

# Promoting Science in Schools

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# What is science?

- Explanations of the material world
- Based on observation and testing of theories against nature (facts, hypotheses, laws, theories)
- Importance historically
- Importance in a modern society

# Why Science?



# Why does science matter?

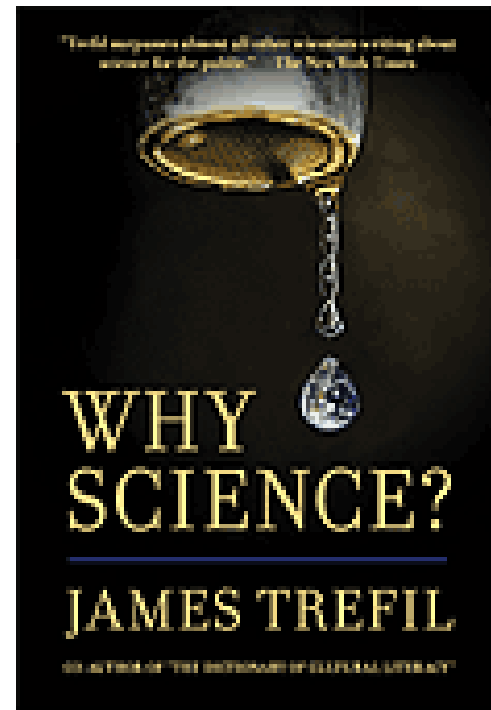
- Science for all
  - Scientific literacy important in a democracy
- Science for future scientists
  - Important for EU – economic growth, competition, prosperity

# Why Science?

## By James Trefil

Why scientific literacy is important in a modern democracy?

What types of understanding to citizens need in science?



# What about Stem Cells?

Stem cell - Wikipedia, the free encyclopedia - Microsoft Internet Explorer provided by Universitetet i Oslo

http://en.wikipedia.org/wiki/Stem\_cell

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Stem cell - Wikipedia, the free encyclopedia

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## Stem cell

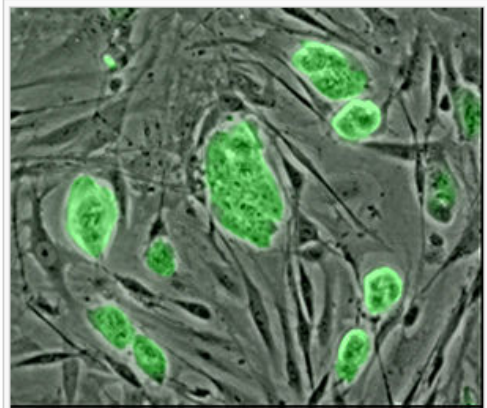
From Wikipedia, the free encyclopedia

**Stem cells** are **cells** found in most, if not all, multi-cellular **organisms**. They are characterized by the ability to renew themselves through **mitotic cell division** and **differentiating** into a diverse range of specialized cell types. Research in the stem cell field grew out of findings by **Canadian** scientists **Ernest A. McCulloch** and **James E. Till** in the 1960s.<sup>[1][2]</sup> The two broad types of mammalian stem cells are: **embryonic stem cells** that are found in **blastocysts**, and **adult stem cells** that are found in adult tissues. In a developing **embryo**, stem cells can differentiate into all of the specialized embryonic tissues. In **adult** organisms, stem cells and **progenitor cells** act as a repair system for the body, replenishing specialized cells, but also maintain the normal turnover of regenerative organs, such as blood, skin or intestinal tissues.

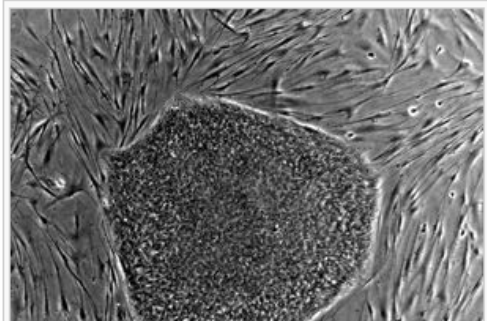
As stem cells can be grown and transformed into specialized cells with characteristics consistent with cells of various tissues such as muscles or nerves through **cell culture**, their use in **medical therapies** has been proposed. In particular, embryonic **cell lines**, **autologous** embryonic stem cells generated through **therapeutic cloning**, and highly plastic adult stem cells from the **umbilical cord blood** or **bone marrow** are touted as promising candidates.<sup>[3]</sup>

**Contents** [hide]

- Properties of stem cells
  - Potency definitions
  - Identifying stem cells
- Embryonic stem cells
- Adult stem cells
- Lineage
- Treatments
- Controversy surrounding human embryonic stem cell research
- Key stem cell research events



Mouse embryonic stem cells with fluorescent marker.





