The Department of Information Technology and Electrical Engineering

EESTEC Workshop: Women in Engineering and Technology, March 9, 2015

Reto Kreuzer, Study coordinator D-ITET

ETH Zurich at a glance

Founded 1855

- Driving force of industrialisation in Switzerland

ETH Zurich today

- One of the leading international universities for technology and the natural sciences
- Place of study, research and employment for approximately 25,000 people from over 100 different countries

Reasons for success:

- Excellent education
- Ground-breaking fundamental research
- Putting new findings into practice

Top university in continental Europe

THE World University Ranking
from the Times Higher Education:
No. 13 in the world (2014/15)
No. 8 in Engineering and Technology

QS World University Ranking
from Quacquarelli Symonds Ltd:
No. 12 in the world (2014/15)
No. 3 in Engineering and Technology

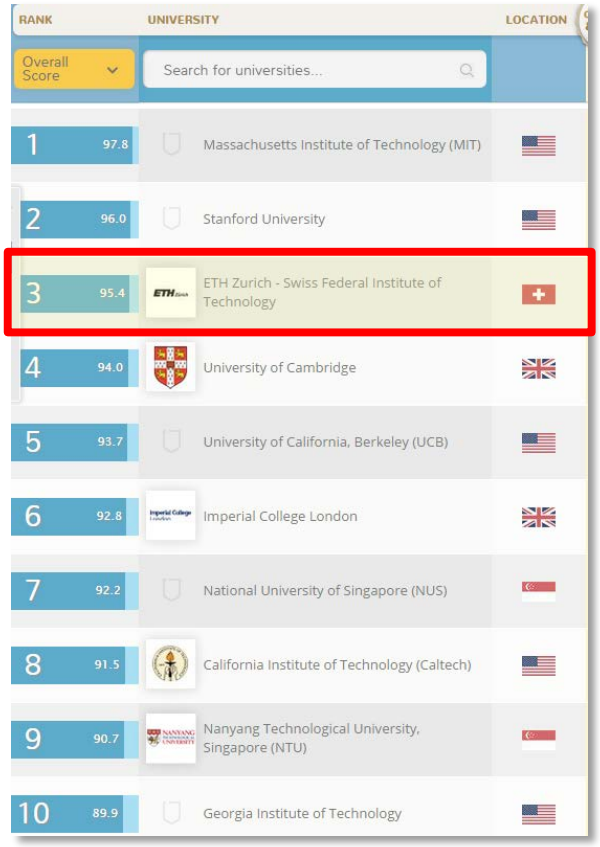
Academic Ranking of World Universities
from Shanghai Jiao Tong University:
No. 19 in the world (2014), both overall an
in the field of Engineering

Highly ranked in Engineering and Technology

Top 100 universities for engineering and technology 2014-2015

Rank ▲	Institution	Location	Overall score
1	Massachusetts Institute of Technology (MIT)	United States	93.6
2	Stanford University	United States	92.9
3	California Institute of Technology (Caltech)	United States	89.9
4	Princeton University	United States	89.3
5	University of Cambridge	United Kingdom	89.2
6	Imperial College London	United Kingdom	88.3
7	University of Oxford	United Kingdom	87.9
8	ETH Zürich – Swiss Federal Institute of Technology Zürich	Switzerland	87.1
9	University of California, Los Angeles (UCLA)	United States	86.3
10	University of California, Berkeley	United States	86.0
11	Georgia Institute of Technology (Georgia Tech)	United States	83.9

Times Higher Education Supplement, Top 100 universities for engineering and technology 2014-2015



