



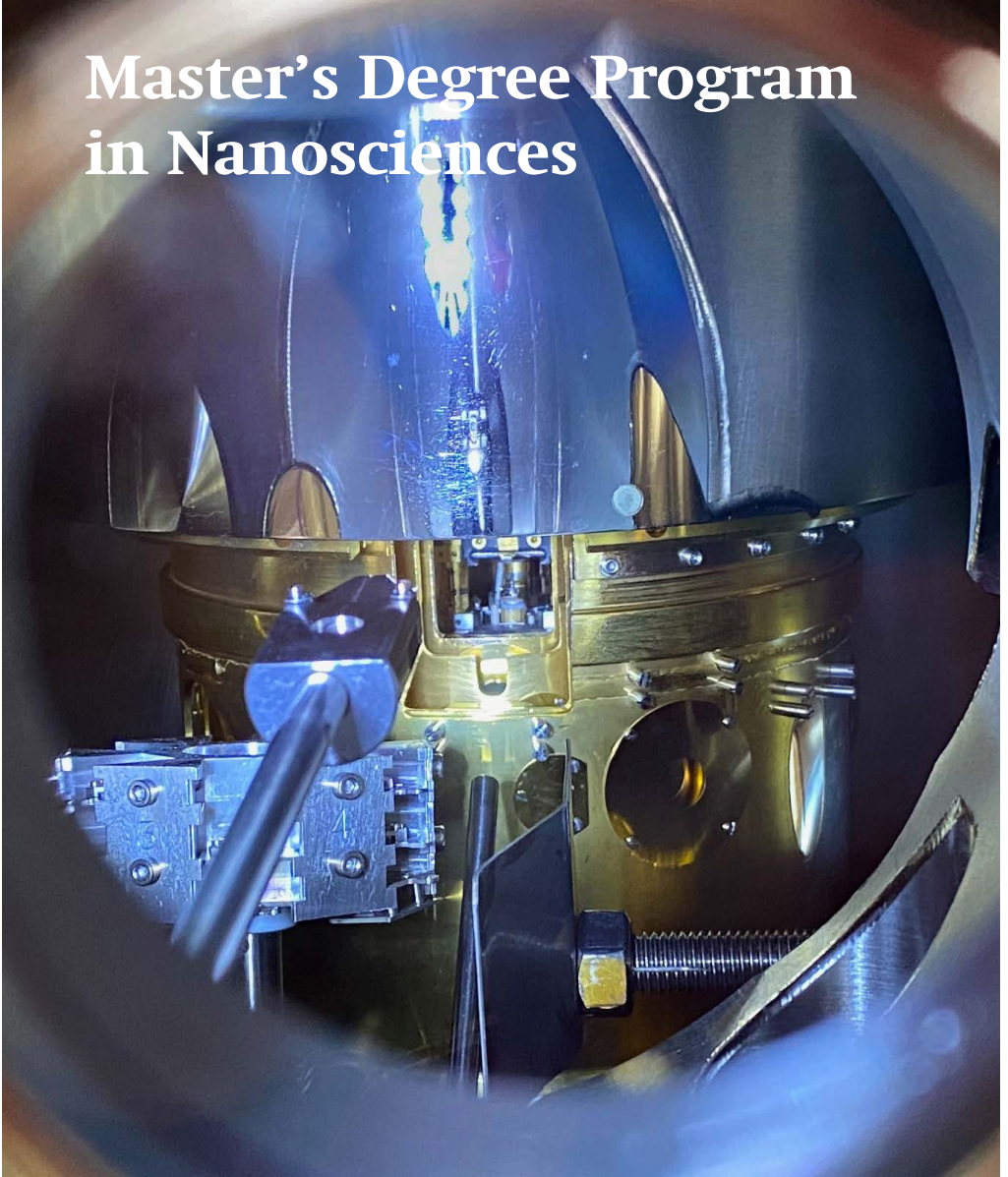
University  
of Basel

Swiss Nanoscience Institute



Swiss Nanoscience Institute  
Center of Excellence supported  
by the University of Basel  
and the Canton of Aargau