<http://stemcells.nih.gov/info/basics>

Stem Cell Basics [Stem Cell Information] - Microsoft Internet Explorer provided by Universitetet i Oslo

http://stemcells.nih.gov/info/basics/ Stem Cells

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Stem Cell Basics [Stem Cell Information]

Stem Cell Information  
The National Institutes of Health resource for stem cell research

INFO CENTER RESEARCH TOPICS FEDERAL POLICY ANNOUNCEMENTS

Frequently Asked Questions

- What are stem cells?
- Can they cure diseases?
- Are there ethical issues?
- What is the U.S. policy?
- More FAQs
- Links to related resources

Stem Cell Research

- Stem Cell Registry
- Current Research
- Upcoming Events
- Funding for Research
- Training Programs
- Scientific Literature


Tools

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Home > Info Center > Stem Cell Basics

## Stem Cell Basics

**What Are Stem Cells?**



**Stem cells** have the remarkable potential to develop into many different cell types in the body. Serving as a sort of repair system for the body, they can theoretically divide without limit to replenish other cells as long as the person or animal is still alive. When a stem cell divides, each new cell has the potential to either remain a stem cell or become another type of cell with a more specialized function, such as a muscle cell, a red blood cell, or a brain cell.

**NEW** [Watch a QuickTime video of stem cells dividing](#)

The pages linked below cover basic information about stem cells. For a more detailed discussion, see our [Stem Cell Reports](#). Or you can check the [Frequently Asked Questions](#) page for quick answers to specific queries.

Throughout **Stem Cell Basics**, the first reference to a [Glossary](#) term on a page appears in **bold, underlined maroon** type. Clicking on the term will open its definition from the Glossary page in a new window.

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- [Introduction](#)
- [What are the unique properties of all stem cells?](#)
- [What are embryonic stem cells?](#)
- [What are adult stem cells?](#)
- [What are the similarities and differences between embryonic and adult stem cells?](#)
- [What are the potential uses of human stem cells and the obstacles that must be overcome before these potential uses will be realized?](#)
- [Where can I get more information?](#)

