



[www.nanoforum.org](http://www.nanoforum.org)  
*European Nanotechnology Gateway*

# NanoForum – EU portal for Information on Nanosciences and Nanotechnologies

Mark Morrison  
NanoForum Coordinator  
Institute of Nanotechnology

EMERGING TECHNOLOGIES  
NEW SKILL NEEDS IN THE FIELD OF NANOTECHNOLOGY  
International workshop  
11-12 July 2005, Stuttgart, Germany



## What will I talk about?

1. Introduction to [nanoforum.org](http://nanoforum.org)
2. Events
3. Reports
4. EU survey on N&N



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## **What is NanoForum and what can you get from it?**

- consortium of 10 European organizations
- funded by the EC under FP5
- provides information to the nanotechnology community
- primary source of information is the website
- over 4000 registered users, 25 000 visits per month, 140 000 page impressions per month





Registered users area

www.nanoforum.org  
European Nanotechnology Gateway

Latest news

Glossary

Information on other EU projects

Links to training & investment opportunities

Database of European nanotech organizations

Publications

Events

**Registered users area**

**Latest News**

04 July 2005  
**EUV microscope explores nanoscale**  
A team of US, Russian and Ukrainian scientists is using a table-top extreme ultraviolet (EUV) illumination source to create an optical microscope that can image features as small as 100 nm.

04 July 2005  
**Nanotube bike enters Tour de France**  
This year's Tour de France will see cyclists from the Phonak Team use a bike with a frame containing carbon nanotubes.

01 July 2005  
**NanoDialogue project to engage the public in a debate on nanotechnologies and nanosciences**  
The development of nanotechnologies and nanosciences (N&N) is still at an early stage, though the market for nanotechnology-based products is expected to rise to hundreds of billions of euro by 2010.

29 June 2005  
**SilMatech and DGA presented the "dragonfly nanodrone" project at the Paris Air Show (Le Bourget).**  
In partnership with the French Defence National Agency (DGA), SilMatech (a CNRS and Franche-comté University spin off) presented its advanced nanomuscle technology applied on a bio inspired artificial insect.

28 June 2005  
**Ten-year nanotechnology plan proposed in Argentina**  
A ten-year strategy to strengthen and guide nanotechnology research and development in Argentina was proposed this month by the Argentinean congress's technology commission.

27 June 2005  
**Huge memory on tiny hard disks**  
A Dutch company shows that billions of mechanical nanolevers can be used to create huge nanomech memory on small harddisks.

[show more](#)

**Global Information**

- News
  - Articles
  - Events
  - Publications
  - Institutions
  - Calls & Programs
- Publications
  - NanoForum Consortium Education Catalogue for Higher Education in Nanotechnology
  - NanoForum Rapport issu de l'enquête en ligne réalisée par NanoForum sur la stratégie pour les nanotechnologies.
  - Ineke Malsch;Mireille Oud Outcome of the Open Consultation on the European Strategy for Nanotechnology
- reports
- Events
  - Past Events



All our information is fully searchable by keyword  
or category

## Technologies

Chemistry and  
environment

Fundamental  
research

Information devices

### **Nanobiotechnology**

- ▶ Biomolecules / Cells
- ▶ Diagnostic Systems
- ▶ Drug delivery systems
- ▶ Imaging
- ▶ Implantable systems
- ▶ Molecular motors
- ▶ Treatment
- ▶ Others

Nanomaterials

Tools and techniques

Others

## Industrial sectors

Chemistry / Materials

Construction

### **Consumer products**

- ▶ Automotive
- ▶ Computers
- ▶ Cosmetics
- ▶ Foods/beverages
- ▶ Health
- ▶ Household
- ▶ Optical components
- ▶ Textiles
- ▶ Others

