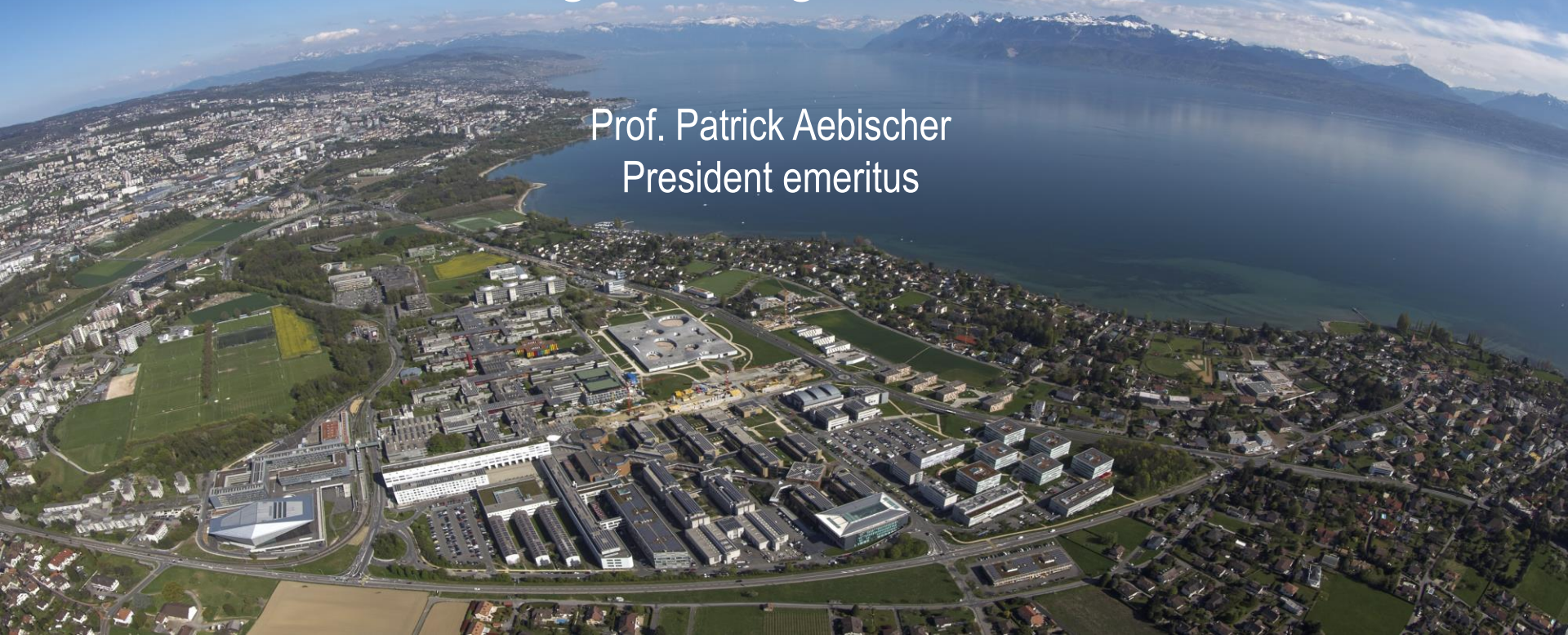


The need to develop world class engineering schools

Prof. Patrick Aebischer
President emeritus



Challenges faced by Universities in the 21st Century

→ Current situation:

- Disruptive technologies
- Need to re-educate the work force → life-long learning
- Rising of tuition fees*

→ Future: “within 15 years more than half of the universities will be bankrupt”



* US students debt: 1.2 trillion US\$

Challenges faced by Universities in the 21st century

Evolving context

- Internationalization of higher education
- Competition for top (and paying...) students
- Impact of University rankings (THE, QS, ARWE etc.)
- Development of powerful e-learning tools
- Generalization of Quality Assurance
- Issue of financial sustainability

