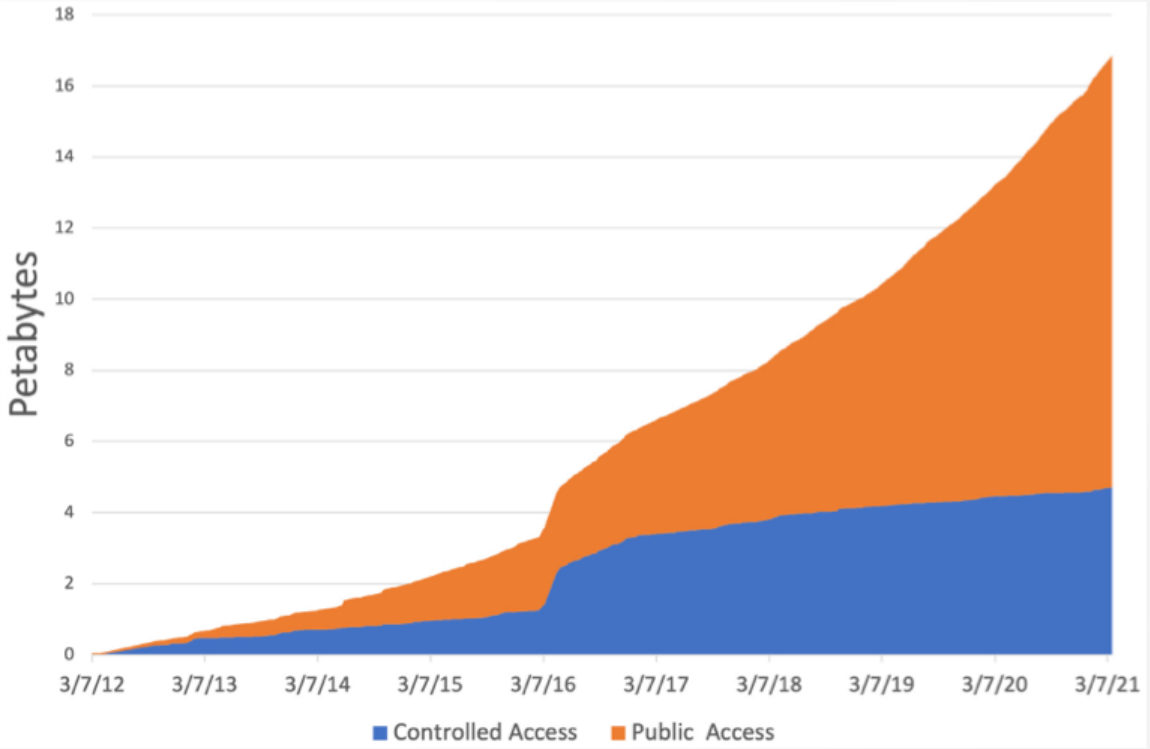
1 Tbp 10^{12}

PLOS Biology | DOI:10.1371/journal.pbio.1002195 July 7, 2015

Published online 24 November 2021 *Nucleic Acids Research, 2022, Vol. 50, Database issue* ***D387–D390***
https://doi.org/10.1093/nar/gkab1053

The Sequence Read Archive: a decade more of explosive growth

Kenneth Katz*, Oleg Shutov, Richard Lapoint, Michael Kimelman, J. Rodney Brister and Christopher O'Sullivan



Growth of SRA over the last decade. Through September 2021 Public Access contains approximately 25.6 Petabase pairs originating from over 14.8 million publicly available runs averaging 1.7 Gbp per run, 0.83 GB per run, 9.6 million spots per run and 187 bp per spot.

