



**Ecole polytechnique fédérale de Lausanne**

# **ECSS 2017 Workshop for Deans and Department Heads**

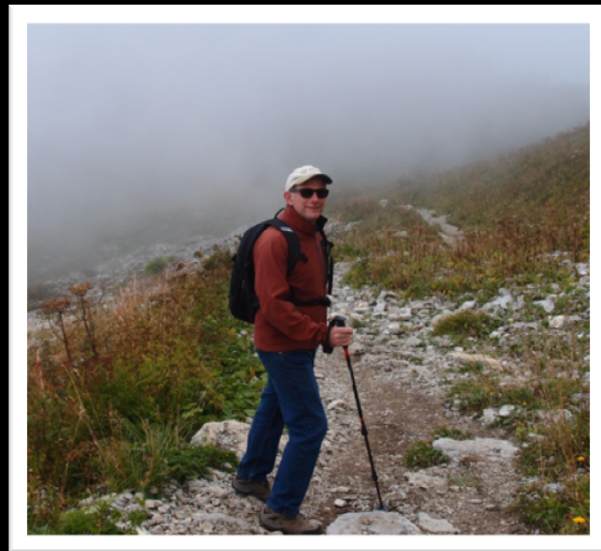
James Larus

Professor and Dean of School of IC (Informatique et Communication)

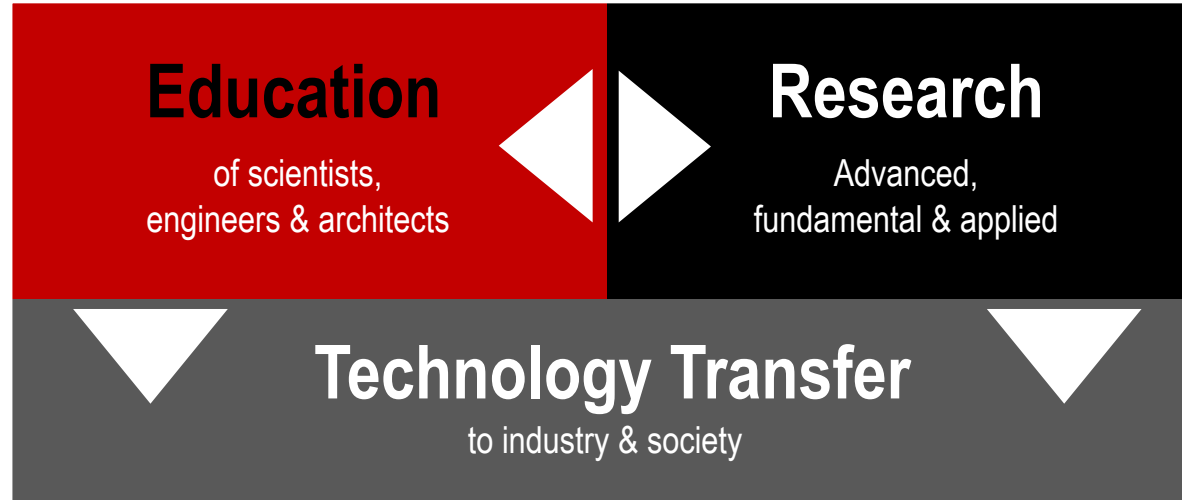


# Jim Larus

- Dean of IC (since October 2013)
- Assistant/Associate Professor: **University of Wisconsin – Madison**
- Researcher, Manager, Director: **Microsoft Research** (16 years)
- Published 100+ papers and book:
  - programming languages
  - compilers
  - software development
  - systems
  - computer architecture
  - parallel programming
  - cloud computing
- Editor ACM CACM, ACM TACO, SP&E
- ACM Fellow
- 30+ US Patents



