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UNIVERSITÄT
DUISBURG
ESSEN

learning and research

**CENTRE OF
MICROSCALE ECOSYSTEMS**

CME

A black and white photograph of a modern building interior. In the foreground, a staircase with a metal railing leads down. In the background, a large glass window with a black frame looks out onto a city street. The text is overlaid on the left side of the image.

“What people out there
in the streets are doing
tomorrow depends on
how people at university
think today”

Ortega y Gasset

objectives

Top-level research The Centre of Microscale Ecosystems (CME - ZMU for german spelling) offers a broad spectrum of interdisciplinary research. The aim is to systematically support research infrastructure and to encourage research relationships.

The focus is a better understanding of microscale processes and their effects on macroscale systems.

Praxis orientation The centre also supports the orientation of its research activities and degree programs to requirements of practice.

An international centre The centre stands up for the continued existence of exchange programs and partnerships with foreign countries and universities, thereby enhancing the international relevance of its own programs.

structure

Board of directors Under the leadership of the Scientific director, the Managing director and six Board members manage the Centre in terms of research, teaching and finances.

Board of Directors

Managing Director - Office

Research Fields

Chemistry
Physics
Biology
Medicine
Engineering
Economics

Working Groups

Study Programs
Network
Research
Groups
Projekt Work



Scientific director

Prof. Dr. R. Zellner is the present board leader of the centre.



Managing director

O. Locker-Gruetjen, M.Sc. Ecology is the present managing director of the centre.



*Work at the CME is very
pleasant - scientific
support is excellent.*

Dr. M. Denecke, member of the centre

facts and figures

Academic staff: 70 members
out of 15 different disciplines and
working groups

Organization of research:
one Network of Excellence,
five different research fields;
over 21 national and international
projects

Study programmes: six existing
and planned programmes with
a multidisciplinary course supply

Workshops: are held on various
subjects covering the fields of the
CME every Year

CME (ZMU)

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The Centre of Microscale Ecosystems (CME) was founded in 2003 as the first interdisciplinary research centre of the new University of Duisburg-Essen. The CME combines the experience and the resources of scientists working in the field of environmental sciences. Project activities focus on processes at microscopic and molecular ("micro-scale") level and their effects on macroscale environments. Interactions between living systems and inanimate matter are of special significance.

CME offers the organisational basis to invite and improve interdisciplinary, cooperative projects between scientists, engineers, physicians and economists. Resulting from these research activities, new interdisciplinary and international research and study projects are developed and established.

In its advantageous location - in the centre of the "Ruhrgebiet" - the CME flourished. It quickly became an important generator of momentum. Within only three semesters, it was the center of an interdisciplinary network linking different fields of research and learning. Special emphasis is given to relations to industrial partners.

moving forward



interdisciplinary and diversified

courses and programs

A broad spectrum of academic subjects with strong interdisciplinary links in research and teaching: These are the characteristics of the courses and programs offered by the Centre of Microscale Ecosystems.

Main Academic Program
with a variety of

M.Sc. degrees

B.Sc. Degree

Diploma

Basic
Academic
Program

Water Science

B.Sc. and M.Sc.

This study program offers various courses on problems with water interdisciplinary linked to all natural sciences.

Main focuses are:

Fundamental knowledge of the natural and engineering sciences disciplines which are necessary to understand the properties of all types of water.

Enhance the **theoretical knowledge** in accompanying practical courses, and demonstrate a high degree of practical competence concerning chemistry, analytics, microbiology and technological understanding and treatment of waters.

Gain knowledge with toxicological, hygiene and legal questions in the area „Water“.

Concerning the practice-oriented aspects of the courses, also put aspects of **management and operational economy** into practice, to ensure an easier transition into practical application.

Experience the **global meaning** of sustainable use of water.

With the newly acquired knowledge, make important contributions to **secure the future in your homeland**.

In addition to the technical content, especially applicable to foreign students, to get familiar with **social structure and culture of our country**.

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TWM

Transnational ecosystem-based Water Management M.Sc.

