

FACULTY OF HEALTH AND MEDICAL SCIENCES
UNIVERSITY OF COPENHAGEN



MSC IN MEDICINAL CHEMISTRY

Master's programme at the University of Copenhagen

MSC IN MEDICINAL CHEMISTRY

Are you fascinated by organic chemistry and designing potential drug substances?

The University of Copenhagen (UCPH) offers a focused international Master's programme in Medicinal Chemistry that provides you with a deep insight into the field of designing and synthesizing new compounds that may be turned into future drugs.

Medicinal Chemistry has a long history as a discipline at the UCPH and the facilities and possibilities to carry out hands-on research are excellent. Moreover, as the university is located in the midst of one of the world's leading pharmaceutical, biopharmaceutical and biotech areas, Medicon Valley, students have good opportunities for establishing collaborations with research teams in the industry.

The two-year MSc programme in Medicinal Chemistry is open for students from Denmark and abroad holding a Bachelor's degree with a solid background in chemistry – for example medicinal chemistry, chemistry or pharmacy.



TURN YOUR INTEREST INTO A CAREER

The MSc in Medicinal Chemistry provides you with competences to apply sophisticated chemical research techniques to design, synthesis and optimisation of drug substances with the potential to become a future drug. Thus, you can expect to find work internationally in the pharmaceutical, biopharmaceutical and biotech industry that conduct research into new drugs.

There are many employment opportunities for holders of an MSc in Medicinal Chemistry. One is that you can enroll in a PhD programme and pursue a research career. You can conduct basic research in the academic environment, or engage in the discovery of new active drug substances in the industry.

Another important job area is working with patent experts to ensure that new promising, chemical substance categories are patented. Moreover, a medicinal chemist's competences are also relevant in the areas of regulatory affairs and chemistry, manufacturing and controls (CMC). Drug design, patenting, production, upscaling and CMC are all cornerstones of successful, profitable drug development.

"Novo Nordisk is one of the world's largest biopharmaceutical companies, and we are still growing. We therefore need to be able to recruit a sufficient number of talented people, like people with a focused background in medicinal chemistry. For holders of a Master's degree in medicinal chemistry there are many job opportunities in Production, Quality and Regulatory Affairs. In the drug discovery divisions Novo Nordisk employs PhDs with substantial research experience."

- Thomas Høeg-Jensen,
Principal Scientist, Novo Nordisk

Headquartered in Denmark, Novo Nordisk is a global healthcare company with 90 years of innovation and leadership in diabetes care. The company also has leading positions within haemophilia care, growth hormone therapy and hormone replacement therapy. Novo Nordisk employs approximately 40,700 employees in 75 countries, and markets its products in more than 180 countries.





WHO CAN BE ADMITTED?

To qualify for admission to the MSc programme in Medicinal Chemistry, applicants must have a relevant Bachelor's degree, courses in chemical and biological subjects, and meet the language requirements.

Previous applicants have held Bachelor degrees in medicinal chemistry, chemistry, pharmacy, biotechnology or biochemistry tailored to meet the specific requirements for admission.

To be admitted, you must have strong theoretical and experimental

competences in the fields of organic and physical chemistry. And you must have competences within biological fields, such as biochemistry, molecular biology, physiology and/or pharmacology.

You can find the specific admission requirements at **studies.ku.dk/masters/medicinal-chemistry**



WHAT IS THE CONTENT OF THE PROGRAMME?

The two-year MSc programme in Medicinal Chemistry consists of compulsory and elective courses and a final thesis. All courses are taught in English.

During the compulsory courses you work mainly with the design of potential drug compounds; both with regard to small-molecule drugs and macromolecular drugs, such as modified peptides or proteins. Advanced organic chemistry and development of effective syntheses are key elements in more of the courses.

We offer a wide range of elective courses that allows you to tailor a programme that matches your interests. Among others, you

can develop a profile in "Organic Chemistry and Drug Discovery", in which you further develop your competences within organic chemistry. Or in "Biopharmaceuticals" which deals with modified peptides and proteins and is a fast-track area of growth in the pharmaceutical industry.

During your studies, chances are good that you can work both with a research group at the university and with researchers in the industry. It will be possible for you to take courses and write your thesis at other universities in Denmark or abroad.

Where are we located?

The university is located in Copenhagen, the capital of Denmark. There are 1.7 million inhabitants in Greater Copenhagen.

