# Masterstudiengang Medical Biometry/Biostatistics

## Introduction to Bioinformatics

### Aims

Module participants will be able to:

- Understand the utility of computer knowledge in the analysis of genomic and high throughput data,
- Apply basic statistical techniques to analyse microarray data,
- Recognize the variety of molecular databases and bioinformatics software, and
- Outline bioinformatics tools used in sequence data analysis.

### Course content

The course will cover following topics:

- Microarray data: Introduction, normalization and inference;
- Multiplicity adjustment, principal component and cluster analysis of high-dimensional genetic data;
- Use of molecular biology databases available at NCBI and UCSC;
- Theory and practice on sequence analysis methods to understand features, functions, structure and evolution of DNA, RNA and peptide sequences, including sequence alignment, profiles, phylogeny and annotation;
- Introduction to R and PLINK for genomic and genetic analysis; and
- Data analysis of massive parallel sequencing data such as RNA-seq.

The module is designed as a mixture of short lectures and practical exercises. Real data will be analysed to illustrate theoretical concepts.

### Programme (subject to change)

- Genomics and Bioinformatics
- Practical: Examining HIV genes and proteins
- Introduction to Microarray Data and its Normalization
- Basic Genetic Analyses using PLINK
- Comparative Inference and Multiplicity
- Introduction to Massive Parallel Sequencing and RNA sequencing
- Practical: Gene expression in visceral leishmaniasis
- Principal Component and Cluster Analysis
- Single cell RNAseq
- Practical: Gene expression in mouse brain cells

### Pre-requisites

Basic knowledge of statistics at similar level of the module ‘Biometrie I’. No previous experience with R is required.

### Course readings

Statistical Methods in Microarray Data Analysis with R. Deshmukh SR and Purohit SG, 2007, Alpha Science International Ltd

Genomics and Bioinformatics: An Introduction to Programming Tools for Life Scientists. Samuelsson T, 2012, Cambridge University Press

### Further information

- Teaching language is English.
- It is strongly recommended to bring your own laptop for practical exercises.