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European Nanotechnology Gateway

**Nanotechnology in the EU  
– Bioanalytical and  
Biodiagnostic Techniques.**

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September 2004

# **Nanotechnology in the EU – Bioanalytical and Biodiagnostic Techniques**

A Nanoforum report, available for download from [www.nanoforum.org](http://www.nanoforum.org).

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# Nanotechnology in the EU – Bioanalytical and Biodiagnostic Techniques

Nanotechnology in the EU – Bioanalytical and Biodiagnostic Techniques .....	2
1 Object of this report .....	5
2 About Nanoforum.....	6
2.1 What is nanotechnology? .....	7
2.2 Present and future of nanotechnology in diagnostics and analytics .....	7
2.3 Key techniques and equipment .....	9
2.3.1 Arrays/biochips .....	9
2.3.2 Lab-on-a-chip .....	12
2.3.3 Imaging .....	13
2.3.4 Metrology .....	15
2.3.4.1 Scanning Probe Microscopes .....	15
2.3.4.2 Quantum Dots.....	16
2.3.4.3 Surface Plasmon Resonance .....	18
3 European Initiatives .....	19
4 Austria .....	22
5 Belgium.....	25
6 Bulgaria.....	27
7 Croatia .....	28
8 Cyprus .....	28
9 Czech Republic .....	29
10 Denmark .....	30
11 Estonia .....	35
12 Finland .....	37
13 France.....	40

14	Germany .....	48
15	Greece .....	69
16	Hungary .....	72
17	Iceland .....	73
18	Ireland .....	73
19	Israel .....	76
20	Italy .....	78
21	Latvia .....	82
22	Lithuania .....	84
23	Liechtenstein .....	86
24	Luxembourg .....	87
25	Malta .....	87
26	Netherlands .....	88
27	Norway .....	91
28	Poland .....	91
29	Portugal .....	94
30	Romania .....	94
31	Slovakia .....	97
32	Slovenia .....	98
33	Spain .....	99
34	Sweden .....	100
35	Switzerland .....	103
36	Turkey .....	106
37	United Kingdom .....	107

# **1 Object of this report**

The aim of this report is to identify European organizations from both the private and public sectors that are using or developing analytical or diagnostic techniques, in biotechnology, medicine and related fields that are based on nanotechnology advances. Research exploiting and developing these technologies is central to the pharmaceutical and healthcare industries, which have combined global market values of several hundred billion euros each year. R&D in nanoanalytical and diagnostic techniques is however fragmented across Europe and if these activities were documented in a central resource, to which all interested parties could have ready access, then this would strengthen the European market with respect to that of other global regions.

## 2 About Nanoforum

This European Union sponsored (under FP5) Thematic Network provides a comprehensive source of information on all areas of nanotechnology to the business, scientific and social communities. The main vehicle for the thematic network is the dedicated website [www.nanoforum.org](http://www.nanoforum.org). Nanoforum encompasses partners from different disciplines, brings together existing national and regional networks, shares best practice on dissemination of national, EU-wide and Venture Capital funding to boost SME creation, provides a means for the EU to interface with networks, stimulates nanotechnology in underdeveloped countries, stimulates young scientists, publicises good research and forms a network of knowledge and expertise.

Nanoforum aims to provide a linking framework for all nanotechnology activity within the European Community. It serves as a central location, from which to gain access to and information about research programmes, technological developments, funding opportunities and future activities in nanotechnology within the community.