A WIDE SPECTRUM OF MASTE THESIS PROJECTS AVAILABLE

Viikki

- Projects combining theory and data, e.g. to understand species interactions in microbial communities
- Method development, e.g. machine learning methods in the context of biology
- Applied bioinformatics, e.g. large scale NGS and phenotype data analysis

→ v.mustonen@helsinki.fi

Meilahti

- Digital pathology (image analysis)
- Data integration (machine learning)
- Drug discovery (deep learning)
- Efficient method development (programming)

→ sampsa.hautaniemi@helsinki.fi

→ jing.tang@helsinki.fi

Kumpula

- Developing algorithmic theory (string algorithms, graph algorithms, etc.)
- Apply novel or existing algorithms to real sequencing datasets
- Developing practical bioinformatics software for the analysis of sequencing data

→ alexandru.tomescu@helsinki.fi

→ **Necessary**: strong programming / algorithmic skills, independent working ability, interest in applying algorithms to real problems

→ Research groups are typically interested in hiring full-time/part-time students

→ Send CV, transcript and short motivation letter to study track leaders

CORE COURSES

LSI31008 Elements of Bioinformatics

LSI31007 Algorithms in Genome Analysis

LSI31003 Machine Learning in Molecular Biology

TMED-917 Introduction to Systems Biology

LSI36002 Systems Medicine Seminar

LSI36001 Clinical Data Mining

OTHER STUDY TRACK COURSES

Computer Science / Data Science

CSM12101 Design and Analysis of Algorithms

CSM12102 String Processing Algorithms

CSM12103 Data Compression Techniques

DATA11002 Introduction to Machine Learning

AYTKT21018 Elements of AI

Genetics & Molecular Biosciences

GMB-204 Population Genetics and Genomics

GMB - 205 Evolutionary genomic data analysis

GMB-203 RNA-seq data analysis

Systems Medicine

Understanding biology / medicine is important: take courses from TRANSMED (MASTER'S PROGRAMME IN TRANS-LATIONAL MEDICINE)

WELCOME TO THE BIOINFORMATICS AND SYSTEMS MEDICINE STUDY TRACK!

Biology and medicine are undergoing a data explosion:

- Great opportunities
  - Personalised cancer therapies, detailed understanding of evolution, successfully combating drug resistance etc.
- Great challenges
  - Computing power grows slower than ability to generate data
- Essential:
  - Powerful algorithms, methods, as well as theory for analysing such data
  - The LSI programme allows you to learn these topics

BIOMATHEMATICS

Life Science Informatics Master’s Programme

Biomathematics courses (70 credits total)

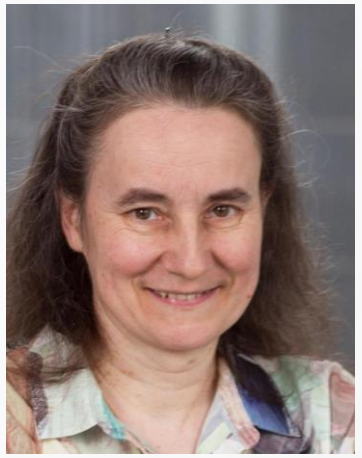
- Mathematical modelling I-II
- Introduction to mathematical biology I-II

- Mathematics of infectious diseases
- Stochastic population models I-II
- Spatial models in ecology and evolution
- Evolution and the theory of games I-II
- Adaptive dynamics

Biomathematics courses (70 credits total)

- **Any questions? Eva Kisdi can answer them on Monday 2nd September in Exactum A405 at 10 am.**
- Mathematical modelling I-II
- Introduction to mathematical biology I-II
- Mathematics of infectious diseases
- Stochastic population models I-II
- Spatial models in ecology and evolution
- Evolution and the theory of games I-II
- Adaptive dynamics

The courses are given every other year
MAST / LSI course codes



Eva Kisdi

Stefan Geritz

Models: Construction and analysis

Data -> insight. Data make sense in the light of models.

- derive models from first principles (rather than ad hoc formulas)
- derive population-level phenomena from the behaviour of individuals

- creative insight and understanding of processes
- at the heart of modern Bayesian statistics
- a variety of mathematical approaches
- transferable skills for modelling real-life phenomena

After graduation

- PhD studies, often abroad
- Positions for applied mathematicians with excellent modelling skills

  epidemiology / public health
  applied ecology / environment

  transferable skills in model construction and analysis

BIOSTATISTICS

Life Science Informatics Master’s Programme

BIOSTATISTICS, WHAT AND WHERE?

