Program research – stimulator of higher education

Dr Stephan Bieri, CEO and Vice-President of the ETH Board

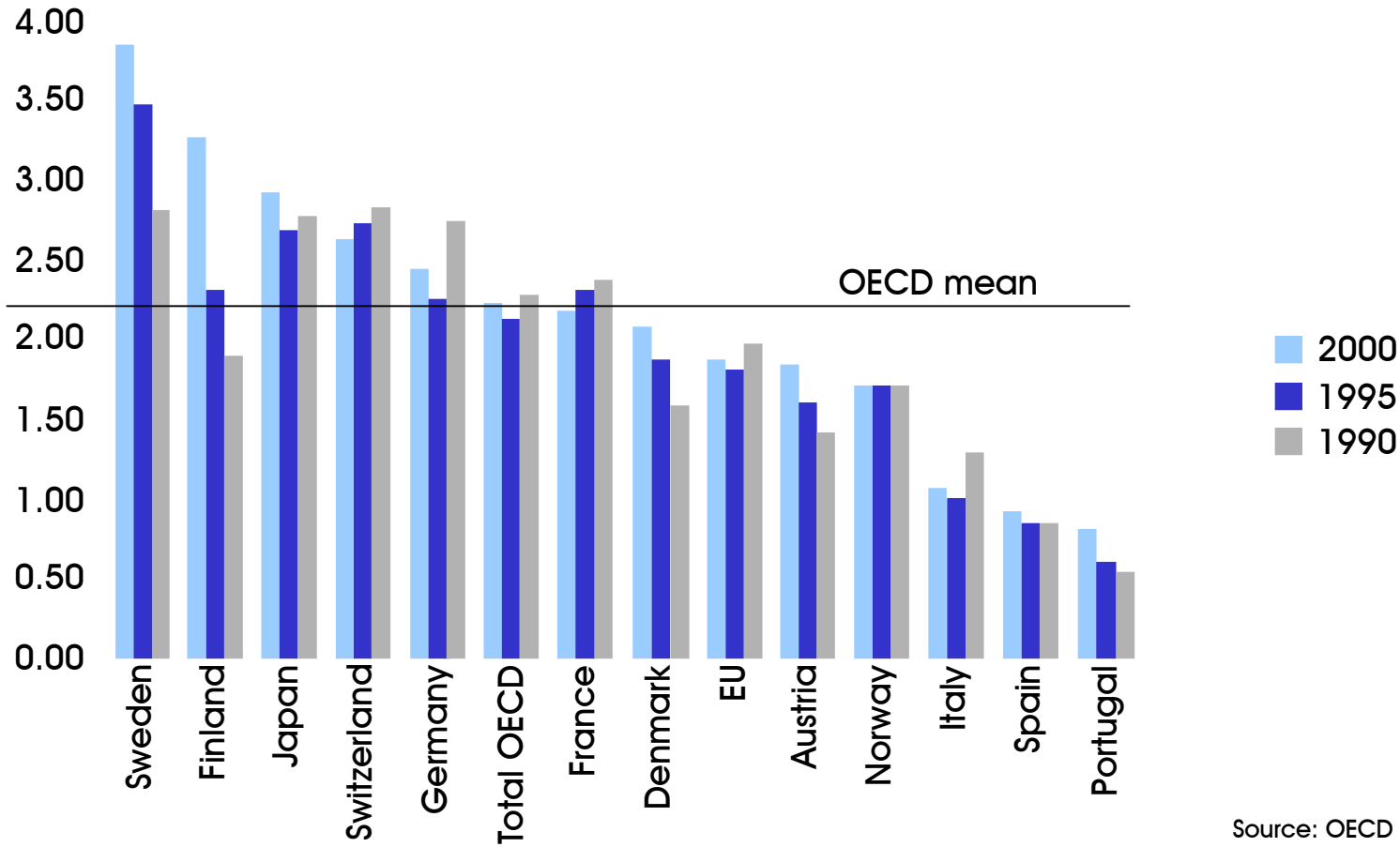
Nano Conference and TOP NANO 21 Annual Meeting 2003, September 11th, 2003

1. Science and technology in Switzerland
2. Developments in higher education
3. The situation of oriented research
4. TOP NANO 21

1. Science and technology in Switzerland

- R&D expenditure in % of the GDP
- Best practices in education: SPINE study
- Development of student numbers