The Nanoforum consortium consists of:

The Institute of Nanotechnology (UK) <http://www.nano.org.uk>

CEA-Leti (France) <http://www-leti.cea.fr/uk/index-uk.htm>

CMP Cientifica (Spain) <http://www.cmp-cientifica.com/>

VDI Technologiezentrum (Germany) <http://www.vditz.de/>

Nordic Nanotech (Denmark) <http://www.nanotech.dk/>

MalschTechnoValuation (Netherlands) <http://www.malsch.demon.nl/>

BIT (Austria) <http://www.bit.ac.at/>

METU (Turkey) <http://www.physics.metu.edu.tr/>

Monte Carlo Group (Bulgaria) <http://cluster.phys.uni-sofia.bg:8080/>

Unipress (Poland) <http://www.unipress.waw.pl/>

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## **2.1 What is nanotechnology?**

Nanotechnology is the manipulation or self-assembly of individual atoms, molecules, or molecular clusters into structures to create materials and devices with new or vastly different properties. This can be achieved by reducing the size of the smallest structures to the nanoscale (e.g. photonics applications in nanoelectronics and nanoengineering) or by manipulating individual atoms and molecules into nanostructures, which more closely resembles chemistry or biology.

The definition of nanotechnology is based on the prefix "nano", which is from the Greek word meaning "dwarf". In more technical terms, the word "nano" means  $10^{-9}$ , or one billionth of something. To illustrate this, a virus is approximately 100 nanometres (nm) in size.

Nanotechnology opens a completely new world of opportunities and solutions in all kinds of areas. An example for daily use is copying the water and dirt-repelling effect of leaves of the Lotus flower, and to use it for applications like newly developed bathroom tiles and surfaces, windows and paints. Apart from the field of diagnostics and analytics, nanotechnology is already appearing in the textile industry, the energy sector, electronics and automotive industry, to name just a few.

## **2.2 Present and future of nanotechnology in diagnostics and analytics**

In the beginning, analytical and diagnostic research was performed most often by invasive techniques and optical microscopes. For example samples of blood or tissue had to be obtained and prepared for analysis. They were examined by light microscopy and compared to healthy tissue, so that differences in morphology could be identified and used to make a diagnosis.

Advances in research provided more powerful tools such as electron microscopes (that for example allow virus particles to be identified in tissue sections); immunological diagnostic kits that detect the presence of specific

pathogens, or antibodies to them, in samples; methods of detecting and differentiating between closely related organisms or genetic differences between normal and diseased samples by analysing DNA, RNA or protein sequence or expression; and equipment and compounds that allow imaging of internal organs without surgery.

Advances in nanotechnology are impacting existing technology and leading to the development of novel tools and techniques through improvements in precision and speed, lower sample requirements and the ability to perform multiple tasks in smaller devices (discussed further in section 2.3 Key techniques and equipment). New ultra small sensors (like lab-on-a-chip) are being developed that require less sample material, can perform sophisticated tests at the point of care (e.g. detection of metabolites or toxins in blood using a handheld device within a few minutes) and have the ability to multiplex (i.e. analyse a given sample for more than one variable simultaneously). Also, the molecular structure of living cells can be investigated in real time (and in the intact organism, or *in vivo*) as opposed to using laboratory prepared samples, which often results in cell death or alteration of morphology and cell function as a result of the isolation procedure and maintenance of cells in a laboratory environment (*in vitro*). Molecular analysis also includes arrays (for DNA, RNA, protein analysis), and sensors for detecting changes in the concentration of bio-molecules or pathogens. These are performed to quantify gene or protein expression (genomics and proteomics respectively), to allow a better understanding of function, interaction with other biomolecules or identification of diseases. Other application fields include pollution monitoring and food quality control (e.g. labels inside food wrappings that change their colour when the product expires) or to easily identify GM food.

Nanotechnology R&D by a number of companies and publicly funded organizations is driving this market forward. This report aims to list these institutions in Europe and will be regularly updated to reflect this rapidly advancing sector.