# Stem cells

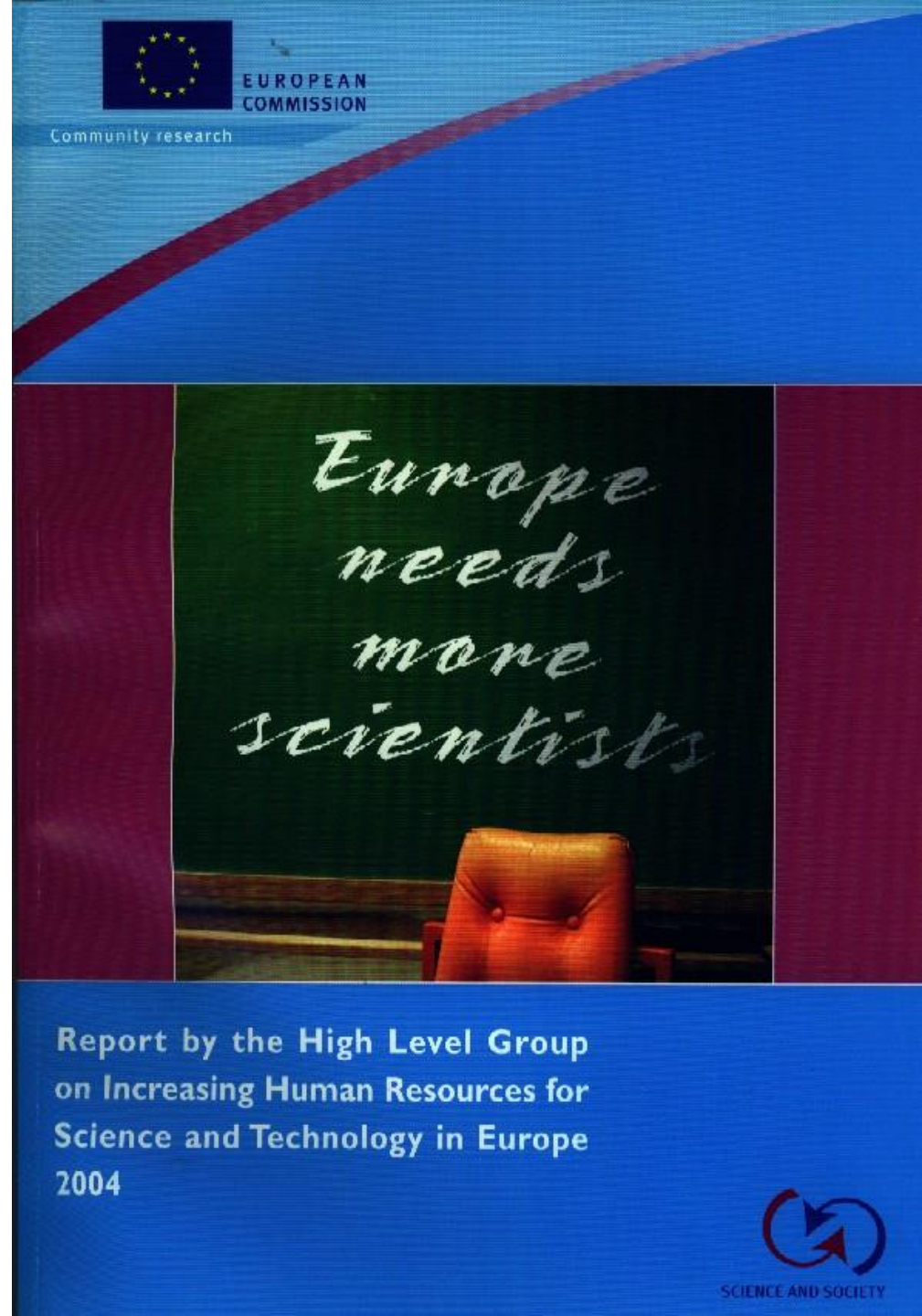
- As cells in an embryo divide, they become specialized and are no longer able to turn into any kind of adult cell
- Up to about 8 cell divisions, cells do retain the ability to develop into any adult cell, and hence are called stem cells
- The most promising way to obtain stem cells is to harvest them from an embryo, killing the embryo in the process



# Scientific literacy

Scientific literacy is a matrix of knowledge needed to understand enough about the physical universe to deal with issues that come across our horizon, in the news or elsewhere.

# Recruitment and interest in S&T: A prime political concern for Europe and (most) OECD Countries...



It can be argued that science education in schools lives in a world of its own. It seems unsophisticated because it is unable to compete with advances within the scientific fields. It is abstract because it is trying to put forward fundamental ideas, most of which were developed in the 19th century, without sufficient experimental, observational and interpretational background....

...without showing sufficient understanding of their implications, and without giving students the opportunity of a cumulative development of understanding and interest. It is heavily in danger of being excessively factual because of the explosion in scientific knowledge and the “adding-on” of topics to an already excessive content base.

Europe needs more scientists, 2004

# Science Education NOW

## A Renewed Pedagogy for the Future of Europe

Michel Rochard (Chair)

