

Module Overview MSc in Life Sciences FHNW (starting Autumn Semester 2024)

type	modules groupe by type	semester	Organic & Supramolecular Chemistry	Analytical Chemistry	Bioanalytics	Applied Cell Biology	Pharmatechnology	Biotechnology	Chemical Engineering	Data science	Environmental Technologies	contents	venue	
Specialisation Modules (Monday - Wednesday)	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	
	Supramolecular Chemistry and Nanochemistry	SS	●	●								supramolecular interactions, reversible covalent bonds, supramolecular catalysis, supramolecular medicinal chemistry	Muttenz	
	Bio-interfaces and Bio-conjugate Chemistry	AS	●	●	●	●						surface chemistry, surface structuring, organ on a chip, bioconjugation, biocompatibility, surface-tissue interactions	Muttenz	
	Analytical Chemistry													
	Advanced Mass Spectrometry	SS		●	●								technological aspects of mass spectrometry, metabolomics, proteomics, trends and applications in mass spectrometry, student presentation	Muttenz
	Advanced NMR Spectroscopy	AS		●	●								one- and two dimensional NMR spectroscopy, polarization transfer experiments, product operator formalism, gradients, fast data acquisition	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 spectrometry, quantification, posttranslational modifications, light-scattering, infrared spectroscopy, calorimetry	Muttenz
	Genomics	AS		●	●	●	●	●	●				next generation sequencing technologies, genomics in a clinical context, liquid biopsy, practical exercise, student workshop: genome engineering	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 biomarker identification	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-mammalian cell systems	Muttenz
	Cellular imaging	AS			●	●	●	●	●				physics of imaging, molecular imaging, confocal imaging, super-resolution imaging, live imaging, alternatives to light microscopy, applications	Muttenz
	Advanced Cell Culture Systems	AS			●	●	●	●	●				Microphysiological systems, Organ on a Chip; technical requirements and limitations; impact of design, materials and microfluidics; specific applications	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 therapy	Muttenz
	Continuous Biomanufacturing	AS			●	●	●	●	●				equipment and concepts for continuous upstream and downstream units, product quality considerations, economics and regulatory aspects, case studies	Muttenz
	Process Analytical Technology	SS			●	●	●	●	●				process analytical technology in research, development and manufacturing, at-line and online analytics, multivariate data analysis and design	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, regulatory aspects	Muttenz
	Process Development and Technology	SS		●					●				separation 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							●				Computer Architecture, Software Engineering, Networks, Data formats, Data conversion, Git, Workflows	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
	Process Modelling and Simulations	SS							●				Using Python multivariate data analysis, data mining, different data algorithms for optimising life science processes in chemical, pharmaceutical and food industries	Muttenz
	Deep Learning	SS							●				Algorithms of CNN, Long/Short-term memory, LLM, AlphaFold	Muttenz
	Computational Omics	SS							●				From Raw Data to Result -> Analysis of Genomics, Transcriptomics, Metabolomics, or NMR data	Muttenz
	Environmental Technologies													
	Environmental Risk Assessment	SS			●								environmental sampling, fate of pollutants, exercise 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, phytoremediation	Muttenz
	Water and Wastewater Treatment	SS							●				basic principles, coagulation, flocculation, sand filtration, wastewater process engineering, activated carbon, micropollutants, lab experiments	Muttenz
Valorization of Biomass Waste and Side Streams	AS							●				material flow and recovery, separation and conversion technologies, recovery examples, case study on resource recovery	Muttenz	
Solid Waste Management	SS							●				environmental laws, regulatory drivers, process technology, case study from industry	Muttenz	
Cluster-Specific Modules (Thursdays, half a semester or block weeks after the semester)	Cluster Chemistry													
	Materials Science	AS-1	●				●	●				solid state bulk materials, crystallographic and electronic structure, structural, optical, mechanical and magnetic properties, metallic and ceramic materials	Olten/online	
	Surface Characterisation	AS-2	●	●								advanced microscopy, infrared and Raman spectroscopy, EDX, WDX, XPS; Interactions with surfaces: SPR, QCM, OWLS, contact angle, ellipsometry	Olten/online	
	Polymers and Applications	AS-B3	●									polymer synthesis, polymer characterization, biopolymer, polymer processing	Fribourg	
	Green Chemistry	SS-1	●	●								green chemistry metrics, 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-B2							●			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-1		●	●	●	●	●	●				target identification, clinical candidate selection, ADME, toxicology assessment, validity of test models, extrapolation from animal and in vitro data	Olten/online
	Physicochemical Principles in Pharmaceutics	AS-2		●	●	●	●	●	●				interfacial phenomena, surfactants, pharmaceutical nanotechnology, colloids, rheology, pharmaceutical polymers, micromeritics, compacted powder	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 biopharmaceuticals, 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, engineered 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 management, challenges	Zollikofen
	Ecological Infrastructure in Landscapes	AS-B3							●				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 processing 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, sustainable 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							●				Bayesian inference, graphical models, classification, ensemble methods	Olten/online
Optimisation and Bio-Inspired Algorithms	SS-1							●				Identification of problems solvable with optimization methods; linear, non-linear, deterministic and stochastic optimization methods, coding theory	Olten/online	
Imaging for the Life Science	SS-2							●				imaging modalities in medicine and life sciences, image processing: denoising, segmentation, registration, student projects	Olten/online	
Core Competences (Fridays, Tuesdays)	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, encryption, 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 and reporting	online/Muttenz
	Modelling and Exploration of Multivariate Data	AS-2B	●	●	●	●	●	●	●	●	●	●	modeling: linear, nonparametric and multiple regression, model selection and diagnosis; exploration: visual inspection, principal component analysis	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, megatrends, innovation management, presentation techniques, project management	online/Muttenz
	Politics and Society	SS-2B	●	●	●	●	●	●	●	●	●	●	politics: a process of negotiation, struggle and compromise; the role of the society; public opinion, responsibility, 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	

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 circles: 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, 22.12.2023

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