QS World University Rankings by Faculty 2014 - Engineering and Technology

Excellent infrastructure

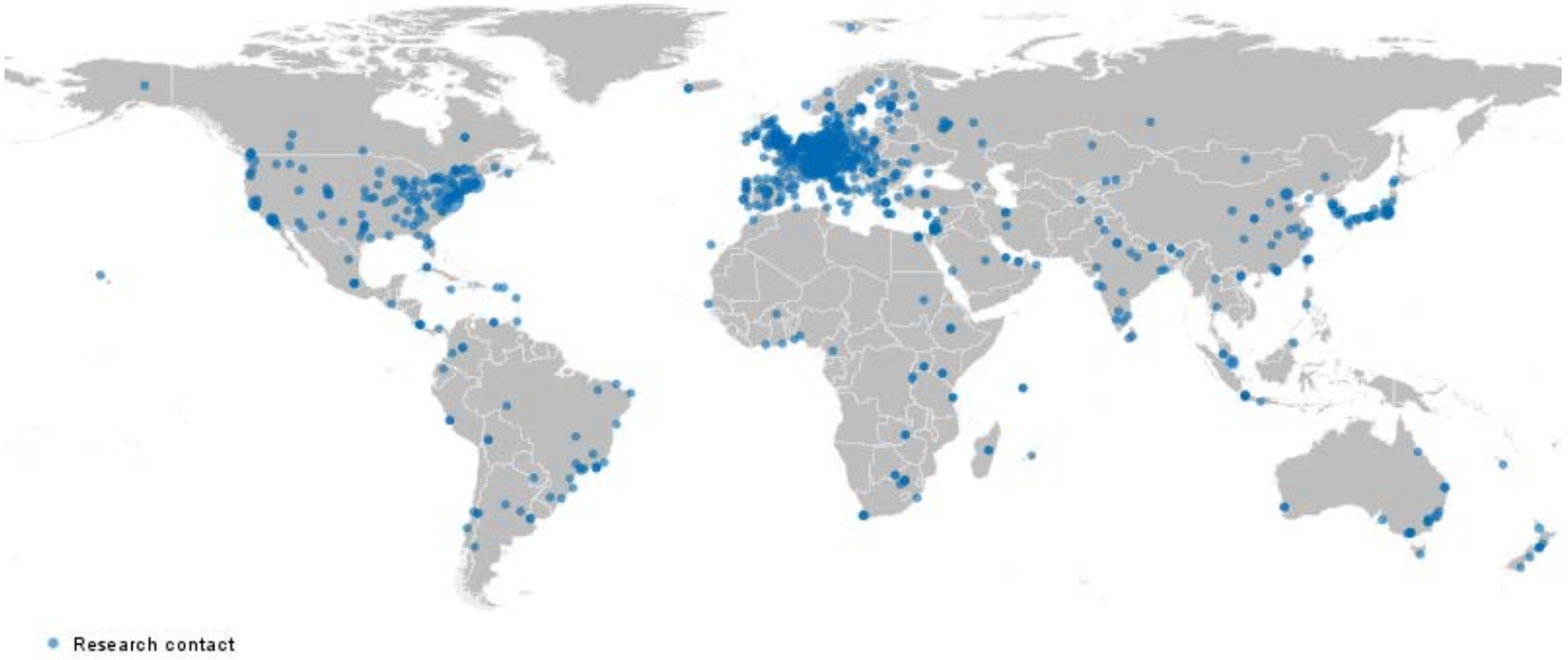
- Two main locations in Zurich
  - Historic main building in the heart of Zurich, built by Gottfried Semper
  - Modern campus on the outskirts of the city, in Hönggerberg, which links science, the business world and the general public
- Additional locations in Switzerland
  - Basel: Department of Biosystems Science and Engineering (D-BSSE)
  - Lugano: Swiss National Supercomputing Center (CSCS)
  - Other decentralized entities
- Research facility in Singapore
  - Singapore ETH Centre for Global Environmental Sustainability (SEC)

ETH Zurich, Zentrum

ETH Zurich, Hönggerberg

Globally networked with leading universities

- International cooperation in research and education
- Partnerships with leading universities (IDEA League, IARU, GlobalTech, UNITECH etc.)



Key statistics

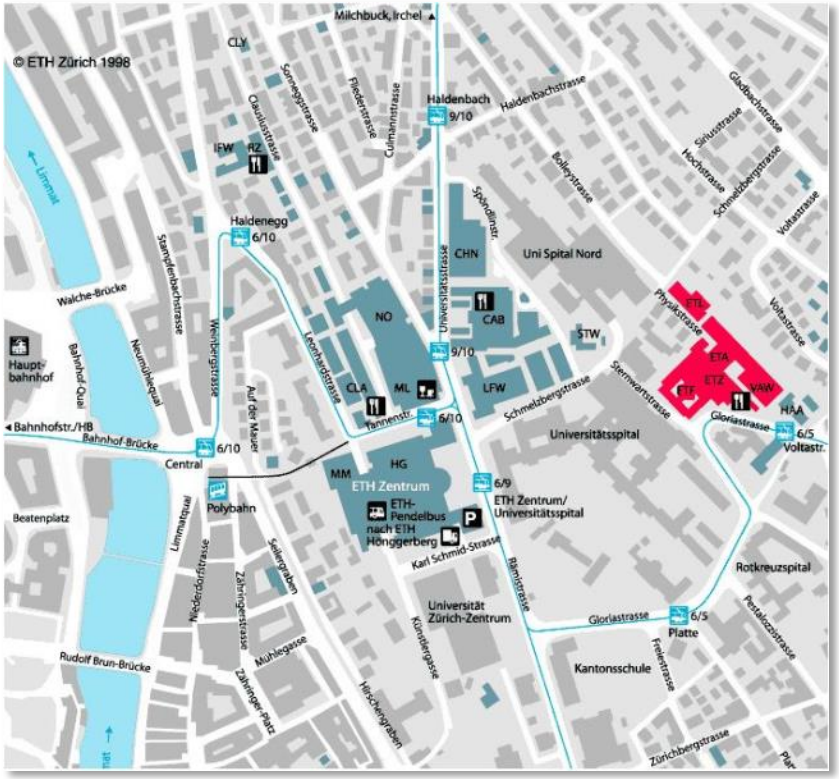
	2000	2010	2013	Percentage women	Percentage international
Students (Headcount)	**10,693**	**16,343**	**18,178**	**31%**	**37%**
of which Bachelor students	n. a.	7,483	8,444	30%	19%
of which Master students	n. a.	4,233	4,778	30%	38%
of which Doctoral students	2,261	3,507	3,889	31%	68%
Professors (Headcount, includes dual professors)	**351**	**446**	**497**	**13%**	**68%**
Professors (full-time equivalents)	333	413	466	13%	69%
Personnel (full-time equivalents)	**5,464**	**7,284**	**7,914**	**32%**	**54%**
of which scientific staff	3,390	4,479	4,925	28%	69%
Expenditure (CHF million)	**1,059**	**1,359**	**1,512**		
of which federal financial contribution	915	1,082	1,147		
of which third-party funding	144	277	366		