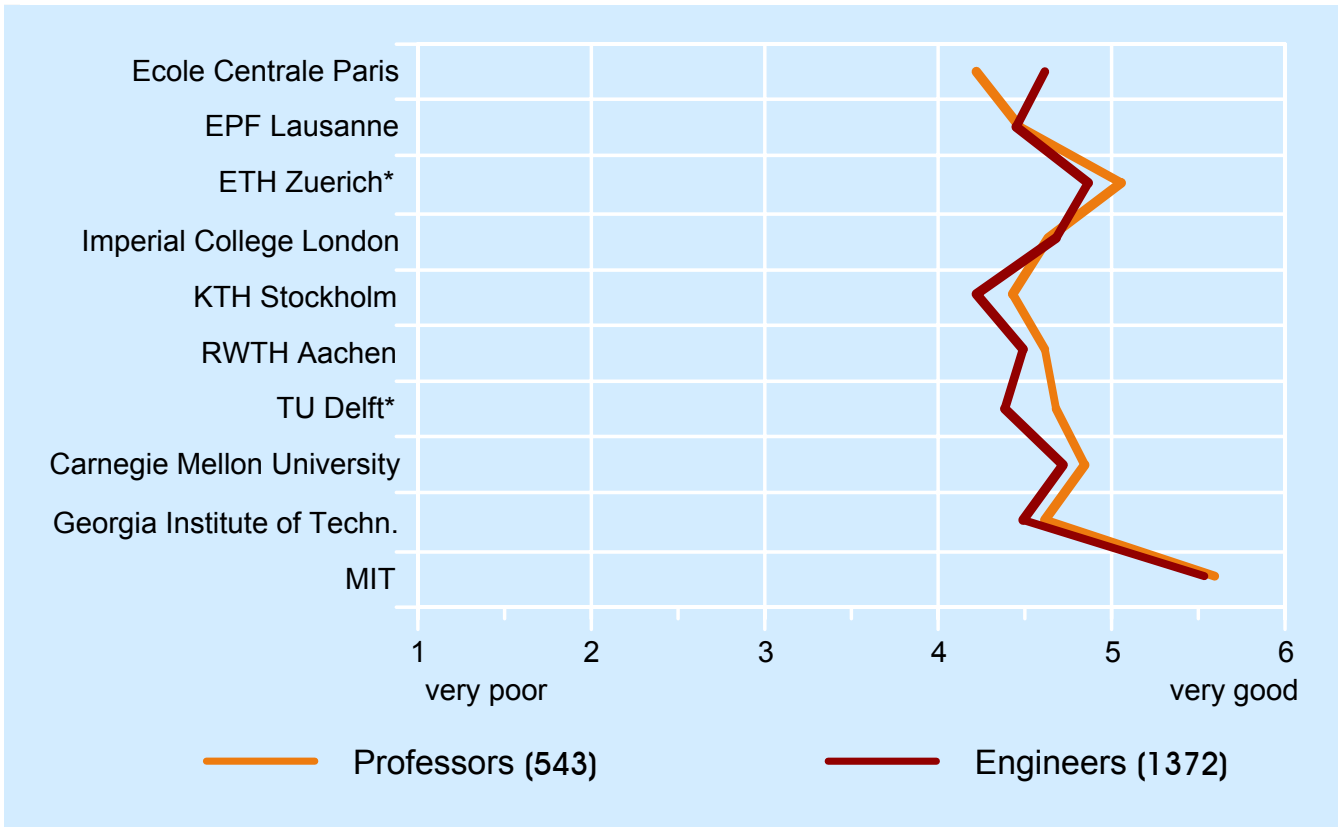
R&D expenditure in % of the GDP



Source: OECD

Best practices in education: SPINE study

Reputation of the universities



* Significance at the 1% level

Development of student numbers

	1998	1999	2000	2001	2002	Δ% 98-02
Universities	78'599	79'370	80'118	82'417	86'732	10.3
ETH	16'098	16'333	16'554	17'152	17'955	6.5
Total universities and ETH	94'697	95'703	96'672	99'569	104'687	9.7
Universities of applied sciences*	10'873	16'918	21'936	24'386	29'178	168.4
Total	105'570	112'621	118'608	123'955	133'865	26.0

