Impact Report 2019

Excellence Scholarships

For outstanding young talent.
For business, science and society.

ETH Foundation

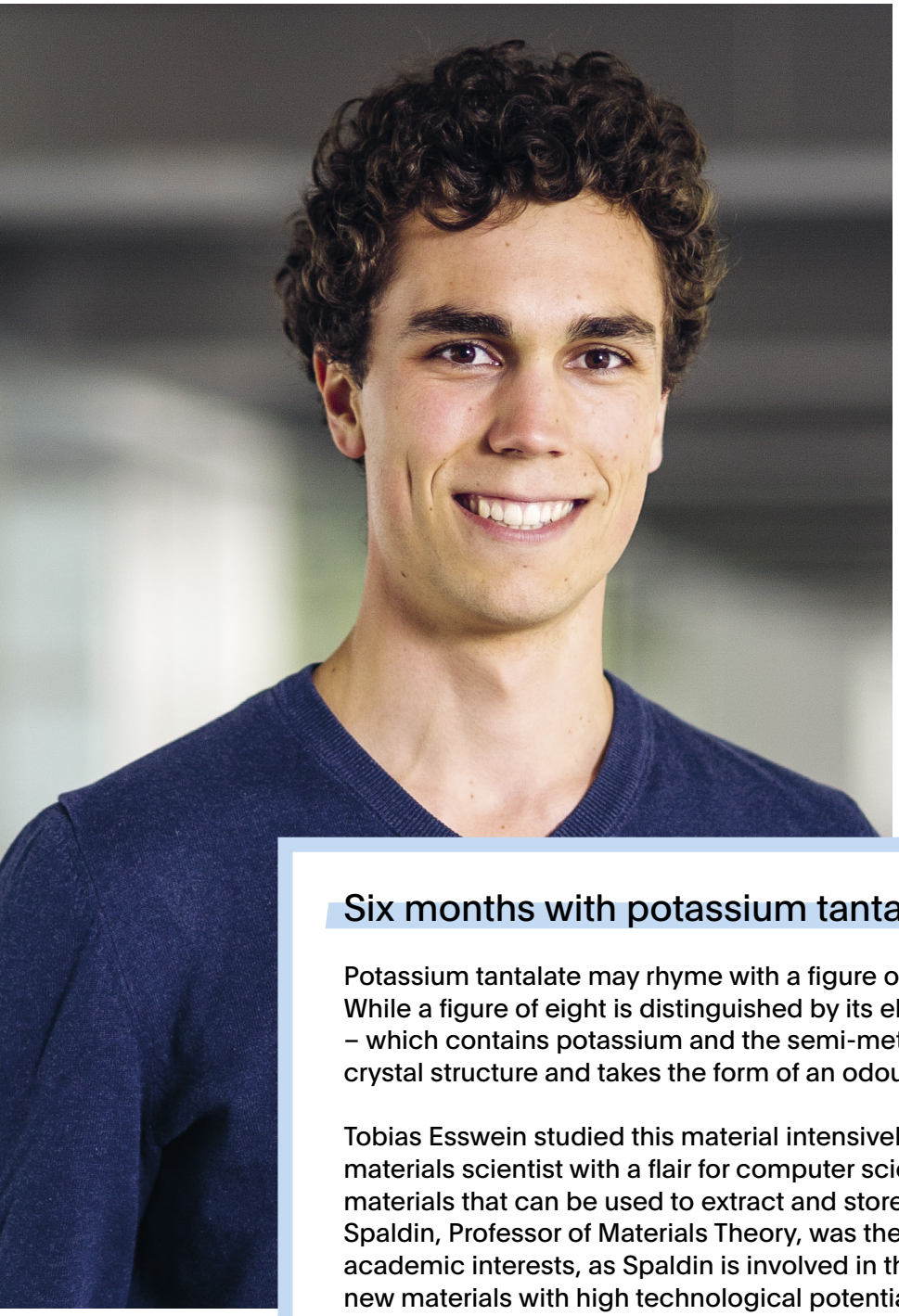
Thank you!