In future water management activities and measures will have to be planned and realized under increased consideration of transboundary aspects. Hence, the master programme Transnational ecosystem-based Water Management is jointly developed and realized by the University of Duisburg-Essen (Germany) and the Radboud University of Nijmegen (The Netherlands). This offers the opportunity to combine different study systems and teaching methods. By integrating and evolving those using the combined expertise of scientists from two universities the future graduates will be well equipped for an increasingly international job market.

The study program covers the scientific fields of Ecology ("Water Ecology"), Engineering ("Water Engineering"), "Water Basin Management" and "Socio-economic Sciences" focusing on integration of Water Ecology and River Basin Management as a core competence of future graduates.

Additionally, **special attributes** of this study programme are:

A strong **job orientation** by (1) participation of lecturers from water boards and industry (future employers), and (2) by practical study phases in water related private and public institutions with focus on interdisciplinary (ecological, technical, economic and planning) projects.

Internationality, the study programme will be presented in English language, except for a few optional courses.

Individual specialisation by a wide variety of optional courses.

Besides acquisition of know-how in relevant fields of water management, a main focus is the transfer of **competences** (soft skills), e.g. integrated problem solution strategies or presentation skills.

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International Water and Waste Water Management - Resources, Technology, Economics M.Sc.

In the Ruhr Area, there is a considerable accumulation of know-how in various fields related to water. Internationally operating companies offer complete technical solutions from water supply and water distribution to water treatment, starting with the planning, financing, preparation of land for building, construction and maintenance of facilities as well as technical support for the future operator. The master study programme "Water and Waste Water Management Resources, Technology, Economics" lives on the interactions and synergisms between universities and water industry, theory and practice between research and application. All persons with extensive knowledge in this field shall combine their efforts to optimise contents and evaluate them, offer actual projects and take responsibility for the study programme.

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The study programme focuses on:

Water supply and waste water disposal in urban areas under consideration of the sustainable use of water

Restoration of existing plants or installations for water supply, water purification, water distribution, waste water collection, waste water treatment and water protection

Commissioning of construction and operation of plants

New **development** and long term operation of those plants

Water supply and **waste water treatment** in rural areas

Management of water resources in consideration of functions of water bodies within cultural and landscape ecological settings

Using **adapted technologies**

Sustainability

Reuse of (purified) waste water

Management of river systems and river catchments

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MES

Molecular Environmental Sciences M.Sc.

The aim of the study programme Molecular Environmental Sciences is to generate knowledge on interactions in the molecular fields of bio-, geo-, hydro- and atmosphere. To use methods of molecular biology and physico-chemical methods related to environmental problems is the core concept of "Molecular Environmental Sciences". Especially, the changing conditions in geo-, bio-, hydro- and atmosphere and the underlying mechanisms and effects to be measured at the molecular level are prominent to this study programme. Molecular mechanisms in organisms and technical components with effects on the "micro-scale" level (e.g. genetic manipulation caused by contaminants or viruses, phylogenetic relationships, technical significance and health aspects of fine dust and others) have a substantial share in the steadily expanding field of research in Molecular Sciences.

By the implementation of the master study programme "Molecular Environmental Sciences" the University of Duisburg-Essen meets these new scientific and technological developments.

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(Managing Director)

CME

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Major study fields are:

Molecular Evolution
Bioinformatics
Bioorganics
Environmental Chemistry and Physics
Technical Chemistry
Nanoecology
Environmental Interactions
Ecotoxicology
Life Cycles Analysis
Molecular Environmental Engineering

MedBio

Medical Biology B.Sc./M.Sc.

Strongly related to the study programmes provided by the CME is the bachelor/master study programme Medical Biology. Due to the fact that research in Medical Biology is expanding ever faster today, there is a strong demand for increasing knowledge and thus a specific education in this scientific field at the universities.

The B.Sc. programme "MedBio" at the University of Duisburg-Essen combines consolidated basic knowledge with practical specialisation to enable the future graduates to successfully participate in research and work at universities and in the industry.