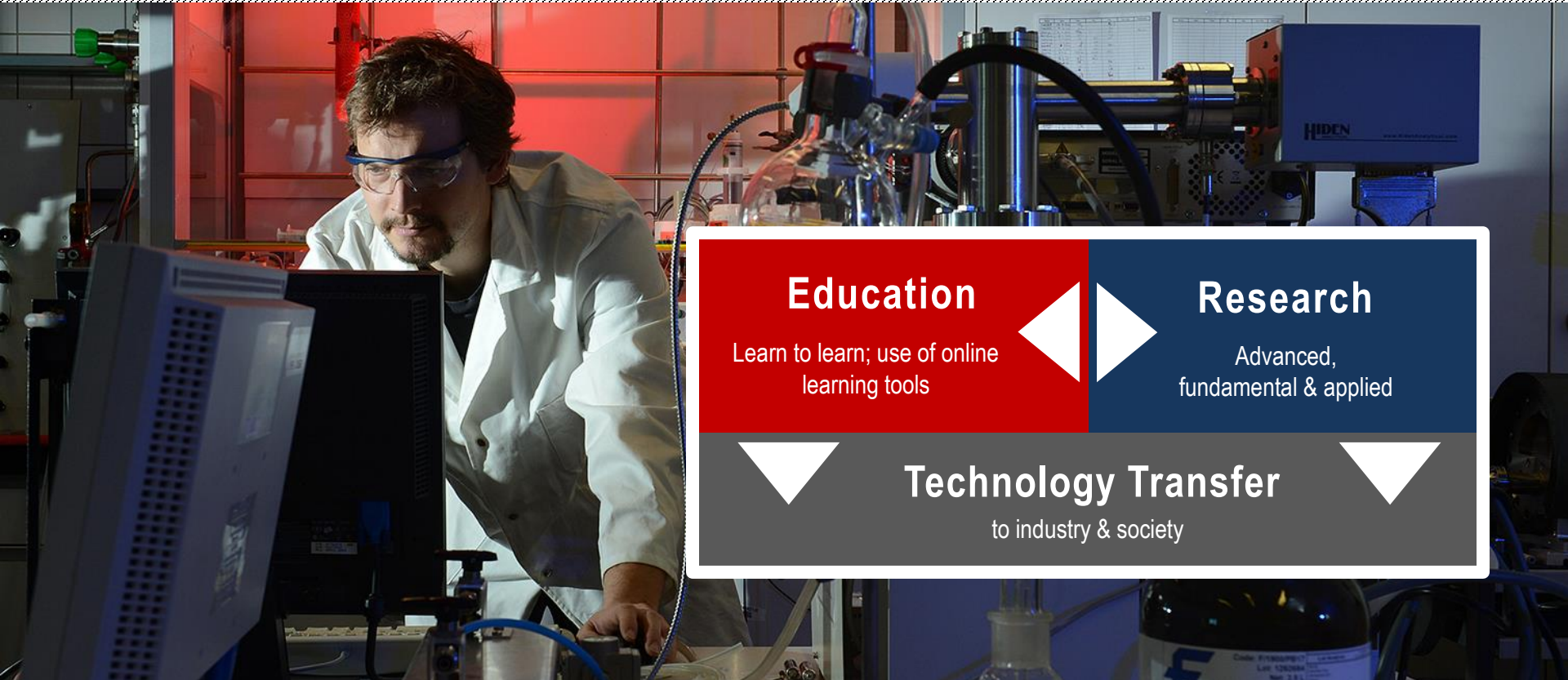


Challenges facing Universities in the 21st Century

World class Universities

- Have a strong engineering school at the heart of converging disciplines
- Allow to show the impact of the research & education effort
 - Economic development (i.e. Silicon Valley, Route 128)
 - “Pull effect” on the overall academic system

Three main missions of a University



Education

Learn to learn; use of online learning tools

Research

Advanced, fundamental & applied

Technology Transfer

to industry & society

How to build a world class research university?

Key ingredients

- Recruit the best students and faculty
- Go online
- Develop high quality infrastructure and facilities
- Provide an innovative environment
- Have a budget > 1 billion €
- Be jealous of your autonomy
- Empower Leadership

The digital revolution

A challenge for education and research

→ Education

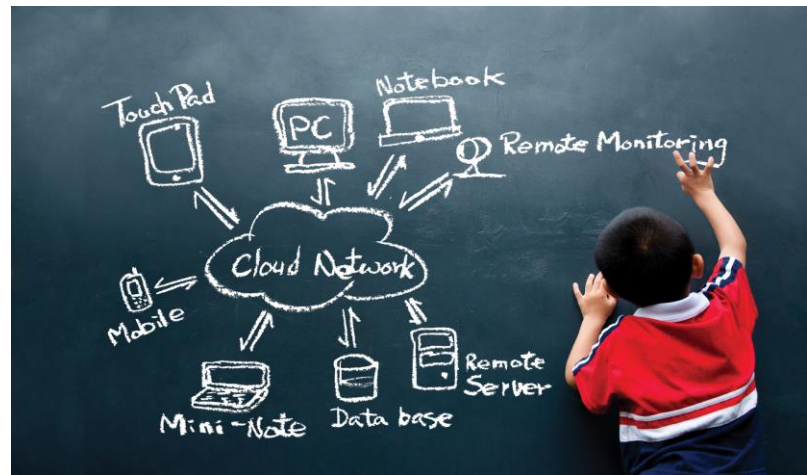
e-learning tools: MOOC, Extension Schools etc.

→ Research

Development of Open Access

Collaborative research ie crowd-based AI

Simulation-based research



Students

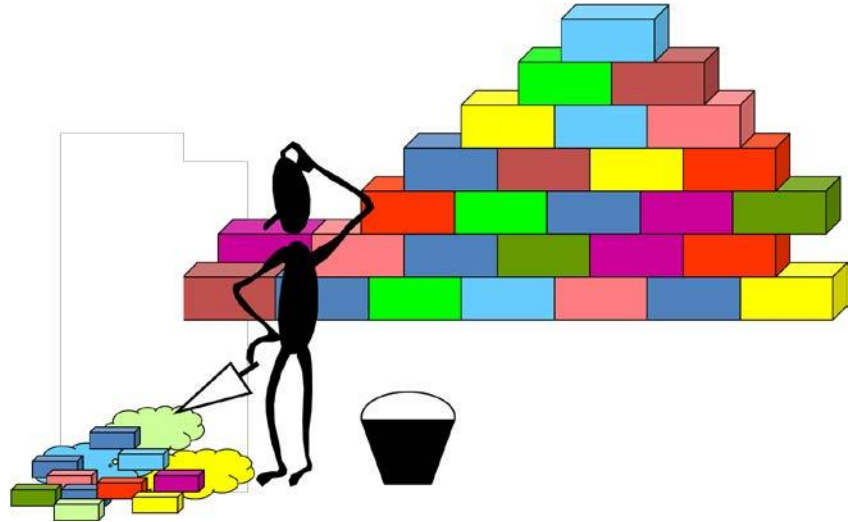
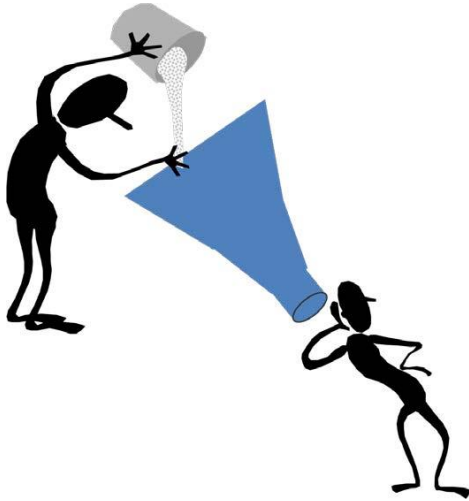
Attract (and retain) the best students

- Offer scholarships
- Guaranty a good student/faculty ratio
- Promote mobility
- Create an attractive and lively campus
- Develop the branding and corporate culture of the University



Higher Education is changing !

From transmission ...



... to accumulation and construction of knowledge

Adapt our education to the digital revolution

Location



Format



Age

18-25 year old



8-88 year old?