Student numbers at ETH Zurich are growing steadily and have almost doubled in the last ten years (today, there are more than 22,000 students). The number of Excellence Scholarships has also risen sharply from just 13 in 2007 to about 50 today. This is a significant increase – considering that every scholarship relies on active support from private donors. After all, the Excellence Scholarships are funded entirely by donations. I would like to thank you on behalf of all the beneficiaries of this support.

In light of the rising student numbers, ETH Zurich aims to award 60 Excellence Scholarships per year starting from autumn 2020/21. To ensure the most talented young students will continue to receive scholarships, future support is needed.

Excellence Scholars are characterised by their outstanding talent and motivation, so it is no surprise that every year several Excellence Scholars also receive awards for their exceptional Master's theses or final grades. The next few pages present some of these promising talents along with their respective projects.

Prof. Dr. Dr. h.c. mult. Sarah M. Springman
Rector of ETH Zurich
Patron of the Excellence Scholarship & Opportunity Programme



Tobias Esswein

Materials Science

Excellence Scholar 2015
ETH Silver Medal 2018 and
IBM Research Forschungspreis 2019
for Outstanding Master's Thesis

Six months with potassium tantalate

Potassium tantalate may rhyme with a figure of eight, but the similarities end there. While a figure of eight is distinguished by its elegant curves, the compound $KTaO_3$ – which contains potassium and the semi-metal tantalum – features a strictly cubic crystal structure and takes the form of an odourless white solid.

Tobias Esswein studied this material intensively over a period of six months. As a materials scientist with a flair for computer science, Esswein is fascinated by materials that can be used to extract and store energy. A Master's thesis with Nicola Spaldin, Professor of Materials Theory, was therefore the perfect match for his academic interests, as Spaldin is involved in the study of the physical principles of new materials with high technological potential, typically with the help of computer models. In potassium tantalate, Esswein found the ideal subject for his research. The compound can conduct electricity without electrical resistance at low temperatures, thus making it suitable for use as a superconductor. This could be of interest in numerous applications, such as energy-efficient data storage. However, the origin of these superconducting properties remains unclear. Through calculations on EULER, ETH Zurich's supercomputer, Esswein has shown that potassium tantalate behaves similarly to another investigated material, strontium titanate. He also studied the interactions between current flow and lattice vibrations in both materials, which is essential for understanding the superconducting properties.