*Transitional period: ongoing approval of new diploma courses

Source: BFS

2. Developments in higher education

- Main trends
- The Bologna Process
- Graduate Schools

Main trends

- Globalisation leads to competition among science locations
- The crisis of the mass universities demands distinguishing profiles
- New forms of teaching and learning
- The Swiss landscape of higher education is transforming

  - autonomy

  - financial restrictions

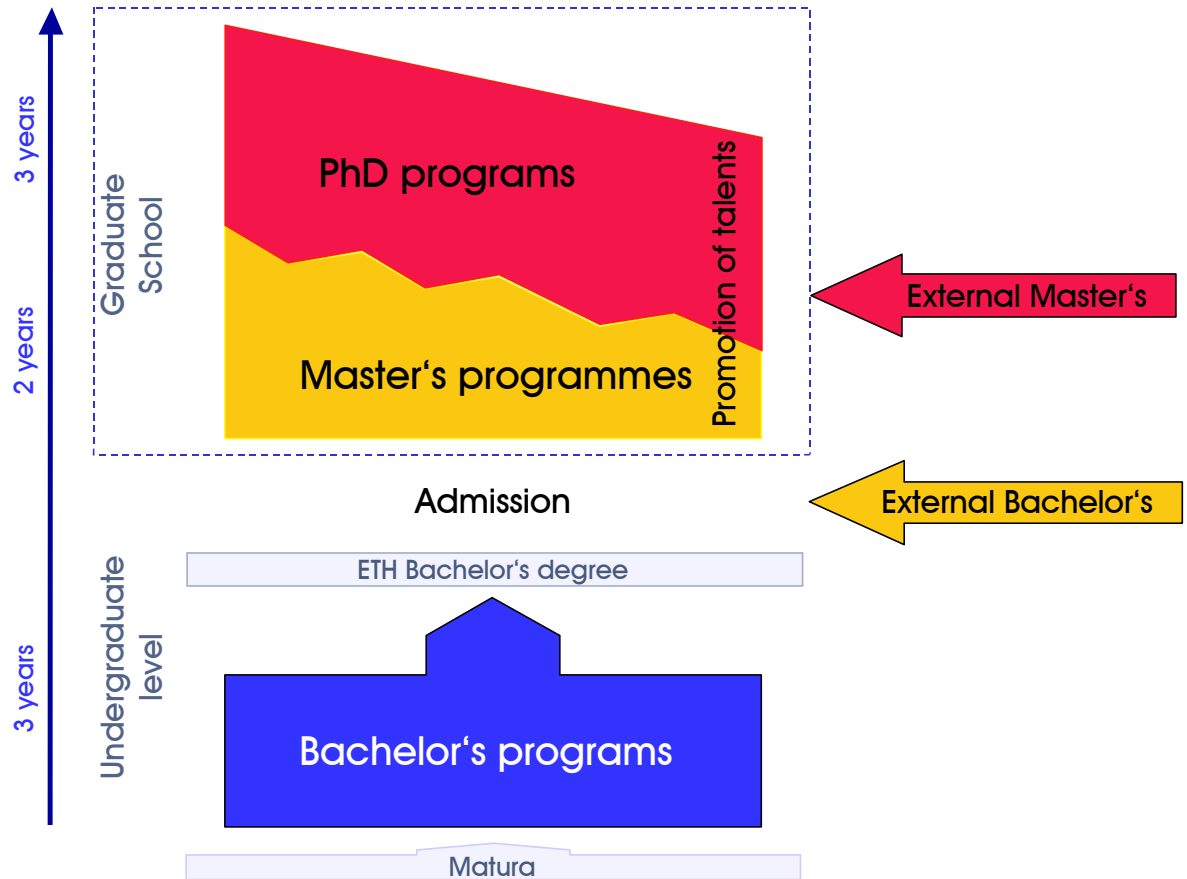
  - new players: universities of applied sciences

  - Project 2008 ("Rahmengesetz")

The Bologna Process

- The Bologna Process provides Switzerland with an excellent opportunity for study reform which should be used judiciously.
- Universities, the ETH Domain, and the universities of applied sciences should be able to profile themselves.
- First-class education and forefront research are not produced by forcing universities to adopt equal requirements or imposing cooperation on them.
- Most important: the system should attract talented PhD students at an early stage.

Graduate Schools (where higher education and research meet)



3. The situation of oriented research

- Program research in Switzerland
- Beyond linear thinking
- What kind of program research?