Public Health (”*Statistical Epidemiology*”, ”*Survival analysis*”)

THL (Institute for Health and Welfare)

Statistical Genetics (”*Genome-wide association studies*, *population genetics*”)

FIMM (Institute for Molecular Medicine Finland)

Statistics in medicine

Faculty of Medicine, pharma companies

Omics (”*High dimensional statistics*”)

Research in life sciences, companies

EXAMPLES OF RECOMMENDED COURSES

A solid background in statistics and programming recommended. If needed, this can be acquired by Bsc courses in Statistics, Mathematics and Computer Science.

LSI: Statistical Epidemiology, Bayesian Data Analysis, Genome-wide association studies, Statistical Population Genetics, Mathematics of Infectious Diseases

MAST: Computational Statistics, High Dimensional Statistics, Advanced Bayesian Inference, Probability Theory, Survival and Event History Analysis, Time Series Analysis

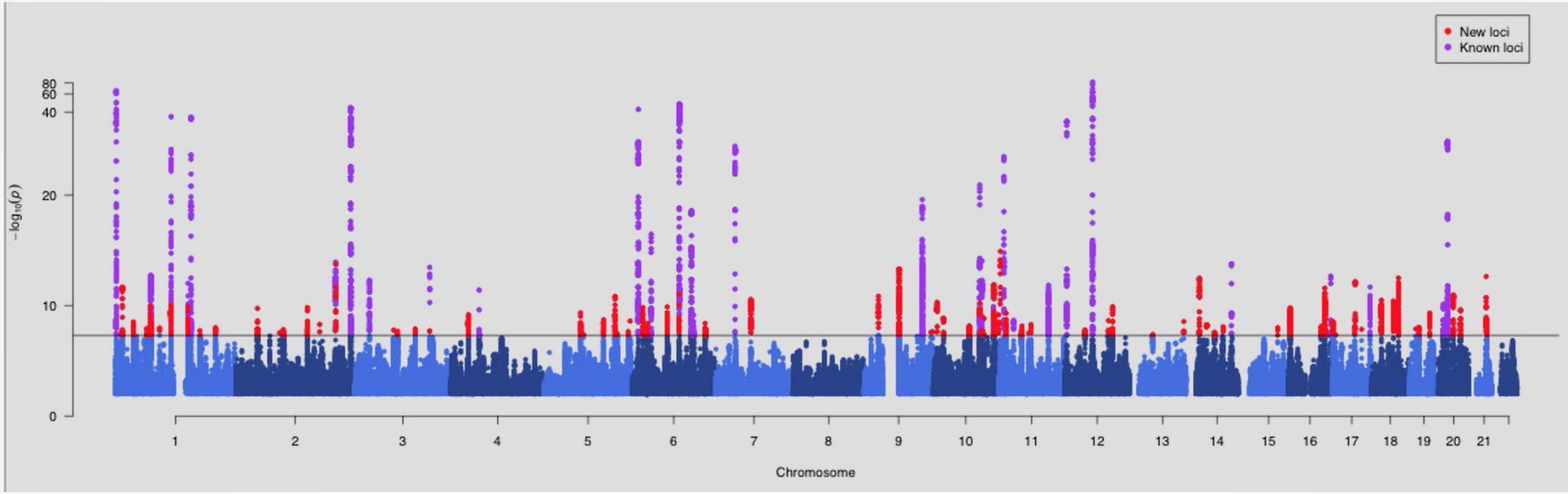
DATA / CS: Advanced Course in Machine Learning, Design and Analysis of Algorithms