Energy

Equipment  
engineering

Environment

Healthcare

Information and  
communication

Transport

Others

*or*

*or*



Extended Search



## University courses



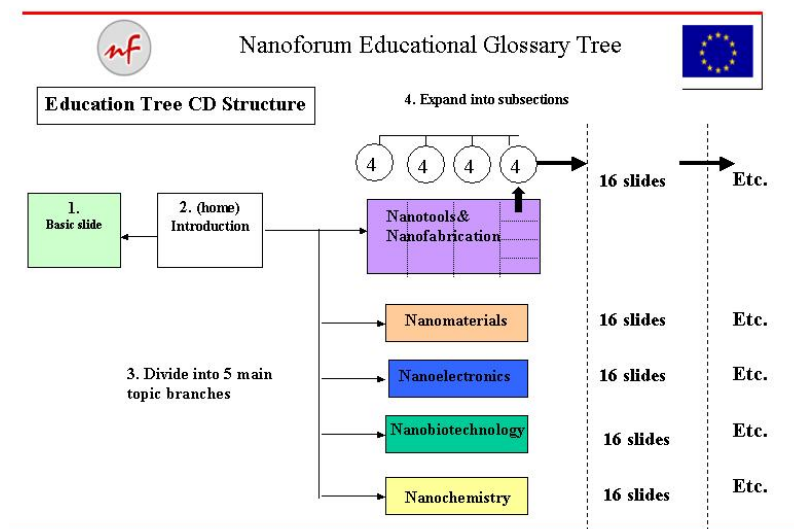
## Info for school pupils



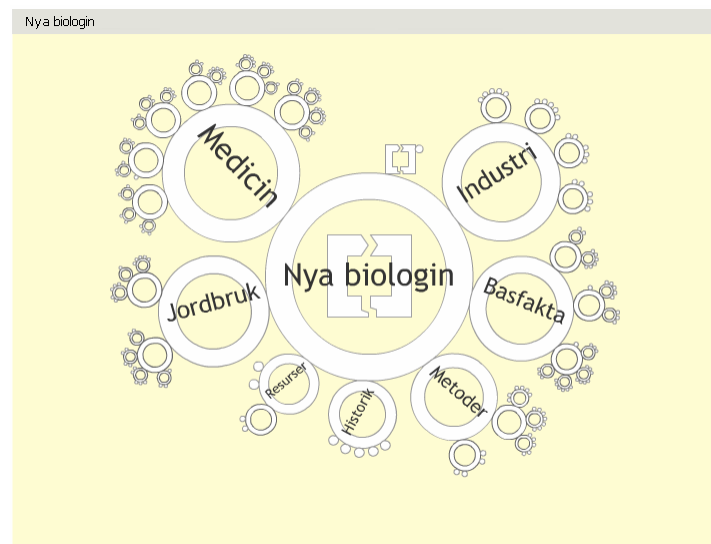


## Web-based information tools for education and training

In development:



In discussion with Forskning.se to develop a more interactive model.





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Our events provide information...



...from summer  
schools and  
graduate student  
days...



...to workshops...



...to industry and business  
conferences.



## Nanoforum Education and Training Events:



### **Summer school - Les Houches (14 - 26.9.03)**

59 students (22 from outside France). Lectures and practical sessions on solid-state physics, nano-mechanics, molecular machines, molecular assembly and biomolecular topics.

### **Graduate student information event – Grenoble (10 - 14.3.04)**

Attended by 30 European students (half from outside France).

Also supported the **ESONN summer school (August 2004)** to allow non-French participation.



## NanoForum Education and Training Events:



### **Graduate student information event – Birmingham (20.4.04)**

Included topics such as academic careers, further training (PhDs, post-docs, business and management training), careers in industry and government agencies. 40 attendees, 5 of whom were University careers advisors.

### **Summer School "Molecular Self-Assembly: Biomimetics as a route to novel products and processes" – Cambridge (6 – 10.9.04)**

Attended by 29 delegates from 13 different European countries and from academia, industry and government agencies. Covered topics from physical to life sciences, with two practical sessions at the Cambridge Nanoscience Centre.



## NanoForum Education and Training Events:



### **NanoCareerforum – Dresden (28 – 29.11.05)**

To be held in conjunction with NanoFair 2005. Aims to connect industrial needs with modern education through company presentations followed by more informal discussions with students.

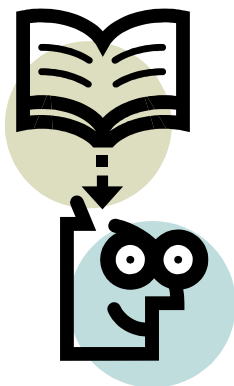


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All our publications are free to download...

...all you have to do is register on the website!



Other titles include:

- energy
- social, ethical and legal considerations
- health
- nanoanalytical and diagnostic tools and techniques
- candidate countries
- reports for SMEs
- outcome of the EU survey on N&N.



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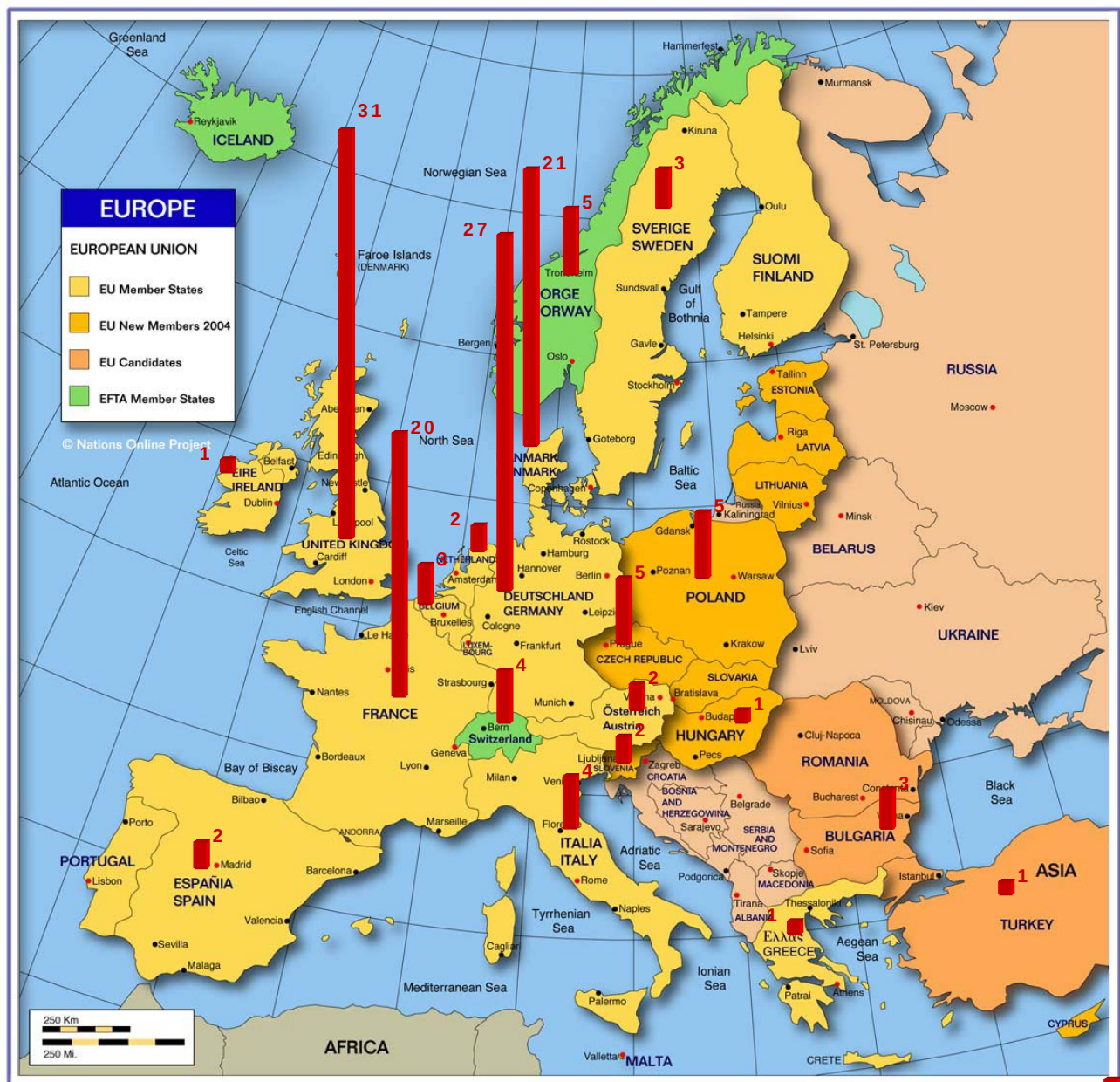
## Structure of report:

All courses show multidisciplinary and have strong N&N component.

Courses subdivided by country.

Courses subdivided by level: graduate, undergraduate and short courses.





**Total of  
144 N&N  
courses  
within 21  
EU and  
associated  
states**



The courses are divided into:

### Graduate level

(requires an undergraduate degree)



**91 in total**

### Undergraduate level

(first degree at University)



**28 in total**

### Short courses

(summer schools and courses of up to a few weeks duration)



**25 in total**

## DENMARK

### Short Courses

**Degree/Course Title:**

Bionano tools and protein structure

**Duration:**

1 - 2 week intensive course

**Location:**

Aarhus University, iNANO

**Overview:**

In this course the student will be introduced to a number of analytical measurement and analytical tools used for the structure-function analysis of biological macromolecules – or biological nanomachines such as functional proteins, membrane pumps and channels. Through a combination of lectures and exercises/demonstrations the course will describe X-ray crystallography, liquid- and solid-state nuclear magnetic resonance (NMR) spectroscopy, (cryo-) electron microscopy (EM), confocal microscopy, surface plasmon resonance, circular dichroism (CD), mass spectroscopy, atomic force microscopy (AFM), small-angle scattering of X-rays and neutrons (SAXS and SANS), and fluorescence resonance energy transfer (FRET). The course will furthermore describe various numerical methods for protein structure analysis and prediction.

**Pre-Requisites:**

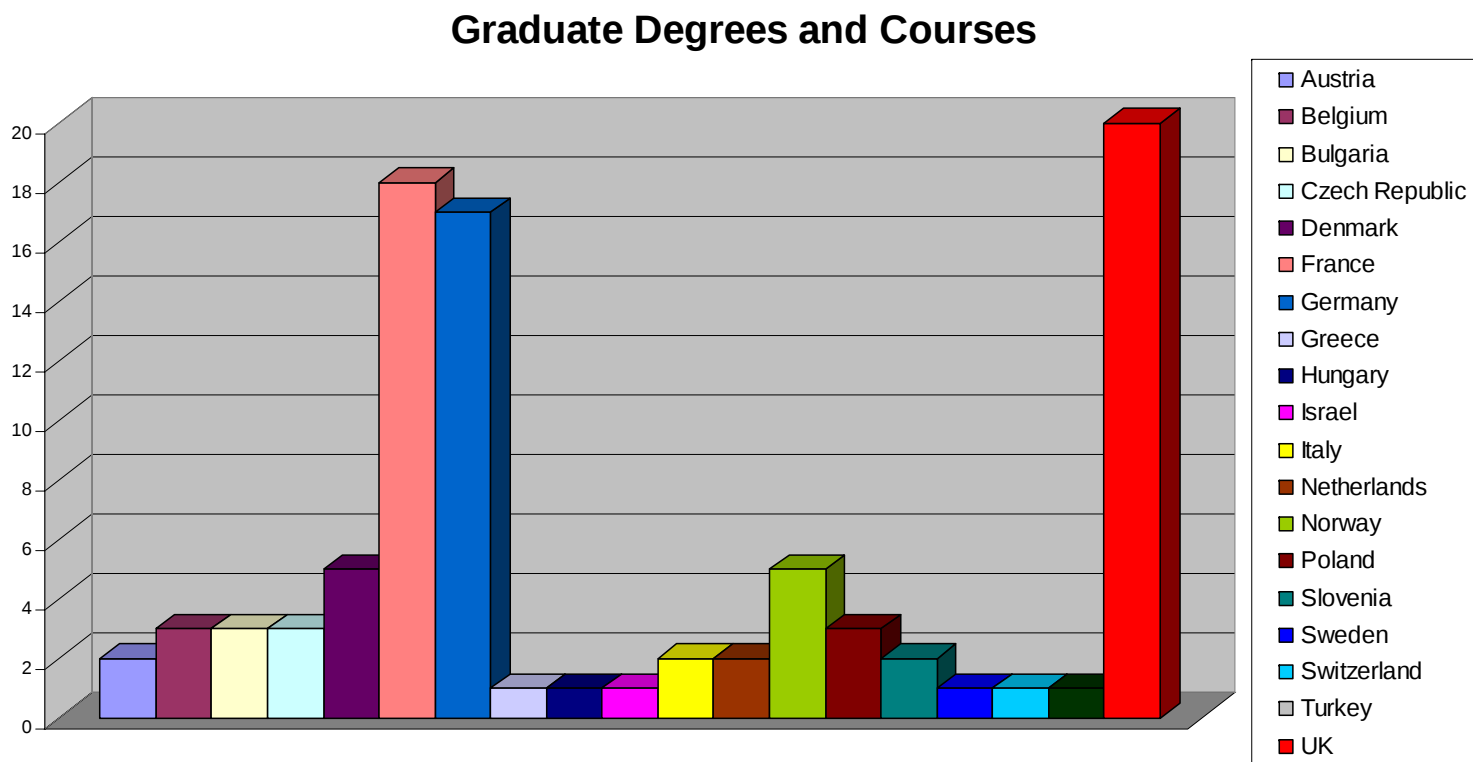
The students expected to apply for an iNANOschooL scholarship have a background in traditional combinations of Biology, Molecular Biology, Chemistry, and/or Physics or alternative combinations with other fields such as Mathematics, Economy, Medicine, Pharmaceutics, Biotechnology or Materials Science.