# EPFL's three missions according to the Federal Act





# EPFL Numbers

## Campus (2016)

10,536 students: 2,124 PhD students

346 faculty

5,879 staff



## Spending (2016)

CHF 675M from State budget

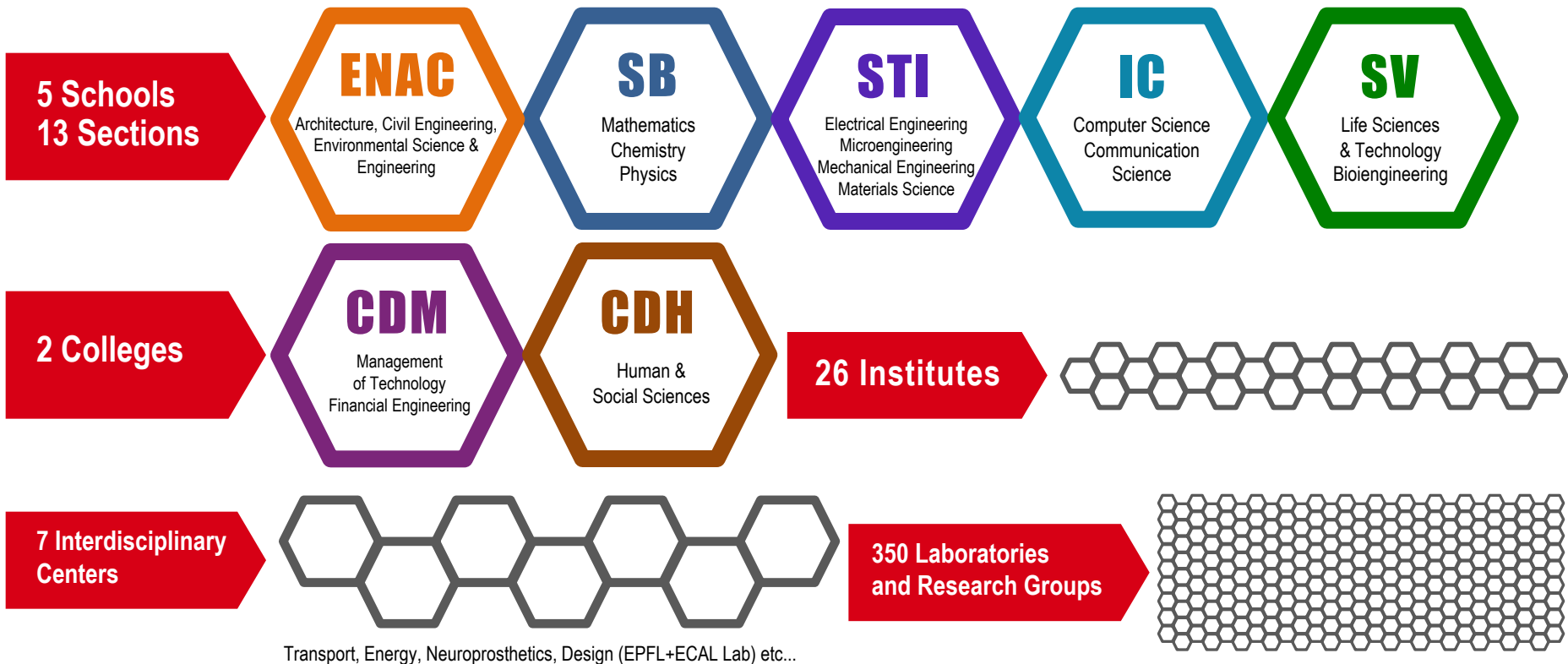
CHF 267M other funding (EU, SNSF, private...)