# Master's Degree Program in Nanosciences



[www.nanoscience.ch](http://www.nanoscience.ch)

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**You have reached the first key milestone on your journey to a career in the sciences.**

**It is time to take the next step with a master's!**

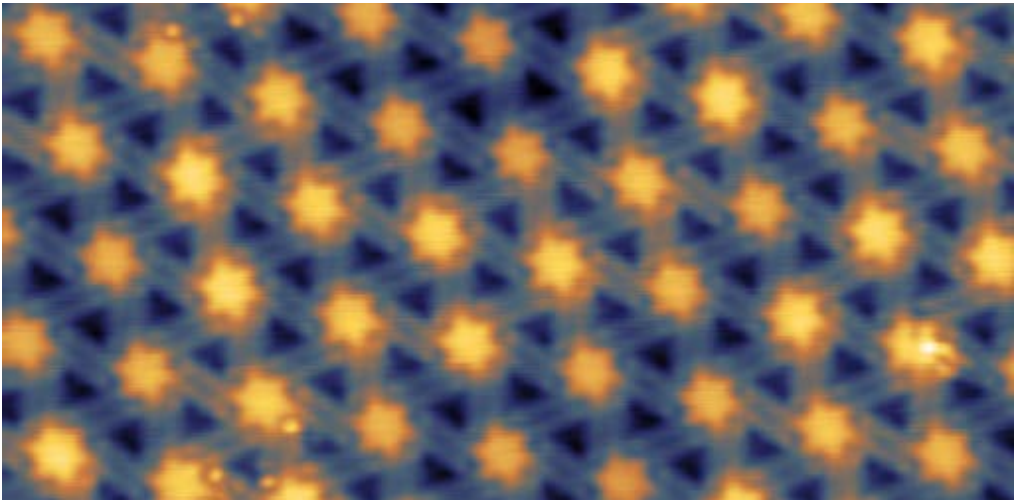
# Studying nanosciences

The nanosciences program at the University of Basel features a high degree of inter-disciplinarity. The aim is to understand the interaction between individual atoms and molecules, to combine these with one another, and to build them up into larger structures with special properties. Scientists from different fields are involved in the production, characterization, and manipulation of individual molecules and atoms – processes that give rise to novel surface properties, better understanding of quantum effects, and self-assembly phenomena.

The insights obtained at the nanometer scale help to shape numerous areas of technology, such as information and communication technologies, the energy sector, and even certain areas of medicine.

**Sound exciting? Do you want to be part of this cutting-edge research?**

**Then the Master's Degree Program in Nanosciences at the University of Basel is the right choice for you!**



*“There's plenty of room at the bottom!”*

**An invitation to enter a new field of physics  
(Richard Feynman, 29 December 1959)**



*“I’m fascinated by exploring novel physical phenomena associated with quantum transport.”*

*For my master’s thesis, I was working on superconducting devices. We aimed to measure features associated with topological superconductivity such as Majorana fermions, which promise future implementations as qubits in a quantum computer.”*

**Melissa Osterwalder in the lab at the Department of Physics,  
University of Basel**

# Research and teaching

The interdisciplinary nature of the bachelor's degree continues in the master's program.

However, you can now focus even more intensely on the topic of your interest by choosing your major subject from the disciplines of physics, chemistry, molecular biology, and medical nanoscience. In the chosen major, you attend lectures and seminars and complete project work, as well as a master's thesis at the end of the program. In your minor subject, you obtain additional credit points for visiting lectures and seminars and completing a second project. In this way, the interdisciplinary character of the study is well preserved and simultaneously enables you to specialize in a specific domain.

You can choose between nanophysics, nanochemistry, nanobiology, and medical nanoscience for your major and minor subject.

