

$$\int_{s=0}^{\infty} E_{int}(v(s,t)) + E_{ext}(v(s,t)) ds dt$$

$$\frac{\partial v}{\partial s} + w_2 \frac{\partial v(s,t)}{\partial t} + w_3 \frac{\partial^2 v(s,t)}{\partial s^2} + w_4 \frac{\partial^2 v(s,t)}{\partial t^2} + w_5 \frac{\partial^3 v(s,t)}{\partial s \partial t}$$

$$\Delta(v, y, z) + w$$



## Master's degree in Life Sciences

### Specialisation in Applied Computational Life Sciences


At a glance | page 3

Objectives and prospects | page 4

Master's Thesis | page 7

Structure of the programme | page 8

About the ZHAW LSFM | page 11



Dynamic exchange:  
in Wädenswil you  
form part of a  
research group and  
study in a creative  
environment.

# The Master's degree in Life Sciences at a glance

<b>Aim</b>	In the research-based Master's degree programme, you systematically deepen the understanding of your subject and expand your scientific skills. Your application focused Master's thesis is the scientific core of the study programme.
<b>Specialisation</b>	You specialise and graduate in one of four fields: Food and Beverage Innovation, Pharmaceutical Biotechnology, Chemistry for the Life Sciences, Applied Computational Life Sciences.
<b>Title</b>	Master of Science (MSc) ZFH in Life Sciences with specialisation in Applied Computational Life Sciences.
<b>Study agreement</b>	Before your studies begin, an individual study agreement (ISA) is worked out with your supervisor. It includes your personal goals and the subject area of your Master's thesis, and is designed to match your interests, educational background and objectives. <b>More on page 9</b>
<b>Cooperation</b>	Students benefit from networking with the four Swiss Universities of Applied Sciences ZHAW, BFH, FHNW and HES-SO. A third of the lessons are taught as part of combined courses run jointly by these different universities. <b>More on page 9</b>
<b>Learning concept</b>	Research-based learning with a strong focus on the Master's thesis; combination of independent learning, contact lessons and e-learning.
<b>Duration and workload</b>	3 semesters of full-time study, with part-time also possible: 90 credits (ECTS).
<b>Teaching location and language</b>	Teaching takes place in Wädenswil, Olten or Berne. Block weeks can also be held directly at partner universities. The language of instruction is English. <b>More on page 9</b>
<b>Study fees</b>	Semester fee CHF 720; for students whose place of residence is not Switzerland when starting the programme, an additional CHF 500 is charged. See the detailed study cost overview at <a href="http://zhaw.ch/lspm/master-lifesciences/en">zhaw.ch/lspm/master-lifesciences/en</a> .
<b>Entry requirements</b>	One of the following prior qualifications is required: <b>Bachelor's degree</b> from a university of applied sciences with an above average performance (ECTS grade A or B or a mark of at least 5.0). <b>FH diploma</b> (forerunner of the Bachelor's degree) with an above average performance (ECTS grade A or B or a mark of at least 5.0). Recognition of at least 2 years of professional experience and/or of postgraduate studies in a corresponding professional area in agreement with the programme directors. <b>University/ETH Bachelor's degree:</b> practice-oriented «passerelle»: 6 months' work experience in the area of your specialisation. Admission «sur dossier» possible with professional experience and prior education in a natural science field.
<b>Start of studies</b>	Every February and September; registration deadline 31 October and 30 April.
<b>Master's Thesis</b>	The Master's thesis is at the centre of your studies and your research. It involves investigating a question from practice or applied research, often in cooperation with national or international research or industry partners. <b>More on page 7</b>
<b>More information</b>	Registrar's office +41 58 934 59 61, <a href="mailto:master.lspm@zhaw.ch">master.lspm@zhaw.ch</a> , <a href="http://zhaw.ch/lspm/master-lifesciences/en">zhaw.ch/lspm/master-lifesciences/en</a> Info events take place every spring and autumn.

# Applied Computational Life Sciences

## Life in numbers

With the advent of new technologies, the life sciences are developing rapidly and producing vast amounts of data. Computational methods are assuming a fundamental role in addressing the challenges of analysing data, extracting useful information, making it available in databases, and modelling and understanding underlying complex systems.