Total: **CHF 942M**

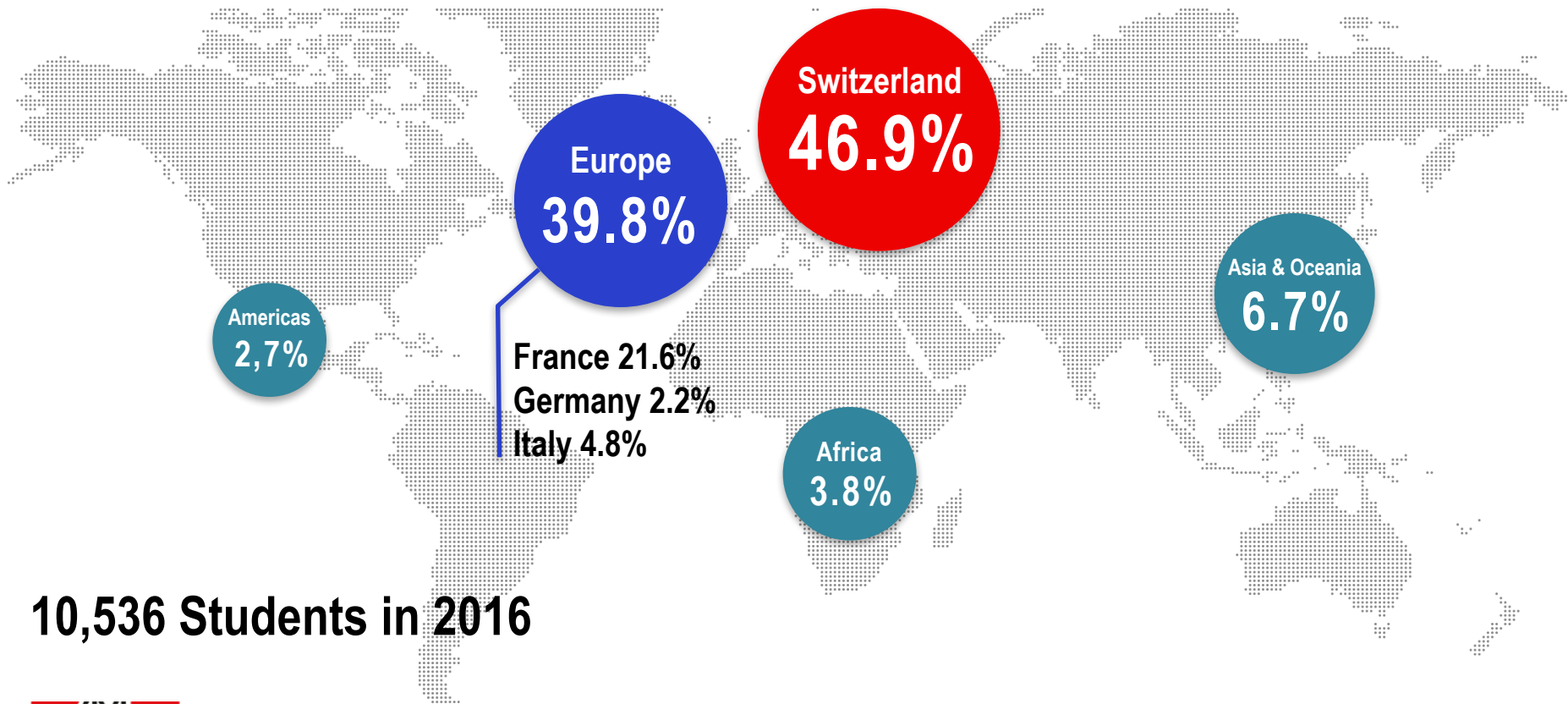




# 13 Study Programs, 350 Research Labs



# Origin of Students (Bachelor + Master + PhD)



10,536 Students in 2016



# A budget of CHF 942 million (2016)

68.0%

640.8M

State budget <sup>1</sup>

10.8%

101.8M

Swiss National Science Foundation & CTI

5.3%

49.6M

European Programmes

6.8%

64.5M

Private sector and other mandates

( 19.2M + 45.3M <sup>2</sup> )  
Industrial mandates      Other mandates

6.7%

63.0M

Other income <sup>3</sup>

1.4% 12,9M

Public sector contracts

1.0% 9,2M

Tuition fees

<sup>1</sup> Including construction expenses.

<sup>2</sup> Not including industry or public sector mandates (foundations, not-for-profit companies, etc.).

<sup>3</sup> Overheads, financial revenues (excluding revenues from the DII or technological platforms), designated and reserve funds from private and public sources, congresses and other activities.

# MOOCs: Massive Open Online Courses

A world map with a dark grey background, overlaid with numerous small red dots. The dots are most densely clustered in Europe and North America, with a significant concentration in Western Europe, particularly around the UK and France. There are also smaller clusters in North America, South America, and parts of Asia and Africa.

September 2012 - February 2017:

**73** MOOCs online, 26 in preparation

32 MOOCs in English

41 MOOCs in French

**1,729,251** registrations

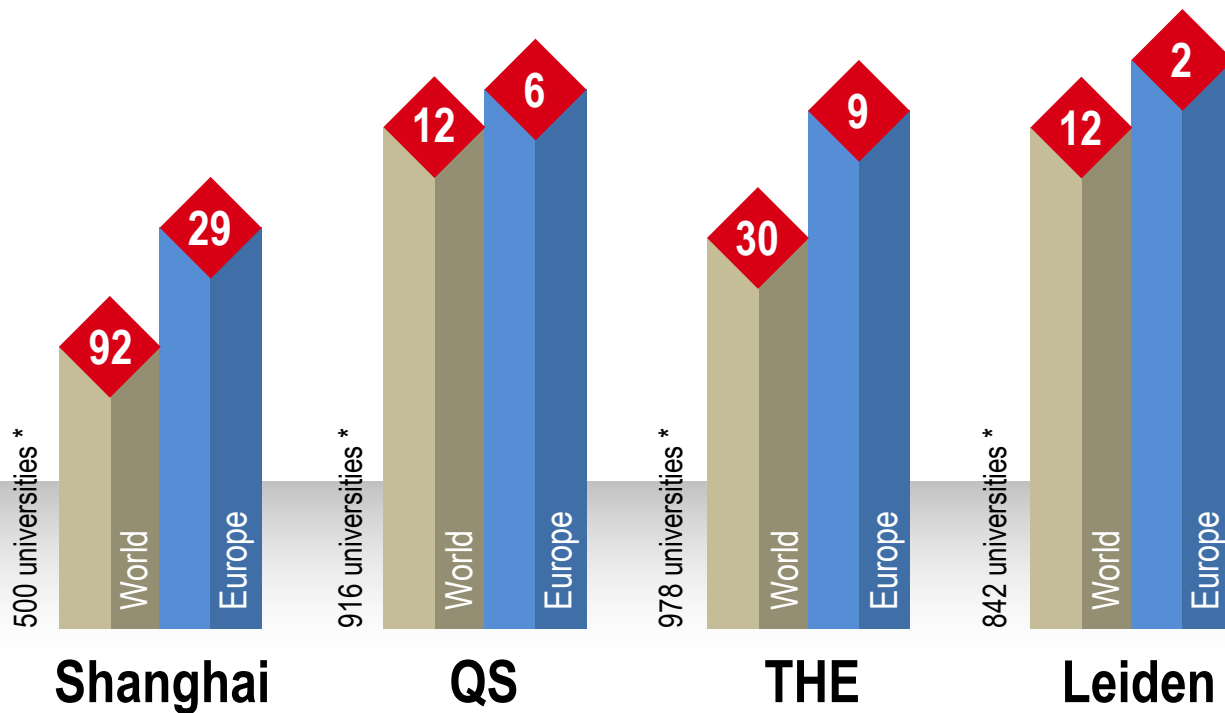
**66%** of the participants are not students, **90%** of which are employed