Excellent education

- 23 bachelor and 44 master programs (2015)
- **Compact** study programmes
  - Bachelor: 6 semester (3 years) – teaching language German
  - Master: 3 or 4 semester (1.5-2 years) – teaching language English
- **Low staff-student ratio** (around 40 students per chair)
- Combination of a sound scientific foundations and practical application
- **Scholarships** for outstanding students (ESOP)

The Department of Information Technology and Electrical Engineering (D-ITET)

Departement ITET: Location



D-ITET in University Rankings

QS RANK	SCHOOL NAME	COUNTRY	QS STARS RATING	OVERALL	ACADEMIC REPUTATION	EMPLOYER REPUTATION	CITATIONS PER PAPER	H-INDEX CITATIONS
1	Massachusetts Institute of Technology (MIT)	United States		96.70	100	93.1	95.4	96.5
2	Stanford University	United States		91.70	90.1	89	97.2	95.7
3	University of California, Berkeley (UCB)	United States		89.20	86.8	85.2	97.7	94.9
4	University of Cambridge	United Kingdom		89.10	80.9	100	95.2	83.3
5	ETH Zurich (Swiss Federal Institute of Technology)	Switzerland		86.80	80.7	87.7	97.3	90.9
6	University of Oxford	United Kingdom		85.80	74.9	97.4	99.7	77.6
7	University of California, Los Angeles (UCLA)	United States		85.40	82.8	78.7	98.8	92.5
8	Imperial College London	United Kingdom		84.60	78.7	85.6	94.5	88.2
9	Harvard University	United States		84.50	75.7	94	94.4	78.8

QS World University Ranking by Subject

Rank	School	Overall Score	Academic Reputation Score	Employer Reputation Score	Citations per Paper Score
#1	Massachusetts Institute of Technology (MIT) United States	95.6	100.0	94.6	90.7
#2	Stanford University United States	94.1	95.8	89.4	96.5
#3	University of California, Berkeley (UCB) United States	90.0	92.2	85.5	91.6
#3	University of Cambridge United Kingdom	90.0	85.7	100.0	85.6
#5	University of Oxford United Kingdom	88.8	82.5	95.0	90.9
#6	ETH Zurich (Swiss Federal Institute of Technology) Switzerland	87.0	85.0	86.6	89.9

US News Ranking, Electrical Engineering 2012

Departement Management

Prof. Bernhard Plattner
Head Department

Prof. Klaas Prüssmann
Deputy Head Department

Prof. Dr. Qiuting Huang
Director of Studies

Faculty staff: currently 37 professors

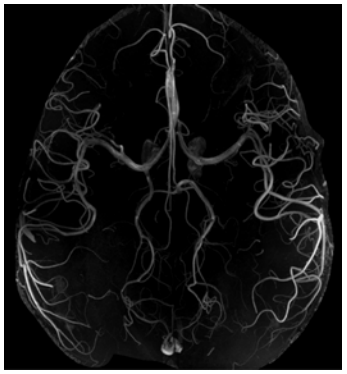
Faculty team D-ITET

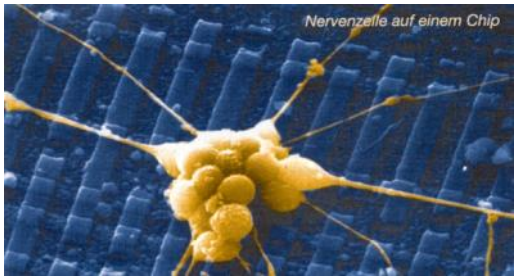
Some Statistics – female students in brackets