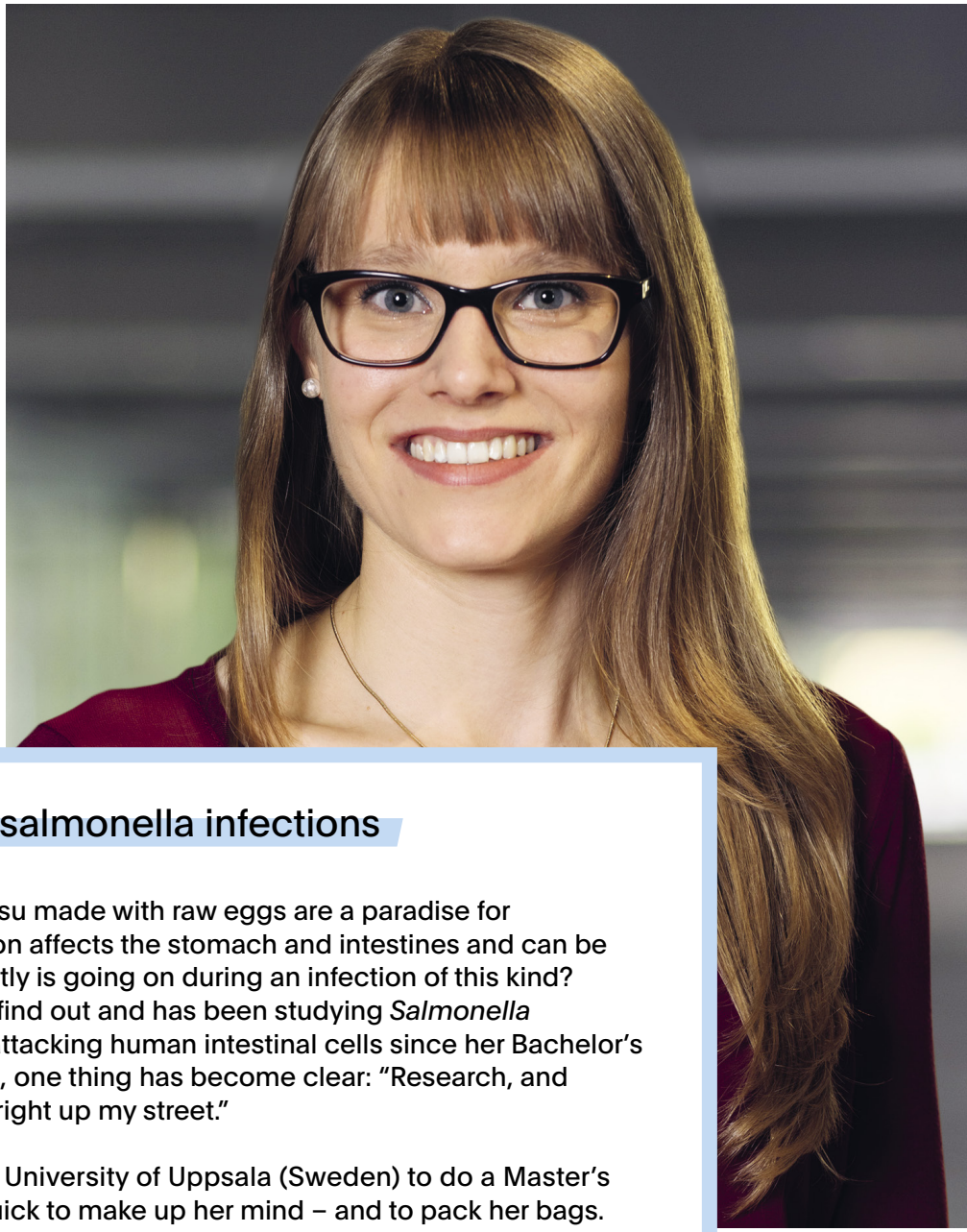
However, six months of intensive research into potassium tantalate was not enough to reach any final conclusions. But that is no problem for Esswein, who wants to continue with his work: "I hope to make significant advances in our understanding of superconductivity during my doctoral studies."

Petra Geiser-Mailänder

Biology

Excellence Scholar 2016
Willi Studer Prize 2018

(The Willi Studer Prize has been awarded to the best graduate in each Master's degree programme since 1993.)



New tools for studying salmonella infections

Undercooked chicken and tiramisu made with raw eggs are a paradise for salmonella. This bacterial infection affects the stomach and intestines and can be highly unpleasant. But what exactly is going on during an infection of this kind? Petra Geiser-Mailänder wants to find out and has been studying *Salmonella typhimurium* and its strategy of attacking human intestinal cells since her Bachelor's degree in biology. In the process, one thing has become clear: "Research, and infection biology in particular, is right up my street."

So when an offer came from the University of Uppsala (Sweden) to do a Master's thesis on the subject, she was quick to make up her mind – and to pack her bags. Geiser-Mailänder went on to investigate exactly what happens when salmonella invades a host cell. Investigating infection mechanisms of this kind calls for different model systems, from simple cell cultures to animal tests, all of which have their specific advantages and disadvantages and are suitable for various purposes.
To gain a better understanding of the initial interaction between salmonella and host cells, Geiser-Mailänder developed a new model system based on cell lines. At the same time, she used organ-like microstructures – organoids – that closely replicate the physiological conditions found in the intestines. The infection of organoids provides a unique opportunity to observe the interactions between pathogen and host cells. Thus, she was able to show that a specific mechanism of the immune system springs into action after the salmonella penetrate the intestinal mucosa.