New data and knowledge have the potential to transform industry. Indeed today, a variety of fields, such as pharmaceuticals, biotechnology, ecology and agriculture, are already taking advantage of the era of big data. The Applied Computational Life Sciences specialisation provides you with the opportunity to enter this research oriented, and industrially and socially relevant domain.

## Objectives and competences

This specialisation is designed for Bachelor's graduates in a life sciences or related discipline. During your studies you develop the conceptual and technical skills to combine your expertise in a life sciences discipline with the potential of computational methods. Specifically, you acquire skills for processing and analysing data of various sizes and levels of complexity. Furthermore, you become knowledgeable in computational modelling and the simulation of processes in your background discipline. To this end, you learn to apply appropriate software solutions, you are introduced to programming using modern scripting languages, and learn about software and computer architectures.

In addition to the skills mentioned above, you also develop analytical skills that enable you to analyse and solve complex problems. Furthermore, you learn to critically evaluate technical, economic and social issues, and to become truly interdisciplinary.

## Participating in a research environment

At the beginning of your Master's studies you choose a supervisor in your application track domain and a Master's thesis (see pages 8/9). You then become a member of a research group, where you are embedded in an exciting environment, working with other scientists, and cooperating on research and development projects. You look at things from a different perspective and are exposed to scientific and entrepreneurial ways of thinking that support your ability to develop skills, such as creativity and team work.

## Prospects

The Master's programme in Applied Computational Life Sciences lays the foundation for a career in a fast developing and prospering field. In the biomedical, pharmaceutical and other life sciences industries, there is a growing need for experts who understand the specifics of data management, modelling and computation in the context of a life sciences discipline and the corresponding business environment. The programme equips you with essential expertise in a field where science meets business and opens up career paths in international companies, agile start-ups as well as research institutions.

## Topics and tracks

The field of life sciences embraces a variety of disciplines such as biotechnology, chemistry, food and beverage technology, medical engineering and environmental sciences that employ methods from both natural sciences and engineering. The Applied Computational Life Sciences specialisation allows you to acquire computational skills and to apply these in the context of the specific life sciences discipline that corresponds to your Bachelor's background.

The programme offers three major tracks reflecting three major research and development topics.

### Genome-oriented ACLS

This track addresses computational genomics and bioinformatics topics, i.e. it focuses on the analysis of genomic sequences and on computational methods for genome sequence and related data analysis.

### Active molecule-oriented ACLS

This track is dedicated to computer-based chemistry, including cheminformatics, molecular modelling and computational chemistry, i.e. ab initio quantum chemistry methods.