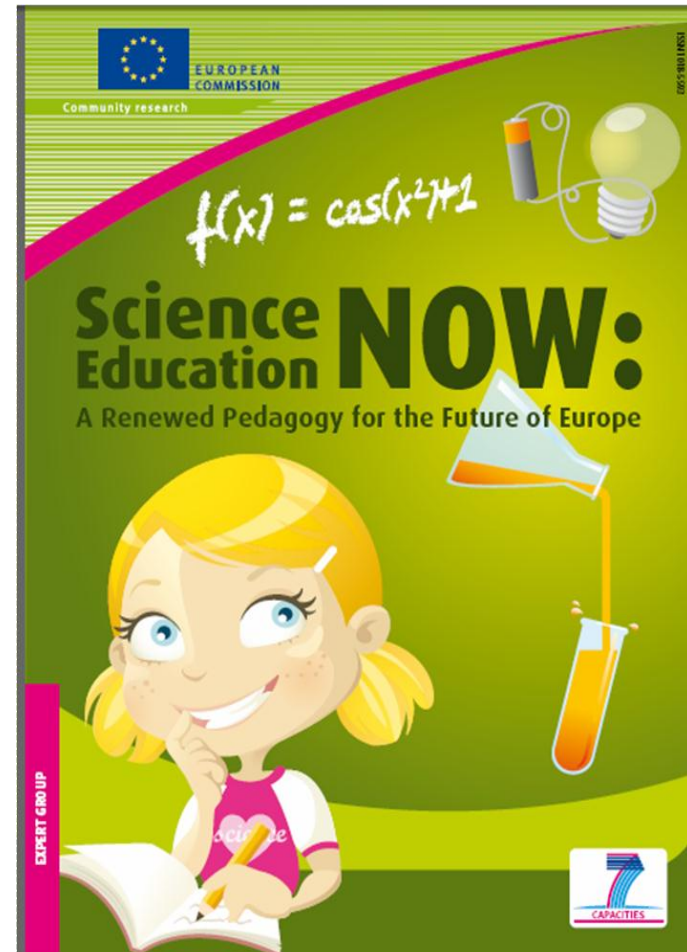
Peter Csermely

Doris Jorde

Dieter Lenzen

Harriet Walberg-Henriksson

Valerie Hermmo (rapportur)

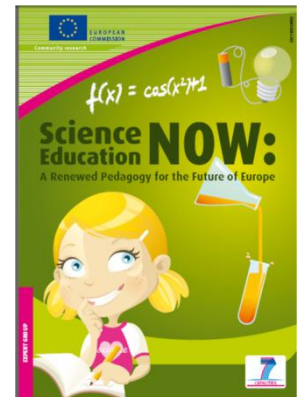


# Background for the report

- Decline in student interest in science, math and technology in Europe
- Modest improvements in Europe despite numerous projects
- Future of SMT important in Europe

# Recommendations

- Science education must be improved at all levels
- The introduction of [inquiry based approaches](#) in schools should actively be promoted
- Specific attention should be given to raising the participation of girls in key school science subjects





# Inquiry Based Science Teaching

The intentional process of:

- diagnosing problems,
- critiquing experiments,
- distinguishing alternatives,
- planning investigations,
- researching conjectures,
- searching for information,
- constructing models,
- debating with peers,
- forming coherent arguments

[Linn, Davis and Bell 2004](#)

# Science Education in Europe

A report to the Nuffield Foundation

Jonathan Osborne & Justin Dillon

- [http://www.nuffieldfoundation.org/fileLibrary/pdf/Sci Ed in Europe Report Final.pdf](http://www.nuffieldfoundation.org/fileLibrary/pdf/Sci%20Ed%20in%20Europe%20Report%20Final.pdf)

# Science Education in Europe

- Leading science educators from across Europe gathered to discuss the state of science education in the EU
- Four central themes
  - Teacher supply, training and teacher retention
  - Pedagogy
  - Curriculum
  - Assessment

# Questions Asked

- What are the major issues confronting formal secondary science education?
- What evidence is there?
- Is the situation common throughout Europe or is there variation?

# The State of Science Education in Europe

- Relevance is lacking
- Reforms in Pedagogy needed
- Girls less interested than boys with fewer choosing careers in physical science and engineering
- Reforms in curriculum needed (more human content)

# Recommendation 1

- The primary goal of science education across the EU should be to educate students both about the major explanations of the material world that science offers and about the way science works. Science courses whose basic aim is to provide a foundational education for future scientists and engineers should be optional.

## Recommendation 2

More attempts at innovative curricula and ways of organizing the teaching of science that address the issue of low student motivation are required. These innovations need to be evaluated. In particular, a physical science curriculum that specifically focuses on developing an understanding of science in contexts that are known to interest girls should be developed and trialled within the EU.



# Recommendation 3

- EU countries need to invest in improving the human and physical resources available to schools for informing students, both about careers *in* science – where the emphasis should be on why working in science is an important cultural and humanitarian activity – and careers *from* science where the emphasis should be on the extensive range of potential careers that the study of science affords.

# Recommendation 4

EU countries should ensure that:

- Teachers of science of the highest quality are provided for students in primary and lower secondary school;
- Emphasis in science before 14 should be on engaging students with science and scientific phenomena. Evidence suggests that this is best achieved through opportunities for extended investigative work and “hands-on” experimentation and not through a stress on the acquisition of canonical concepts.