## 2.3 Key techniques and equipment

This section describes the main diagnostic and analytical techniques and equipment in more detail and the improvements that can be achieved through the application of nanotechnology. They can be loosely grouped into the following areas:

- 2.3.1 Arrays/biochips
- 2.3.2 Lab-on-a-chip
- 2.3.3 Imaging
- 2.3.4 Metrology

### 2.3.1 Arrays/biochips

Arrays and microarrays are used to analyse a large number of samples simultaneously. They have microscopic functionalised test tubes or spots, where each spot is designed to perform a distinct test. These reaction spots are arranged in arrays with up to 100,000 spots per cm<sup>2</sup>. Microarrays can be used to perform several tasks including genetic disease diagnosis, drug efficiency tests (high-throughput screening) and gene expression studies.



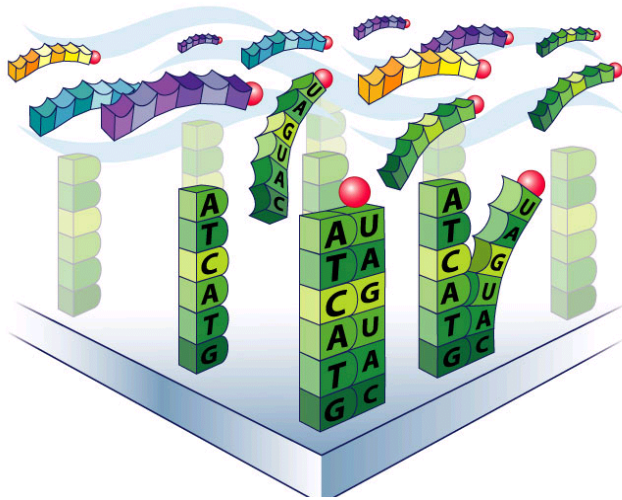
*Figure 1: Affymetrix Gene Chip® probe array. Image courtesy of Affymetrix.*

DNA functionalised microarrays represent one of the most prominent biochips exploiting the correlation of cell function and the expression of genes (Figure 1 depicts an Affymetrix Inc. GeneChip®). The operation principle of such DNA-chips can be understood by considering the process of events within a cell that converts genetic information, stored in a sequence of base pairs in DNA, into protein, i.e. gene expression. In this process DNA is copied first into messenger RNA (mRNA), a process called transcription. The mRNA then acts as a template for the synthesis of the particular protein (a process called translation), which fulfils the functional role of the gene.

DNA microarrays are the culmination of several decades of work that have seen:

- Southern blots in the 1970's (which is a labour-intensive and time-consuming method of detecting differences in DNA, and also requires the use of radioactive isotopes). Southern blots also require a large amount of sample material.
- The polymerase chain reaction (PCR) in the 1980's that utilises the cellular system to replicate DNA (including an enzyme called DNA polymerase) and specifically the heat-resistant DNA polymerase isolated from the *Thermus aquaticus* bacterium (which is found at hotspots on the ocean floor). PCR is several orders of magnitude more sensitive than Southern blots requiring only 10's of molecules or less, and also offering a faster turnaround.

In contrast to both these methods, arrays offer much higher throughput because of the parallel analysis – a large number of different genes or samples can be investigated on a single array simultaneously. DNA microarrays provide specific “addresses” for different oligonucleotides (short single-stranded sequences of DNA). Different single-stranded DNA fragments, representing the genes under investigation, are immobilised on a substrate in discrete spots (target). Each spot contains a large number of identical molecules increasing sensitivity. mRNA from samples to be tested are labelled, usually with a fluorescent dye, and then applied to the chip. At this stage, mRNA molecules (probe) that match the target oligonucleotides fixed to the chip will bind to these in a process called hybridisation, see Figure 2. Probes that do not have a complementary, single-stranded DNA target fixed to the chip, will not bind. Thus, only those spots where hybridisation takes place give rise to fluorescence, which can be read by optical means (fluorescence imager). The location and the intensity of fluorescent spots provide information about which genes have been expressed by the cell and to what degree, respectively.