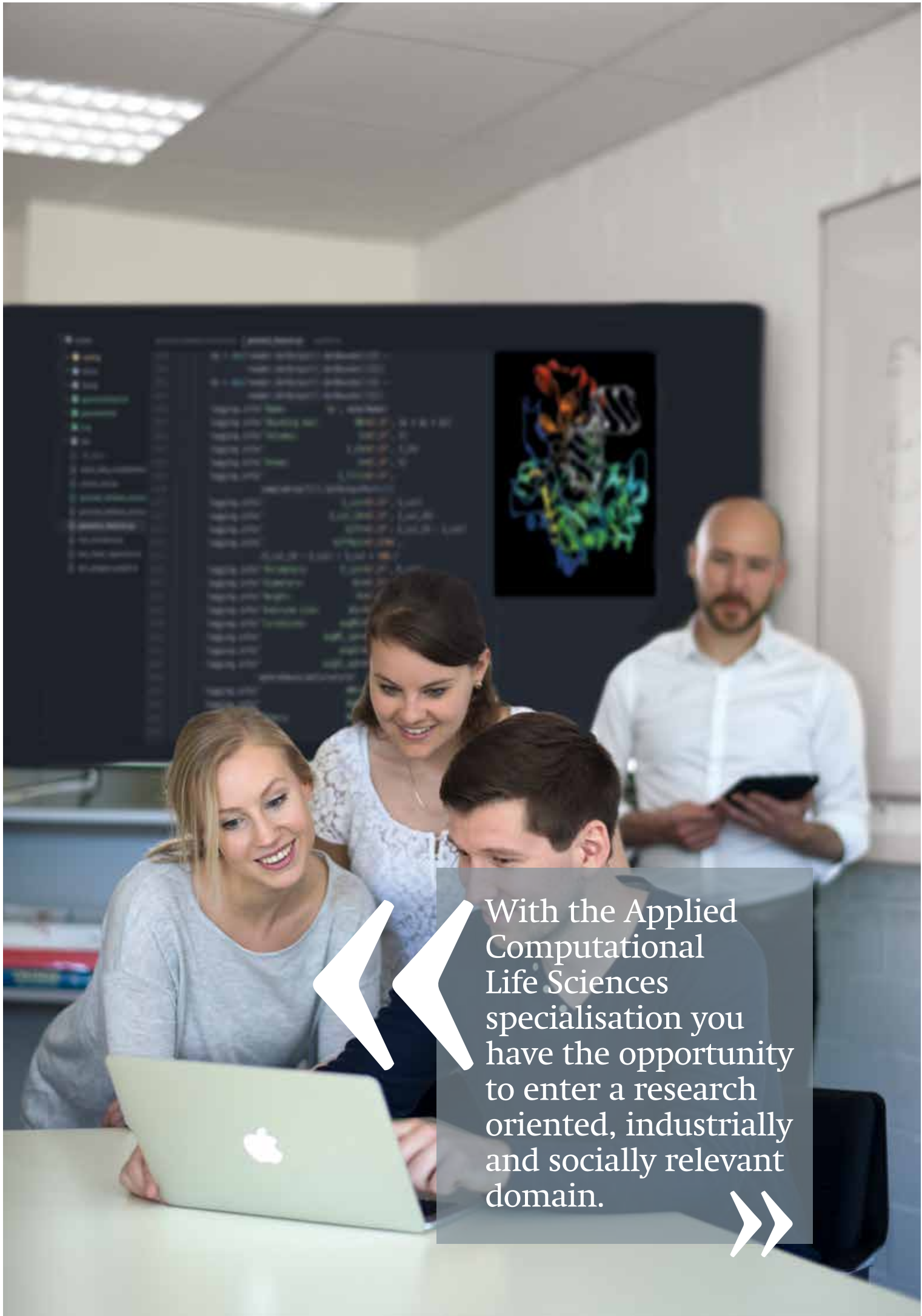
### Process-oriented ACLS

This track focuses on computer-aided process analysis in order to examine, model and, ultimately, better understand biochemical and biopharmaceutical processes.

### Special tracks

For students with a different background or focus, we offer the possibility of special tracks that are set up in collaboration with corresponding research groups at the ZHAW (provided the focus is in line with the overall goals of the programme). The list of special track topics comprises (but is not limited to):

- Biomedical simulation and modelling
- Model-based data analysis for clinical applications
- Applications in geoinformatics
- Biometrics
- Process control and process modelling in food industry



With the Applied Computational Life Sciences specialisation you have the opportunity to enter a research oriented, industrially and socially relevant domain.

# Master's Thesis

## General modules

The specialisation builds around the specialisation modules, consisting of five mandatory modules and an optional elective seminar. The second part of your studies consists of cooperation modules, which take place with students from other specialisations in the Master of Life Sciences programme. By completing the Core Competences modules you acquire knowledge in the following two areas: Management, Business and Society as well as Handling and Understanding Data. You take at least five of seven modules (each 3 ECTS). The cluster-specific modules broaden your knowledge in computational life sciences. You take at least three modules (each 3 ECTS).

## Your track modules and Master's Thesis

You apply the computational skills you have acquired in one of the application tracks (described on page 5). A track consists of two track modules worth five credits each and the Master's thesis. The track modules are a personally tailored mixture of lectures and tutorials, organised in close collaboration with your Master's thesis supervisor to provide optimum preparation for your thesis work. During your thesis you are part of a research group at the ZHAW or you can work at an external company, organisation, or research institute in close collaboration with your supervisor at the ZHAW.

## Master's Thesis topic and supervisors

Before you start your studies you choose your track, your supervisor and the topic of your Master's thesis. Proposed topics are published by accredited supervisors in an online topic market place on the programme's website, where you can apply for your favourite choice.