Geiser-Mailänder liked working at the lab and living in the old university city so much that she stayed in Uppsala for her doctorate. She has now spent a year continuing her research into the mechanisms underpinning a salmonella infection and can draw on the experience and insights she gained during her Master's thesis. She has also set herself some ambitious goals: "I want to contribute to developing new model systems that can replace animal experiments. And I also hope to find out which factors are responsible for an infection."

Bob Hoffmann

Mechanical and Process Engineering (specialisation Robotics, Systems and Control)

Excellence Scholar 2015
ETH Silver Medal
for Outstanding
Master's Thesis 2018
with Marc Meyers (below)

Two engineers behind the "Wheelie" project

For a long time, wheelchair research was consigned to the margins, yet this is a field that is calling for ingenuity and optimisation. Although there are more than 65 million wheelchair users worldwide, by no means all are able to use the device to its full potential. This may be due to the fact that many lack the necessary upper-body strength to operate the wheelchair in an optimum fashion. Steps, in particular, often present an insurmountable hurdle. To overcome this, the user must be able to balance the wheelchair on its back wheels – a complex task that only experienced and trained users can master. Accordingly, there is a need to develop lighter, more mobile and user-friendly wheelchairs with electric assistance – and this was precisely the aim of the Master's thesis by Bob Hoffmann and his fellow student and long-time friend Marc Meyers. The two researchers from Luxembourg had previously worked together as part of a focus project under Professor Roger Gassert. Now, their task was to develop a mechanism that allowed the wheelchair wheels to absorb and amplify the force applied by the user autonomously. At the same time, the idea was to make it easy for the user to do a "wheelie" in order to tackle kerbs.

The two mechanical engineers had lofty ambitions. "For us, it wasn't just about achieving technical excellence, we also wanted to make the wheelchair as user-friendly as possible," explains Hoffmann. With this in mind, they organised regular meetings with suppliers and with wheelchair users and experts. The resulting prototype combines the low weight and manoeuvrability of a manual wheelchair with the assistance features of an electric device, and will now undergo further development in cooperation with a mobility aids company.

Hoffmann and Meyers were so pleased with their "Wheelie" that they even considered founding a start-up. But this idea has been shelved for the time being, as the two researchers first want to gain some industry experience. Hoffmann is working as a system and control engineer at the ETH spin-off Verity Studios AG, while Meyers is employed as a development engineer at Helbling Technik in Wil. But they haven't cut all ties with ETH yet: "We still feel very connected to the academic world and can easily imagine developing an idea from ETH as part of a doctorate or by founding a company."

Awards are not only presented by ETH Zurich, as the following example illustrates.

Prabhat Joshi
Environmental Engineering

Excellence Scholar 2017
2. Prize Geneva Challenge 2018

Glacial melting and heavy rainfall

Each year, the Graduate Institute in Geneva organises a call for innovative solutions to global challenges. Projects can be submitted by Master's students from all five continents, with one project from each continent selected to enter the final. For the purposes of the competition, the continents are defined as Asia, North America and Oceania, Europe, Africa and South America.

Prabhat, your project was selected as the finalist for Europe at the Geneva Challenge 2018 and went on to win second prize. How did this come about?
I found the call for proposals online and thought it sounded interesting, so I teamed up with two other students at ETH Zurich to develop a project. The fact that all three of us are from Nepal and had the chance to represent Europe at the Geneva Challenge was obviously something of a novelty. Our work addresses the question of what happens if the earth's glaciers melt away in the course of global warming and can therefore no longer perform their vital role in maintaining a region's water balance. Our project focuses on glaciers in Nepal. The basic idea is to build dams at suitable locations to replace the melting glaciers with lakes.