**Tuition fees:****Contact details**

Faculty of Science  
Ny Munkegade, Building 520  
University Interdisciplinary Nanoscience Center (iNANO)  
The University of Aarhus  
8000 Aarhus C  
Tel: +45 8942-3586  
[inano@inano.dk](mailto:inano@inano.dk)  
[www.inano.dk](http://www.inano.dk)



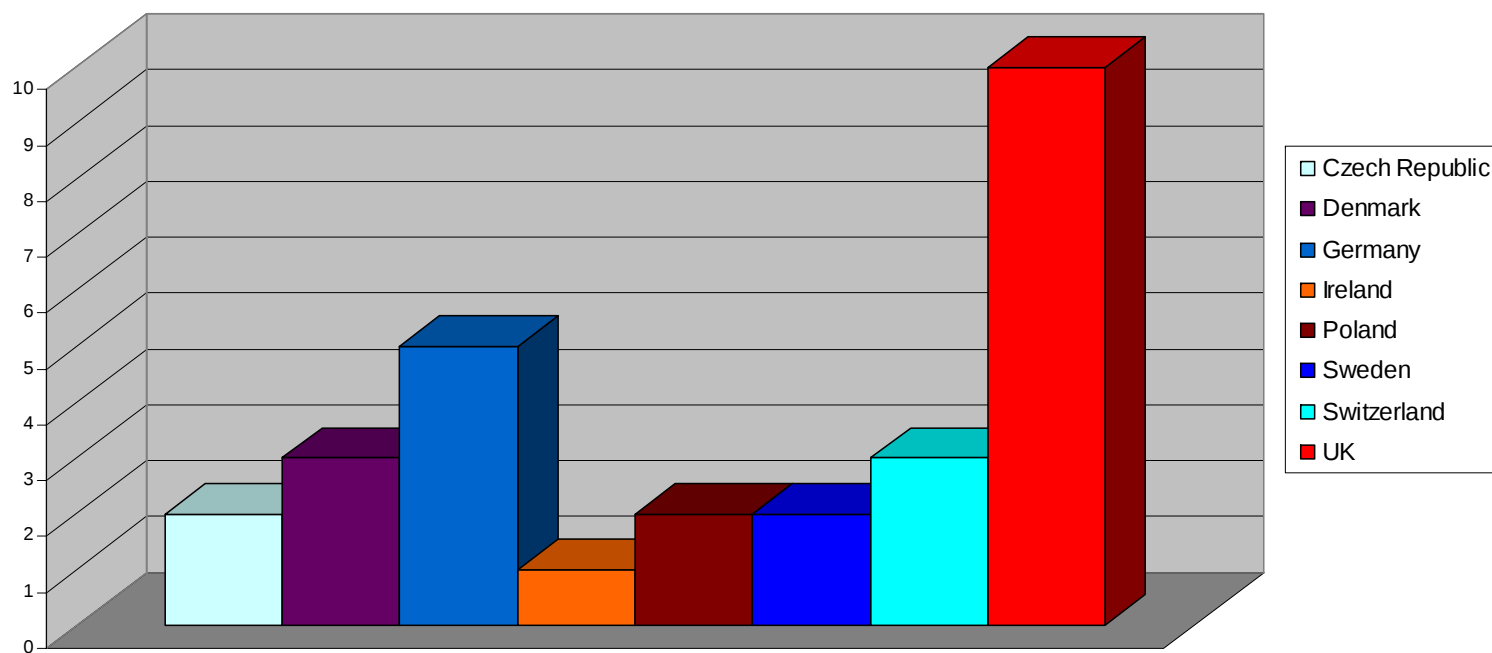
19 countries within the EU and associated states offer graduate-level courses





8 countries within the EU and associated states offer undergraduate-level courses