The **contents** of the B.Sc. Medical Biology are composed of the fields of Biology and Medicine covering:

Botany and Zoology
Evolutional Biology
Microbiology and Genetics
Biochemistry
Biomathematics, Physics and Chemistry
Basics in Medicine
Molecular Biology, Cytology, Bioinformatics
Applied Medicine (Pathology, Pharmacology)

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research expertise

The 15 disciplines and research groups of the CME - ranging from chemistry and economics to the engineering sciences and medicine - offer a very broad spectrum of academic research.

Within the context of new scientific questions, the CME conducts joint research projects funded, e.g. by the EU or the German Research Foundation or ministries.

The main research work is organized within five research fields and one network of excellence.

network

Water Science

research fields

RF1: Ultrafine particles

RF2: Microscale processes

RF3: Mobility in porous systems

RF4: Cell interactions

RF5: Biology and technical systems

network Water Science



"We people should use water such that our children and relatives have the same chance. For this purpose, we must plan, manage and integrate our water resources so that the various user groups can obtain sufficient quantities of drinking water and other potable water, and at the same time ensure water quality and maintenance of ecosystems."

Agenda 21, United Nations

Water Science

coming soon

The future world wide water demand, especially in the cities, is increasing dramatically. Parallel with higher living standards, there will be a demand for improved quality and availability of water. All human activities impact on limited water either indirectly or directly. Due to chronic pollution, the directly available amount of water is limited.

In order to solve such complex problems a broad knowledge of various disciplines such as Ecology, Chemistry, Biology, Physics, Engineering and Medicine is needed.

Concerning the above problems different working groups with a broad interdisciplinary spectrum of research skills cooperate within the Centre for Microscale Ecosystems in order to establish a Network of Excellence and contribute to solutions of these water related problems.

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Centre of Microscale Ecosystems
Network "Water Science"
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International Graduate School Water Science

disciplines

Biofilm Centre

Division 1: Aquatic Microbiology

Division 2: Aquatic Biotechnology

Division 3: Molecular Enzymatic Technology

Chair for Instrumental Analytical Chemistry and Water Chemistry

Curriculum: Water Sciences, TWM, IWM

Institute for Energy and Environmental Protection Technology

Division 2: Water Technology

Department of Hydrobiology

Faculty of Engineering

Division 1: Waste Management and Technologies

Division 11: Urban Water Management

Division 12: Water Engineering

research fields

1 ultrafine particles

Properties, exposure and health effects of ultrafine particles in the urban area (Ruhrgebiet)

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projects:

- > Health effects of ultrafine particles in the rural area ("Ruhrgebiet")
- > Mobile analysis of ultrafine particles in urban areas
- > Biological responses of nanoscale particles
- > Chemical elements and human life
- > Aerosols and traffic besides borderlines

2 microscale processes

Reactivity, catalysis and structures of molecular designed surfaces

Membrane research and technology

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projects:

- > Surface controlled processes
- > Fouling and antifouling
- > Polymer materials and membrane technology
- > Molecularly imprinted polymer layers with high affinity for biomacromolecules
- > Minimizing membrane fouling via „smart“ surface functionalization

3 mobility in porous systems

Soil interactions on a molecular level

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4 Cell interactions

Cell-cell interactions and
their environmental influence

projects:

- > Ecological study Haarscheider Bach
- > Water stress and microbes
- > Coral bleaching
- > Protein detection
- > Sediment ecology

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5 Biology in technical systems

Biosensors, FISH, Microenvironment of
waste-water

projects:

- > Biosystems for industrial components
- > Anaerob ammonium oxidation in Water
- > Composting and fermentation processes
- > Domestic and Commercial Waste Analysis
- > Modelling and optimization of anaerobic treatment plants

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Further projects

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projects:

- > Sustainable Development Group (SuDe)
- > Development of industrial landscapes
- > Laboratory for electron-microscopy
- > River ecology and management
- > Programme for academic cooperation and transfer (Kenya)

published and produced

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