

Studies in Pharmaceutical Technology at the School of Life Sciences – FHNW, University of Applied Sciences Northwestern Switzerland

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Pharmacy and Pharmaceutical Sciences encompass every aspect of medicines, pharmaceuticals and drugs, from inception and sourcing to manufacture and from patient bedside to health care system. Being integral part of Pharmaceutical Sciences, Pharma Technology focuses on the technical research and development and the manufacture of pharmaceutical products. As such, Pharma Technology covers all activities and operations required for making an active pharmaceutical ingredient into a ready-to-sell drug product. Individual subjects prominently featured in the topic are dosage form, formulation, delivery, manufacturing process, production facility, quality management, bioavailability and efficacy. Pharma technology has therefore a strong technical character resting on one hand on natural science including physics, chemistry and biology and on the other hand on engineering science.

The strongly regulated environment of the pharmaceutical industry and the ever-rising quality standards of health care products require highly specialized professionals to meet today's needs of the industry. A growing variety of pharmaceutical products including next to hitherto established forms, specialized / targeted drug delivery systems, devices, biotechnological products derived from recombinant techniques, precision pharmaceuticals, in combination with emerging industrial working practices such as quality by design, operational excellence, process modeling and simulation, continuous manufacturing, lean and sustainable manufacturing have been evident in recent decade(s). These have immensely broadened the area of Pharmaceutical Technology while the new challenges have increased the demand on depth of understanding, making Pharmaceutical Technology a study subject in its own right.