Copenhagen's special features:

- a lively city with many young people
- a green city with many parks and green oases
- a blue city with a long waterfront, canals and lakes
- a bicycle city with clean air
- a city that offers a wide range of leisure activities and cultural events, including music, theatre, film, art and food festivals
- a city with good public transport and high public service levels

We have established a so-called double degree programme in collaboration with Vrije Universiteit, Amsterdam. You can find more information at **studies.ku.dk/masters/medicinal-chemistry**

For more information about the content and structure of the programme please visit: **studies.ku.dk/masters/medicinal-chemistry/programme-structure**

You can learn more about the MSc programme in Medicinal Chemistry from the students themselves. See the film on the website: **studies.ku.dk/masters/medicinal-chemistry/film**



BEING A MEDICINAL CHEMIST IN INDUSTRY-BASED RESEARCH

Most medicinal chemists who are engaged in industry-based research are involved in the early stages of the drug discovery and development process. After a so called 'hit' identification of chemical compounds that have exhibited an interesting biological activity, it is the job of the medicinal chemist to synthesize and optimise the hits into compounds with a potential to become a future drug.

To do this does not only require hands-on skills in the laboratory and an in-depth knowledge about the structures of the active substances, and the sites and mechanisms of actions at a molecular level. The medicinal chemist must also possess out-of-the-box-thinking skills to come

up with original ideas for the design of new promising drug candidates. Furthermore good communication skills are important qualities as medicinal chemists usually work in teams with various professional specialists, including pharmacists, pharmacologists, molecular biologists, physicians, engineers etc.

The development of new drugs is a long and complicated process, which can take from 10 to 15 years. Medicinal chemists are especially involved during early stages.

A rough overview of the drug development process:

- Hit identification – including identification of disease target (2-3 years)
- *Medicinal chemists design, synthesize and optimise hits alongside with other specialists testing metabolic stability, unwanted off-target activity etc. Often it takes hundreds of modifications to get a drug-like compound that exhibit the desired properties (2-3 years)*
- Apply for a patent
- Early and preclinical development. Tests on animals (2-3 years)
- Clinical development. Tests on people. Regulatory affairs. Scale up and launch (3-5 years)



“When recruiting scientists for the discovery of new drug candidates, we primarily look for solid hands-on experience in organic chemistry, but also for dedication and an ability to think originally. There is a large unmet need for new and innovative therapeutics, and the industry needs people with original ideas to push forward the research and development of new drugs.”

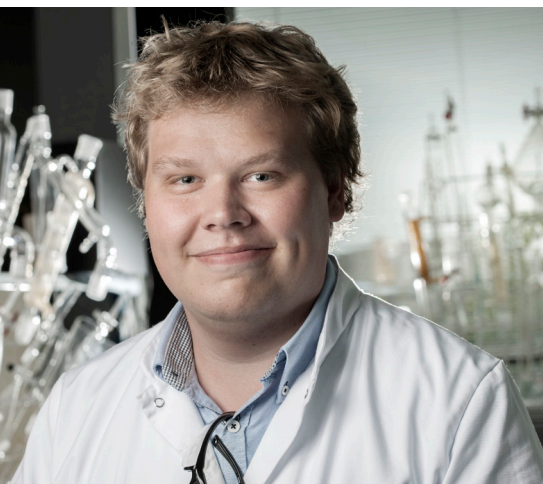
- Niels Svenstrup, Head of Department, Medicinal Chemistry, H. Lundbeck A/S

Lundbeck is a global pharmaceutical research-based company discovering, developing, manufacturing, marketing, selling and distributing pharmaceuticals for the treatment of psychiatric and neurological disorders. Lundbeck employs approximately 6,000 people in 57 countries, and their products are registered in more than 100 countries.

“... the first semester connects to all other subject areas in the programme, **constituting a solid foundation for the ability to gain a deep insight** into the different subject areas and disciplines in the subsequent courses.” - Søren Wedel Svenningsen

“MY PRIME FOCUS IS POTENTIAL DRUG TRANSPORTERS”

Søren Wedel Svenningsen, BSc in Biochemistry from the Faculty of Science, University of Copenhagen:



The combination of biology and chemistry has always had a strong appeal to Søren, and he enrolled in the biochemistry Bachelor's programme at the Faculty of Science at the University of Copenhagen (UCPH).

Soon he developed an interest in design and synthesis of drug substances, and in order to direct his Bachelor programme towards the MSc programme in Medicinal Chemistry he took courses in advanced organic chemistry as electives.

“Being able to chemically synthesize molecular structures and build substances that may form the basis of a future drug, fascinates me,” he says.

In his Master's thesis, which he is conducting together with a research group at the Department of Chemistry at the UCPH, he is focusing on the synthesis and development of highly functionalized molecular structures, which are likely to be used as drug transporters to increase bioavailability and decrease toxicity of other drugs.

“Once I get my Master's degree I want to pursue a PhD in that same field of the early stages of the drug development process,” says Søren.