> **91'000** participants completed a course



# Ranking - EPFL is well-placed

\* Overall institutional ranking, all scientific fields combined



# EPFL Innovation Park

INFORMATION TECHNOLOGY  
FINANCE  
COMPUTING



HEALTH  
NUTRITION



Nestlé Institute of Health Sciences



ENGINEERING, TRANSPORT,  
MATERIALS



June 2017



... and > 110 start-ups  
> 30 start-ups in the Swiss EdTech Collider

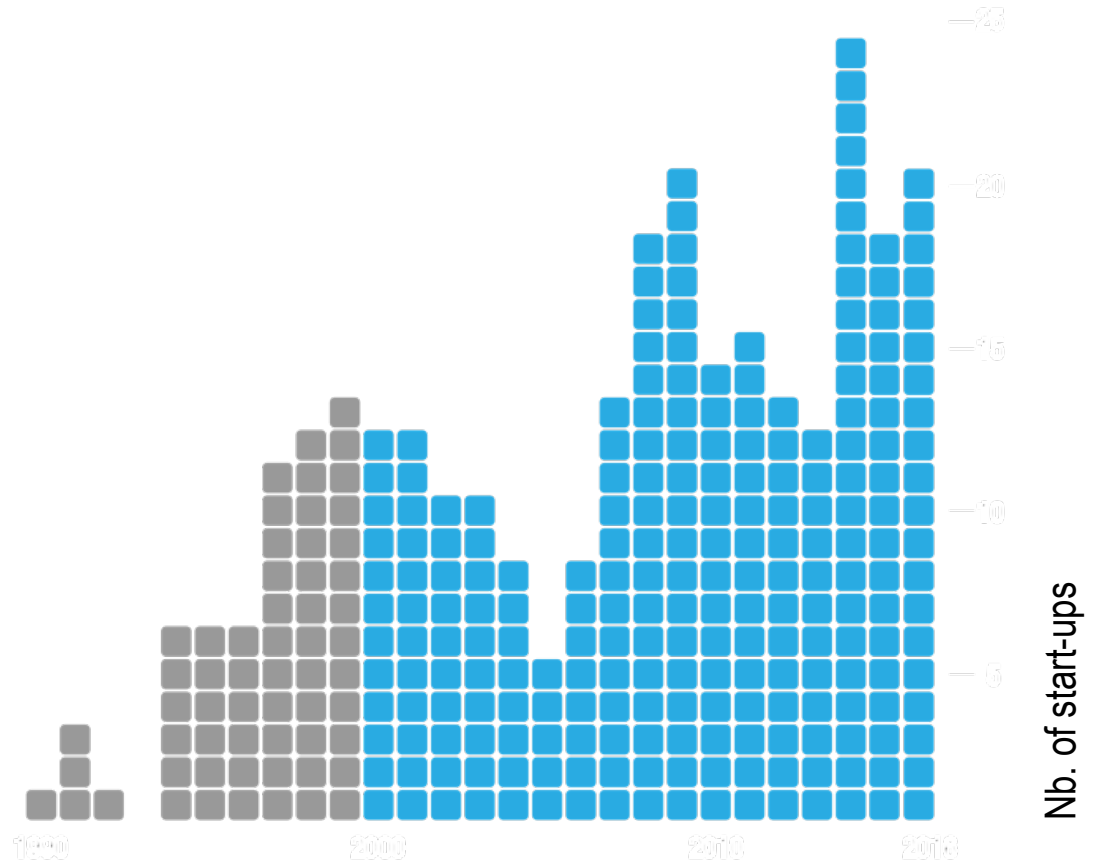




# 230 start-ups created since 2000

**CHF 397M**

Raised in 2016



# Building an outstanding campus in Lausanne



516 units

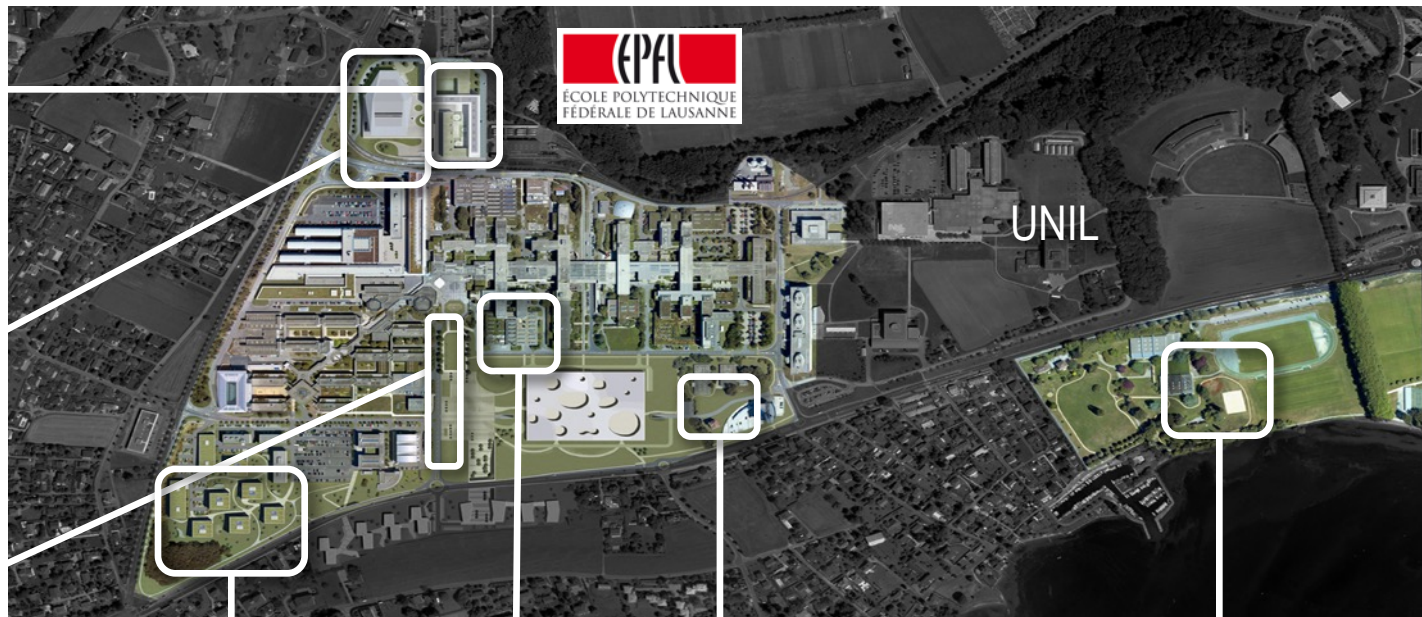
Student housing



Swiss Tech Convention Center



ArtLab



EPFL Innovation Park



Robotics, Discovery Learning Labs



RTS



Sports Center extension

# Extended campus

## Geneva - Campus Biotech

- Bio- and neuroengineering (Wyss center)