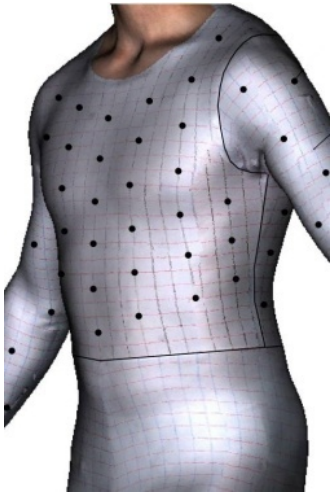
	2005	2011	2012	2013
Students	1280 (9%)	1395 (13%)	1462 (13%)	1470 (14%)
Bachelor students	605 (6%)	589 (8%)	599 (8%)	578 (9%)
Master students – all D-ITET Master's degree programs	283 (9%)	406 (15%)	440 (15%)	457 (19%)
Diploma students – previous to the Bachelor/Master programs	36 (6%)	-	-	-
Guest students	30 (17%)	40 (28%)	42 (26%)	48 (17%)
Doctoral students	318 (12%)	360 (16%)	381 (17%)	387 (17%)
Professors (FTE)	23	25	25	26
Full Professors	18	20	19	22
Assistant professors – including tenure track	5	5	5	4
Personnel (FTE)	442	441	454	466
Scientific staff	365	365	377	390
Technical, IT and administrative staff	77	76	77	76

Four Core Research Areas

- Electronics and photonics
- Information and communication
- Energy
- Biomedical engineering