INTRIGUED BY BRAIN CHEMISTRY

Fundamentally fascinated with the human brain and brain chemistry, Kasper has developed a strong interest in medicinal chemistry and holds both a Bachelor's degree and a Master's degree in Medicinal Chemistry.

"I'm particularly intrigued by the fact that it is possible to design drug substances that to some extent can restore chemical imbalances in the brain," he says.

Not surprisingly he was thrilled that he got the opportunity to conduct his Master's thesis at Lundbeck, a large Danish pharmaceutical company specialized in brain diseases and neuroscience research. Now, having attained his Master's degree, he hopes to embark on a PhD programme at

Lundbeck, partly financed by the company.

"I spent the entire second year of the Master's programme at Lundbeck. It was a great experience. Among other projects I took part in the investigation of a new drug category and succeeded in chemically modifying small molecules that showed a biological activity," he says.

"I also appreciated the courses at the university. While the Bachelor programme consisted of several compulsory courses, I enjoyed the wide range of electives in the Master programme. It allowed tailoring the programme towards the individual's interests."

Kasper Fjelbye, MSc in Medicinal Chemistry, 2014, from the Faculty of Health and Medical Sciences, University of Copenhagen



YOU SHOULD ALSO KNOW

In the midst of a pharmaceutical hub

The MSc programme in Medicinal Chemistry at the University of Copenhagen is anchored at the School of Pharmaceutical Sciences at the Faculty of Health and Medical Sciences and is developed in close collaboration with the Faculty of Science and the pharmaceutical companies based in the Medicon Valley.

Medicon Valley is a leading life science cluster, including one of Europe's largest biopharma clusters. It spans the Greater Copenhagen area in Denmark and the Skåne region of southern Sweden. The close concentration of almost 300 companies generates a dynamic and innovative life science environment that is fruitful for students. It presents optimal openings to find student jobs related to the field, initiate thesis projects at one of the many companies and to build contacts with future employers already while they are studying.

Research and teaching at the university

Academic staff – whether in the Master programme or in any other programme at the faculties of Science and Health – conduct research as well as teach, and the academic staff make strong efforts to include the latest research techniques and scientific developments in the courses.

Another feature is problem-based learning focusing on an active problem-solving approach. Teaching is often a combination of lectures, classroom teaching, hands-on laboratory exercises and report, article and poster preparation. Group projects are also common. The underlying philosophy is to ensure that programme graduates acquire the competences required by the job market.

Student life

The student life at the University of Copenhagen is truly vibrant, which is

reflected in numerous social activities such as sports, choirs and orchestras, international clubs, the Student House and the traditional Friday-bar that takes place at departments or faculties on Friday afternoons.

Furthermore Copenhagen is rich in charming areas like the hip and colourful Nørrebro, just a 10 minute walk from the university's North Campus, where most of your courses as a student in Medicinal Chemistry will take place.





The International Relations Office at
the Faculty of Health and Medical
Sciences: E-mail:
medicinalchemistry@sund.ku.dk

Address and Office Hours:
The Panum Building, Blegdamsvej 3B,
2200 Copenhagen N, Denmark

Check out the office hours at
**[studies.ku.dk/masters/
medicinal-chemistry/contact](https://studies.ku.dk/masters/medicinal-chemistry/contact)**



Apply online

To apply for admission to the MSc
programme in Medicinal Chemistry,
you need to apply using the Online
Application Portal. Please find the
Application Procedure at **[studies.
ku.dk/masters/medicinal-chemistry](https://studies.ku.dk/masters/medicinal-chemistry)**



Application deadlines

15 January for NON-EU/EEA citizens.
Admission the following September
1 April for EU/EEA/Swiss citizens.
Admission the following September

Tuition

All EU/EEA/Swiss citizens are exempt
from tuition fees for the MSc in
Medicinal Chemistry, which are
covered by the Danish state.

Non-EU/EEA citizens must pay tuition
for Danish educational programmes.
For information about the annual fee,
please visit: **[studies.ku.dk/masters/
medicinal-chemistry](https://studies.ku.dk/masters/medicinal-chemistry)**

Living costs

The average cost of living for students
in Copenhagen is DKK 7000/EUR 950
per month depending on housing
expenses and general living standard
(2014 level).

Housing

For tips regarding finding housing in
Copenhagen please go to
studies.ku.dk/welcome/housing

Visit Copenhagen

The official tourist website for
Copenhagen: visitcopenhagen.dk

Would you like to know more?

Find more detailed information at
**[studies.ku.dk/masters/
medicinal-chemistry](https://studies.ku.dk/masters/medicinal-chemistry)**