Adapt our education to the digital revolution

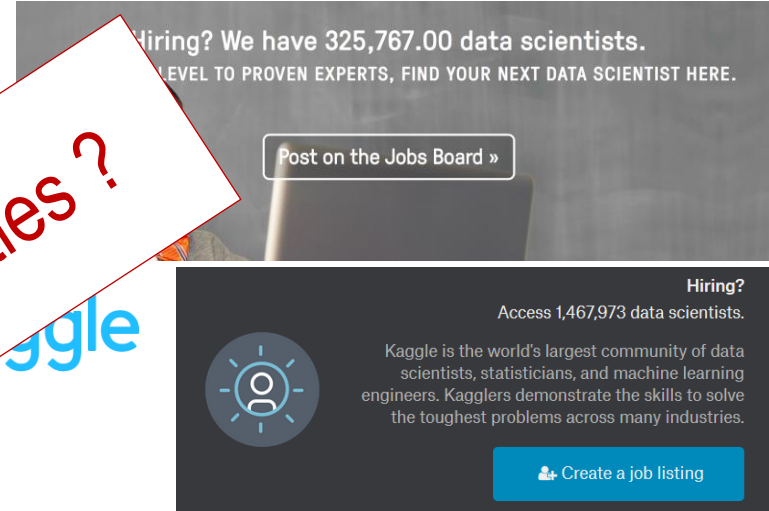
How to train professionals ?

Reputation
of the university



“Uberification” of Universities ?

- Recognition without certificate? Kaggle points
- Companies like Google fight for getting the best Kagglers



Go online...

EPFL MOOCS USERS

A world map with a dark blue background and a light blue grid. The map is covered with numerous small, bright yellow-orange dots representing EPFL MOOCs users. The dots are most densely clustered in North America (USA and Canada) and Europe, with a significant concentration in Western Europe. There are also many dots across Asia, particularly in the eastern part, and some in South America and Africa. The text 'EPFL MOOCS USERS' is written in white, bold, sans-serif font in the upper left quadrant of the map.

Total : 2'262'611 students registred on EPFL MOOCs

MOOCs – the EPFL experience

- 81 MOOCs EPFL on line; 33 in production
- September 2012 – December 2016 :
2'056'471 participants from 186 countries
- 66% are not students (continuing education), of which 90% are employees
- 34% of the EPFL MOOCs are taken in French
66% of the EPFL MOOCs are taken in English
- > 100'000 users have succeeded and received a certificate



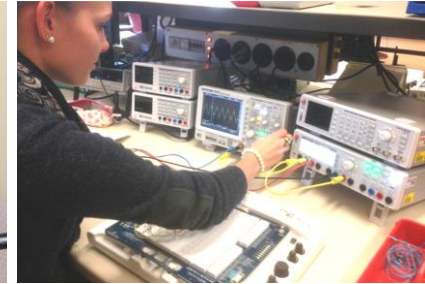
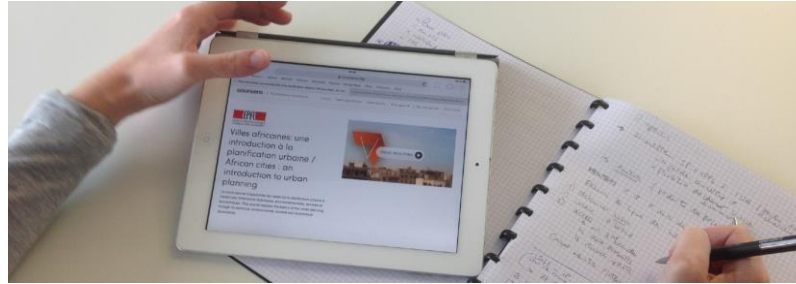
Continuous education

Concept of the Extension school

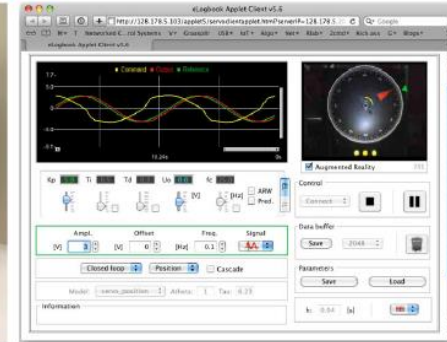
- Develop new forms of life long learning
(blend of online/residential experience)
- COS (Certification of Open Studies), with no prerequisites
- Establish a “Nanodegree” offer using on-line tools
- Development of vouchers for industry



Education 2.0



- Reduce the number of ex-cathedra lectures
- Flip the class and use of the MOOCs
- Problem solving approach
- Foster team work and projects