**Nanophysics:** Analysis of structures on the nanometer scale, understanding and control of quantum phenomena, and much more

**Nanochemistry:** Study of self-assembly phenomena and individual macromolecules (e.g. nanocontainers), surface chemistry, nanostructured materials, and other topics

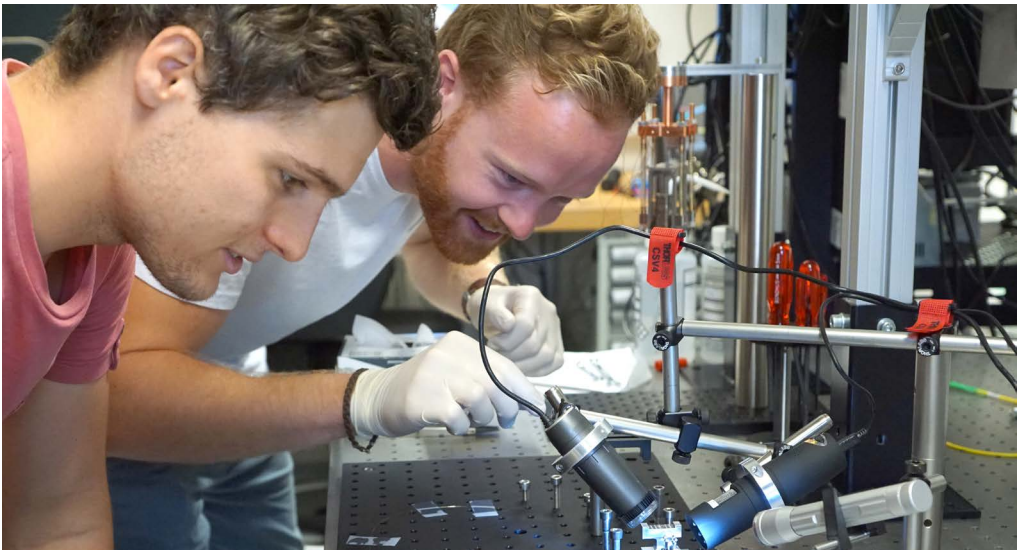
**Nanobiology:** Structure and function of biomolecules, mechanisms of natural nanomachines (e.g. molecular motors and energy converters), and much more

**Medical Nanoscience:** Applying nanotechnology to develop new drug therapies and medical diagnostics. Provides insights into the synthesis, characterization, design principle and evaluation of nanopharmaceutical formulations and interactions of nanomaterials with biomolecules



*“I was working on a way to selectively filter valuable metals out of solutions using special types of membranes. Ultimately, the aim was to incorporate this new system into water treatment plants.”*

**Manuel Kraus on his project work at the  
Department of Chemistry,  
University of Basel**



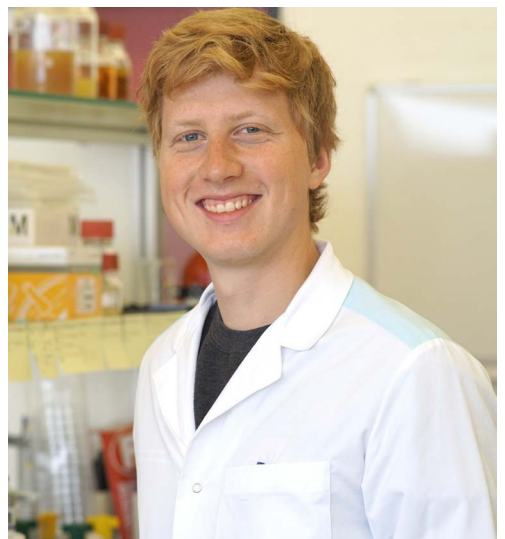
*“I developed software to simulate a fiber Fabry Perot cavity.”*

**Julian Koechlin (right) with his supervisor, Thibaud Ruelle, discusses his project work at the Department of Physics, University of Basel**

The master’s program will strengthen your knowledge in specific areas. It will teach you to work independently and in a goal-oriented manner. You will conduct and present your scientific projects in both written and oral form.