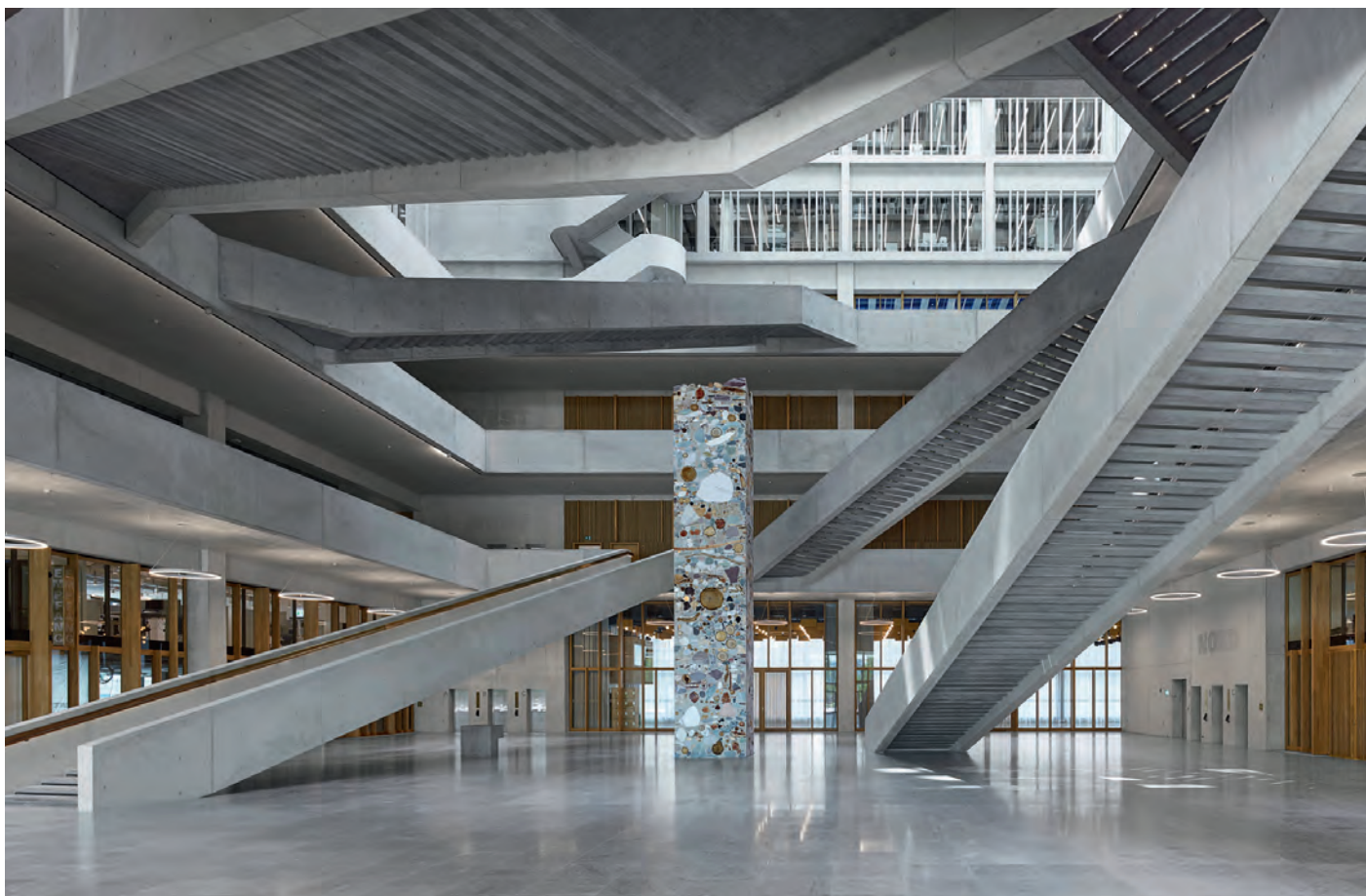
Objectives

The School of Life Sciences – FHNW established Switzerland's first full study program at Bachelor and Master level in Pharmaceutical Technology. The purpose of the program is to provide praxis-oriented training and education in Pharma Technology addressing the needs of the local, regional and supranational industry. For this, the program is designed to integrate all science and engineering topics that are implemented in transforming the active ingredient into the final drug product. It should provide maximal employability and enable Bachelor as well as Master graduates to immediately enter the workforce with no need for or minimal on-the-job training. To this end, the studies are based on a matrix system of compulsory and

elective modules that allows maximum flexibility of earning credit points and whose contents are continuously adjusted to meet the changing demands of industry and future employers. The program is subject to regular supervision by an advisory network of external and industrial partners and peers.

The curriculum

The curriculum of Pharma Technology is embedded in the programs of Bachelor of Science in Life Sciences and Master of Science in Life Sciences comprising the following seven disciplines: Chemistry, Bioanalytics, Chemical and Bio-Process Technology, Medical



View into the entrance hall of the New Campus Muttenz, site of the School of Life Sciences – FHNW.

(Photo FHNW)



Process automation laboratory, Process Technology Center (PTC), School of Life Sciences – FHNW.

(Photo FHNW)

Technology, Medical Informatics, Environmental Technology, and Pharma Technology. While each discipline has its own backbone of courses, students have the possibility and are encouraged to earn credits from parallel disciplines in order to broaden and/or deepen their set of acquired skills and attain complementary qualification in minor topics such as Materials and Digitalization.

In compliance with the European Credit Transfer System (ECTS), 180 credits are required for the Bachelor's degree and 90 to 120 credits are required for the Master's degree. Study content is praxis-oriented and focused on applicability of acquired knowledge whereas one third of the curricula consist of practical courses. Bachelor and Master studies may be completed in full-time modus within 3 years and 1.5 to 2 years, respectively, or in part-time modus. The final theses at the Bachelor and at the Master level are carried out in collaboration with life science industry and take place in more than half of the cases in an industrial laboratory.

As no standardized curriculum in Pharma Technology exists, the individual modules of the program for the Bachelor's and the Master's degree are listed in the following tables. The curriculum is organized in thematic blocks of modules. Students must take a minimal number of credits from each block.