- Human Brain Project
- Center for neuroprosthetics

- 320 staff
- 9 chairs
- 26,000 m<sup>2</sup>

## Neuchâtel - Microcity

- Microengineering and nanotechnologies

- 230 staff
- 11 chairs
- 8035 m<sup>2</sup>

## Fribourg - Smart Living Lab

- Building technology and sustainable architecture

- 19 staff
- 2 chairs + 1 RG\*
- 1370 m<sup>2</sup>

## Sion - Energypolis Campus

- Industrial energy
- Green chemistry
- Environmental engineering
- Biotechnology
- Bioengineering

- 176 staff
- 10 chairs + 3 RG\*
- 7600 m<sup>2</sup>

\* Research groups



# IC



# EPFL IC at a glance

42 faculty

9 ACM Fellows, 13 IEEE Fellows

1187 BS/MS students (125 MS awarded '16)

231 PhDs (49 PhDs awarded '16)

38.5M CHF EPFL ('16)

15.1M CHF external funding

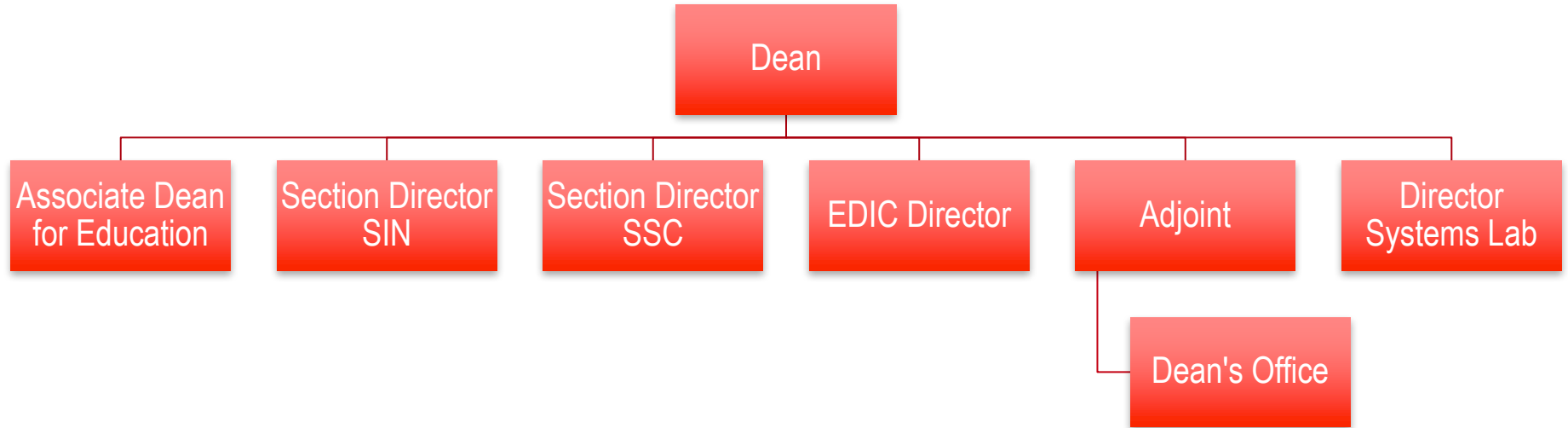
20 ERCs (7 Adv., 1 Con., 10 Starting, 2 PoC)