*“I developed a microfluidic system that allows rapid replacement of the bacterial culture medium, which makes it possible to study the influence of various components of the nutrient medium on the assembly of a bacterial harpoon.”*

**Julius Winter completed his master’s thesis at the Biozentrum, University of Basel**



# Structure of the master's degree program

To successfully complete the Master of Science in Nanosciences, you will need to obtain 90 credit points (CPs).

You will receive 16 CPs for attending seminars and lectures in your major subject and 14 CPs for courses in your minor subject. In general, the lectures in the master's program are given in English.

For the two projects in your major and minor subjects, which take about two months each, you will obtain 20 CPs. For the master's thesis, which is completed over a period of about six months, you will receive 30 CPs and a further 10 CPs for the final oral examination/presentation.

Every year, a CHF 2,000 prize is awarded to the best master's thesis.



*“I wrote my master’s thesis about aging processes in the blood-brain barrier at Stanford University (Palo Alto, California, USA)”*

**Daniel Stähli, winner of the prize for the best master’s thesis (2020)**



*“In my master’s thesis, I synthesized a complex organic compound with potential applications in molecular electronics.”*

**Charlotte Kress, one of the winners of the prize for the two best master’s thesis (2021)**



*“In my master’s thesis, I characterized a helper protein using nuclear magnetic resonance (NMR) spectroscopy.”*

**Anna Leder, one of the winners of the prize for the two best master’s thesis (2021)**



|   |       |
|---|-------|
| Courses and seminars in one major subject<br>(Physics, Chemistry, Molecular Biology or Medical Nanoscience) | 16 CP |
| Courses and seminars in minor subjects<br>(Physics, Chemistry, Molecular Biology or Medical Nanoscience)    | 14 CP |
| Project work in major subject   | 10 CP |
| Project work in minor subject   | 10 CP |
| Master's thesis   | 30 CP |
| Master's examination  | 10 CP |

**Total** **90 CP**

One ECTS credit point (CP) equals approximately 30 working hours.



*“In my master’s thesis, I studied a superconducting metamaterial that could potentially be used to study losses in quantum systems.”*

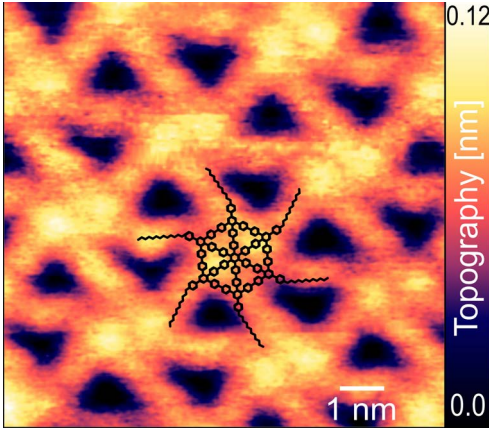
**Vera Weibel, one of the winners of the prize for the two best master’s thesis (2022)**



*“I developed a torsion rocker that can be used to study the magnetization of tiny magnets in precise detail.”*

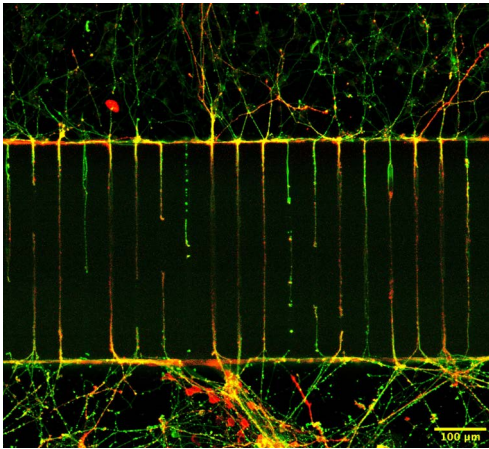
**Mathias Claus, one of the winners of the prize for the two best master’s thesis (2022)**