Did you work on the project alongside your regular studies?
Yes, we did most of the work during the semester breaks.

What approach did you adopt?
We follow two strategies in order to identify suitable locations for dams of this kind. First, we use machine learning to derive information about future trends from historical data. Second, we use remote sensing data to obtain information about the geometry, melting rates and mass balance of the glaciers. For this work, we received support from Professor Daniel Farinotti at the Section of Glaciology at ETH, who is working on a similar project in Switzerland. At the moment, we're still working to develop a suitable model in order to identify glaciers where storage dams would make sense.

You started your Master's thesis in September. Is that about glaciers too?
No. My Master's thesis follows on from my Master's project work. It's all about extreme precipitation events, which are becoming increasingly common in our changing climate. These events often overload drainage systems, thus allowing water to drain away untreated. The conventional approach assumes that drainage systems can be adapted to handle larger volumes of water, but that is not very sustainable. We explored whether there are ways to prevent the water from draining away and to hold it at the point of origin. For example, roofs could be adapted to retain water for longer, or porous road surfaces could be developed so that water percolates through rather than running off into gutters. Our calculations show that if appropriate steps are taken, it is possible to reduce water volume by up to 12 percent. For my Master's thesis, I'm going to run through all this with data from my home city, Kathmandu. Max Maurer, Professor for Urban Water Systems, and Dr Joao Paulo Leitao and Dr Peter Marcus Bach of Eawag supervised me during my Master's project and will now also support me as I work on my Master's thesis.

In less than a year you will complete your studies at ETH Zurich. Where will you go then?
I want to go back to Nepal and put the knowledge I've acquired at ETH Zurich to use in my home country. Nepal is currently undergoing some radical changes both politically and economically. There are huge efforts underway to decentralise the country, and in the process new urban centres are emerging in the country as a counterpoint to Kathmandu. My dream is to plan these centres from the ground up in terms of sustainability, including urban water management.

Instead of wine, a small box to promote young talent

Mr Zollinger, to celebrate your retirement, you asked your guests to make a contribution to ETH Zurich in lieu of gifts. How did you come to this decision?
Before my own retirement, I'd attended retirement or milestone birthday parties for a number of colleagues and friends. At all these events, the gift table ended up full of bottles of wine brought along by guests. I didn't want that to happen at my party, so I set up two decorated boxes – one for a charitable organisation and another for ETH's Excellence Scholarship & Opportunity Programme. The idea went down well with the guests and we raised a decent amount of money for ETH.

"It's important for me to give something back to ETH, an institution to which I owe so much."

Why did you pick ETH and the Excellence Scholarship & Opportunity Programme in particular?
As a chemistry student, I benefited from a cantonal scholarship myself. It's therefore important for me to give something back to ETH, an institution to which I owe so much. On the whole, my student days and subsequent doctorate at ETH were a very positive experience, although university was an intense time even then. The knowledge I acquired at ETH laid the ideal foundation for my future career. For that reason, I'm convinced that the Excellence Scholarships are a good thing. They provide an opportunity for young people and allow them to enjoy a relatively carefree student life, at least from a financial perspective.

The ETH Foundation organises regular events such as "Meet the Talent", at which the beneficiaries can present their work and meet donors and benefactors. You have also attended one of these events in the past: do you have any advice for the beneficiaries?
My advice is to study something you're really interested in. If you do, everything will turn out well. Where you ultimately end up is largely down to chance. For example, I would never have imagined that I would later work for the police. I didn't even know they needed chemists. A job advertisement took me to the world of forensic science, and I stayed there until my retirement.

What does ETH mean to you today?
When people come to visit me from abroad, I often take them to the Polyterrasse, partly of course for the beautiful views of the city and the Uetliberg, but above all because it somehow gives you a sense of the significance of ETH for Zurich and Switzerland as a whole. In my opinion, this impact should not be underestimated.