Distance practical work for students

Develop an attractive campus



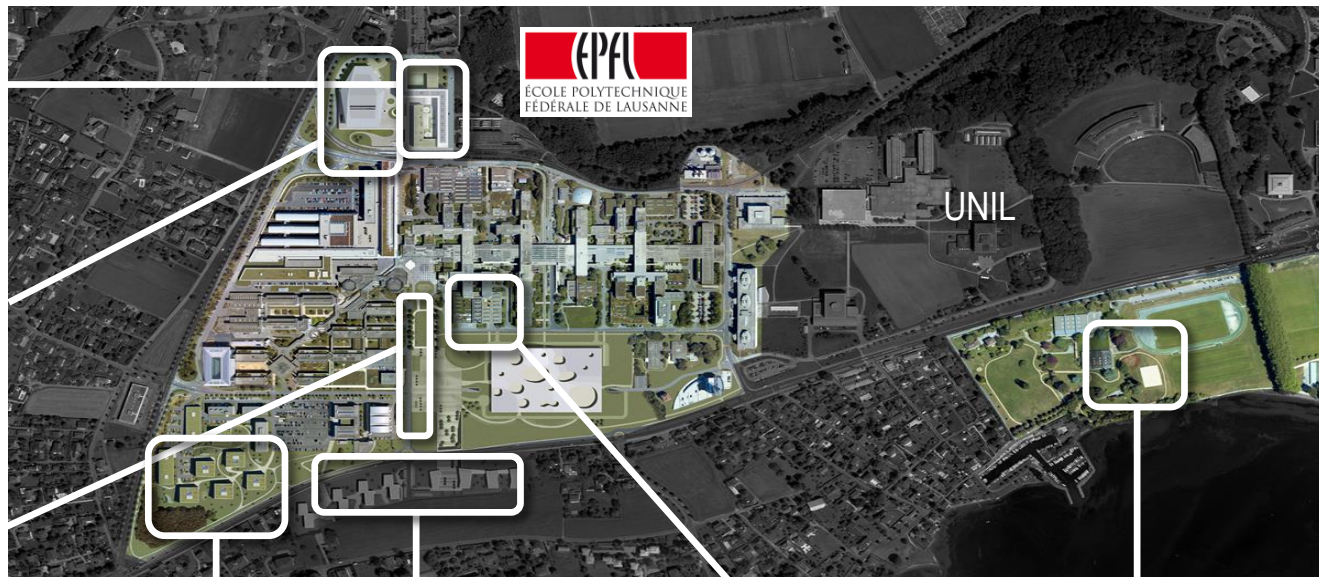
Student housing



Swiss Tech Convention Center



Under One Roof



EPFL Innovation Park



Les Estudiantines & Starling Hotel

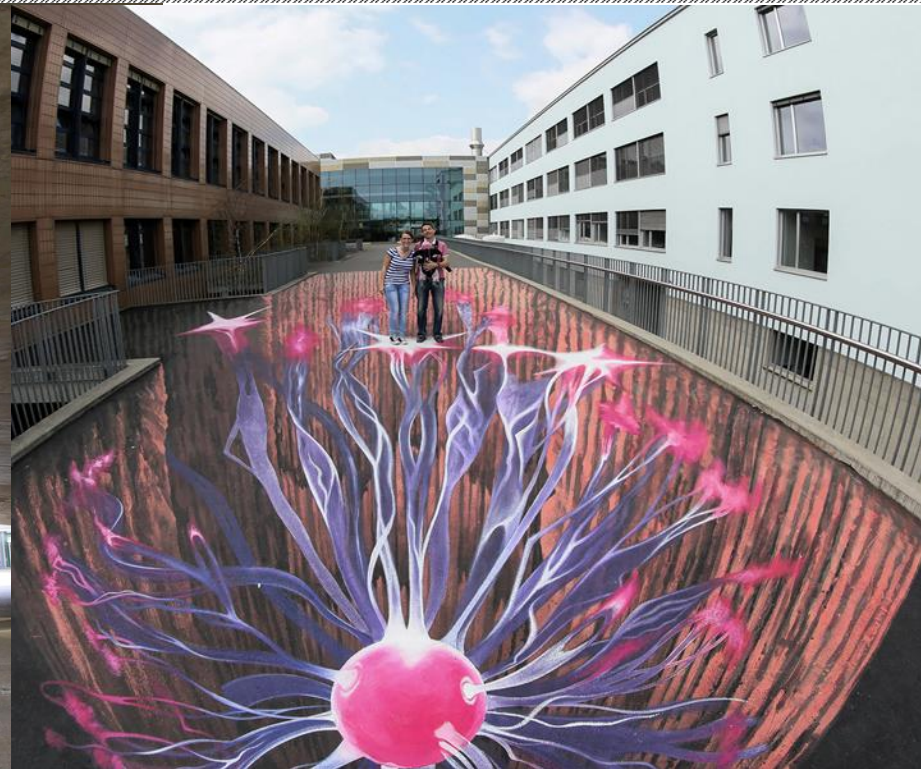


Mechanical Engineering



Extension sports center

Campus: need for socialization



School projects to promote transdisciplinarity

Alinghi



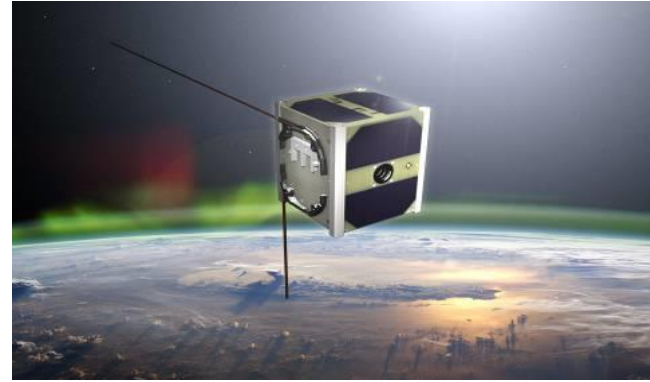
Hydroptère



Solar Impulse



Swiss Cube



Faculty

Attract (and retain) the best Faculty

- Recruit on a world wide level
- Develop a tenure track system
- Competitive funding
(start-up costs + running budget)
- Modern infrastructure
- Competitive salaries



Faculty recruitment philosophy

“Elite revolutionary science should (...) be a place that welcomes brilliant, impulsive, inspired, antisocial oddballs – so long as they are also dedicated truth-seekers”

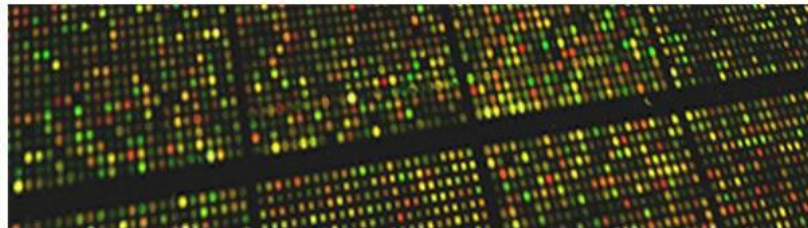
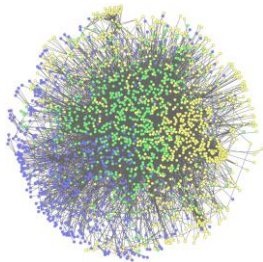
Bruce G. Charlton

Science megatrends

« Info-nano-bio-cogno » convergence, leading to a deluge of data

+

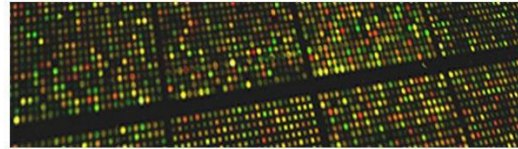
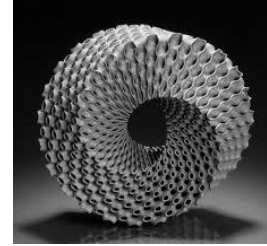
the AI potential to extract meaning of big data