This specialisation is an inter-institutional collaboration and, hence, the ZHAW supervisors are associated with a diverse range of institutes. If you are interested in a specific track or topic for your Master's thesis that cannot be found on the market place, you may also contact one of our supervisors directly. A list of supervisors can be found online.

List of participating institutes at ZHAW Wädenswil:

- Institute of Applied Simulation
- Institute of Chemistry and Biotechnology
- Institute of Food and Beverage Innovation
- Institute of Natural Resource Sciences

Affiliated partners from the ZHAW School of Engineering:

- Institute of Applied Mathematics and Physics
- Institute of Applied Information Technology
- Institute of Data Analysis and Process Design
- Institute of Mechanical Systems

## Contact

If you have any questions about the specialisation in Applied Computational Life Sciences, please contact us by email.



Prof. Dr. Thomas Ott  
thomas.ott@zhaw.ch



Dr. Manuel Gil  
manuel.gil@zhaw.ch

# Structure of the MSc programme

## Four steps to your degree

The three semesters of full-time study, which lead to your Master of Science in Life Sciences, comprise the following four fields of competence, giving a total of 90 credits (**module descriptions at [zhaw.ch/ias/master](http://zhaw.ch/ias/master)**).

All modules of the specialisation take place in English.

### Core Competences – minimum 15 credits

The Core Competences consist of data and business modules (each 3 ECTS). Each module lasts half a semester –  $\frac{2}{3}$  of the lessons are held centrally in Olten and  $\frac{1}{3}$  consists of decentralised teaching (accompanied exercises, case studies etc.) directly in Wädenswil.

#### The following data modules are mandatory:

- Handling and Visualising Data
- Design and Analysis of Experiments
- Modelling and Exploration of Multivariate Data

#### You choose at least another two from the following business modules:

- Business Administration for Life Sciences
- Management and Leadership for Life Sciences
- Innovation and Project Management
- Politics and Society

### Cluster-specific modules – minimum 9 credits

Cluster-specific modules (each 3 ECTS) complement the specialisation modules. The ACLS specialisation is part of the Biomedical Engineering and Computational Science (BECS) group. However, you can also supplement your studies with modules from other clusters.

#### The following modules are mandatory:

- Modelling of Complex Systems
- Optimisation Methods

#### You choose at least another one of the following modules from all clusters:

- Medical Imaging and Image Processing (Cluster BECS)
- Compound Profiling in Pharmaceutical Drug Discovery (Cluster Bio/Pharma)
- Drug Formulation and Delivery for Solid Dosage Forms (Cluster Bio/Pharma)
- Design of Biopharmaceutical Production Facilities (Cluster Bio/Pharma)
- Regulatory Affairs (Cluster Bio/Pharma)
- Physiology and Immunotherapies (Cluster Bio/Pharma)
- Tissue Engineering for Drug Discovery (Cluster Bio/Pharma)
- Materials Science (Cluster Chemistry)
- Surface Characterisation (Cluster Chemistry)
- Polymers and Applications (Cluster Chemistry)
- Chemistry and Energy (Cluster Chemistry)
- Green Chemistry (Cluster Chemistry)
- Progresses in Food Processing (Cluster Food)
- Advanced Sensory Techniques (Cluster Food)
- Foodomics (Cluster Food)
- Sustainable Sourcing, Processing and Tracing of Food (Cluster Food)
- Nutrition and Nutrition Related Chronic Diseases (Cluster Food)
- Journal Club Environmental and Natural Resource Sciences (Cluster Environment)
- Life Cycle Assessment (Cluster Environment)

- Sustainable Natural Resource Management (Cluster Environment)
- Ecological Infrastructure in Landscapes (Cluster Environment)
- Biodiversity (Cluster Environment)
- Water Management for Households, Industry and Agriculture (Cluster Environment)

### Specialisation skills and Master's Thesis – 60 credits

#### Core modules – 20 credits

The obligatory core modules equip you with skills in modelling and computation:

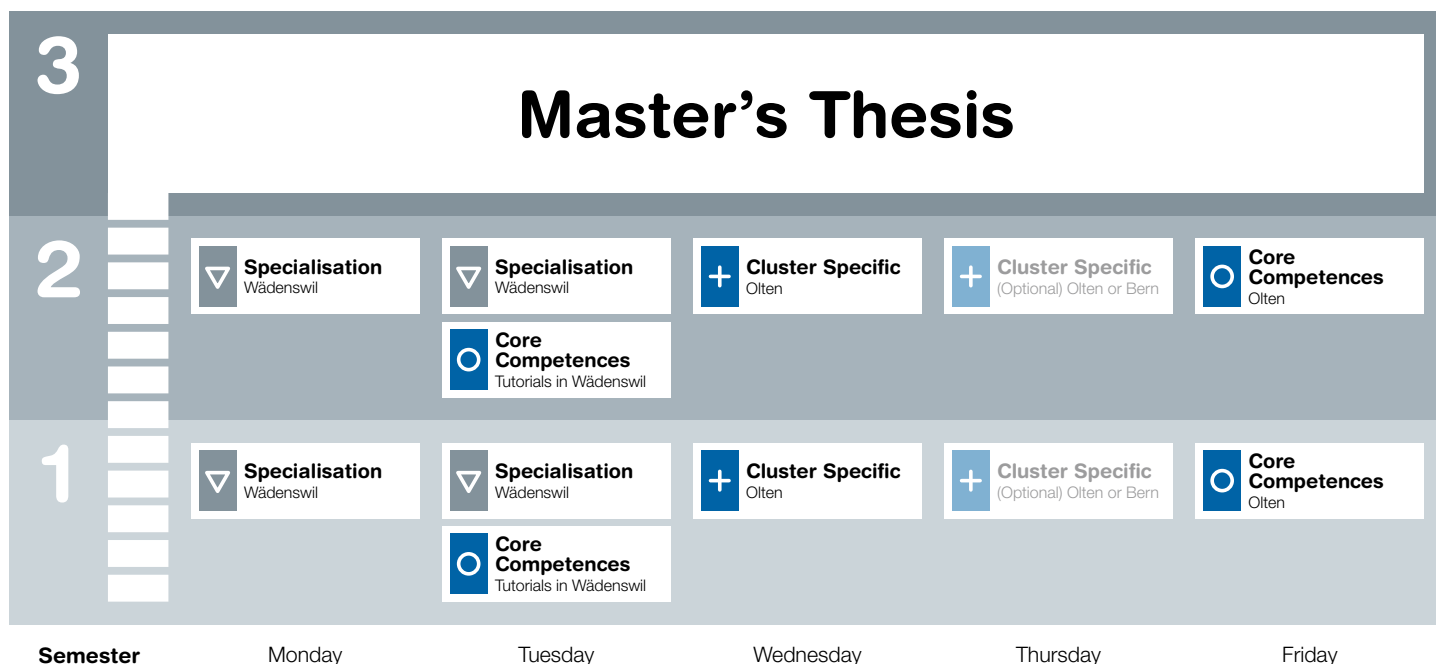
- Programming, Algorithms and Data-Structures
- Mathematical Modelling
- Databases and Data Architecture Systems
- Machine Learning and Pattern Recognition
- Neural Networks and Deep Learning

In addition, the elective module Computational Life Science Seminar (3 ECTS) is offered.

#### Track modules and Master's Thesis – 40 credits

You prepare for your Master's thesis with two track modules that amount to 10 credits in total. 30 credits are reserved for work on your Master's thesis which you can spread over your studies as appropriate.





## Structure of the programme

The diagram shows the general structure of a full-time Master's programme. You usually determine the actual sequence and focal points yourself (see the Study Agreement section).

## Study Agreement


Before your studies begin, you decide on your personal educational goals, define the topic of your Master's thesis, and select your individual plan of study from the selection of modules together with your supervisor. Your personal study programme is based on your educational background, your interests and your objectives. Not only at this stage, but also throughout your studies, you profit from fruitful interaction with your supervisor. The Study Agreement, a learning tool covering independent learning, contact lessons and e-learning, enables you to create your own contemporary learning context, which includes a high degree of flexibility.

## Cooperation

The Master of Science in Life Sciences is a cooperative venture run by the ZHAW together with three other Swiss Universities of Applied Sciences:

- The Berne University of Applied Sciences BFH
- University of Applied Sciences and Arts Northwestern Switzerland FHNW
- University of Applied Sciences and Arts Western Switzerland HES-SO

In the cooperation modules you benefit from the expertise of all four partners, create a broad network, and participate in interdisciplinary exchange. In the Core Competences and cluster-specific modules, classes take place in English (required language level C1).