Research Laboratories: Electronic and Photonics

Integrated Systems Laboratory

Analogue and mixed-signal design, **Prof Qiuting Huang**

Digital circuits and systems, **Prof Luca Benini**

Computer-based modelling of nanostructures, **Prof Mathieu Luisier**

Nano-electronics and nano-photonics, **Prof Vanessa C. Wood**

Electronics Laboratory

Digital systems, **Prof Gerhard Tröster**

Millimetre-wave Electronics Laboratory

High-speed electronics, **Prof Colombo Bolognesi**

Research Laboratories: Electronic and Photonics

Electromagnetic Fields and Microwave Electronics Laboratory

Photonics and communications, **Prof Jürg Leuthold**

Photonics Laboratory

Photonics, **Prof Lukas Novotny**

Photonics Laboratory, EMPA

Photonics, **Prof Gian-Luca Bona**

Research Laboratories: Information and Communication

Automatic Control Laboratory

Control and computation, **Prof John Lygeros**

System dynamics and control, **Prof Manfred Morari**

Complex systems Control, **Prof Florian Dörfler**

Computer Engineering and Networks Laboratory

Communication systems, **Prof Bernhard Plattner**

Computer engineering, **Prof Lothar Thiele**

Distributed computing, **Prof Roger Wattenhofer**

Network Systems, **Prof Laurent Vanbever**

Research Laboratories: Information and Communication

Signal and Information Processing Laboratory

Information theory, **Prof Amos Lapidoth**

Signal processing, **Prof Hans-Andrea Loeliger**

Communication Technology Laboratory

Communication theory, **Prof Helmut Bölcskei**

Wireless communication, **Prof Armin Wittneben**

Computer Vision Laboratory

Visual communications, **Prof Luc Van Gool**

Medical imaging, **Prof Gabor Székely**

Computer-assisted applications in medicine, **Prof Orçun Göksel**

Research Laboratories: Energy

Electric Power Systems and High-Voltage Technology Laboratory

Electric power systems, **Prof Göran Andersson**

High-voltage engineering, **Prof Christian M. Franck**

Power Electronic Systems Laboratory

Power electronic systems, **Prof Johann W. Kolar**

Laboratory for High-power Electronic Systems

High performance electronics, **Prof Jürgen Biela**

Advanced Power Semiconductor Laboratory

Power Semiconductors, **Prof Ulrike Grossner**

Research Laboratories: Biomedical Engineering

Institute for Biomedical Engineering

Bioimaging, **Prof Klaas P. Prüssmann**

Biomedical Imaging, **Prof Sebastian Kozerke**

Molecular imaging and functional pharmacology, **Prof Markus Rudin**

Biosensors and bioelectronics, **Prof Janos Vörös**

X-ray imaging and microscopy, **Prof Marco Stampanoni**

Computational neuroimaging, **Prof Klaas Enno Stephan**

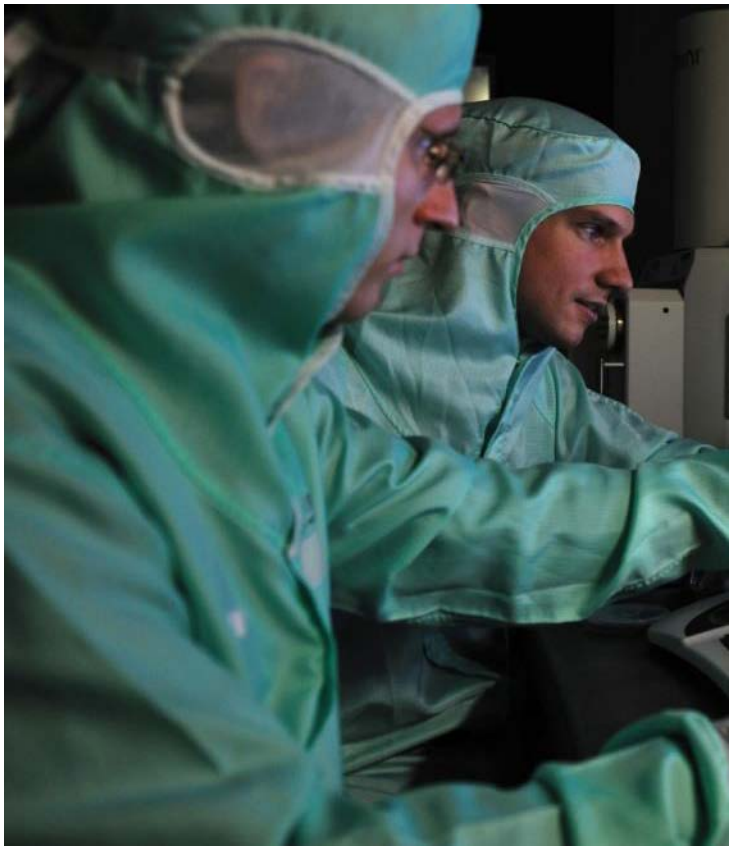
Neuro-technology, **Prof Mehmet Yanik**

Institute of Neuroinformatics

Systems neuroscience, **Prof Richard Hahnloser**

System neurophysiology, **Prof Kevan A. C. Martin**

Electronics and Photonics



The main driver for our information society is aging: Limits of the silicon scaling paradigm require new technologies.

Green energy and communication trends are the driving forces for future electronics and photonics research activities.

We need completely novel concepts like carbon, molecular and organic electronics.

Challenges

Beyond Si: Limits of scaling paradigm require new technologies

- *Novel material/device/circuit concepts* extend transistor age:
  From lower-dimensional systems to carbon and molecular/organic electronics

The future of photonics: Higher speed, more secure, more reliable

- Industrialization of novel communication principles: quantum communication
- Clean energy harvesting and lighting: solar energy, solid-state lighting
- Photonic systems in the health industry: cancer therapy, monitoring,
  MI surgery

Application drivers

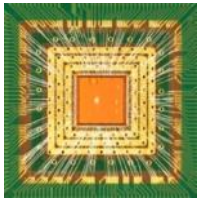
- *Green Energy:* Power generation, automotive and power systems
- *Computation and communication:* Higher speed and bandwidth at lower power
- *Health:* Portable and implantable electronics, wearable systems

Information and Communication

In our globalized world massively increasing amounts of data need to be collected, processed, exchanged and stored.

As information technology enters almost all spheres of life, safety and reliability of the infrastructure must be guaranteed.

And we still do not understand how the brain works!



Challenges

What is it about?

- *Transmission, processing, and storage of information*
- Algorithms, architecture of computing systems
- Information & Communication (theory and technology) laid the foundations of the modern information society

Some major challenges ahead

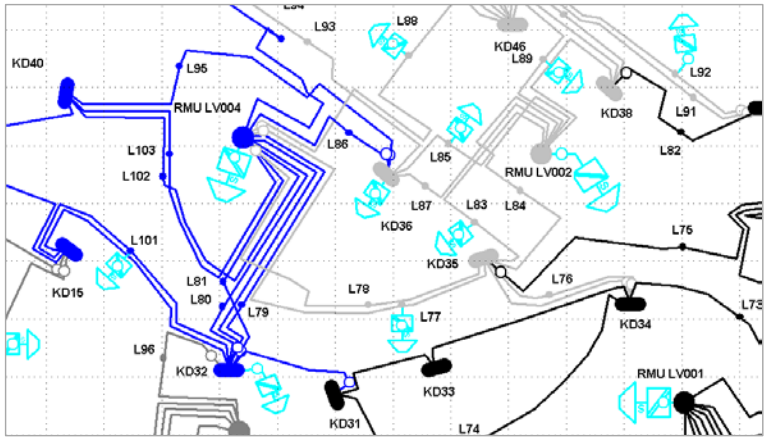
- Massive and growing amounts of data need to be processed quickly and intelligently.
- High mobility complicates reliable communication and computation.
- New base materials for nano-electronics need to be put to good use.
- The safety, reliability and security of critical infrastructure must be guaranteed.
- And we still do not understand how the brain works!

Energy

A secure, reliable, and sustainable supply of energy is widely regarded as the most important intellectual and technological challenge of the 21st century.

This comprises the integration of new renewable energy source, increased capacity of energy storage and long distance bulk power transmission, as well as the development of smart grids for efficient energy distribution.

Challenges



- Integration of New Renewables (esp. distributed generation)
- Energy Storage
- Demand Side Management (smart metering, ICT networks)
- Distributed Monitoring/Communication/Control in Power Systems
- Energy Efficiency
- E-Mobility
- Long Distance Bulk Power Transmission
- Ultra-Efficient Electronic Power Processing & Control

Biomedical Engineering

The care of human health and well-being as well as the diagnosis and therapy of diseases increasingly depend on innovative and affordable healthcare technology.

