Faculty of Mathematics and Technology: B.Sc. in Biomathematics

HOCHSCHULE KOBLENZ
UNIVERSITY OF APPLIED SCIENCES
■ **RheinAhrCampus**

Why biomathematics?

Biomathematics – what's that? Briefly, it's a branch of mathematics which deals with problems in biosciences.

Research and development in medicine and modern biology need more and more support from mathematics. And mathematics has begun to describe biological processes in quantitative terms, as it has been doing with physical phenomena for a long time. In medicine, recommendations for best therapy should be based on systematic research in large groups of patients rather than on subjective observations of a few patients. All groups involved in the health system, patients, physicians, hospitals and insurance companies are highly interested in applying the best available therapy based on a consolidated diagnosis. This has opened a new field of activity for mathematicians.

However, this increasing demand for mathematicians in biosciences is opposed to the limited number of educational courses in Germany. Only three German universities offer degree courses in biomathematics. As a first remedy, the program in biomathematics has been established at the RheinAhrCampus in Remagen, a site of the University of Applied Sciences in Koblenz.

Students of biomathematics do not only acquire a deep knowledge of biometry, image analysis and mathematical models in cell biology, but also become acquainted with computer science and learn how to deal with complex problems. Hence, they are not restricted to working in their specific application areas, but are also able to engage in different areas of mathematics. Due to this universal competence, mathematicians have ideal chances of getting a job in industry, business, research, or service enterprises. Parallel degree courses offered at our university include our B.Sc. in Business Mathematics.

Both Bachelor courses prepare students for the common Master program Mathematics in Finance and Life Science, where students familiarize themselves with advanced mathematical topics like functional analysis, partial differential equations and stochastic analysis. Lectures on modeling and special topics in biomathematics will enhance competence in the respective application areas.

Contents of courses

In the first few semesters, lectures, exercises and short presentations in analysis, linear algebra and probability/statistics qualify you for self-supporting work in mathematics. Problems in understanding mathematical thinking may arise at entry into university. We reduce them by extended care in the first semester.

In numerical mathematics, the newly acquired knowledge is applied to practical problems and solved with computers. As a student of mathematics you become acquainted with several programming languages, e.g. C++, Java and Visual Basic, with professional statistics software and, of course, with office programs.

In addition, lectures in English and physics supplement your mathematical skills, broaden your scope and enhance your professional competence.

During your ongoing studies you deepen your knowledge in analysis, numerical mathematics and statistics and you dig into new mathematical subjects like differential equations, biometrical methods of experimental design and biostatistics, image analysis and mathematical models in cell biology. You gain knowledge in biology from lectures on biology, biochemistry and genetics. Mathematical methods are motivated and demonstrated by applications in preclinical and clinical studies.

Your programming skills are extended and you become acquainted with modern relational and object-oriented data base technologies.

Exercises, seminars and practical work will enable you to successfully solve projects in your favorite areas.

The last semester of your studies offers the opportunity to transfer your knowledge from university to real life by practical training, where you work for a German or foreign enterprise or public institution, in industry, research or business. You may deepen your contact to business in the subsequent Bachelor thesis which should be done in co-operation with an external site. This close relation to professional work opens promising perspectives for your future.

Studying in REMAGEN (Koblenz University of Applied Sciences)

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Aims of the course

After your successful studies of biomathematics you have learned how to analyze the structure of images and how to compress them. Furthermore, you have familiarized yourself with methods of biostatistics in epidemiological and therapeutic research, including experimental design and quality control. You also got acquainted with mathematical analysis and efficient storage of data from cell biology (e.g. proteins and DNA sequences).

You know how to implement algorithms in relevant programming languages. You know about modern data base technology and you are able to define data base models for practical problems and to implement them in commercial data base systems.

Beyond your knowledge of mathematical techniques, you have gained competences which characterize mathematicians: you understand complex logical interrelations; you are able to translate problems into mathematical terms, to select appropriate methods for their solution and to develop efficient algorithms. Finally, you can solve the problem, usually using a computer, and display the results in a language which is within everybody's grasp.

You have got contacts to business and industry. This opens the possibility to continue working in your special area, or you may decide to rely on your mathematical skills and achieve a new area by work.

Mathematics is valid at all times, not a fashion. Therefore, mathematicians are less dependent on fluctuations in the job market.

Career perspectives

- Pharmaceutical companies
- Service units for data management, programming and statistics (e.g. contract research organizations)
- Biometrical and epidemiological institutes in university hospitals
- Biotechnological companies
- Manufacturer of image processing systems
- Business consultants
- Software and data base developers

Final degree:

Bachelor of Science

Admission criteria:

- Advanced Technical College Certificate *(Fachhochschulreife)*, general qualification for university entrance *(Abitur)* or recognized international equivalent.

- Students whose native language is not German need to document their proficiency in German. Additional information is provided by the Admissions Office.

Applications can be made for winter and for summer term.

Duration of studies

6 semesters (= 3 years); with practical training and the Bachelor thesis in the last semester.

The practical training can be done in an enterprise or public institution, where students gain experience in professional work and should get ideas for their thesis.

Equipment

There are several PC-pools and UNIX-workstations available for students. All of them have access to the scientific network and to the internet. For work on projects and thesis we will finally have six mathematics laboratories with powerful workstations and software. Online inquiries in literature and in data bases can be done at several workstations in the library.

Additional information

Our internet site, www.rheinahrcampus.de, supplies additional information about our courses in biomathematics and business mathematics (Wirtschaftsmathematik) and on other courses offered at the RheinAhrCampus Remagen. Click "Studienangebot" and then "Biomathematik" and browse through our pages (presently in German only).

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Structure of the Course/Curriculum

1	2	3	4	5	6
7,5 Analysis I	7,5 Analysis II	7,5 Analysis III	7,5 Analysis IV	7,5 Introduction to Optimization and Selected Topics	16 Practical Study Phase
7,5 Linear Algebra I	7,5 Linear Algebra II	7,5 Programming II and Data Base Systems	7,5 Numerical Methods in Linear Algebra	7,5 Numerical Methods in Analysis	
7,5 Programming I	7,5 Probability Theory	7,5 Statistics I	7,5 Statistics II	7,5 Bioinformatics	12 Bachelor Thesis
2,5 Computer Mathematics	7,5 Biosciences I	7,5 Biosciences II	7,5 Image Processing	7,5 Biometry	
5 Languages					2 Bachelor Colloquy

Please note that the B.Sc. programs in **Mathematics** are also available for two other areas of specialisation (Business Mathematics, Technomathematics). Please refer to the respective course descriptions for more information.

Successful completion of this B.Sc. degree qualifies a student for acceptance onto a Master's degree course, e.g. our M.Sc. Program in Mathematics in Finance and Life Science. Specific regulations may apply.