# Recommendation 5

Developing and extending the ways in which science is taught is essential for improving student engagement. Transforming teacher practice across the EU is a long-term project and will require significant and sustained investment in teacher professional development.



## Homepage

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The key concept of this project is inquiry-based teaching of secondary school science. Research and development done in Europe in the area of inquiry-based science teaching (IBST) is abundant, however, the knowledge is spread and indistinct, and thereby not utilised to its full potential by teachers and educators throughout Europe. The project will gather, exchange, develop and disseminate ideas of good practices in IBST.



# Recommendation 6

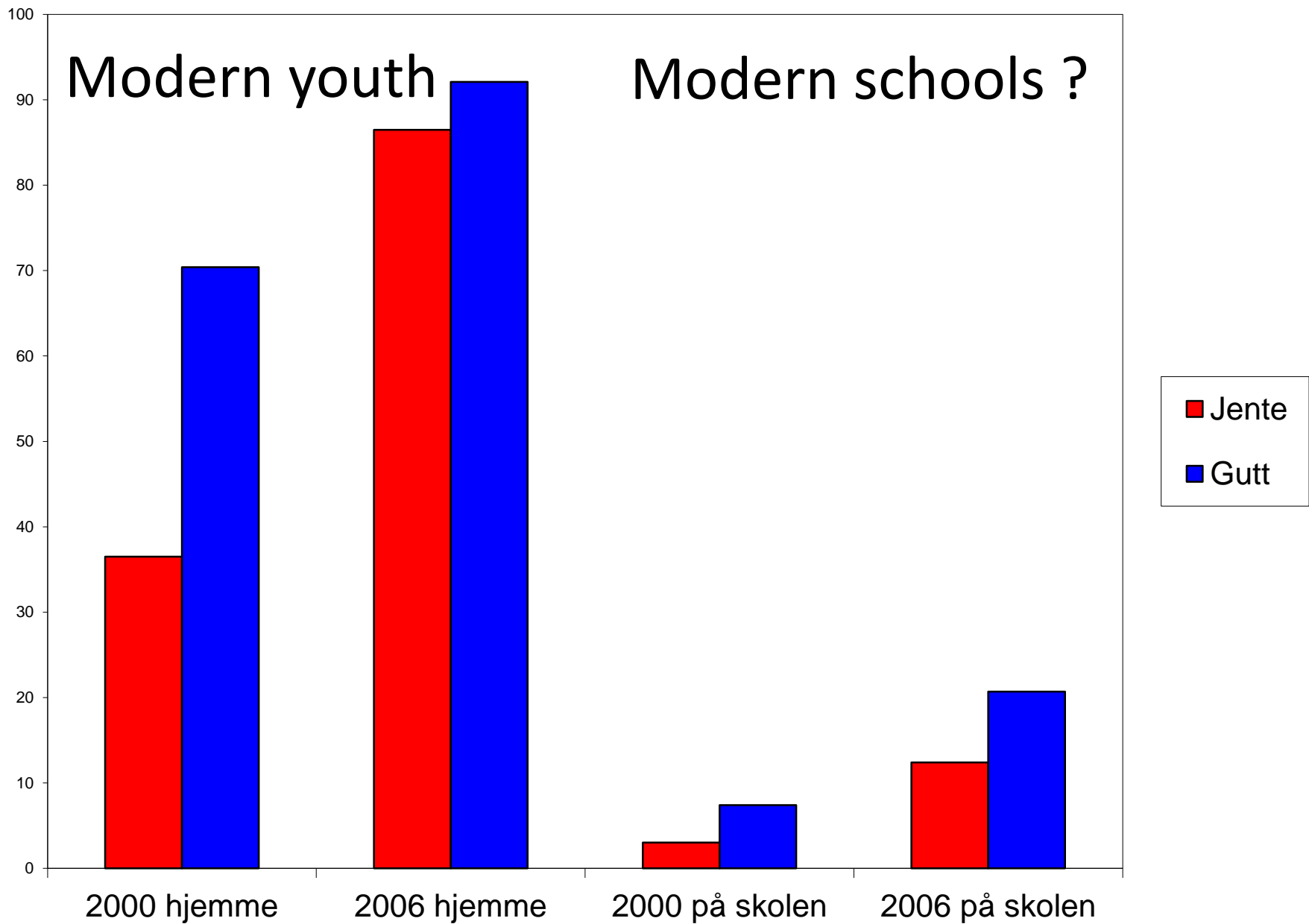
Good quality teachers, with up-to-date knowledge and skills, are the foundation of any system of formal science education. Systems to ensure the recruitment, retention and continuous professional training of such individuals must be a policy in Europe.