# It's all about science



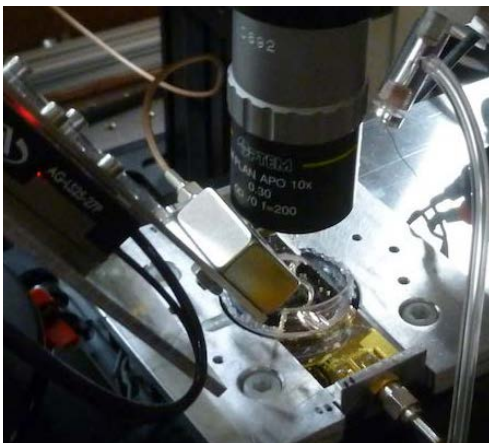
**Scanning probe microscopes can be used to image surfaces in atomic resolution.**

In his master's thesis at the Department of Physics, University of Basel, Sebastian Scherb investigated whether the electro-spray method is suitable for depositing large molecules on surfaces without destroying the molecules in the process.



**A microfluidic system is used to grow nerve cells that simulate an important signal pathway in the brain. This pathway is damaged in patients who suffer from Parkinson's disease.**

In his master's thesis at the Technical University of Denmark, Sebastian Buchmann worked on the development of one example of a two-dimensional brain model on a chip.



**Using nitrogen-vacancy (NV) centers in diamonds, it's possible to detect the magnetic fields of tiny magnetic particles in liquids.**

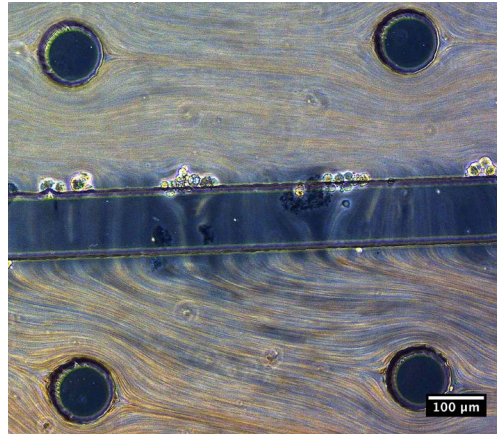
Gabriel Zihlmann used NV centers to image bacteria for his master's thesis at the University of California, Santa Barbara (USA).

For information on currently advertised master's theses, please visit:

<https://nanoblog.unibas.ch/category/master/>

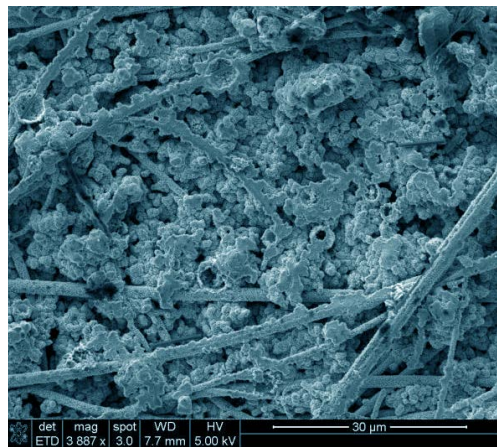
### **Individual circulating tumor cells can be detected in a microfluidic system.**

Till Ryser worked on the development of this type of detection system as part of his master's thesis at the Department of Biomedicine, University of Basel.