Bridging electrical technology and biology is essential for all areas of medicine, from prevention and diagnostics to therapy and rehabilitation.

Challenges

Drivers for innovation

Healthcare

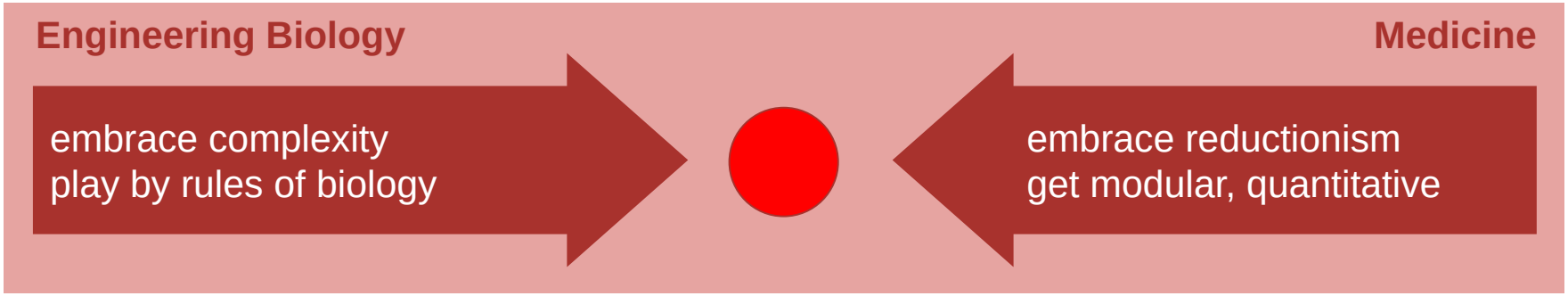
- improve prevention, diagnosis, treatment, rehabilitation
- personalize medicine

Aging Society

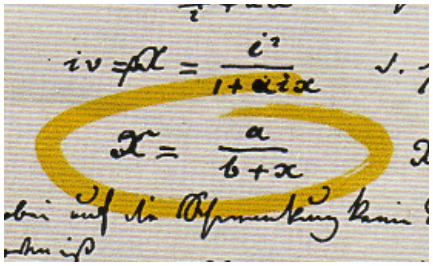
- keep the elderly independent
- health monitoring, assist devices, regenerative medicine

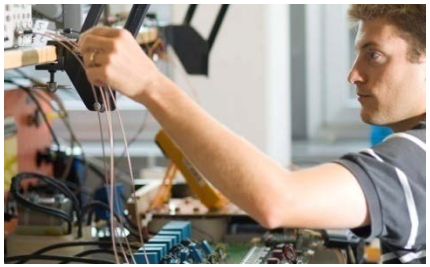
Economy

- contain healthcare cost
- high value-added industry



Education at D-ITET:
An optimal mix of theory and praxis





Theoretical foundations:
Lectures, seminars and exercises

+

Practical application:
Lab Practice
Group Projects
Semester Projects

+

Starting a career:
Internship in Industry *(optional)*
Master Thesis

Curriculum

Consecutive Master's Degree Program
Semester 7 and 9 (courses and 2 semester projects)

Master Thesis (6 months)

Interdisciplinary Master Programs

Master (1.5 years)

Areas of specialization
Semester 5 and 6 (courses and labs)

- Communications
- Computers and Networks
- Electronics and Photonics
- Energy and Power Electronics
- Systems and Control
- Biomedical Engineering

Compulsory Basic Courses
Semesters 1 to 4 (2 years)

Bachelor (3 years)

Education: the degree programs at D-ITET

Bachelor

- Electrical Engineering and Information Technology

Master

- Master in Electrical Engineering and Information Technology
- Master in Biomedical Engineering
- Master in Energy Science and Technology
- Master in Micro and Nanosystems (hosted by Mechanical Engineering)
- Master in Robotics, Systems and Control (hosted by Mechanical Engineering)

Education: Master's degree programs

All master programs at D-ITET are 90 credit (cp), 1.5 year programs:

Master in Electrical Engineering and Information Technology

- core courses (42 cp)
- 2 semester projects (14 weeks, part-time, 8 cp each)

Master in Energy Science and Technology

- compulsory core courses (21cp)
- elective/multidisciplinary courses(21 cp)
- 1 internship in industry (3 months, 8cp)
- 1 semester project (14 weeks, part-time, 8 cp)

Master in Biomedical Engineering

- 50 cp courses (out of which 12 cp core courses)
- 1 semester project (14 weeks, part-time, 8 cp)

Common to all Master's degree programs at D-ITET

- 2 credits humanities
- 1 Master Thesis (6 months, full time, 30 credits)