BIOSTATISTICS SUPERVISORS

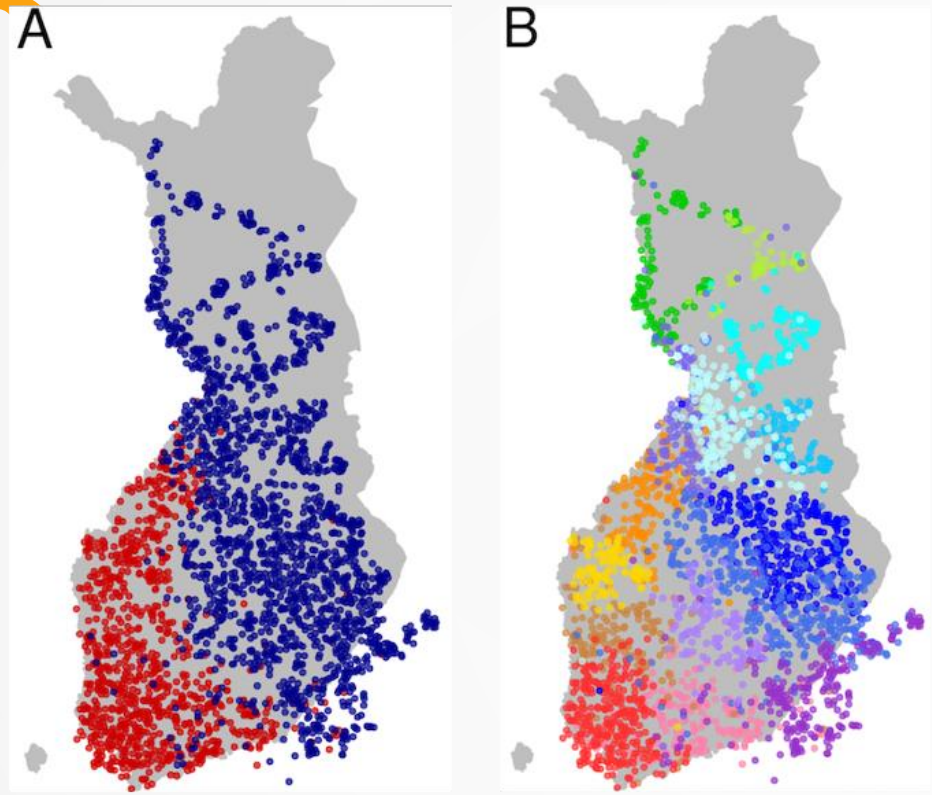
Matti Pirinen	Sangita Kulathinal	Jukka Jokinen
Institute for Molecular Medicine Finland, Faculty of Medicine	THL (Institute for Health and Welfare)	THL (Institute for Health and Welfare)
genetics, high-dim. stats	public health, survival analysis	public health, registries
matti.pirinen@helsinki.fi	sangita.kulathinal@helsinki.fi	jukka.jokinen@helsinki.fi

EXAMPLE: GENETICS OF MIGRAINE

- Statistical problem: Is genetic variation at a particular position associated with disease, here migraine
  - We compare 100,000 migraineurs to 750,000 healthy people
  - We have 123 leads to the biological background of migraine



