Module Overview MSc in Life Sciences FHNW (starting Autumn Semester 2025)

Legend of columns (specialization/elective markers): ● red = module group of the specialisation; ● orange / ● green = elective module groups; ● grey = Core Competences.

Specialisation Modules (Monday – Wednesday)

modules group by type	semester	Org. & Supramol. Chem.	Analytical Chem.	Bioanalytics	Applied Cell Biol.	Pharmatech.	Biotech.	Chem. Eng.	Data sci.	Env. Tech.	contents	venue
Organic and Supramolecular Chemistry												
Advanced Organic Chemistry	AS	●									structure and electronic effects, pericyclic reactions, multicomponent reactions, industrial applications and case studies	Muttenz
Modern Technologies in Organic Synthesis	SS	●	●				●				photochemistry, electrochemistry, synthesis in flow systems, organocatalysis and biocatalysis	Muttenz
From Supramolecular Chemistry to Drug Discovery	SS	●	●			●					structure-activity relationship (SAR), drug design, complex supramolecular assemblies, protein-protein interaction, inhibition	Muttenz
Bioorganic and Bioconjugate Chemistry	AS	●	●	●							reactivity of biomacromolecules, bioconjugation, bioorthogonal chemistry, biocatalytic bioconjugation	Muttenz
Analytical Chemistry												
Advanced Mass Spectrometry	SS		●	●		●	●				technological aspects of mass spectrometry, metabolomics, proteomics, trends and applications in mass spectrometry, student presentat	Muttenz
Advanced NMR Spectroscopy	AS		●								one- and two dimensional NMR spectroscopy, polarization transfer experiments, product operator formalism, gradients, fast data acquisi	Muttenz
Biostructures and Solid State Sciences	AS	●	●	●							crystallography, powder X-ray, protein structure determination, cryo electron microscopy, solid state characterization	Muttenz
Molecular & Translational Imaging	SS		●	●	●						current key imaging modalities, positron emission tomography, magnetic resonance imaging, spectroscopic imaging methods	Muttenz
Bioanalytics												
Proteomics and Protein Analytics	SS	●	●	●	●	●	●				protein identification by mass spectroscopy, quantification, posttranslational modifications, light-scattering, infrared spectroscopy, calorim	Muttenz
Genomics	AS		●	●	●	●	●				next generation sequencing technologies, genomics in a clinical context, liquid biopsy, practical excercise, student workshop: genome eng	Muttenz
Chromatography and Mass-Spectrometry	AS			●	●	●					fundamentals on chromatographic separations and mass spectrometry, applications of bioanalytical mass spectrometry, case studies	Muttenz
Biomarker	SS		●	●						●	type of biomarkers, design of study to identify biomarkers, traditional and novel types of biomarkers, student group work on biomaker ide	Muttenz
Applied Cell Biology												
Bioassays: engineered Cells, Tissues and Organisms	SS			●	●	●					In vitro methods, cell-based assays, genome engineering and basic concepts of high throughput screening; mammalian and non-mammal	Muttenz
Cellular imaging	AS		●	●	●	●					physics of imaging, molecular imaging, confocal imaging, super-resolution imaging, live imaging, alternatives to light microscopy, applicatio	Muttenz
Advanced Cell Culture Systems	AS				●	●					Microphysiological systems, Organ on a Chip; technical requirements and limitations; impact of design, materials and microfluidics; specifi	Muttenz
Laboratory Automation in the Pharmaceutical Industry	SS		●		●	●	●				robotics, liquid handling, sensors, automated pharmacological characterization of drug candidates, automated cell culture and production	Muttenz
Pharmatechnology												
Continuous Pharmaceutical Production	AS					●	●	●			continuous production of solid forms and of extrudates, incl. laboratory course at an industrial site	Muttenz
Pharmaceutical Production Facilities	AS					●	●	●			design of production plants; containment systems; heating, ventilation, air-conditioning (HVAC); water, vapour and gas distribution	Muttenz
Formulation of Biologics and Routes of Drug Delivery	SS					●	●				formulation and delivery of biologics (liquid and solid forms), drug delivery, drug targeting	Muttenz