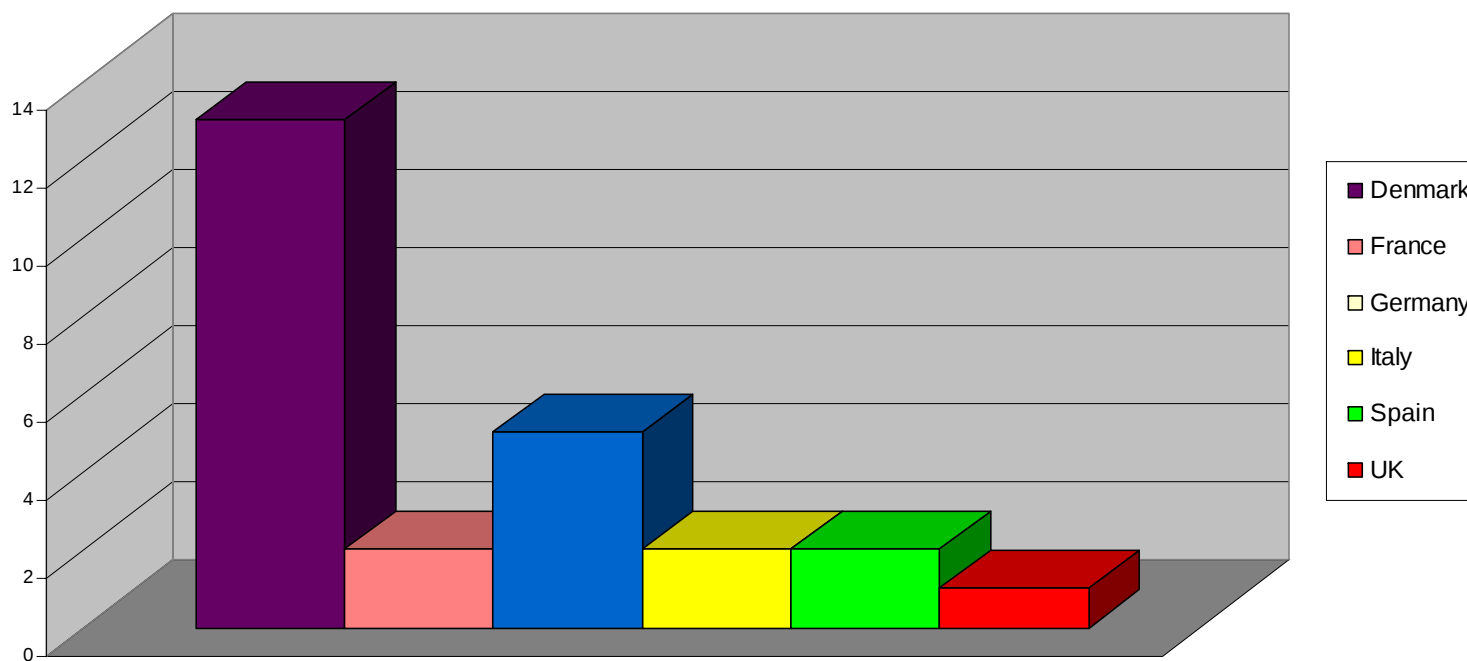
### Undergraduate Degrees and Courses





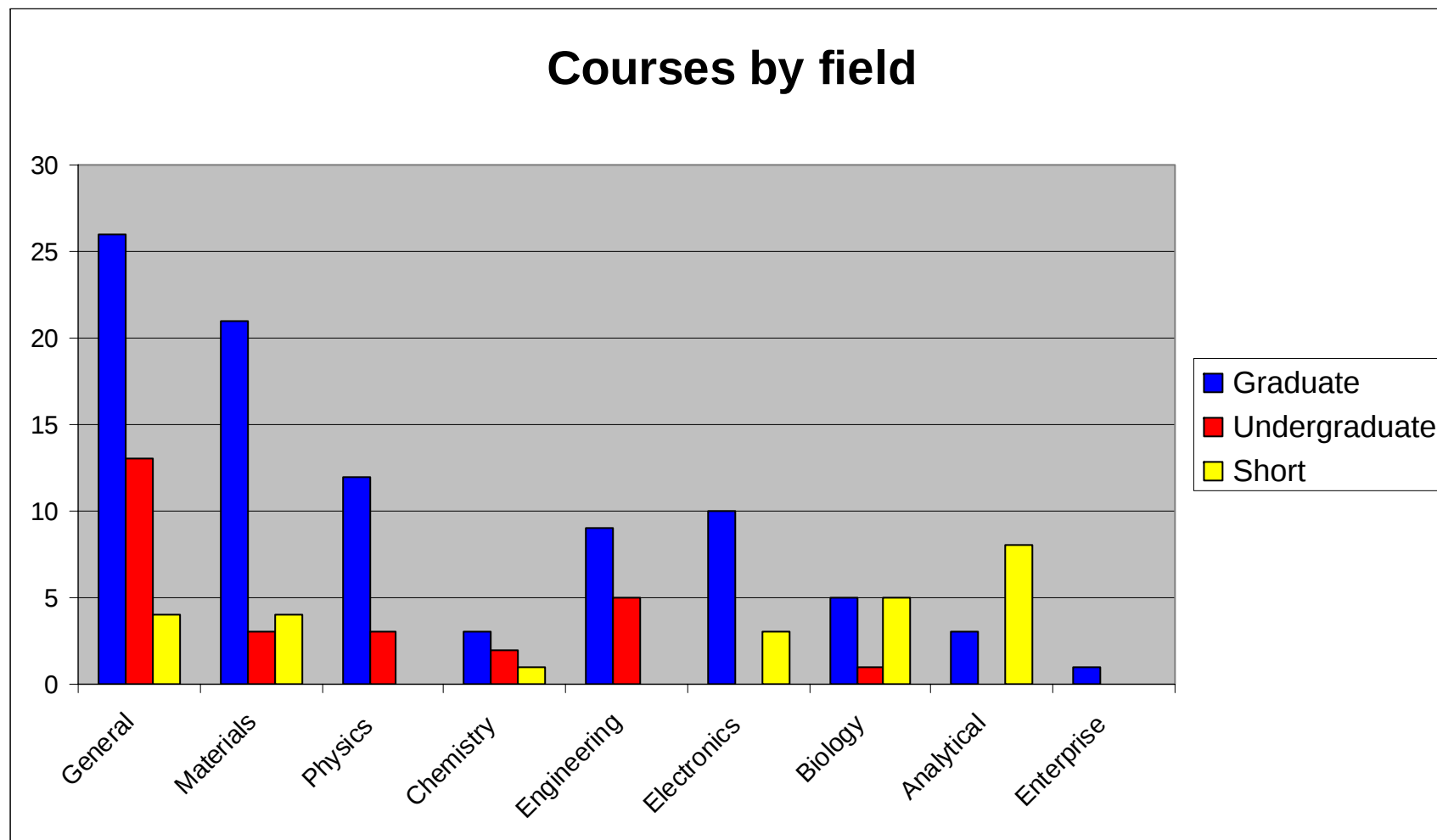
6 countries within the EU and associated states offer short courses

### Short Courses





## Breakdown of courses by main disciplinary field





## E-learning

### University of Kaiserslautern

Certificate in Nano-Biotechnology (Distance Education Program Nano-biotechnology) – 1 year duration.