7 H2020 Grant (5 Excellent Science, 1 Societal Challenges, 1 Industrial Leadership)

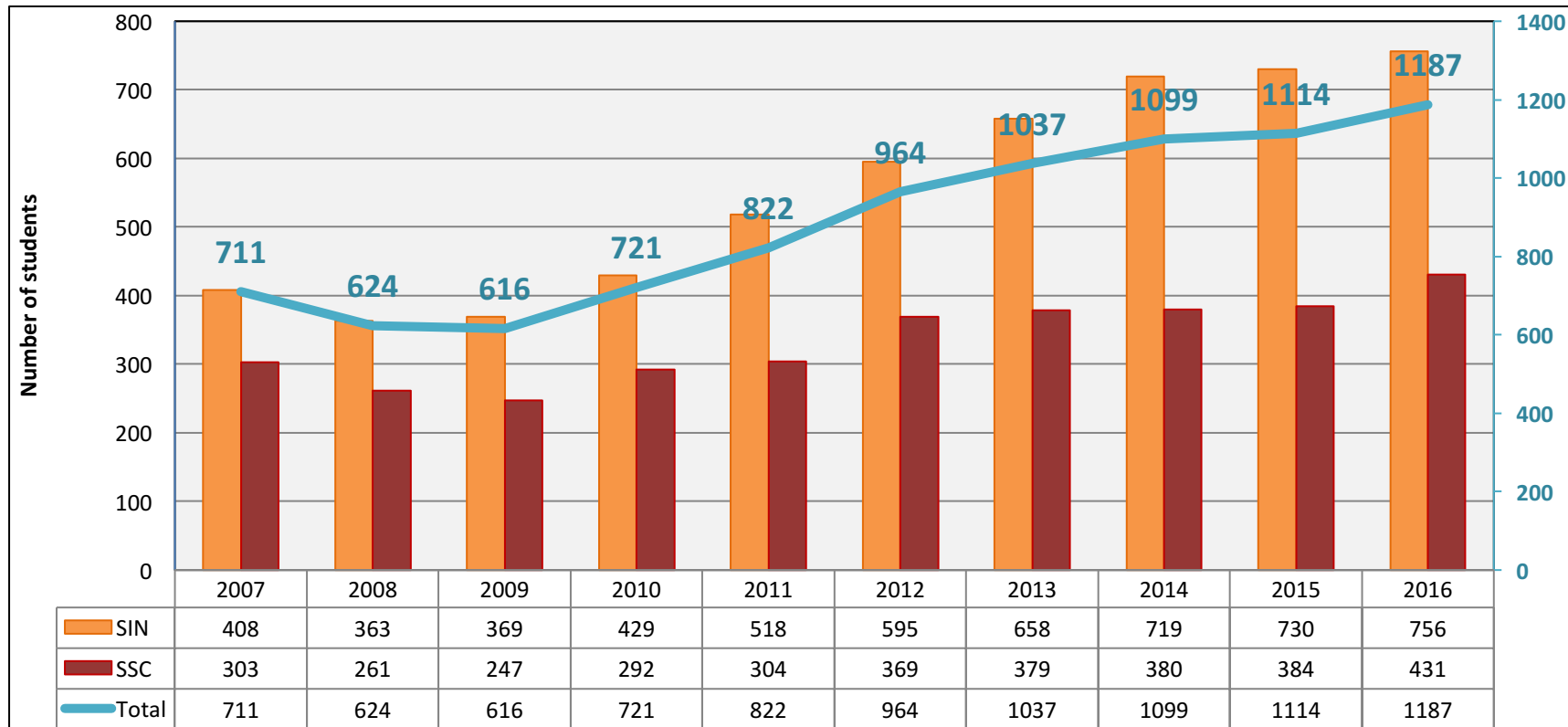
30+ startups



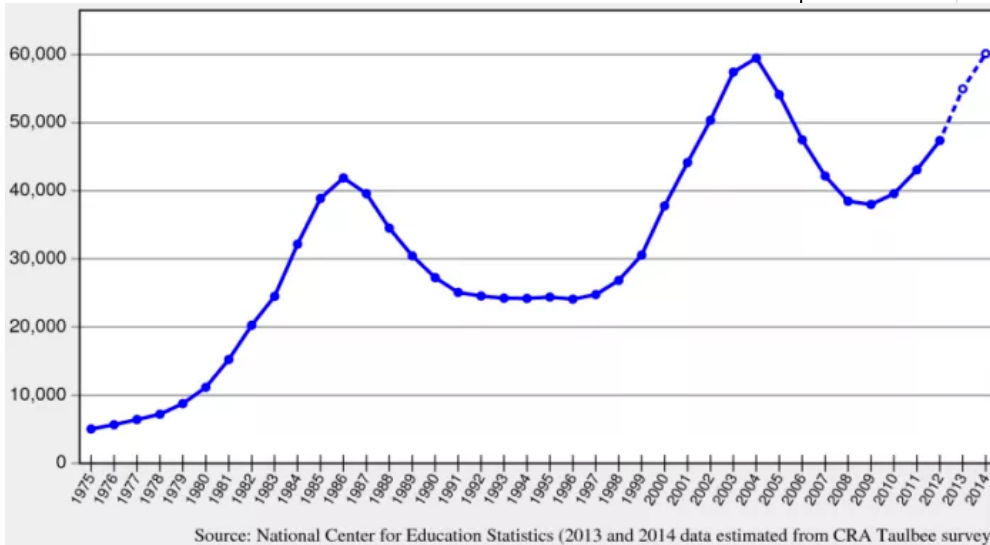
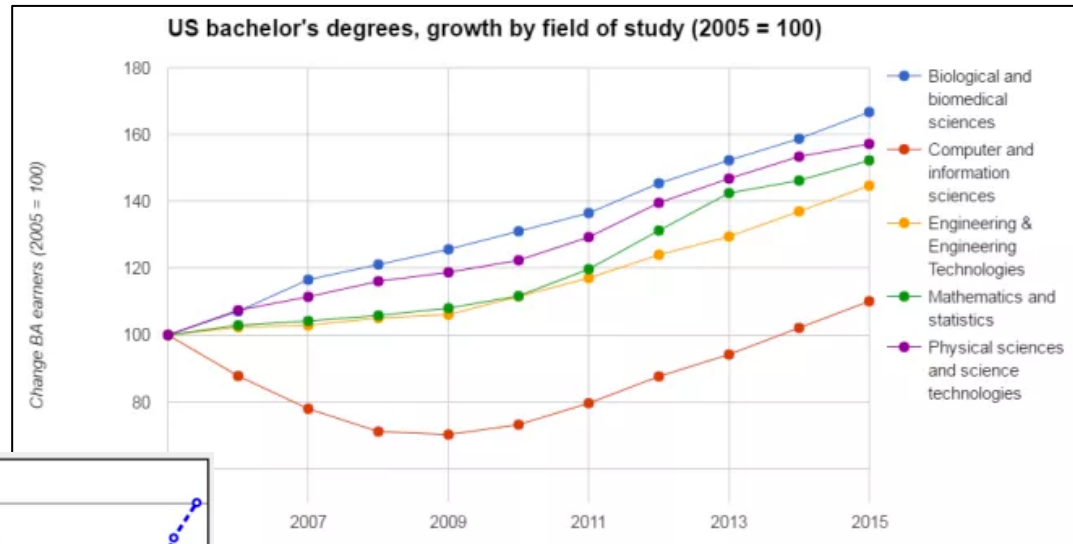
# Organization