Drug Formulation and Delivery for Solid Dosage Forms	SS					●					controlled release technologies, per-oral drug delivery, formulation of poorly-water soluble drugs, biopharmaceutical modeling	Muttenz
Biotechnology												
Gene- and Cell-Therapeutics	AS			●	●		●				ex-vivo gene manipulation, viral vectors, stem cells as therapeutics, toxicology, pharmacokinetics and manufacturing of gene- and cell the	Muttenz
Continuous Biomanufacturing	AS		●			●	●				equipment and concepts for continous upstream and downstream units, product quality considerations, economics and regulatories, case	Muttenz
Process Analytical Technology	SS		●	●		●	●	●			process analytical technology in research, development and manufacturing, at-line and online analytics, multivariate data analysis and des	Muttenz
Process Automation	SS		●			●	●	●			control strategies, implementation of chemometric models, case studies	Muttenz
Chemical Engineering												
Reaction Technology	SS	●						●			reactor technology, reaction kinetics, simulation of reactions, operational modes, regulatories	Muttenz
Process Development and Technology	SS	●			●			●			seperation principles, mass and energy balances, process design and layout studies	Muttenz
Sustainable Process Development	AS	●			●			●			process simulation (case studies), cost estimations, mass and energy balances, life cycle assessment of processes	Muttenz
Process Transfer and Scale-up	AS				●			●			key performance indicators, mass and energy balances, design of experiment for scale-up, case study with experimental part	Muttenz
Data Science												
Computer and Software Architectures	AS								●		Open Science, Hardware and Limitations, Workflows, Networks, Software Engineering	Muttenz
Programming, Algorithms and Data Structure	AS								●		Unix, Python, Object Oriented Programming, Recursive Algorithms, Sorting Algorithms, Finding/Hashing	Muttenz
Databases	AS								●		Databases (SQL vs NoSQL), Data Cleansing, API (RESTful)	Muttenz
Computational Modelling Project	SS								●		recap of a data science pipeline: data cleaning, exploratory analysis, modelling approaches (regression models, classification , ODE-based,	Muttenz
Deep Learning	SS								●		Algorithms of CNN, Long/Short-term memory, LLM, AlphaFold	Muttenz
Human Machine Interaction and Bias Mitigation	SS								●		transparency and interpretability in algorithmic decision-making, interactive machine-learning, data quality and impact on algorithmic per	Muttenz
AI in Drug Discovery	SS								●		High-Throughput Technologies and Single-Cell Data; Data Mining of Chemical Structures and Biological Molecules with network analysis;	Muttenz
Environmental Technologies												
Environmental Risk Assessment	SS			●						●	environmental sampling, fate of pollutants, excercise on fate, effects and risk assessment, mixtures, risk communication	Muttenz
Costs and Benefits of Sustainable Production	SS				●		●			●	decision making frameworks, cleaner production, circular economy, industrial symbiosis, resource recovery case study	Muttenz
Process Technology for Industrial Pollution Control	AS				●					●	air: emission reduction, off-gas treatment, water: emission control, industrial water treatment, resource efficiency	Muttenz
Remediation	AS									●	management of contaminated sites, biogeochemical basics of remediation, physical, chemical remediation technologies, bioremediation,	Muttenz
Water and Wastewater Treatment	SS									●	basic principles, coagulation, flocculation, sand filtration, wasterwater process enginneering, acitivated carbon, micropollutants, lab experi	Muttenz
Resource Recovery from Wastewater	AS						●			●	material flow and recovery, separation and conversion technologies, recovery examples, case study on resource recovery	Muttenz
Circular Economy and Solid Waste Management	SS									●	recycling process technology, sustainable raw material supply, environmental protection	Muttenz