The pace of technological developments has never been so fast

How technology is transforming the world

- Big data and IA (info)
- Robotics and advanced manufacturing (nano)
- Gene editing (bio)
- Cognitive sciences (cogno)



An extraordinary opportunity for engineering schools

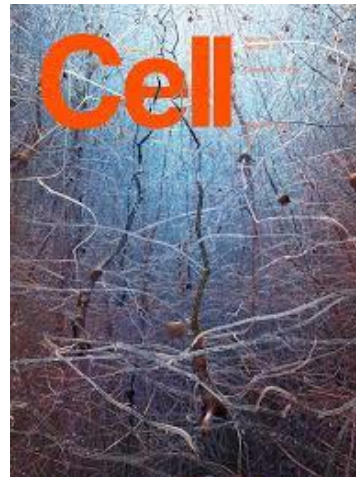
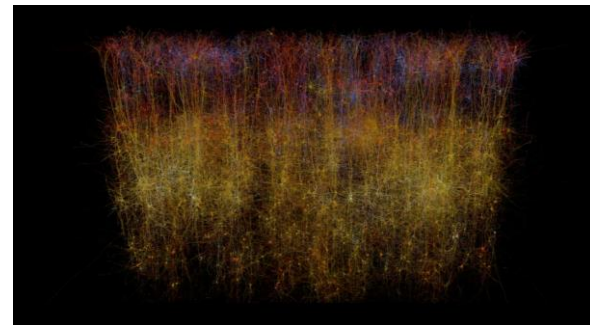


Ambition

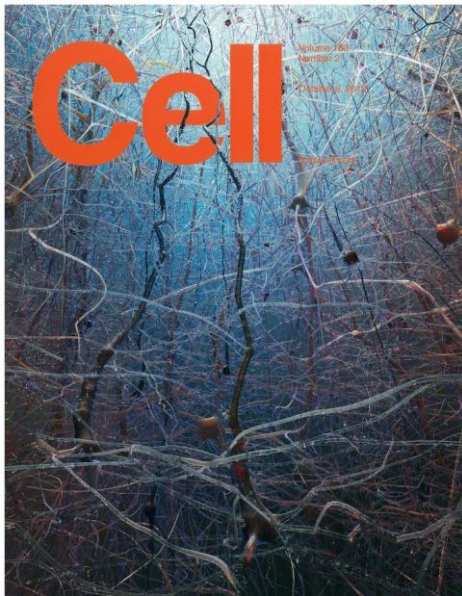
Build a simulation-based research facility capable of constructing unifying software models of the brain

Current achievement

Published the first detailed reconstruction of the somato-sensory cortex of juvenile rats (8 million connections and 37 million synapses)

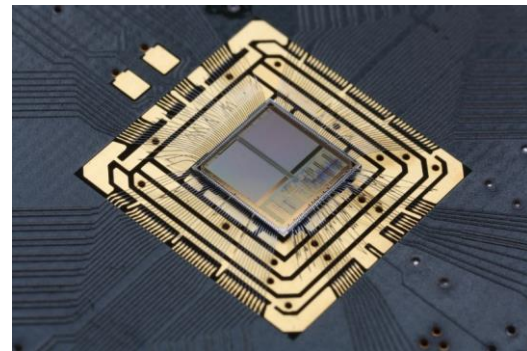


Development of neuro-inspired Artificial Intelligence



Modelling the neocortex
(Blue Brain Project)

- Design chips based on our understanding of how the brain computes
- Smarter chips for the next generation of robots



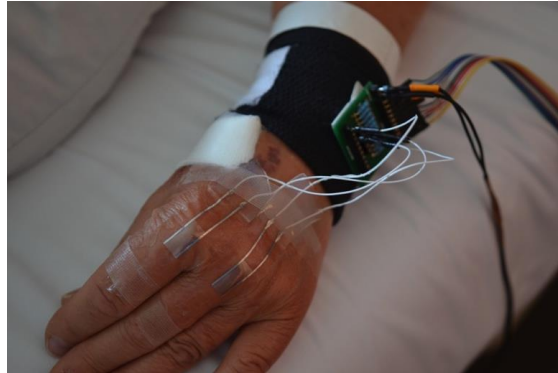
Neuromorphic Chip
(Human Brain Project)

Brain machine interfaces

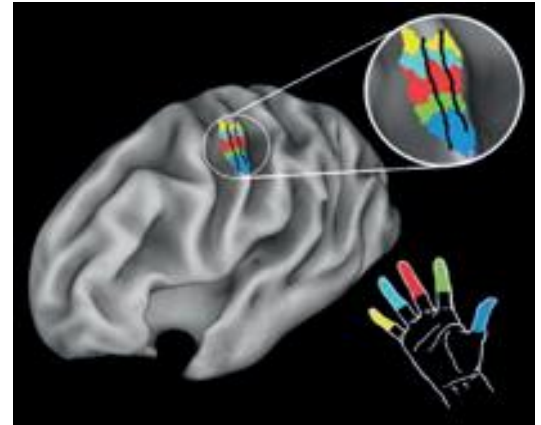
Connected artificial hand (Prof. Micera)



Sensing skin (Prof. Lacour)



Cognoceuticals (Prof. Blanke)



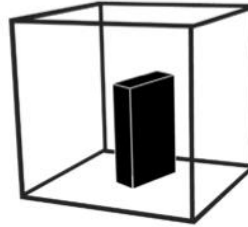
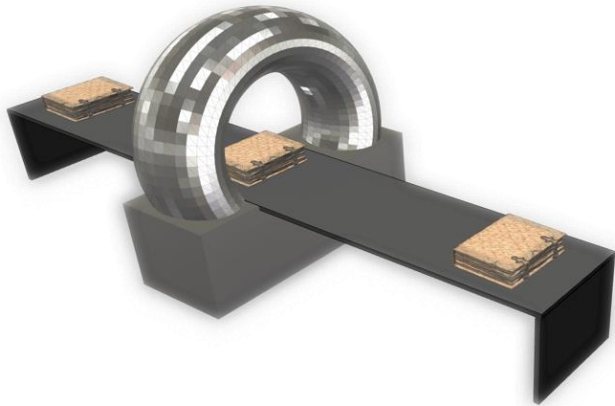
Digitization of the Venice archives