Bachelor

Basics of Mathematics and Physics 15 Credits	Analysis I – Basic mathematics
	Analysis II
	Linear algebra
	Advanced mathematics – Analysis and inductive statistics
	Statistics and Computer applications
	Mechanics and Heat
	Electrodynamics and Optics
	Dynamic systems
	Technical mechanics
Basics of Biology and Chemistry 21 Credits	General and inorganic chemistry
	Basic analytical chemistry
	Basic organic chemistry
	Basic physical chemistry
	Physical chemistry I
	Physical chemistry II
	Basic biology
	Anatomy and physiology
	Human biology
	Microbiology
	Biochemistry
	Bioanalytics
Fundamentals 15 Credits	Development of drug products, devices and combination products
	Basic pharmacology
	Special pharmacology
	Pharmacokinetics
	Clean room and aseptic manufacture
	Heat conduction and mass transport
Laboratory courses and workshops – Fundamentals 21 Credits	General laboratory techniques
	Microbiology
	Pharmacology
	Biochemistry
	Analytical chemistry
	Physics
	Bioanalytics
	Applied statistics in life sciences
Specialization 27 Credits	Drug profiling – Pre-formulation
	Parenteral preparations and biologics
	Molecular Galenics
	Particle technology I
	Particle technology II
	Process engineering
	Plant design – Production facilities – Logistics
	Packaging and devices
	Quality management and Registration
Laboratory courses – Specialization 15 Credits	Quality by Design and Process analytics
	Drug profiling – Pre-formulation
	Particle technology
	Solid dosage forms
	Semi-solid dosage forms
	Clean room and sterile production
	Packaging and devices
	Plant automation
Informatics 6 Credits	Introduction in informatics
	Introduction in programming
	Programming I
	Programming II
	Data banks and data analytics
Business and Soft skills 6 Credits	Introduction in business administration and law
	Introduction in business economics
	Project management
	Scientific / technical writing
	Self-management
	My future
	Ethics in science

Interdisciplinary & free choice 18 Credits	Any module
	Any module
	Any module
	Any module
	Any module
	Any module
English 6 Credits	English language
	Written academic English
	Spoken academic English
Thesis & Project 30 Credits	

Master

Specialization 21 Credits	Drug formulation and delivery of solid dosage forms
	Formulation of biologic and Routes of drug delivery
	Continuous pharmaceutical production
	Pharmaceutical production facilities
	Compound profiling in pharmaceutical drug discovery
	Advanced mass spectrometry and NMR Spectroscopy
	Process development and technology
	Proteomics and protein analytics
	Bioassays
Extended specialization 9 Credits	Design of biopharmaceutical production facilities
	Tissue engineering for drug discovery
	Medical device regulatory affairs
	Bioanalytics in a regulated environment
	Cellular physiology and therapies
Data literacy 6 Credits	Handling and visualization of data
	Design and analysis of experiments
	Modeling and exploration of multivariate data
Soft skills 9 Credits	Business administration for life sciences
	Management and leadership for life sciences
	Innovation and project management
	Politics and society
Electives 6 Credits	Any module
	Any module
Thesis 40 Credits	



University of Applied Sciences Northwestern Switzerland
School of Life Sciences

Concluding remark

Education in the area of Pharmaceutical Technology and Pharmaceutical Engineering is highly dynamic. Several programs have been introduced in recent years internationally reflecting this dynamic. For example, a Master's degree in Chemical and Pharmaceutical engineering has emerged from the collaboration between the University of Graz and the Graz University of Technology (Master Programme Chemical and Pharmaceutical Engineering – NAWI Graz). At the Technical University of Braunschweig, a collaboration between the faculty of life sciences and the faculty of engineering brought about the Master's degree in Pharma Engineering (Pharmingenieurwesen (Master) (tu-braunschweig.de). Further, the University of Strasbourg offers a Master's degree in Pharmaceutical Engineering in collaboration with industry (<https://www.unistra.fr/etudes/decouvrir-nos-formations/par-facultes-ecoles-instituts/sante/faculte-de-pharmacie/faculte-de-pharmacie/cursus/ME181?cHash=b259e6368ef6d1e1933e4efcd001e9f7#data-rof-tab-presentation>). (all sites last accessed in February 2021).

These programs address the need of providing technical pharmaceutical training and education to professionals for the pharmaceutical industry. However, they are all based on existing structures and feed on graduates from different Bachelor programs, mostly of Pharmacy or Chemical Engineering. The Bachelor and Master curricula in Pharma Technology of the School of Life Sciences – FHNW are unique in that from their inception back in 2006/2008 and through successive revisions they have been designed as stand-alone, self-contained programs focusing exclusively on the evolving requirements of the subject of Pharma Technology.

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