Cluster-Specific Modules (Thursdays, half a semester or block weeks after the semester)

modules group by type	semester	Org. & Supramol. Chem.	Analytical Chem.	Bioanalytics	Applied Cell Biol.	Pharmatech.	Biotech.	Chem. Eng.	Data sci.	Env. Tech.	contents	venue
Cluster Chemistry												
Materials Science	AS-1	●				●		●			solid state bulk materials, crystallographic and electronic structure, structural, optical, mechanical and magnetic properties, metallic and	Olten/online
Surface Characterisation	AS-2	●	●								advanced microscopy, infrared and Raman spectroscopy, EDX, WDX, XPS; Interactions with surfaces: SPR, QCM, OWLS, contact angle, ell	Olten/online
Polymers and Applications	AS-B3	●									polymer synthesis, polymer characterization, biopolymer, polymer processing	Fribourg
Green Chemistry	SS-1	●	●							●	green chemistry metrices, industrial green chemistry, green solvents	Olten/online
Chemistry and Energy	SS-2	●									chemical energy storage, biogas, bioenergy, photocatalysis, photovoltaics, energy and mobility	Olten/online
Industrial Chemical Process Safety	SS-B1							●			process safety and production unit design, thermal safety, green process design of hazardous reactions, environmental, health and safety	Fribourg
Cluster Bio/Pharma												
Compound Profiling in Pharmaceutical Drug Discovery	AS-2		●	●	●						target identification, clinical candidate selection, ADME, toxicology assessment, validity of test models, extrapolation from animal and in v	Olten/online
Physicochemical Principles in Pharmaceutics	AS-1	●	●		●	●					interfacial phenomena, surfactants, pharmaceutical nanotechnology, colloids, rheology, pharmaceutical polymers, micromeritics, compac	Olten/online
Design of Biopharmaceutical Production Facilities	AS-B1						●				facility concept, modularization of production facilities, zone concept, regulatory aspects, supply chain, automation	Wädenswil
Bioanalytics in a regulated Environment	AS-B3		●	●	●	●					concept of specification, development phases of a test methods, monographs for pharmaceuticals, GMP requirements, analytical SOP	Muttenz
Physiology and Immunotherapies	SS-1		●		●	●					3D-construction of human tissues, co-cultures of blood immune cells and infectious microorganisms, immune-based therapies	Bern/online
Tissue Engineering for Drug Discovery	SS-2				●	●					tissue engineering techniques, bioprinting, skin, cosmetic testing, engineerid liver and kidney, cancer models	Olten/Bern/online
Regulatory Affairs	SS-B1				●	●					quality management in production and development, license application process	Sion
Cluster Environment												
Journal Club Environmental and Natural Resource Sciences	AS-1										scientific publishing, reading and presenting selected publications, discussion and wrap-up of groups of related publications	Bern/online
Life Cycle Assessment	AS-2									●	seminal examples of LCA, use and misuse of LCA, environmental management methods, steps of an LCA procedure	Bern/online
Sustainable Natural Resource Management	AS-B1									●	Rio+20, conflicts in natural resources managment, challenges	Zollikofen
Ecological Infrastructure in Landscapes	AS-B2									●	landscape and movement ecology, GIS tools, ecological infrastructure, ecological connectivity, land-use planning	Genf
Biodiversity	SS-1									●	global change, species loss, functioning of the ecosystem, ecosystem services, international conventions, biodiversity maintenance	Bern/online
Water Management in Households, Industry and Agriculture	SS-2									●	water resources, water supply and distribution, water use, water cycle management	Olten/online
Cluster Food												
Journal Club Food and Nutrition Sciences	AS-1										scientific publishing, reading and presenting selected publications, discussion and wrap-up of groups of related publications	Bern/online
Progresses in Food Processing	AS-B1/2										food processsing techniques, practical on shelf life extension and micro-encapsulation	Sion
Nutrition and Nutrition Related Chronic Diseases	AS-B3										healthy and unhealthy diets, epidemiology, diet as risk factor for diseases, public health approaches	Olten
Foodomics	SS-1		●						●		digestive tract and ingestion, techniques for nutrigenome, microbiome and metabolome analysis, data mining	Bern/online
Sustainable Food Supply Chains	SS-2										process analysis, sustainalbe agriculture, social aspects, sourcing, energy management, sustainable diet, customer information	Olten/online
Advanced Sensory Techniques	SS-B1										innovative sensory evaluation methods, analysis of sensory data, cognitive and psychophysical aspects of perception	Changins
Cluster Computation												
Modelling of Complex Systems	AS-1							●	●		system theory, system dynamics, modeling software Vensim, numerical integration methods, Monte-Carlo simulation	Olten/online
Machine Learning and Pattern Recognition	AS-2								●		theoretical foundations of ML, feature engineering, types of ML tasks, basic ML algorithms, supervised learning	Olten/online
Optimisation and Bio-Inspired Algorithms	SS-1								●		identification of solvable problems. abstraction and modelling, coding of optimization tasks, bio-inspired algorithms, implementation of e	Olten/online
Imaging for the Life Science	SS-2								●		imaging methods, image processing techniques & workflows, application to different fields in the life sciences, student projects	Olten/online
Generative AI Models in Life Sciences	AS-B1								●		natural language processing, representation techniques, information retrieval systems, image-based foundation models, stable diffusion	Olten
Bioinformatics Methods for Genomics and Applications	SS-B1								●		sequencing technology, phylogenetics, 16S RNA, large-scale sequencing data analyses, imachine learning immunoinformatics	Olten