ETH Admission procedure

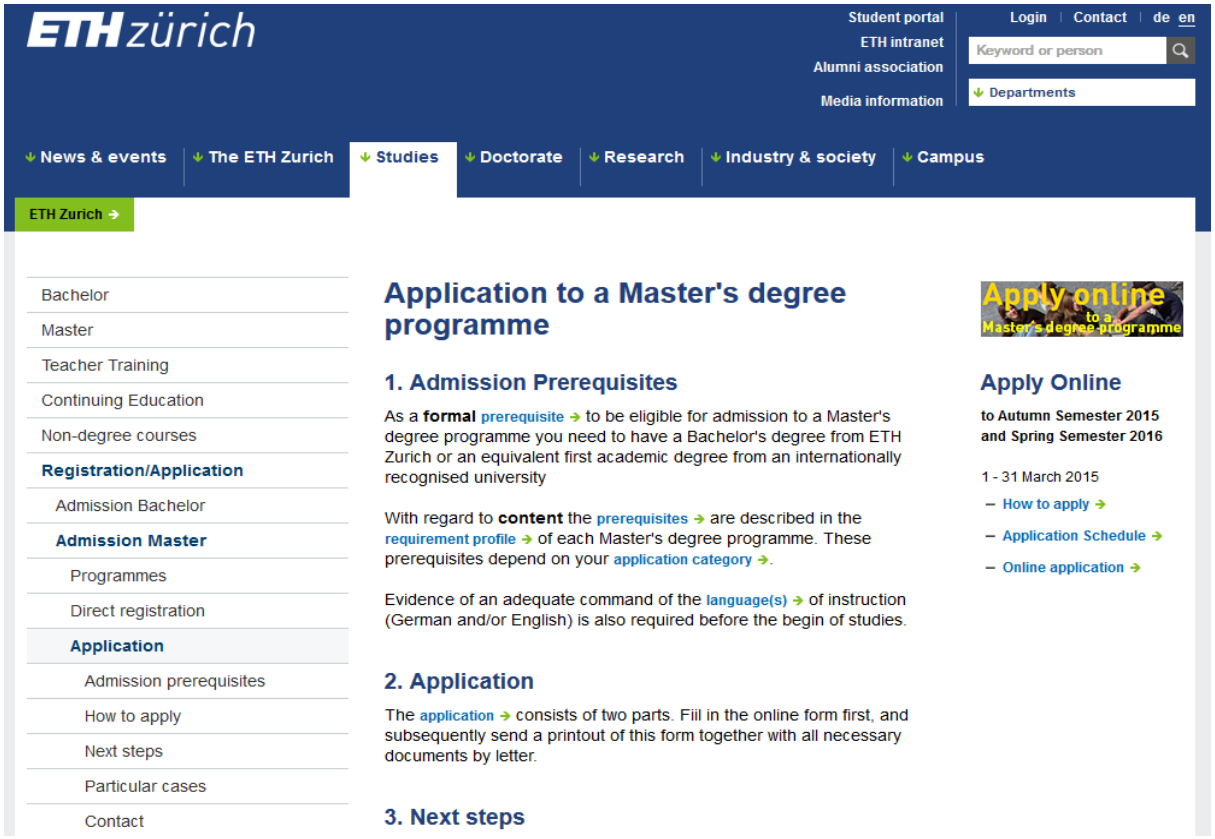
- All admissions must be submitted **online** (1)
- 2 **admission periods**: Nov 1 – Dec 15 (ESOP) and Mar 1 – 31 (non-visa)
- Admission is **highly competitive**
- Around 30 places available for each program
- D-ITET seeks a balanced mix of students form different nations/backgrounds in its programs

Admission to doctoral programs: direct contact with a supervisor (professor) at ETH, to be established by the candidate. PhD vacancies are usually advertised on the institutes websites.

(1) https://www.ethz.ch/en/studies/registration-application/master/application.html

Admission Website

All relevant information, in particular regarding prerequisites, required documents and other conditions can be found on the admission office's website:



Admissions office contact

Please contact the admissions office for any question regarding the application process (**master@ethz.ch**)

Office:

Admissions Office

ETH Main Building (HG)

F floor, Room 21.2-21.5

More information can be found on the admissions office's website:

https://www.ethz.ch/en/studies/registration-application/master/application/contact.html

Scholarships

Funding studies is primarily the **responsibility of the student** and his/her immediate family. ETH Zurich can offer students a scholarship if they and their family cannot afford this funding, provided that the students can demonstrate that they are making adequate progress with their studies.

Note that scholarships from ETH Zurich are **always** intended to provide **subsidiary** funding. In other words, they are designed to supplement other financial resources, and in particular other scholarships from the student's country of origin (e.g. Bafög (Germany), Studienbeihilfe (Austria) etc.).

ETH Zurich scholarships **do not completely cover the costs of studies and living**. (foreign students may receive a contribution of up to 40%).

Foreign Master's students who have not completed their BSc at the ETH may apply for a scholarship **after they have successfully completed the second semester** of their Master's program (i.e. only in the second year).