Combination of online e-learning and residential practical courses.

### The Open University (UK)

Engineering Small Worlds: Micro and Nano Technologies – 8 months duration.

Can be taken as part of an OU undergraduate degree eg BEng or MEng.

## GERMANY

### Graduate Degrees & Courses

**Degree / Course Title:**  
Certificate in Nano-Biotechnology (Distance Education Program Nano-biotechnology)

**Duration:**  
1 year

**Location:**  
University of Kaiserslautern, Germany

**Overview:**  
The online-based course for natural scientists and engineers consists of a combination of distance education parts (off-campus) and residential phases on weekend (on-campus). Learning material suitable for self-instruction and multimedia-based learning units will be available to the participants. The certificate is obtained by means of written tests and of tasks to be sent in regularly over the two semesters. The course language is English. This unique offer in Germany combines the most modern educational devices and makes it possible to acquire high-level scientific knowledge.

**Pre-Requisites:**  
Postgraduates with natural sciences or engineering background are admitted to the distance education on nano-biotechnology.

**Tuition Fees:**  
1400€.

**Contact details:**  
Contact Person: Dr. Maria Elisabetta Berbenni, Tel. +49 (0)631 205 4941  
Email: [berbenni@chrk.uni-kl.de](mailto:berbenni@chrk.uni-kl.de)  
Website: <http://ecampus.zfuw.uni-kl.de/nano-engl/nbe-top.html>



## Enterprise training

### University of Cambridge

MSc. in Micro- and Nanotechnology Enterprise Degree

Includes courses on life and physical sciences, nanofabrication, setting up a company, and the societal and ethical aspects of nano- and biotechnology.

### iNANO

Offers 1-2 week intensive courses on commercialization and entrepreneurship to its students.

UK

#### Graduate Degrees & Courses

**Degree /Course Title:**

MSc. in Micro- and Nanotechnology Enterprise Degree

**Duration:**

10 months

**Location:**

Dept. of Materials Science, Cambridge University, Cambridge CB2 3QZ, UK

**Overview:**

This international programme will bring together outstanding individuals from all over the world who intend to pursue a career at the interface of technology and business.

This programme has been developed by the [Nanoscience Centre](#) at the University of Cambridge in association with the Judge Institute of Management at the University of Cambridge. The programme is part of a suite funded by the Professional Practice Programme of the Cambridge-MIT Institute ([CMI](#)).

The pages on the left give you information about the course structure and contents and details of the application procedure.

**Pre-Requisites:**

All applications for admission to this Master's programme should initially be made through the Board of Graduate Studies from whom an application package, including application forms and Graduate Studies Prospectus, can be obtained via <http://www.admin.cam.ac.uk/offices/gradstud/>. Completed application forms should be sent to: The Board of Graduate Studies, University of Cambridge, 4 Mill Lane, Cambridge, CB2 1RZ. There is no formal deadline for applications but they should reach us as soon as possible to avoid delaying the process. [The Graduate Studies Prospectus contains information about the various funding](#) schemes for which you might be eligible.

**Tuition Fees:**

A number of bursaries are likely to be available for this course. For UK students these will pay full fees and maintenance for the programme. For European Union Students, the bursary would cover University and College fees. For further information please email [nanoenterprise@msm.cam.ac.uk](mailto:nanoenterprise@msm.cam.ac.uk).

**Contact details:**

Contact Person: Dr. Rosie Ward

Master's Programme in Micro- and Nanotechnology Enterprise

Department of Materials Science

Pembroke Street, Cambridge CB2 3QZ, UK

Email: [nanoenterprise@msm.cam.ac.uk](mailto:nanoenterprise@msm.cam.ac.uk)

Website: <http://www.msm.cam.ac.uk/nanoenterprise/index.html>



## What will I talk about?

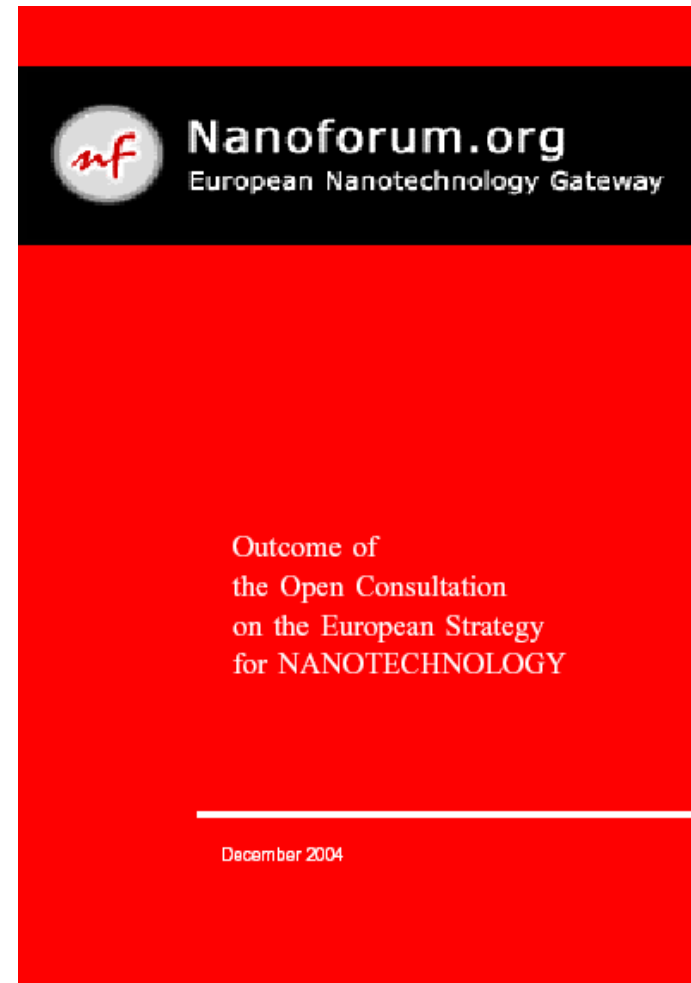
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## What does the EU N&N community want?