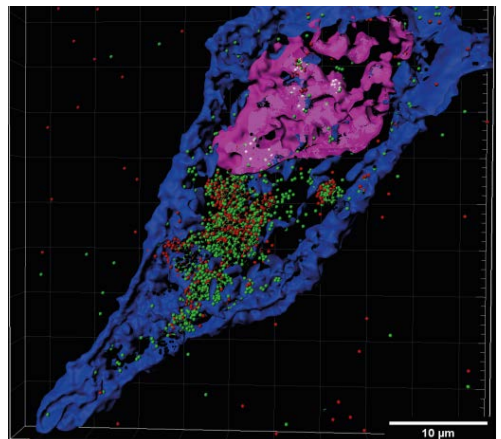
### **A variety of electrolytes are being studied with a view to investigating new types of cost-effective and environmentally friendly lithium-ion batteries.**

For her master's thesis at Empa and the Department of Physics, University of Basel, Camilla Vael studied a range of mixtures and salts for this application.



### **Polymeric nanomaterials might once be used for DNA delivery in gene therapies.**

In his master's thesis at the Department of Pharmaceutical Sciences and the Biozentrum, University of Basel, Matej Siketanc studied polymeric nanomaterials for DNA delivery. He applied a biomimetic approach to increase the transfection efficiency of this non-viral gene delivery system.



# Mobility, study abroad, and internships

Many students on the nanoscience program take the opportunity to spend a semester at a foreign university. Mobility programs facilitate these stays at Swiss and foreign universities.

Further information:

Student Exchange

Petersplatz 1

4001 Basel, Switzerland

T +41 61 207 30 28

<https://www.unibas.ch/en/Studies/Mobility.html>



In addition to the University's mobility programs, nanoscience students can apply for travel grants from the Swiss Nanoscience Institute (SNI) for master's and project work at a research institution or university abroad. It is an excellent opportunity to start building an international science network and to discover a different culture.

*“My project at Osaka Prefecture University was demanding and covered many of the topics I'd learned about in the block courses during the last year of the bachelor's program.”*

**Charlotte Kress worked with a natural enzyme that can be used in chemical reactions.**



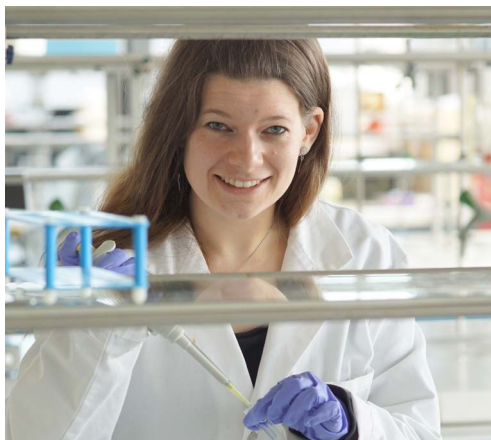
*“I did my master's thesis at Harvard Medical School – and I liked it so much that I will continue with a doctoral dissertation there, too.”*

**Laurent Dubois investigated the last step of bacterial cell division. A better understanding of this process could lead to the development of new antibiotics.**

# Career opportunities

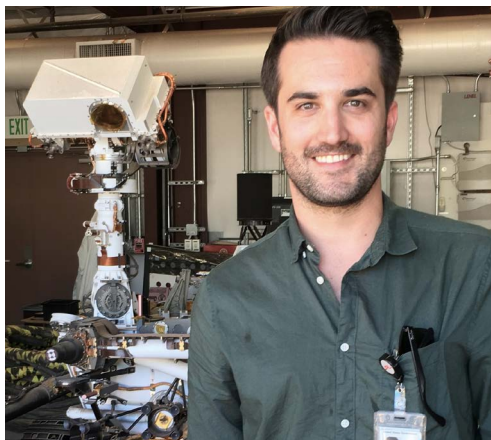
Most scientists with a Master of Science in Nanosciences work in basic research at a range of academic institutions or in applied research – either at global companies or at SMEs and start-ups in Switzerland and abroad.

For example, nanoscientists are sought after in the areas of medical engineering, sensor technology, analysis, and production on the nanometer scale, and especially in any field that calls for interdisciplinary knowledge and understanding.