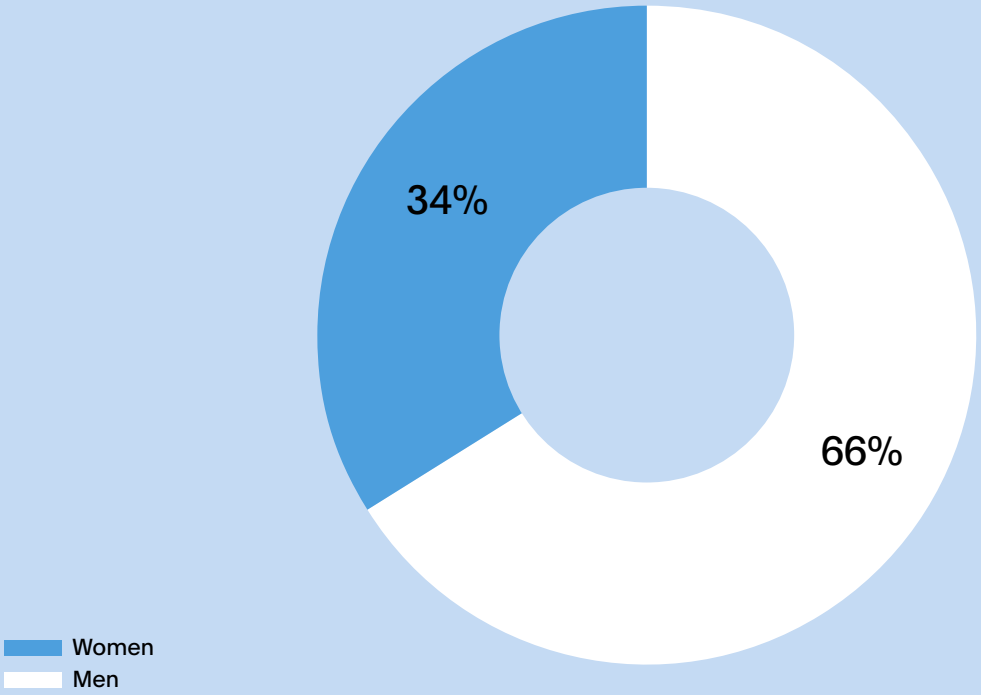
Doctor of Science Kurt Zollinger

ETH Foundation donor

Facts & figures

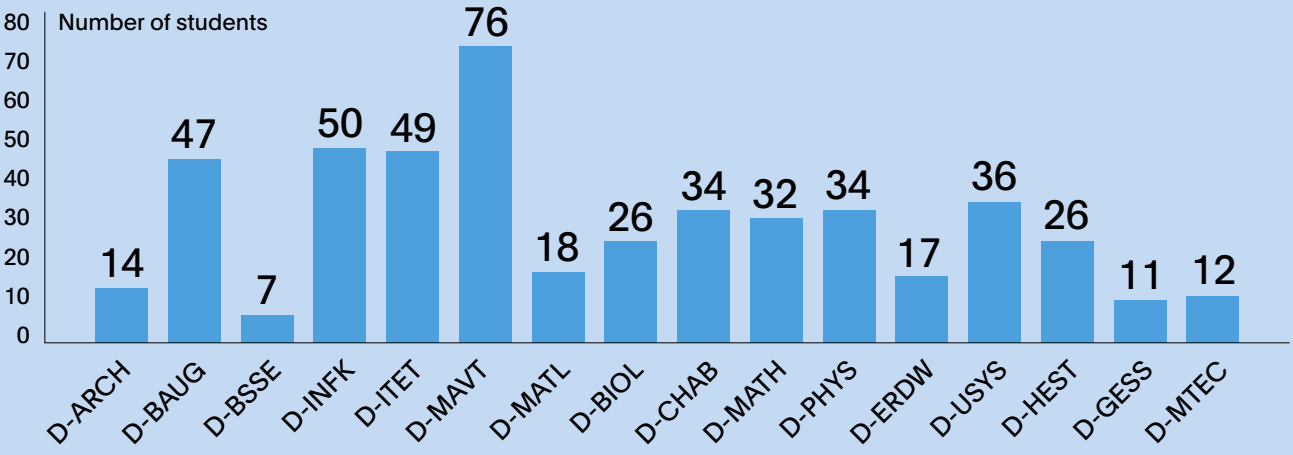
Men and women

Over the last ten years, women have made up 34% of Excellence Scholars. This is slightly higher than the proportion of women in the total number of Master's students at ETH Zurich (31%).