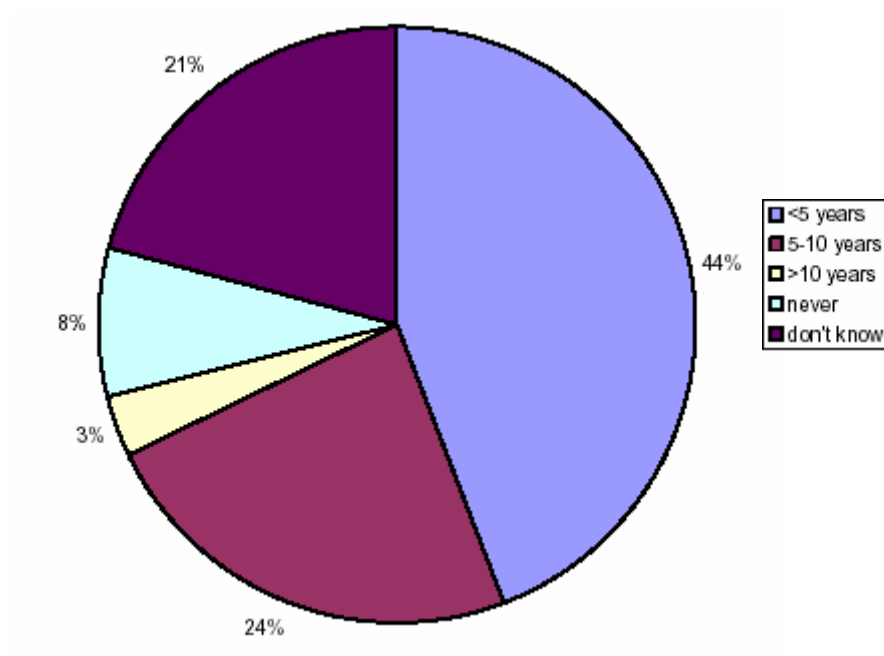
Between August and October 2004 NanoForum conducted a survey in collaboration with the EC to determine the community's opinions on a number of issues related to N&N development and the EC's strategy for Nanotechnology.

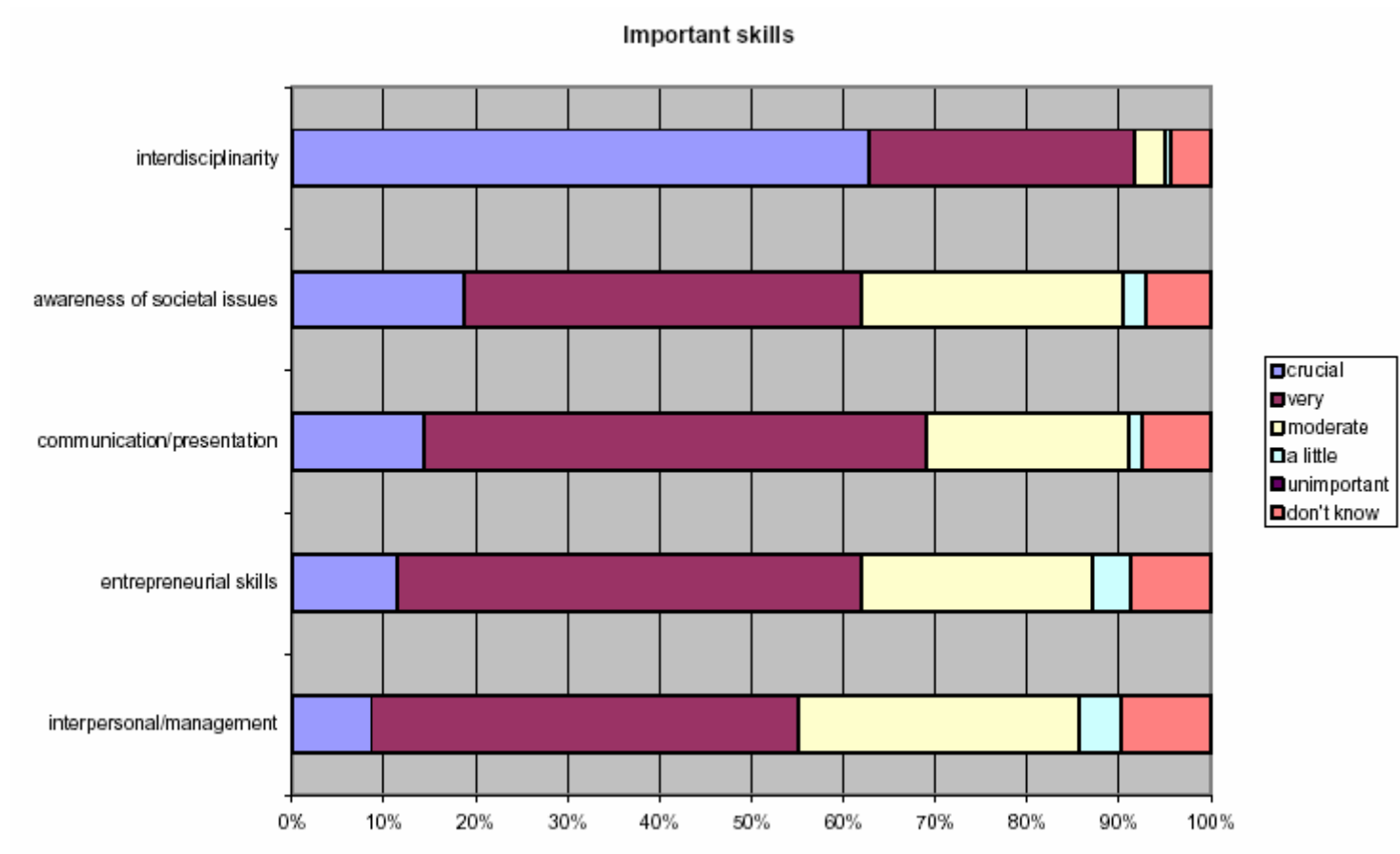
- total of 749 responses
- 93% from 32 European states
- specific questions on human resources (education and training)