*“The nanosciences degree provided an excellent foundation for my subsequent activities.”*

**Dr. Natascha Kappeler,  
Specialist Laboratory Medicine,  
SYNLAB Suisse**



*“Thanks to my interdisciplinary training, I often act as a bridge-builder between engineers and scientists.”*

**Dr. Florian Kehl,  
Senior Research and Teaching Assistant at  
the University of Zurich Space Hub, Lec-  
turer at the Lucerne University of Applied  
Sciences, and Subcontractor at NASA Jet  
Propulsion Laboratory**

More examples of careers paths can be found at:  
<https://nanoscience.ch/en/media/brochures/>

# Admission

Direct admission to the master's program is possible if you hold a Bachelor's degree in nanosciences from the University of Basel or with the proof of equivalent academic achievements.

After registering with the Student Administration Office, the relevant board will review your application documents.

If you hold a bachelor's degree from a different university or in a subject other than nanosciences, the Faculty responsible may only partially recognize it as equivalent. In this case, admission to the master's program may require the applicant to obtain further credits (up to a maximum of 30 credits) from the bachelor's degree program in nanoscience.

For further information on admission requirements, please visit:

<https://www.unibas.ch/en/Studies/Application-Admission/Admission.html>

## Registration & matriculation

Information on how to register for the master's program will be sent after you have received confirmation of admission.

Registration is available at

<http://www.unibas.ch/registration>

The registration fee is CHF 100.

Registration deadline for the fall semester is 30 April, for the spring semester 30 November.

The master's program usually starts in the fall semester and lasts three semesters, without a time limit.

## Study costs

Tuition fees per semester (also for examination semester) are CHF 850.

This does not include personal living costs. If you would like to apply for scholarships and student loans, please send your application to the scholarship department of the canton where your parents legally reside.

## Further information

You will find more information on our website:

<https://nanoscience.ch/en/studium/>



Nanoscience students in the master's program talk about their experience and what they like best:

<https://youtu.be/jjbz1DKJ3Qc>



On YouTube, you will find more information about the SNI, nanoscience education and research under the keyword "Swiss Nanoscience Institute". The SNI was founded by the Canton of Aargau and the University of Basel.

[https://youtu.be/B\\_nkPd84ufU](https://youtu.be/B_nkPd84ufU)



# **We look forward to welcoming you to the Master's Degree Program in Nanoscience. Contact us with any questions!**

**Nano study coordination and student advice**

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# Images

- Cover: The inside of a scanning probe microscope (C. Möller)
- Page 1: Self-assembly of HCB molecules on Au(111) (R. Pawlak)
- Page 2: Melissa Osterwalder at the Department of Physics, University of Basel  
(C. Möller)
- Page 4: Manuel Kraus at the Department of Chemistry, University of Basel (C. Möller)
- Page 5: Julian Koechlin and Thibaud Ruelle at the Department of Physics, University  
of Basel (C. Möller)  
Julius Winter at the Biozentrum, University of Basel (C. Möller)
- Page 6: Daniel Stähli, Charlotte Kress und Anna Leder (C. Möller)
- Page 7: Vera Weibel und Mathias Claus (C. Möller)
- Page 8: AFM image of Spoked Wheel molecules on potassium bromide (S. Scherb)  
Microfluidic system that can be used as a brain model (S. Buchmann)  
Experimental setup to study magnetic fields in liquids (G. Zihlmann)
- Page 9: Microfluidic systems that is used to detect circulating tumor cells (T. Ryser)  
SEM image of a cathode after charge-discharge cycling with electrolytes  
(C. Vael)  
Crosssection of a 3D model of cells (M. Siketanc)
- Page 10: Charlotte Kress at Osaka Prefecture University (C. Kress)  
Laurent Dubois (C. Möller)
- Page 11: Natascha Kappeler (C. Möller)  
Florian Kehl at the NASA Jet Propulsion Laboratory (F. Kehl)
- Page 13: Anja Car, Simone Chambers are here to support you during your studies  
(C. Möller)

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