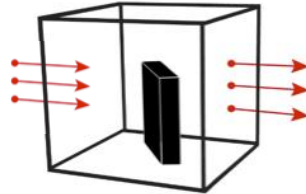
- 80 km of archives about 1000 years of Venice history
- Classic digitization: 450 books/day → 20 years
- Develop new technologies (tomographic approach) → 2 years

Ambition: transform archives into an information system with a user friendly interface

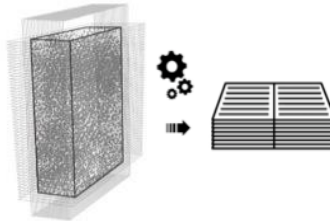
X-Ray Digitization



Place the book



Scan the entire volume



Computer extraction of pages

Venice Time Machine

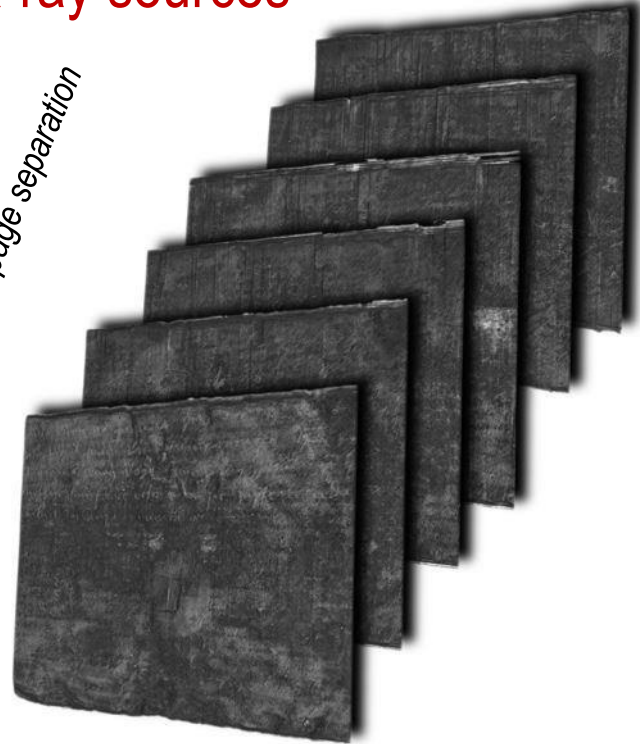
3D imaging of sealed venetian testaments with x-ray sources



X-ray Digitization

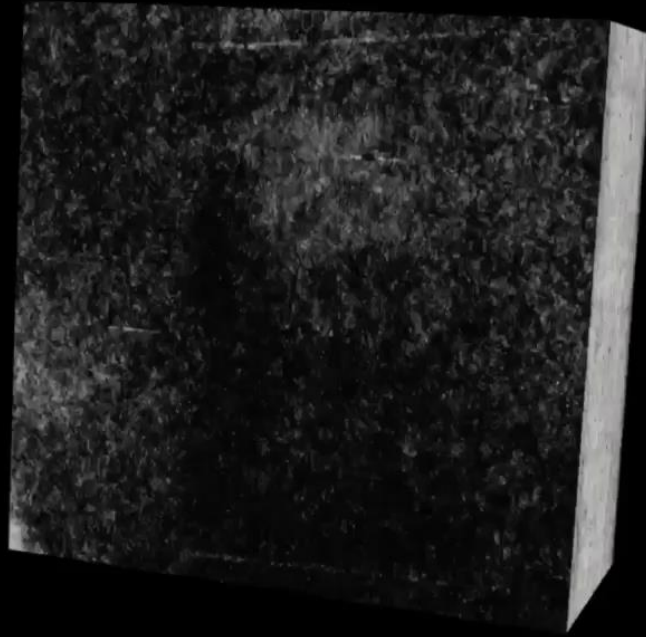


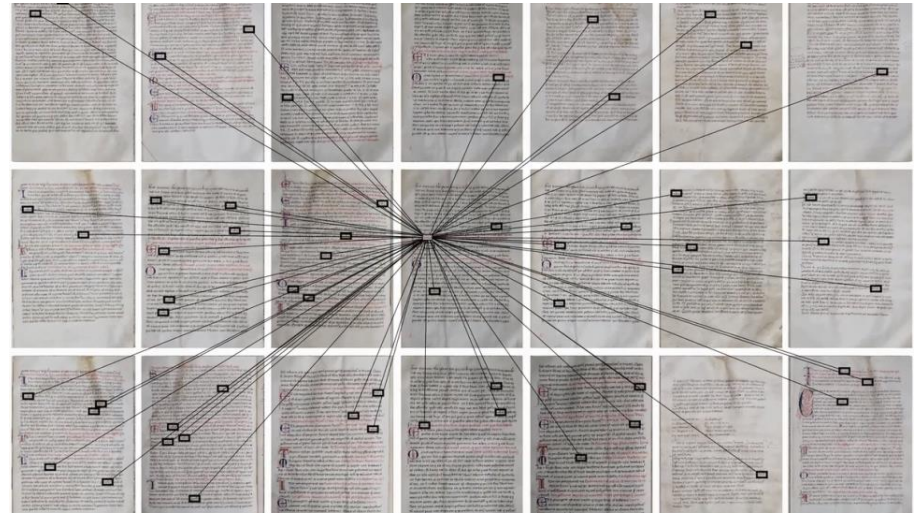
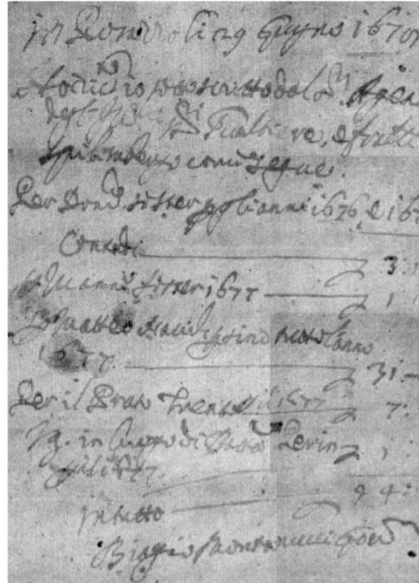
Digital page separation