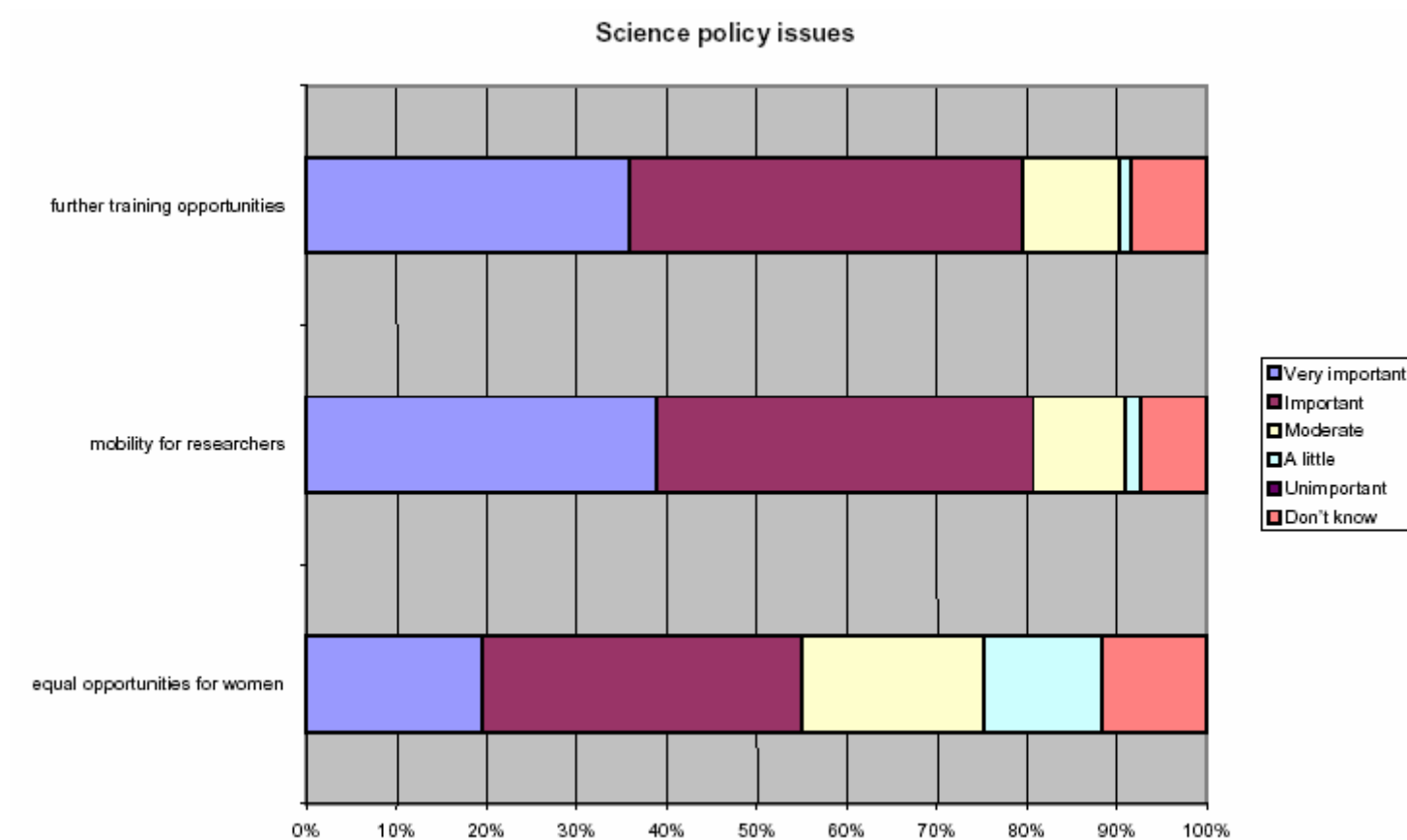




### Shortage of Nanoscientists and Nanotechnologists









## **Specific comments**

- web-based learning and training should be made available.
- summer schools / short residential courses for practical training.
- more emphasis on ethics during training.
- creation of EU institutions for training, centres of excellence and sharing of best practices.
- only 9 respondents saw **no** need for specific nanotechnology education.



## Conclusions

1. EU and associated states have a number of N&N courses (144, Dec. 2004)
2. Majority are graduate level
3. Countries such as France, Germany and UK lead the way
4. Many traditional courses are being adapted to give a broader, more multidisciplinary approach
5. Collaboration between institutions and online learning impacting N&N education
6. Need to address long-term training and education needs (including life-long learning and mobility)



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Please send news, details of events and other information you want to share with the community to

[mark@nano.org.uk](mailto:mark@nano.org.uk)

Remember to register on the website!



Thank you!



UK



Germany



France



Spain



Netherlands



Austria



Turkey



Poland



Bulgaria



Netherlands