# Can ICT contribute to ways of teaching science well?



# Modern youth

# Modern schools ?





# Why ICT in Science Teaching?

- Direct link between current science and school science (access)
- Animation and simulation helpful for understanding complex ideas in science
- Possibility for virtual experiments
- Encourages collaboration and communication
- Motivation – modern youth

# Teaching and learning have changed!

- Role of the curriculum
  - Inquiry based learning
  - Learning in real world contexts
  - Learning takes place also outside of the classroom
- Role of the teacher
  - Assessment ongoing
- Role of the student
  - Increased collaboration

# Challenges and opportunities

- Modern kids deserve a modern curriculum
- Engaging students in the curriculum
- Seeing new potentials of ICT
- Developing new forms of assessment
- Building on “out-of-school” learning environments



## Northern lights

<http://northernlights.viten.no>

## Global warming

<http://globalwarming.viten.no>

## Gene technology

<http://genetechnology.viten.no>

## [Naturfag.no](http://naturfag.no)

Web site for science teacher resources  
(teaching programs, experiments, videos,  
animations)

Where and when can we see the northern lights? The auroral oval

### The auroral oval

The northern lights occur in an oval around the earth's magnetic pole and rotate along with it. The interaction between the solar wind and the earth's magnetic field leads to the oval being pushed towards the night side of the earth.

The earth rotates around the geographic North Pole and brings different places under different parts of the auroral oval.

At which time of day does the auroral oval lie along the coast of Northern Norway?

- 1
- 2
- 3
- 4
- 5
- 6

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Global warming: Climate changes in the Arctic

### Climate changes in the Arctic

Temperatures increased twice as much in the Arctic as they did in the rest of the world. According to the major research initiative (ACIA), future warming will also be especially dramatic here. The polar bear will be particularly at risk.

How do you think the temperature increase in the Arctic can affect people and animals in the region? Will climate changes in the Arctic affect the rest of the world?

### Observed temperature in the Arctic from 1900 to 2000:

Year	Temperature (°C)
1900	-1.0
1920	-0.5
1940	0.0
1960	0.5
1980	1.0
2000	1.5

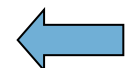
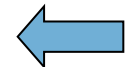
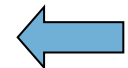
Source: ACIA

- 1
- 2
- 3

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Overview of the available Viten programs and corresponding number of registered student users (viten.no)

Year (Launched)	Program	Student users by June 2008
2002	Radioactivity	59 369
	Wolves in Norway	17 768
	Cycles of malaria	8 546
	Plants in space	24 356
2003	Earth processes	31 000
	Bears	9 244
	Hydrogen as energy source	22 056
2004	Gene technology	90 182
	Cloning of plants	11 357
	Health up in smoke	18 875
2005	Global warming	20 689
	Dinosaurs and fossils	8 557
2006	Northern lights	17 981
	<b>Total</b>	<b>339 980</b>



## Seventh Research Framework Programme (FP7)

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### Science in Society

#### Highlights

- **The call for proposals on Science Education (Science in Society-2008-3) was published on 21 April with a deadline of 24 July 2008. The separate planned call for proposals on science prizes (Science in Society-2008-2) has been cancelled.**

- [Highlights in 2007](#)

The European Commission published an annual report with the highlights of the programmes "Socio-economic Sciences and Humanities" and "Science in Society"

- [The synopses of projects funded under the FP6 Science and Society programme are published](#)

The document presents the synopses of over 130 projects with information on participating institutions and funding.

- [European Commission and research integrity](#)

[more highlights](#)

#### Objective

With a view to building an effective and democratic European knowledge-based society, the aim is to stimulate the

#### News

[First FP7 social sciences and science in society projects announced](#)

[Date: 2008-01-07]

[Science and space prioritised at Africa-EU summit](#)

[Date: 2007-12-10]

[more news](#)

#### Events

[KNOWING Conference on "The politics of knowing: research, institutions and gender in the making"](#)

This conference is organised at the occasion of the closing of the FP6 research project KNOWING - Knowledge, Institutions and Gender: an East-West Comparative Study. It will take place in Prague on 27-28 November 2008.