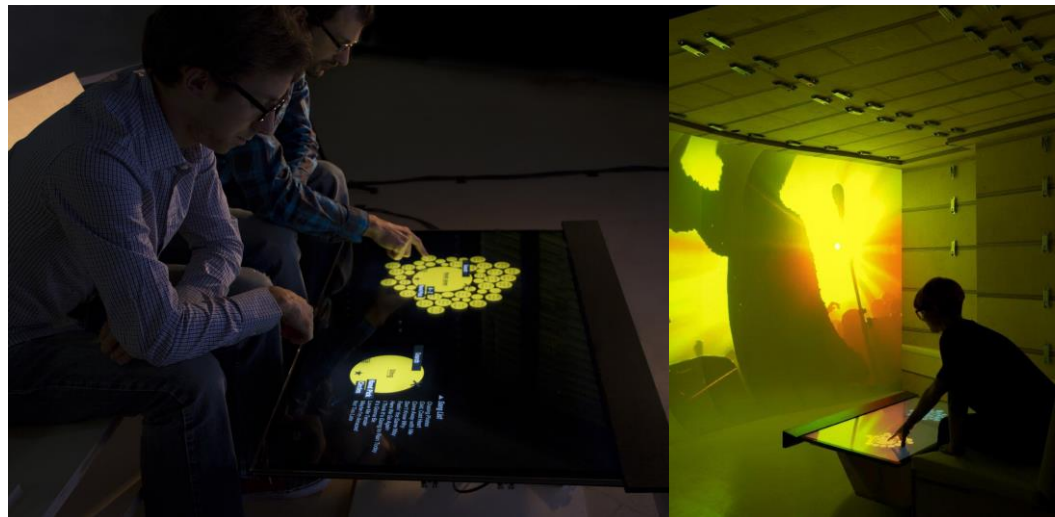
Saponario Cataruccia ux. Martin (13 August 1351)

Venice Time Machine





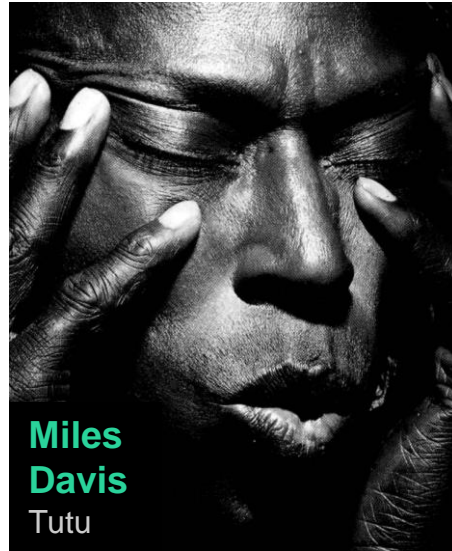
Montreux Jazz Festival Archiving project



- Research on indexing, access and post-production of digital archives
- Prototypes of navigation in the archives

Collaboration Twist - EPFL

Samples of the Montreux Jazz Festival Archives stored on DNA



00	01	11	10
↓	↓	↓	↓
A	G	T	C



Claude Nobs foundation

Innovation culture

A question of emotion



Rolex Learning Center@epfl.ch

Development of innovative ecosystems

University active engagement for innovation

Science park on campus

Tech transfer office

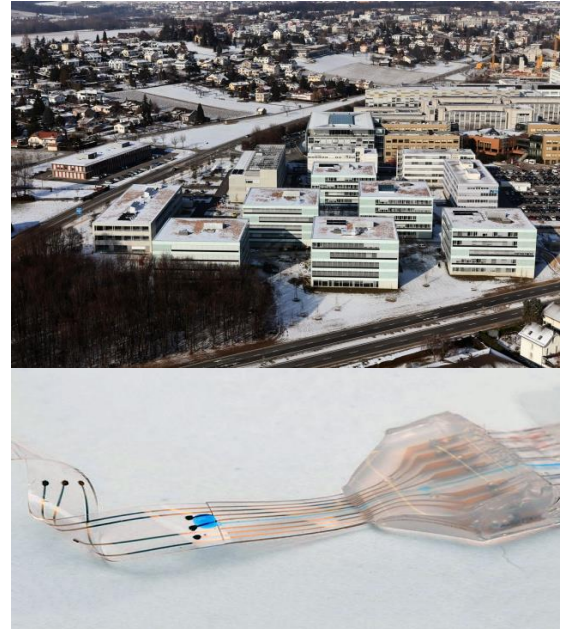
Entrepreneurship programs

Access to coaches

Seed funding (ie angels, state etc)