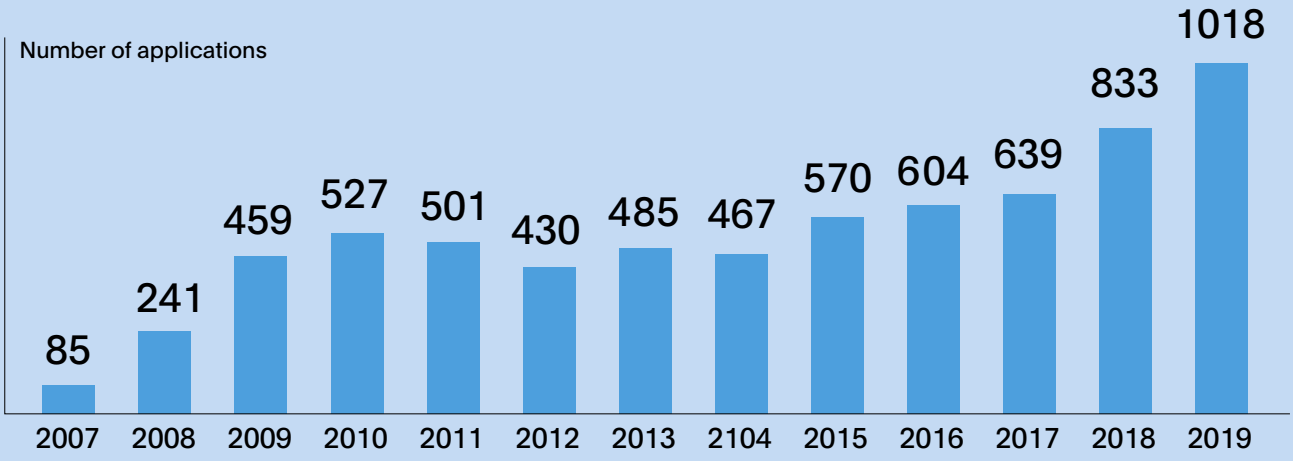
Excellence Scholars by department, 2007–2019

The largest group of Excellence Scholars – namely, 76 or about 15% of the total – are from the Department of Mechanical and Process Engineering, followed by students of computer science and electrical engineering.