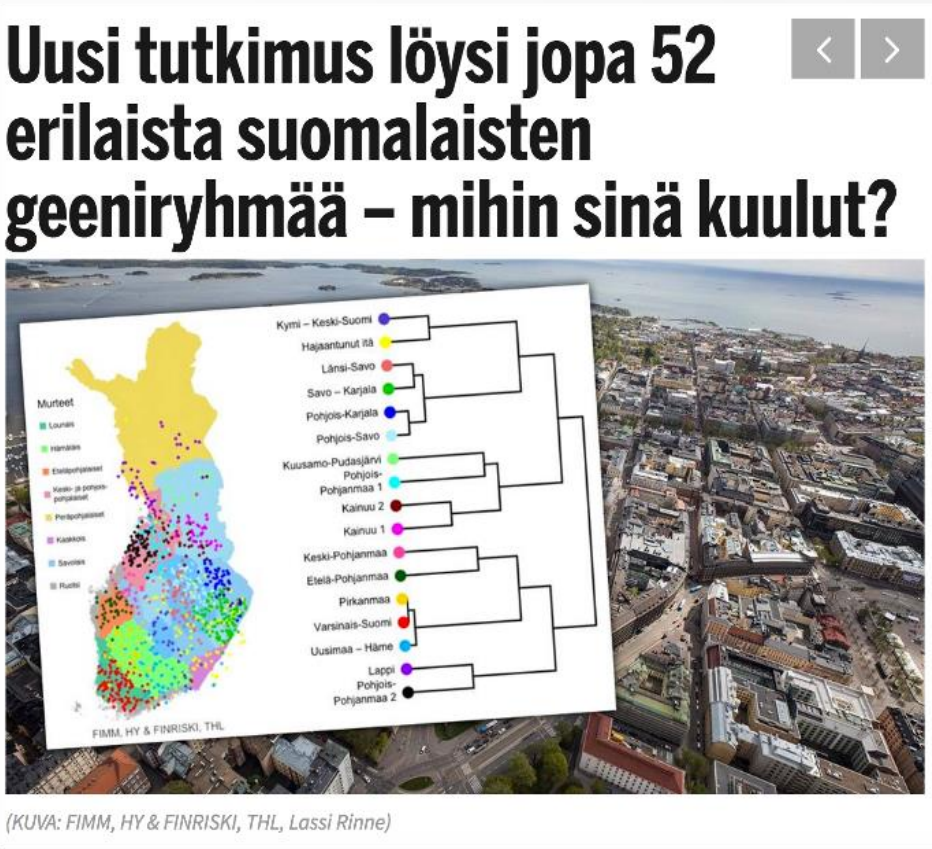
EXAMPLE: POPULATION GENETICS IN FINLAND



Population structure before 1950s

A. Main split: East vs. West
B. Finer-scale structure

From a Finnish tabloid 7.10.2017



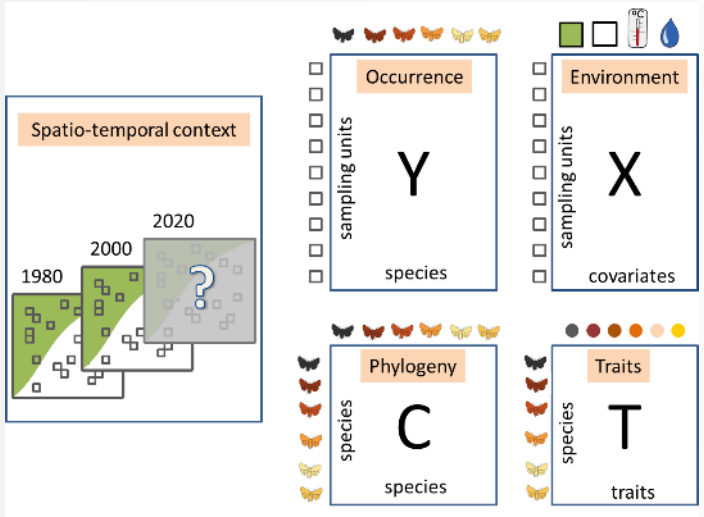
(KUVA: FIMM, HY & FINRISKI, THL, Lassi Rinne)

ECOLOGICAL INFORMATICS

Life Science Informatics Master’s Programme

INTRODUCTION

ECOLOGICAL INFORMATICS



Ecological informatics specialization teaches **mathematical, statistical and/or machine-learned modelling of ecological and evolutionary processes**

The focus is on quantitative ways to analyze and understand:

- how animal and plant species are distributed, how they interact with their environments and each other, how they react to environmental changes
- how the biodiversity of today has evolved in the past, and predicting how it is to change in the future
- how the resources on Earth scale in relation to abundance of life, human activities and land use, as well as climate change
- how natural resources can be used sustainably
- how conservation actions can be implemented efficiently

STUDIES

COURSES

Core courses in the track

- Bayesian data analysis
- Introduction to mathematical biology or Mathematical modeling
- Statistics of ecological monitoring and experimental design
- Book exam in ecology
- Statistical methods in ecology
- Introduction to ecological modeling
- Master's thesis seminar
- Master's thesis

Elective courses

You can additionally take wide range of other studies

- Biology, ecology, sustainability sciences
- Mathematics, statistics
- Computer science, machine learning
- Language courses
- etc.