Accelerators

Innovation culture



Innovative environment

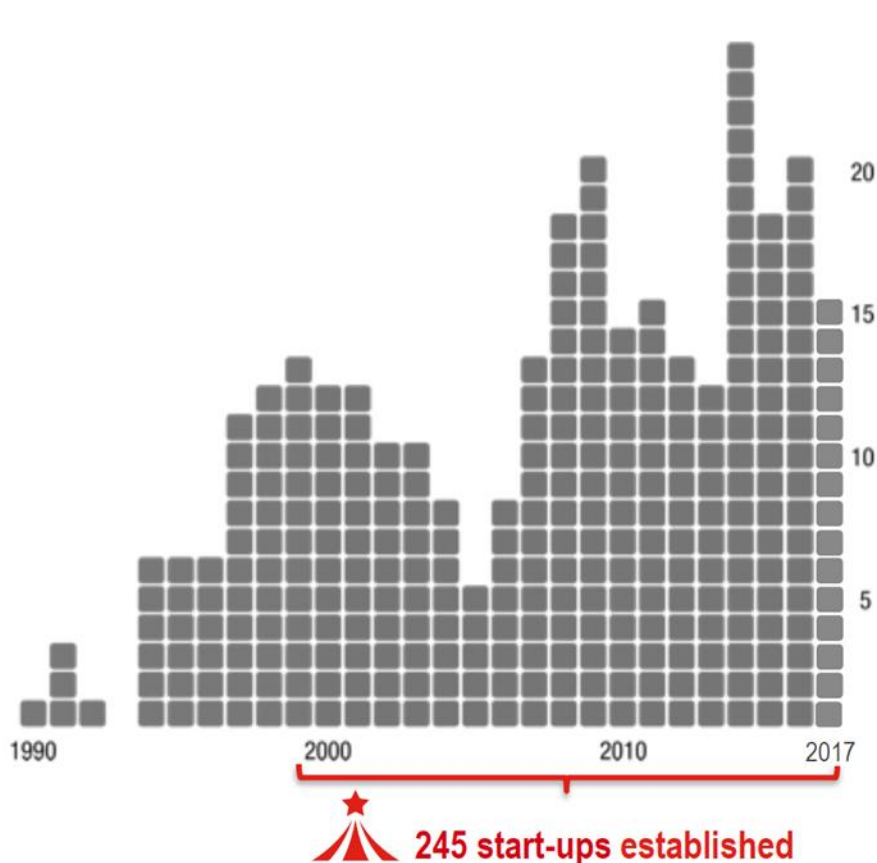
Interactions



EPFL Innovation Park

Being next door

Development of EPFL start-up



EPFL Innovation Park

- 55'000 m² of labs and space offices
- More than 120 start-ups
- 23 large companies
- Creation of 2'000 high added value jobs

INFORMATION
TECHNOLOGY
FINANCE
COMPUTING



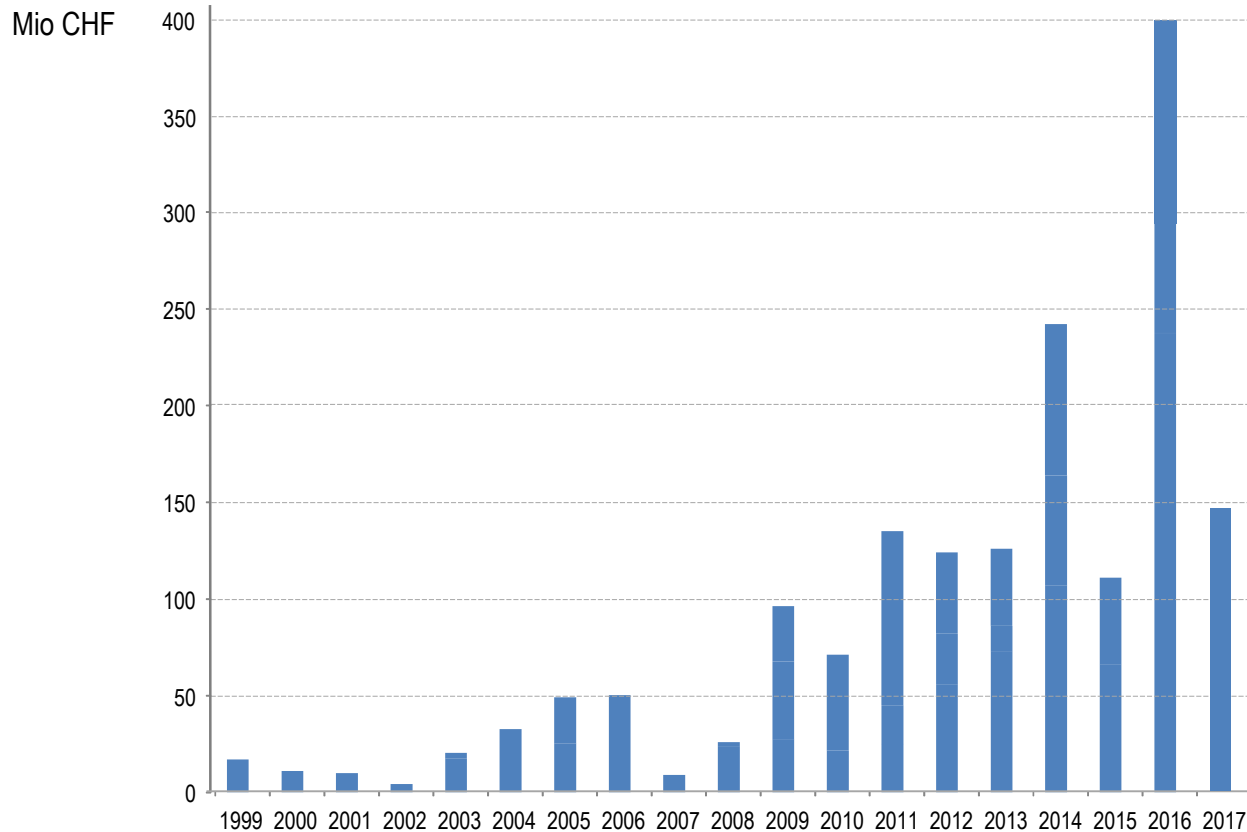
HEALTH
NUTRITION



ENGINEERING, TRANSPORT,
MATERIALS



VC financing of start-up @ EPFL Innovation Park



Leadership & management

« Empowerment of the leadership »

- Promote professional leaders (presidents, vice-chancellors, deans, etc.)
- Acquire sufficient autonomy vis-à-vis of the political power
- Promote organizational flexibility
- Develop a corporate culture



Image source: Consulting Quest

Leadership

- « An academic Institution is not like an orchestra with a president as conductor. MIT is more like a jam session among a lot of talented musicians who listen to each other and get into the flow. The president, provost, deans and other administrators strive to hire the right « musicians », draw the themes from the evolving music, and keep the beat going. »
- « An academic Institution evolves 50% by planning and 50% by serendipity. »

Charles Vest, past president MIT

EPFL 2017 rankings



QS Ranking : 12



Times Higher Education : 38



Shanghai Ranking : 76



CWTS Leiden : 17 *



Nature Index: 22



US News & World Report: 36

THE under 50: 1st



EPFL: 2015, 2016 & 2017
best young University
worldwide

Conclusion

« Things take longer to happen than you think they will and then they happen faster than you thought they could »

Ruedi Dornbusch, MIT

Thank you for your attention



Conclusion

« To meet oncoming global challenges, we will need to better link discovery, innovation and entrepreneurship »

Phil Scharp, Nobel laureate, 1993