# SIN/SSC number students



# Aside



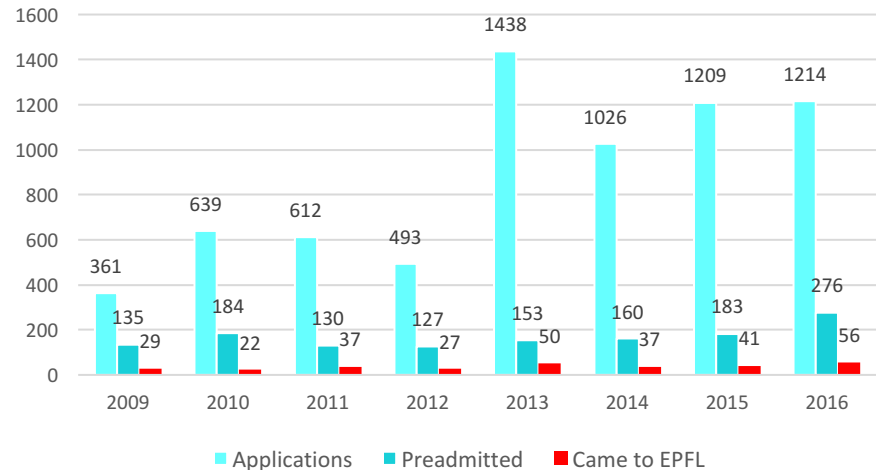
<http://danwang.co/why-so-few-computer-science-majors/>



# Educational Outreach

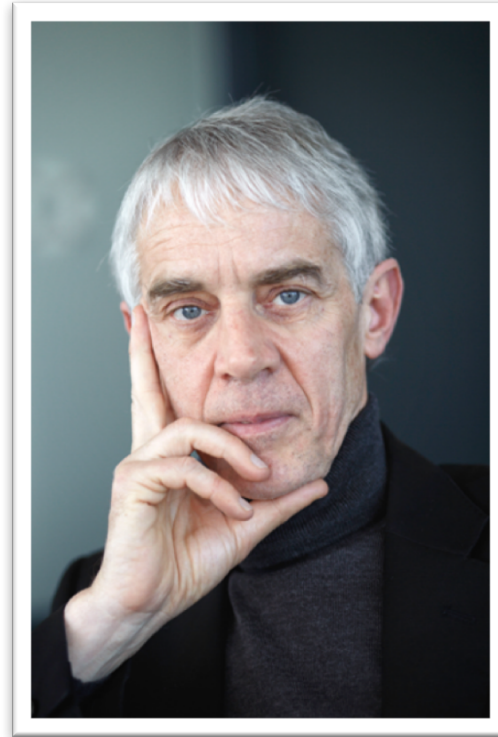


- Continued programs
  - Internet pour les filles
  - Visites de gymnases
  - TecDays
  - Bus des Sciences
  - Rencontre profs secondaires supérieurs
- New programs
  - Ateliers pour les filles de 13-15 ans
- Summer@EPFL includes IITs
  - 461 applicants (of 748)

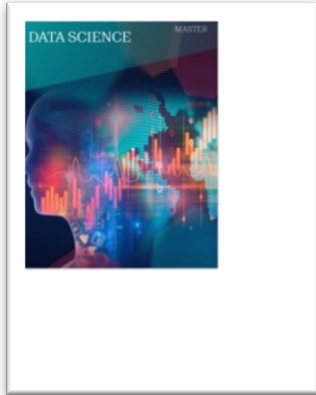


# New President of EPFL from IC

**Martin Vetterli**  
President of EPFL



# IC Initiatives



Master's program  
in Data Science



Swiss Data  
Science Center

Digital  
Humanities



MOOC Registrations Counter:  
1,740,250

Digital Education:  
MOOCs, Wandida,  
ZettaBytes



# Wandida

14,725 subscribers  
• 1,668,522 views



Prof. Rachid Guerraoui

**Wandida.Com** Subscribe 14,651

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### Popular uploads

- Premier principe de la thermodynamique** | El Mahdi El | 63,181 views • 3 years ago
- Réussir ses projections vectorielles en mécanique** | El | 57,831 views • 4 years ago
- Méthode de calcul de la complexité d'un algorithme** | El | 56,966 views • 2 years ago