Deadline for registration: 30 September 2008.

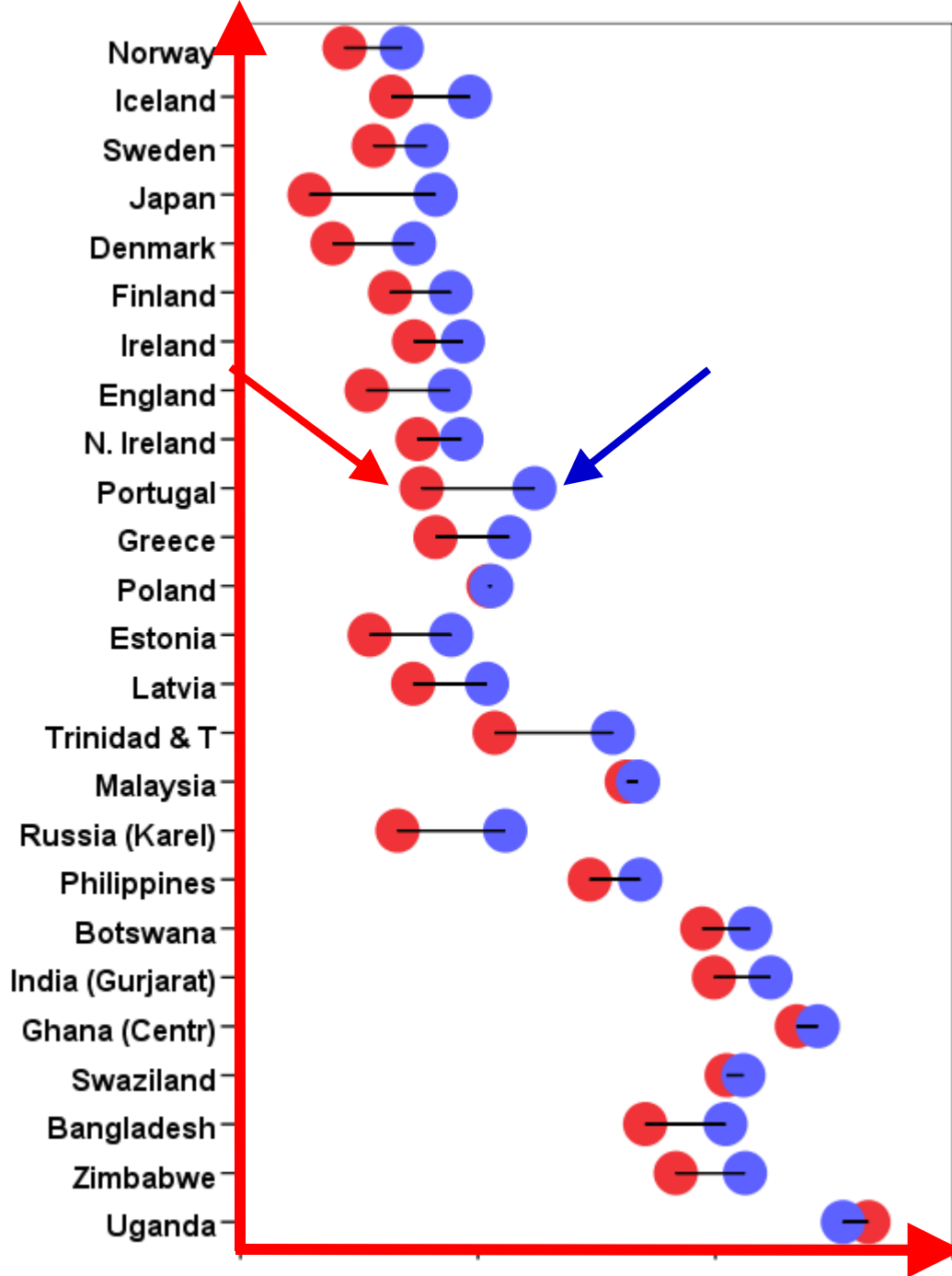
[ESF conference on European state system and reform](#)