Excellence Scholarships

ETH Zurich supports outstanding students wishing to pursue a Master's degree this institution with two special scholarship programs:

- Under the *Excellence Scholarship & Opportunity Programme* (ESOP) students receive a special scholarship for the duration of their Master's degree program as well as specific supervision. This scholarship **covers the full study and living costs** during their Master's degree course.
- Under the *Master Scholarship Programme* (MSP) students receive a partial stipend during their Master's degree course (at D-ITET this is the equivalent of 75% of an ESOP).

Applications for ESOP an MSP **must be submitted during the first application period** (November 1 to December 15 of the year previous to the start of studies).

For more information, please consult:

https://www.ethz.ch/en/studies/financial/scholarships/excellencescholarship.html

Scholarship office contact

Please contact the scholarship office for any question regarding finances and studies (**stipendien@rektorat.ethz.ch**)

Office:

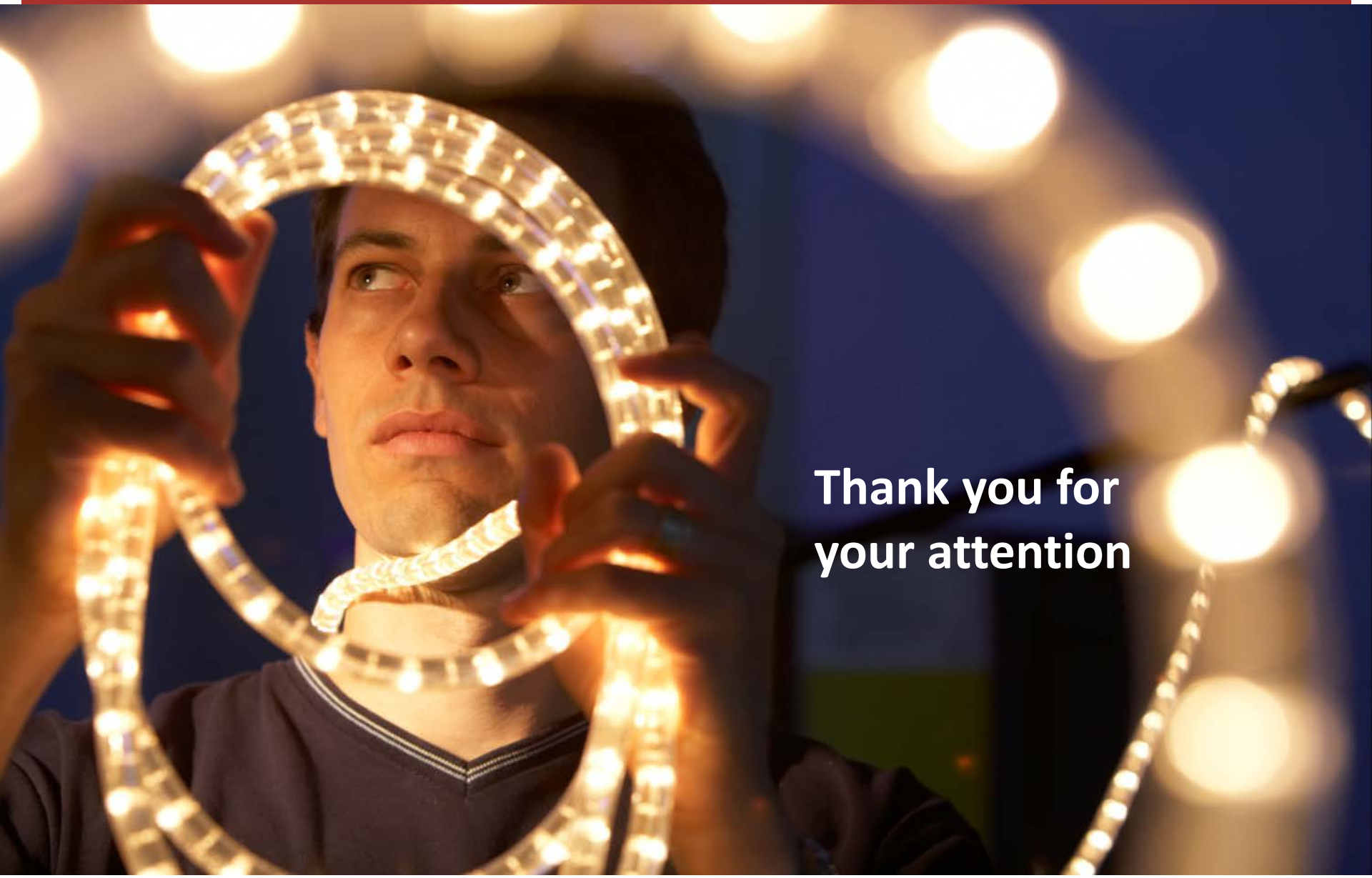
Scholarship Office

ETH Main Building (HG)

F floor, Room 22.1

More information can be found on the scholarship office's website:

https://www.ethz.ch/en/studies/financial.html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