

## Introduction

The Chair of Urban Water Systems Engineering at the Technical University of Munich (TUM) organizes the Course on Microbiology in Engineered Water Systems. The Course will highlight the operational benefits of understanding microbial community composition in engineered water systems for professionals and postgraduate students in the fields of water and environmental engineering. The course is comprised of the following intensive program:

### Lecture series

International experts and guest speakers will cover the fundamentals of microbiology and its relevance for engineered water treatment systems (activated sludge, managed aquifer recharge, biofiltration, bioremediation)

### Laboratory program

Covering everything from basic to advanced methods for characterization and identification of microbial communities and microorganisms (DNA extraction and quantification, PCR, quantitative PCR, next-generation sequencing, community profiling, microscopy). It also includes a DNA sequence-processing module developed by the Centre for Biotechnology at the University of Bielefeld covering statistics, experimental design, bioinformatics, and phylogeny.

The course will run for two weeks (Mon-Fri) in the first half of September. The course will consist of 10 full days with 2 x 1h lectures each morning (20 h total) and practical laboratory activities each afternoon. Laboratory activities will include wet lab experimentation and computer lab based bioinformatics training. Morning, midday and afternoon breaks will offer ample opportunity for interactive discussion. Course participants will undertake their own small project and present the findings at the conclusion of the course. Certificates of course participation and completion will be provided.

## Program

### Course content (theory and practice (italicized)):

Day 1	Course overview and housekeeping Introduction to water systems engineering <i>Laboratory safety instructions, laboratory tour and setup of the workspaces</i>
Day 2	Introduction to microbiology (relevance, cell structure, diversity, abundance), microbial genetics and biochemistry <i>DNA extraction, isolation and purification from different matrices</i>
Day 3	Microbial physiology and ecology Microbial processes in activated sludge <i>Assessing DNA quality and quantity using different assessment tools (photometric, fluorometric, electrophoretic)</i>
Day 4	Microbiology in managed aquifer recharge systems and rapid gravity filtration Anaerobic digestion (biogas, methanogenesis) <i>DNA amplification by PCR</i>
Day 5	Bioremediation of contaminated groundwater Constructed wetlands and biofilters <i>Quantitative PCR (qPCR)</i>

## Program

### Bioinformatics Module:

Day 6	Statistics and experimental design Quality control of sequencing data by applying FASTqc and CHROMAS <i>Using BLAST and other phylogeny tools to describe the samples phylogenetic diversity</i>
Day 7	High throughput amplicon sequencing analyses <i>Step 1: Experimental design, sequencing and pre-processing</i> <i>Step 2: Taxonomic classification, visualization and statistics</i> <i>Step 3: Hands on data processing</i>
Day 8	<i>Whole genome shotgun metagenome sequencing, Assembly, Binning, and hands on experience</i>

### Project analysis and presentations:

Day 9	Project sequence analysis <i>Preparation of the presentations</i>
Day 10	<i>Final project presentations</i> <i>Group discussion</i> Course conclusion and hand out of certificates

## Venue

Chair of Urban Water Systems Engineering  
Technical University of Munich  
Am Coulombwall 3  
85748 Garching b. Muenchen  
Germany

## How to get here

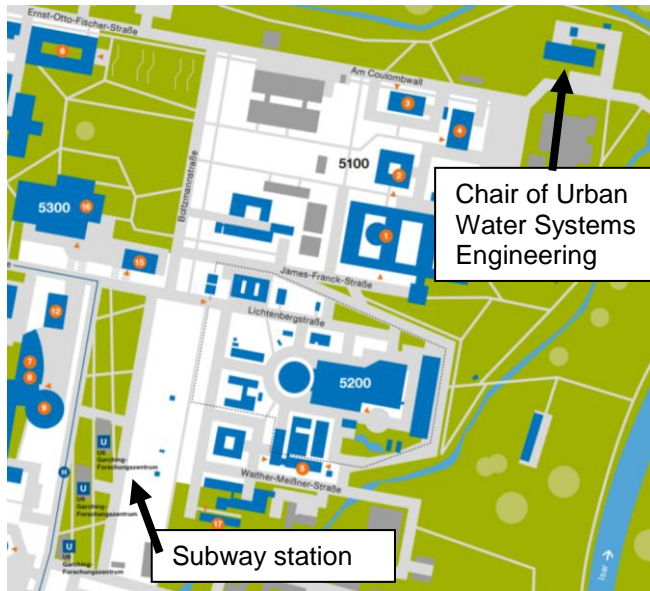
### Car:

Leave the Autobahn A9 at Garching-Nord, direction TUM Forschungszentrum.

Follow the signs ‚Kläranlage‘ and ‚Lehrstuhl für Siedlungswasserwirtschaft‘. Free parking lots are available in front of the institute.

### Public transport:

From Munich, take the Subway U6 and leave at the last stop, ‚Garching Forschungszentrum‘. From the airport take the Train S1 to Munich main station (Hauptbahnhof) and then take the U6 to ‚Garching Forschungszentrum‘.



## Organization

Gesellschaft zur Förderung des Lehrstuhls für Siedlungswasserwirtschaft der TU München e.V.  
Am Coulombwall 3, D-85748 Garching

## Registration

Registration for the TUM Course in Munich opens from **9<sup>th</sup> January 2017 to 21<sup>st</sup> July 2017**.

Registration and information:

<https://www.sww.bgu.tum.de/veranstaltungen/summer-school/>

## Course fees

Course registration fee **1500,00 €**

Course fees cover course proceedings including lectures, laboratory costs, morning and afternoon coffee breaks and lunch. Course fees do not cover accommodation, living expenses or transport to and from Munich.

Course participants will receive an invoice for the payment of the course fee on registration.

## Contact

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## TUM Workshop

04 - 15 September 2017, Munich,  
Germany

# Microbiology in Engineered Water Systems

Chair of Urban Water Systems  
Engineering  
Technical University of Munich