An aerial photograph of a university campus. In the foreground, there are several large, multi-story brick buildings with dark roofs, interspersed with green lawns and trees. A parking lot with many cars is visible. To the right, there are large, long greenhouses with glass roofs. In the middle ground, there are more residential-style buildings and a large green field. In the background, a large blue lake stretches across the horizon, with rolling green hills and mountains under a clear blue sky. A semi-transparent blue rectangle is overlaid on the left side of the image, containing white text and two white arrow icons pointing left and right.

Innovative learning  
and professional  
research are in  
store for you at this  
inspiring location  
above the Lake of  
Zurich.

# About us

## The ZHAW

The ZHAW (Zurich University of Applied Sciences) is one of the leading universities of applied sciences in Switzerland. Teaching, research, continuing education, consulting and other services are scientifically-based and practice-oriented. The ZHAW comprises eight schools at three locations (Wädenswil, Winterthur, Zurich). Currently, over 12000 students are enrolled at the ZHAW.

## The School

The School of Life Sciences and Facility Management (LSFM) is located in Wädenswil on the left shore of the Lake of Zurich. Teaching and research are carried out in the fields of environment, nutrition/food, health and society. The degree and continuing education programmes include five Bachelor's degree programmes, three Master's degree programmes, and a wide range of continuing education courses. Around 1500 students are currently enrolled at the LSFM in Wädenswil.



**Environment | Food | Health | Society**  
Our competences in Life Sciences  
and Facility Management.

## Bachelor's, Master's and continuing education

The Bachelor's degree programme provides practically-oriented knowledge, general education and training in work methodology, and leads to a professional qualification. The consecutive Master's degree programme allows you to specialise within your chosen field and acquire an additional professional qualification. Three Master's degree programmes are offered at the ZHAW campus in Wädenswil: Life Sciences, Facility Management and Natural Resource Sciences. Engaging in ongoing education and keeping your skills and know-how up to date are important for ensuring professional success. The ZHAW offers customised, practice-oriented courses, symposiums and continuing education programmes.

## Research and development

Working in conjunction with businesses, public agencies and associations, our institutes engage in applied research and provide services for third parties. Close collaboration with external parties ensures the transfer of knowledge and technology between the academic realm and professional practice. Our technical installations and equipment are state-of-the-art. In our modern laboratories and testing and production facilities, applied research and development projects can be conducted to the highest professional and practical standards.

### Picture credits

**Title page:** Maya Wiestner, student and Yihwa Kim, lecturer

**Page 2:** Ludwig Glöckhofer, student, Dr. Susanne Miescher Schwenninger, supervisor and lecturer

**Page 6:** Linda Schatzmann, Maya Wiestner and Joel Varonier, students and Manuel Gil, lecturer

**Page 10:** Grüental campus

**Page 12:** Aerial view of Wädenswil

# Study and research in Wädenswil: practically-oriented, creative, passionate and reflective

ZHAW Campus Reidbach / Einsiedlerstrasse

ZHAW Campus Reidbach / Seestrasse

ZHAW Campus Gruental

The ZHAW is one of the leading Swiss universities of applied sciences. The School of Life Sciences and Facility Management currently has around 1500 students and over 600 employees. Its study and continuing education options include five Bachelor's and three Master's degree programmes as well as a broad selection of continuing education courses.

Our expertise in life sciences and facility management in the areas of the environment, food and health enables us to make a vital contribution to solving social challenges and improving quality of life. Our success is based on five dynamic institutes with extensive competence in research, development and services in the disciplines of chemistry and biotechnology, food and beverage innovation, natural resource sciences, applied simulation, and facility management.

## Contact

Zurich University of Applied Sciences  
School of Life Sciences and  
Facility Management  
Gruentalstrasse 14  
P.O. Box  
8820 Wädenswil/Switzerland  
+41 58 934 59 61

[master.lsfm@zhaw.ch](mailto:master.lsfm@zhaw.ch)  
[zhaw.ch/lsfm/master-lifesciences/en](http://zhaw.ch/lsfm/master-lifesciences/en)

Visit us



bilden und forschen  
wädenswil