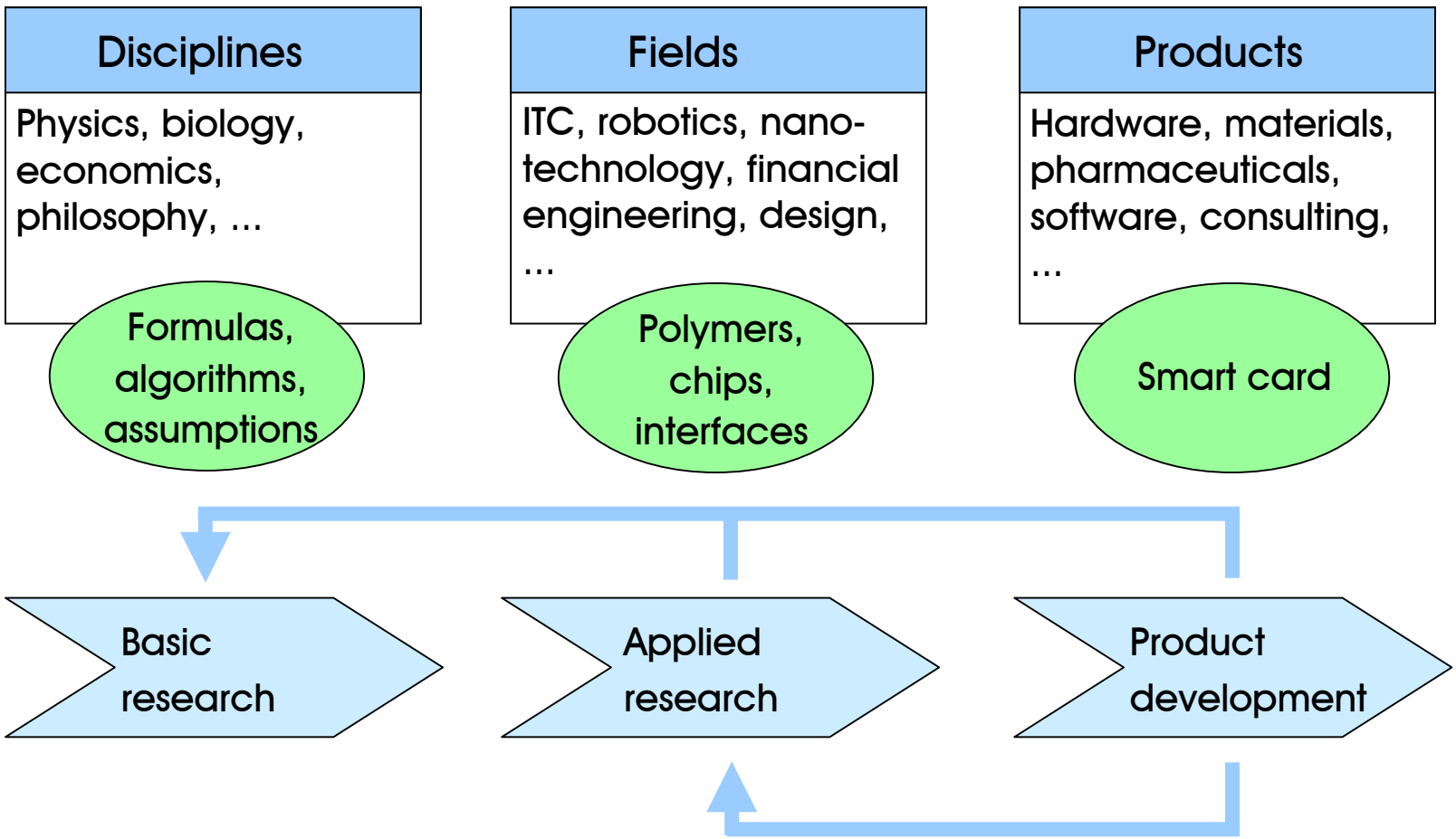
Program research in Switzerland (I)

since 1975	SNF	National Research Programmes (NRP) >50 NRP until now, 37 NRP completed, duration 4-5 years
1992 — 2000	SNF	Swiss Priority Programmes (SPP) - Biotechnology - Information and Communication Structures - Environment - Switzerland: Towards the Future (1996 - 2003)
	ETH Board	Swiss Priority Programmes (SPP) - Power Electronics, System and Information Technology (LESIT) - Optical Science, Application and Technology (OPTIC I+II) - Material Research (WF) - Micro and Nano System Technology (MINAST)

Program research in Switzerland (II)

since 2000	ETH Board	Technology Oriented Program (TOP NANO 21)
		Innovation and Cooperation Projects (ICP) 12 ICP until now, duration 4 years
since 2001	SNF	National Centres of Competence in Research (NCCR) 14 NCCR until now, duration 10-12 years

Beyond linear thinking



What kind of program research?