A conference entitled 'Reforming the European State System in the Long Eighteenth Century' will be held in

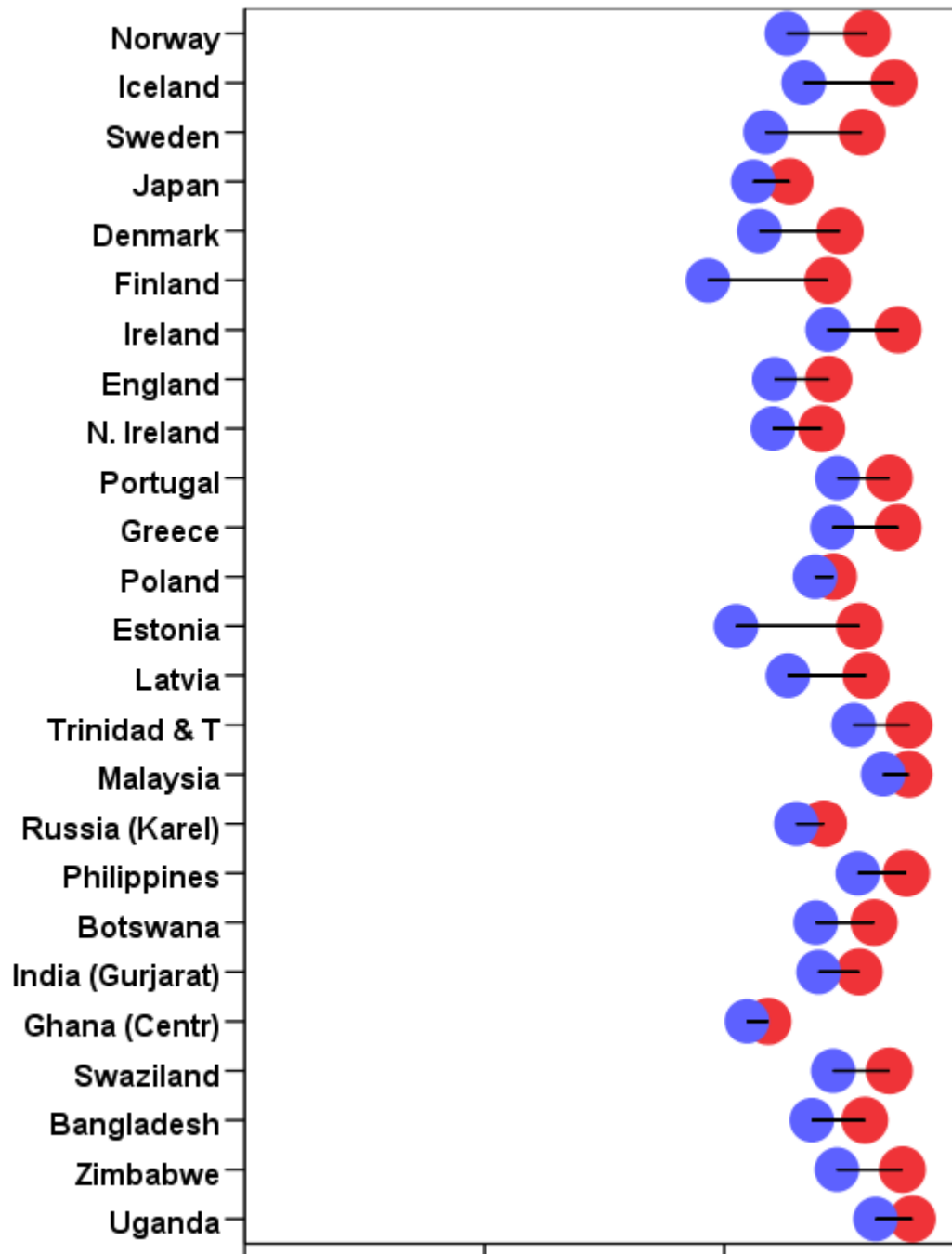




**ROSE** is an international comparative research project meant to shed light on factors of importance to the learning of science and technology (S&T) – as perceived by the learners. Key international research institutions and individuals work jointly on the development of theoretical perspectives, research instruments, data collection and analysis.



I would like to become a scientist



Working with  
something  
I find  
important and  
meaningful