LOCATION

- Viikki campus
- Kumpula campus

THESIS

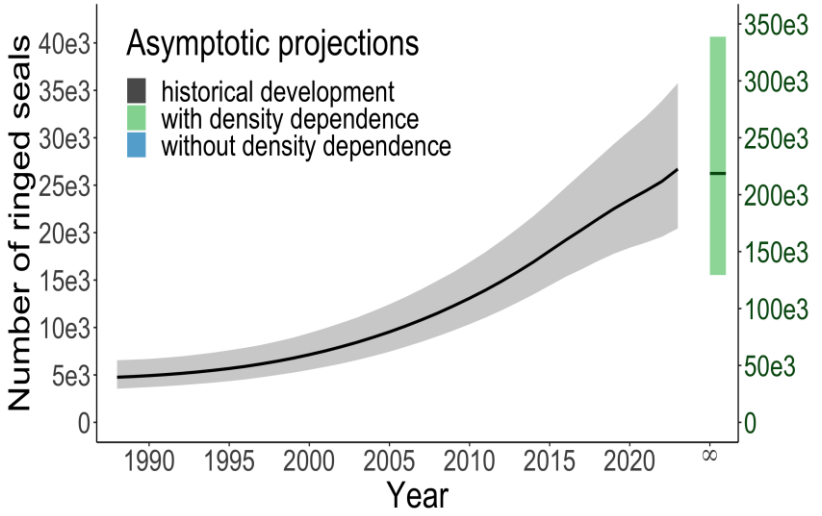
- Typically started immediately after the first year
- Integrated to research groups
  - Can lead to a publication

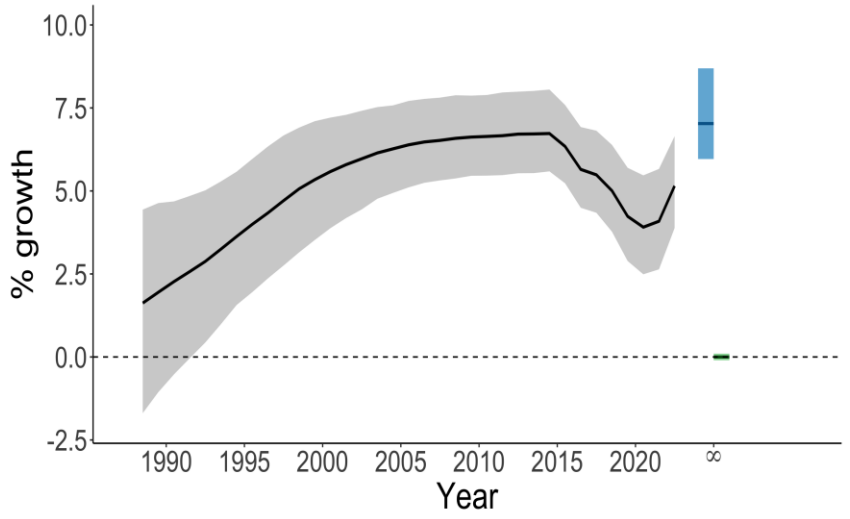
RESEARCH

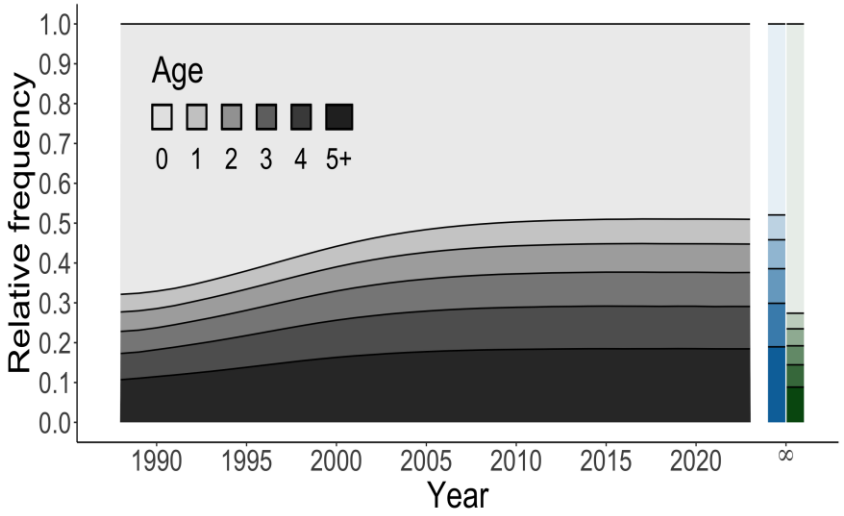
Associated research groups

- Environmental and Ecological statistics group
- Research group on Data science and evolution
- Research Center for Ecological Change

Thesis example: Bayesian Integrated Population Model for Baltic Ringed Seal Monitoring







Thesis example: Bayesian Integrated Population Model for Baltic Ringed Seal Monitoring