- Innovation cannot be planned and does not occur in predictable places
- Competition has to play a major role, guaranteed by:
  - transparent criteria
  - international evaluation of the project proposals
  - pressure on publications
  - annual progress reviews
- Funder and provider must clearly be separated
- Time limitation is a considerable scientific merit and leads to an improvement of project management and portfolio selection

"But Europe also suffers from serious misconceptions about how science works. Many of our research programs implicitly assume that fundamental discoveries can be planned; that research is more efficient if the scientists are told what to do, and how to do it; and that coordination, cooperation and evaluation can replace first-rate single brains."

Gottfried Schatz, Swiss Science and Technology Council, Jeff's View: Networks, fretworks, in press.

4. TOP NANO 21

- Impetus shows results
- Evaluation of the program
- Some final remarks
- Award of PhD grant

Impetus shows results

62 CHF m

TOP NANO 21 – an invaluable instrument to pursue the strategic planning of the ETH Board

September 2003

scientific	Projects	296
	PhD students	108
	Post docs	170
	Completed theses	11
	Scientific publications	224
economic	Firms involved (in some cases in several projects)	294
	New jobs created	50
	Patent applications	17
	Spin-offs	22

Evaluation of the program

- Analysis of scientific results
- First assessment of the impact on the national science system, the Swiss economy, and the international position
- Consequences regarding the implementation of the ETH Board's strategy, the continuation of CTI funding, and the development of the federal innovation policy

Some final remarks

a) Scientific excellence is not the result of political planning or bureaucratic promotion.

b) Program research should be controlled by the responsible bodies of universities ("Träger") themselves.

c) Links with industrial R&D and know-how-transfer remain important, yet the contribution to teaching is the critical success factor.

d) For me, PhD students are one of the major targets of program research.

"The best universities and colleges of the future will be those demonstrating the most effective gains in learning and learning skills among their students. This new accountability will demand a better understanding of the learning process . . . "

Frank H.T. Rhodes et al., Challenges Facing Higher Education at the Millennium,
Oryx Press: Phoenix (Ar.) 1999, S. 171

Award of PhD grant

The ETH Board will hand over the patronage and guidance of TOP NANO 21 to the CTI by the end of the year.

I therefore wish to express my thanks to the management team of the program and to the CTI.

As a last milestone, the ETH Board wants to motivate young researchers and awards a PhD grant.

The winners are

Lucio M. Robledo Esparza

"Spectroscopy and laser sideband cooling of single diamond nanocrystals suspended in vacuum using optical tweezers"

Supervisor: Prof. Ataç Imamoglu,
Institute for Quantum Electronics, ETHZ

Contribution to the questions of coherence in quantum information processing. The applicability of single photon emitting sources for linear optics quantum computation schemes is strongly limited by the coherence time of the emitter. The focus is on increasing this coherence time.

Dino Keller

"Exploiting carbon nano-tubes as ultimate bio-sensors (Nanotube-BIO-FET)„

Supervisor: Prof. Christian Schönenberger, Institute of Physics, University of Basel

Use a carbon nanotube Field Effect Transistor as a new, very sensitive biosensor. The electrical conductivity of carbon nanotubes shows a high sensitivity to charged molecules, in particular to ions. A carbon nanotube field-effect transistor will monitor the electrical conductivity. The sensitivity to adsorbed biomolecules, such as DNA and proteins, will be studied.

Yves Casta

"A molecular photomagnetic switch as information storage device"

Supervisor: Prof. Thomas Ward, Inorganic Chemistry, University of Neuchâtel

Synthesis of a molecular switch based on Nickel complexes. A molecule which possesses two metastable states can serve as a binary molecular storage device which finds applications in information technology as a bit with molecular dimensions. This device should operate in the solid state, be finally reversible, and display an easily addressable response to a photochemical trigger.