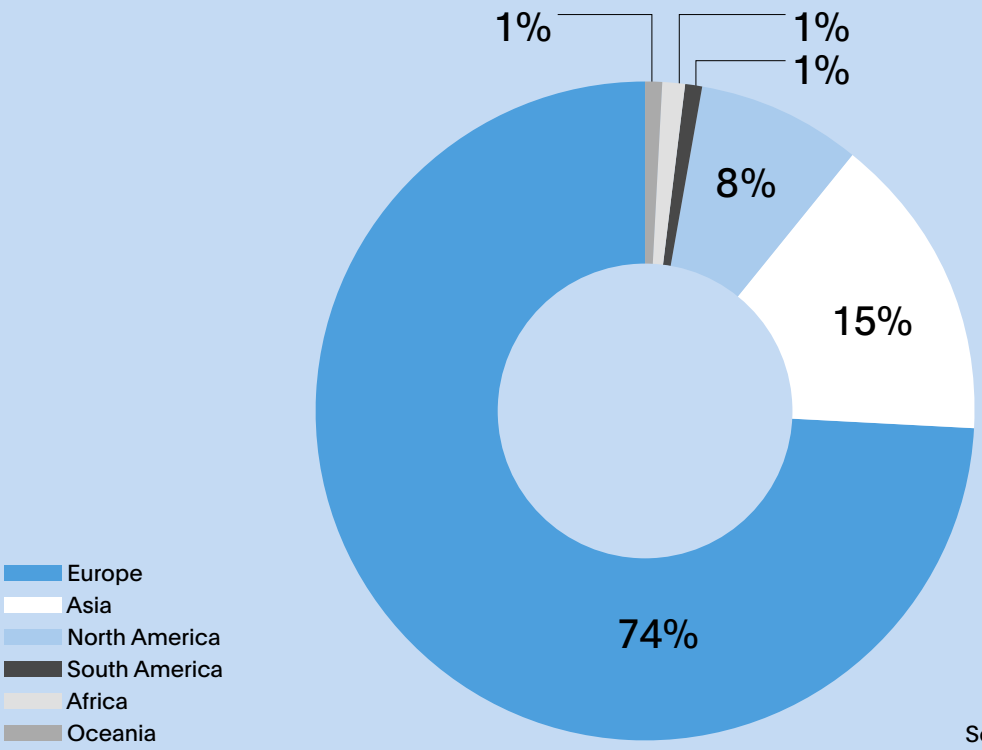
Applications per year

Following the introductory phase, about 500 students applied for the Excellence Scholarship & Opportunity Programme every year until 2014. Since 2017, however, the number of applications has risen rapidly. In 2019, for example, more than 1,000 students expressed their interest in an Excellence Scholarship – of which 52 were accepted. In total, 489 students have benefitted from an Excellence Scholarship since 2007.



Nationality of scholarship students

About 30% of all Excellence Scholars are from Switzerland with 44% coming from other European countries.



Source: ETH Zurich Foundation

Fostering exceptional talent

ETH Zurich awards Excellence Scholarships to students from Switzerland and abroad who rank in the top two to three percent of their year. The scholarships cover study and living costs and tuition fees for the entire Master's degree course, giving recipients the scope to focus fully on their studies. The excellence programme is funded wholly by donors.

www.ethz-foundation.ch/en/esop

Statements from this year's Excellence Scholars:

"The Excellence Scholarship & Opportunity Programme opened up so many doors and opportunities for me."

"From the bottom of my heart: thank you"

"I hope that one day I will feel I have fulfilled the donors' expectations."

Thank you!

The Excellence Scholarship & Opportunity Programme is supported by more than 4,000 alumni, as well as friends of ETH Zurich and the following partners:

Adrian Weiss Stiftung, Amman Group, Avaloq, Basler & Hofmann, BKW, Bühler, Bühlmann-Kühni Stiftung, CA Indosuez, Clariant Foundation, Dätwyler, Dectris AG, Disney Research Zürich, DMSP Portmann, Dow, Dr. iur. Jstvan Kertész Stiftung, EBP Schweiz, Familie Eric Winkler, Forum for Supply Chain Management, Franke, Gamil-Stiftung, Gemeinnützige Stiftung Basler & Hofmann, Glencore, Google, Gruner, GVM, Green Leaves Education Foundation, Hardturm AG, Helmut Fischer Stiftung, IMG Stiftung, Implenia, Josef P. und Nelly Spiess-Mohn Stiftung, Leoni, Monique Dornonville de la Cour-Stiftung, Novartis Stiftung, Open Systems, PwC, RMS Foundation, Rütli-Stiftung, Sensirion, Shell, Starr International Foundation, Stavros Niarchos Foundation, Stiftung Agnostizismus und Meritokratie, tibits, upc, Yvonne Lang-Chardonnens Stiftung

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