### Uploads

- La dérivée est la pente de la tangente** | Lê Nguyễn Hoang | 237 views • 1 day ago
- La dérivée est une variation** | Lê Nguyễn Hoang | 291 views • 4 days ago
- La dérivée est une moyenne instantanée** | Lê Nguyễn Hoang | 426 views • 6 days ago

### Géométrie

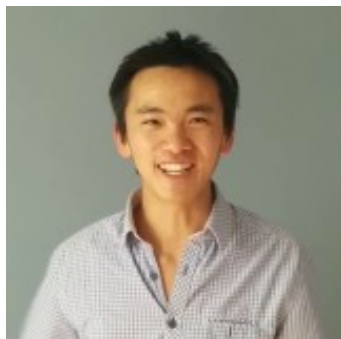
- Le théorème de Pythagore en algèbre linéaire** | Lê Nguyễn Hoang | 7 months ago • 1,579 views  
Cette vidéo généralise le théorème de Pythagore aux espaces euclidiens, avec une preuve purement algébrique.
- Le déterminant d'une matrice** | Lê Nguyễn Hoang | 7 months ago • 1,727 views

### Related channels

- Science4All (françai... Subscribe
- ENJOY STUDYING Subscribe
- Maths Adultes Subscribe
- KhanAcademyFranc... Subscribe
- El Jj Subscribe
- Mickaël Launay Subscribe



2,404 subscribers  
• 30,998 views



Dr. Lê Nguyễn Hoàng

A screenshot of the ZettaBytes YouTube channel page. The channel name is 'ZettaBytes' with a 'Subscribe' button showing 2,388 subscribers. The 'Popular uploads' section lists five videos:

- 4 Big Challenges in Machine Learning** (ft. Martin Jaggi), 4 months ago, 5,372 views.
- What's a Random Number?** (ft. Peva Blanchard), 6 months ago, 4,441 views.
- The Universal Turing Machine** (ft. Rachid Guerraoui), 6 months ago, 3,884 views.
- Machine Reading with Word Vectors** (ft. Martin Jaggi), 3 months ago, 2,364 views.

The right sidebar shows recommendations for 'Science4All', 'Wandida.Com', and 'Science4All (françai...)'.

# Computational Thinking

# Computational Thinking

Teach all first-year EPFL students the foundations  
of Computational Thinking



1752 students (2017) +7%



# ICC - Information, Calcul and Communication

- Started teaching to all 1st year students in 2013
  - "Light" course in crowded schedule (3 credits)
  - No programming (separate 3 credit course)
- Popular with students and other faculties
- Fall 2018 becomes part of first year core
  - On same level as Analysis and Physics
  - Must pass
  - Programming section merged (6 credits)

Week 1: Introductory Lesson

## **Module 1: Calculation**

Week 2: Basic principles

Week 3: Algorithm design

Week 4: Calculability

Week 5: Information representation

## **Module 2: Information and Communication**

Week 6: Signal sampling and filtering

Week 7: Signal reconstruction

Week 8: Entropy

Week 9: Data compression

## **Module 3: Systems**

Week 10: Processors

Week 11: Memory hierarchy

Week 12: File systems

Week 13: Networks

Week 14: Security



# ICC Content



## 1. Calcul

- Quels problèmes sont solubles? Quels problèmes sont solubles efficacement? Et comment? Dans ce module, les étudiants apprennent les principes de base des algorithmes et apprennent aussi à évaluer leur complexité. Une introduction à la théorie de la calculabilité de Turing est présentée.

## 2. Information et Communication

- Comment convertir des signaux physiques en des suites de 0 et de 1, et réciproquement? Dans ce module, les étudiants apprennent les principes de base du traitement du signal, ainsi que de la compression de données et de la correction d'erreurs, avec pour notion centrale l'entropie de Shannon.

## 3. Systèmes

- L'idée de ce troisième module est de faire découvrir aux étudiants le fonctionnement d'un ordinateur. En particulier, l'architecture des processeurs de Von Neumann est présentée.
- Et le cours se conclut par une leçon sur la sécurité.



# Practicalities

- Taught in 5 sections
  - Group together students from related faculties (eg Math + Physics)
  - Approximately 10 (!) faculty + lecturers
- Moving towards more conventional model
  - But fewer faculty (uncomfortable outside of their home area)
  - Will recruit senior faculty to teach
  - Language issue (FR)

# Lessons

- Can (and should!) teach a CS/communications course without programming
  - Students are reasonably mathematically sophisticated
  - Students enjoy material and see that CS is more than video games, word processing, and programming
  - “Intro physics is taught by a noble prize winner, we teach them loops”
- Integration with programming would be beneficial
  - Students want to see applications of ideas
  - Each school wants a different language (C, Java, Python, ...)
- Lot of work to teach a service course for entire university!
  - Had to bribe faculty at beginning: could teach 1 of 3 units
  - Are teaching staff better for this course than faculty? Effect on students?

# Computational Thinking / Computational Science

- Major initiative of Martin Vetterli
  - EPFL effort to focus students' attention computational science
  - Outreach to high schools and Swiss public
  - Digital Switzerland and Industry 4.0
- Make connections between computational ideas from CS and other fields
- Emphasis importance of computing in all disciplines
- CS education
  
- What is “computational thinking?”