PROSPECTS AFTER THE DEGREE

- PhD studies
- Researcher / data analyst in natural resources management
  - Government organizations (Luke, Syke,…)
  - Forest/fisheries industry
  - non-governmental organizations
- Data scientist / statistician

ECOLOGICAL INFORMATICS SUPERVISORS

Jarno Vanhatalo	Indrė Žliobaitė	Elina Numminen
Department of Mathematics and Statistics; Organismal and Evolutionary Biology Research Program	Department of Computer Science	Department of Mathematics and Statistics
jarno.vanhatalo@helsinki.fi	indre.zliobaite@helsinki.fi	elina.numminen@helsinki.fi

MASTER'S THESIS IN LSI

- 30 credits, about half a year of hands-on work, but start thinking about your direction early
- An opportunity to practice research work
- Cross-disciplinary master theses are encouraged
- Master's thesis topics are provided by
  - study track teachers
  - other research groups in the University of Helsinki
  - in some cases MSc thesis can be made also for research groups outside UH
- You can also suggest your own thesis topic

Start planning your thesis at the latest during spring term of your first year!

https://studies.helsinki.fi/instructions/article/thesis-and-maturity-test-masters-and-licentiates-programmes

RESEARCH SEMINAR IN LSI (LSI30009)

- 5 credits, periods I and II of the second year of your studies
- Each student selects a topic based on recent research literature in life science informatics. The topic is studied thoroughly in order to give a presentation and to write a report.
  - Includes two presentations (short and long ones) and a report

CONTACT INFORMATION

- Programme director, Matti Pirinen Department of Mathematics and Statistics, matti.pirinen@helsinki.fi
- Study track contact persons
- Your personal teacher tutor
- Student tutors

STUDY TRACK CONTACT PERSONS

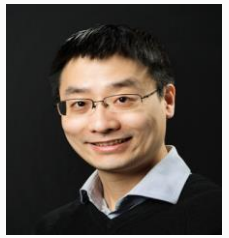
biomathematics

Stefan Geritz
- University researcher, Department of Mathematics and Statistics, Kumpula

Eva Kisdi
- University researcher, Department of Mathematics and Statistics, Kumpula

systems medicine

Sampsa Hautaniemi
Professor,
Associate Professor,
Research Program in Systems Oncology (ONCOYS), Meilahti



Jing Tang

applied bioinformatics

Alexandru Tomescu
- Associate Professor, Department of Computer Science, Kumpula

Ville Mustonen
Professor,
- Organismal and Evolutionary Biology Research Programme, Viikki
- Department of Computer Science, Kumpula
- Institute of Biotechnology
- Helsinki Institute for Information Technology

biostatistics

Matti Pirinen
- Professor, Department of Mathematics and Statistics, Kumpula
- Institute of Molecular Medicine, Meilahti

Ecological informatics

Jarno Vanhatalo
Associate Professor,
- Department of Mathematics and Statistics, Kumpula
- Organismal and Evolutionary Biology Research Program, Viikki

Indrė Žliobaitė
Professor
- Department of Computer Science and Department of Geosciences and Geography, Kumpula

KUMPULA STUDENT SERVICES

- Helps and guides you forward with questions and problems concerning the faculty and your program (degree structure etc.).
- Low-threshold DROP IN guidance with study advisors (almost) every Wednesday at 13.00-15.00 at Physicum E207. More information here.
- Email: **kumpula-student@helsinki.fi**
- Phone 02941 50066 (telephone service hours Thu 1pm-3pm)
- **If you don't know who to ask, ask the Student Services!**

GENERAL STUDENT SERVICES

Kaisa House Student Services

Main Library Kaisa entrance hall (3rd floor), Fabianinkatu 30

- Kaisa Talo also offers remote counselling
- Enrolments for the academic year
- Academic year stickers
- Name and address changes
- Official transcripts of records
- Proof of purchase of student travel tickets
- General advice on university enrolment and student benefits
- In other matters, local service points specialising in one or more faculties are at your service.