Core Competences (Fridays, Tuesdays)

modules group by type	semester	Org. & Supramol. Chem.	Analytical Chem.	Bioanalytics	Applied Cell Biol.	Pharmatech.	Biotech.	Chem. Eng.	Data sci.	Env. Tech.	contents	venue
Data												
Handling and Visualizing Data	AS-1A	●	●	●	●	●	●	●	●	●	introduction to R, organising data, databases, describing data: scatter, skewness, outliers, visualising data, informative plots	online/Muttenz
Data and Ethics	AS-1B	●	●	●	●	●	●	●	●	●	personal data security, information security, encrpytion, digital signatures, data stewardship, data ethics, privacy	online/Muttenz
Design and Analysis of Experiments	AS-2A	●	●	●	●	●	●	●	●	●	statistical interference, experimental design, feasibility, efficiency and power of experiment designs, statistical analysis, interpretation an	online/Muttenz
Modelling and Exploration of Multivariate Data	AS-2B	●	●	●	●	●	●	●	●	●	modeling: linear, nonparametric and multiple regression, model selection and diagnosis; exploration: visual inspection, principal compone	online/Muttenz
Business, Management and Society												
Business Administration for Life Sciences	SS-1A	●	●	●	●	●	●	●	●	●	Business models, marketing, production, sourcing, capital budgeting, financial accounting, cost accounting	online/Muttenz
Management and Leadership for Life Sciences	SS-1B	●	●	●	●	●	●	●	●	●	Management, corporate ethics, strategic management, HR-management, leadership, change management	online/Muttenz
Innovation and Project Management	SS-2A	●	●	●	●	●	●	●	●	●	Entrepreneurship, megatremds, innovation management, presentation techniques, project management	online/Muttenz
Politics and Society	SS-2B	●	●	●	●	●	●	●	●	●	politics: a process of negotaiation, struggle and compromise; the role of the society; public opinion, responsabilitiy, ethics	online/Muttenz
English for Master Students (no ECTS gained)	AS										optional English module; the passed exam allows to meet the English competence requirement	Muttenz

Legend:

AS: autumn semester
SS: spring semester

-1 or -2: first or second half of semester
Bx: block week at the end of the semester

● red cirlces: module group of the specialisation (most modules have to be taken)

● orange and green circles: elective module groups (only a few modules have to be taken)

● grey circles denote the module group Core Competences (4 modules have to be taken)

Muttenz, 09.05.2025

Other elective modules can be chosen freely, in total 17 modules à 3 ECTS are required.