OTHER SERVICES FOR STUDENTS

- **The Guidance Compass is the most convenient way to search for possible services.**

- **Common examples:**
- Finnish Student Health Service FSHS
- UniSport (sports services)
- Services of Study Psychologists
- Nyyti ry – Student Support Centre
- University Chaplain
- Student Union of the University of Helsinki (HYY)
- University Career Services (also available on campus)

INTERNATIONAL STUDENT SERVICES

- International Student Advice is the first point of contact for all international degree students at the University of Helsinki, especially in cases where you do not know whom to contact. They provide advice on matters such as:
  - tuition fees and scholarships
  - registering with authorities
  - healthcare
  - other topics related to living and studying in Finland.

  - More information here.

INTERNATIONAL EXCHANGE SERVICES

Kumpula Specialists:

Kaisa Paavola & Yonca Ermutlu

E-mail: studentexchange@helsinki.fi

Phone number: +358 2941 22401, phone hours Mon-Fri 12-14

Drop-in hours at Campus Library every Wed 13-14, 2nd floor, G231 (room Q)

For longer consultations students can book appointments

on Vihta on Thursdays.

OTHER SERVICES FOR STUDENTS

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JOO STUDIES IN OTHER FINNISH UNIVERSITIES

- The flexible study right scheme (Joustava opinto-oikeus, JOO)
- An opportunity to study courses in another Finnish university.
- Information on JOO studies available at other universities and about the application process can be found on the Instructions for students.
- **Annual application periods**
  - The application round for studies starting in spring is 1.9. - 30.9.
  - The application round for studies starting in autumn is 1.3. - 31.3.

Please note! The possibility for JOO studies is going to end in the near future. This doesn't affect this year's application round.

EXCHANGE STUDIES

- As a degree student at the University of Helsinki, you have the opportunity to do an exchange as a part of your degree
- You can choose from more than 450 exchange destinations all over the world.
  - There are also field specific agreements with partner universities in Europe
- Links and tips on practical matters that help to plan an exchange: Instructions for Students – study abroad. You can also come to information sessions to hear more about the student exchanges.
- Application period for exchanges taking place in
  - the spring semester 2025 (EU destinations)
    27 August 2024 - 10 September 2024 (at 15.00)
  - the academic year 2025-2026 (non-EU destinations)
    9 October 2024 - 23 October 2024 (at 15.00)
  - the academic year 2025-2026 (EU destinations)
    3 February 2025 - 17 February 2025 (at 15.00)

EQUALITY AND NON-DISCRIMINATION

- The Kumpula Campus Code of Conduct defines how we behave in our faculty and what kind of behaviour we expect from others.
- With the help of the guidelines, the faculty takes a proactive and preventive role to ensure that it is safe to study and visit Kumpula.
- See also the pocket guide for students of the Faculty of Science on equality and non-discrimination (PDF)
- If you encounter harassment or inappropriate treatment, you can turn to the wellbeing support contact persons.

PROMOTION OF ACCESSIBILITY AND INDIVIDUAL ARRANGEMENTS

- If you have been diagnosed, for example, with challenges such as those mentioned below that affect your ability to study, please contact the faculty's accessibility liaisons at specialneeds@helsinki.fi
  - **Motor or sensory impairments, chronic illnesses, learning difficulties, mental health problems**
- Remember this especially if you know that in your previous studies you required, for example, extra time to submit tests/assignments or a calm/separate exam room.
- More information on accessibility issues and individual arrangements can be found here.

SISU

- SISU - Log in with your University of Helsinki username
- The most important tool for planning studies
- Offered studies and course registration
- Registration for general exam dates
- In SISU, you can see the accumulation of ECTS credits and order a transcript of records and a study certificate with an electronic certificate

STUDENT TUTORS

- Gayani Anandagoda gayani.anandagoda@helsinki.fi
- Charles Ocran charles.ocran@helsinki.fi

WHAT SHOULD YOU DO NEXT?

- **Send an email to matti.pirinen@helsinki.fi by the 3rd of September** and tell him which of the study tracks you are currently most interested in (helps us to allocate the teacher tutor)
- Start planning your studies. See:
  - Program requirements: https://guide.student.helsinki.fi/en and LSI web-pages
  - Model study timetables for each study track
  - Registration to courses: https://sisu.helsinki.fi/
  - Course information: https://studies.helsinki.fi/courses
- Your teacher tutor will be in contact with you in near future


We wish you success in your studies!