*Figure 2: Schematic representation of the hybridisation of fluorescently tagged mRNA with their complementary single stranded DNA. Each spot on the biochip contains a huge number of identical molecules. Image courtesy of Affymetrix.*

DNA microarrays are made of a substrate that can be silicon, glass or nylon. The DNA is positioned with various methods like photolithography, contact and contact free printing methods. These methods produce spot sizes from 20µm to 200µm. However with nanotechnology advances in the form of a process called dip pen nanolithography (DPN) it is possible to deposit molecules onto the substrate with spot sizes down to 15nm. This utilises the atomically sharp tip of an atomic force microscope (AFM) to deposit molecules on the substrate surface (see 2.3.4.1 Scanning Probe Microscopes). In that way, arrays can be manufactured with features more than 1,000 times smaller than those used in conventional arrays. This leads to nanoarrays with more than 1 million times the density of current microarrays and a much greater throughput.

The DNA chip read out process is done predominantly using optical techniques, such as fluorescence microscopy. Alternatives to fluorescent tags include chemiluminescent/luminescent or radioactive markers. In the future the use of electrical signals is a possibility. However, fluorescent tags have the advantage of multiple colours and therefore multiplexing of experiments (see also 2.3.4.2 Quantum Dots).

### 2.3.2 Lab-on-a-chip

Nanotechnology can play a key role in meeting the demands of faster, cheaper and more accurate sensors. Biological samples can often be very difficult to obtain and therefore expensive or only available in small amounts for example blood or DNA samples for forensic investigation; specific metabolites, pathogens etc. Usually, sample analysis requires transfer to a laboratory, followed by multiple processing steps that require a lot of time and manpower, and each step of which can be prone to artefacts due to operator or instrument error. In many cases these analyses are vital for the correct treatment to be applied in the appropriate time frame.

Current research aims to perform all these individual steps within a single device, which also needs only a fraction of the sample, in amounts of femtolitres (equivalent to  $\mu\text{m}^3$ ). Such a device has been termed a Lab-on-a-chip (LOC) as it represents an entire laboratory on a single chip, made of glass, silicon or polymer substrate. It combines microfluidic and nanoelectrical systems that can mix, process and separate fluids in microchannels and provide sample analysis in real time.

Guiding fluids in micrometre-sized channels can be achieved in several ways such as electrohydrodynamic pumping, electro osmotic flow, electrowetting and thermocapillary pumping or temperature gradients<sup>1</sup>. Such an integrated LOC requires micro-engineered surface topographies or a chemical wetting contrast in combination with electronics, which are commonly referred to as micro electromechanical systems (MEMS). Further reducing of size leads to nano-electromechanical systems (NEMS). The creation of nanostructured surfaces is performed on a routine basis at present; however problems still arise from the guidance of ultra-small quantities of liquids in the pico- and attoliter range.

The analysis of nanoscaled objects, such as proteins or pathogens, can be achieved by multiple means; however a technique known as dielectrophoresis can be integrated into microfluidic systems for detection purposes. Dielectrophoresis (DEP) uses non-uniform alternating electrical fields to separate and to

guide small objects through field gradients. This manipulation requires high electrical field strength, which can be obtained using nanosized electrodes with feature sizes well below 100 nm. The first LOC devices are already available in this relatively young market.

### **2.3.3 Imaging**

There are a number of imaging methods in use such as X-ray, computer tomography, nuclear imaging, ultrasound and magnetic resonance imaging (MRI). These are used mainly to investigate anatomy and morphology of the whole human body, compared to methods that concentrate on individual cells and their functions. These methods can be used to image certain tissues directly (for example x-rays for bones) however in most circumstances contrast agents are injected to differentiate between particular tissue-types, therefore allowing morphological changes (such as diseased or damaged tissue) to be identified.

One of the issues of using contrast agents (such as gadolinium, iron or manganese compounds that have strong paramagnetic properties) or radioactive substances is that they tend to spread throughout the body making it difficult to distinguish between diseased and healthy tissue. Also in some cases certain tissues can absorb the contrast agent more easily than others. It is here that advances in nanotechnology are beginning to have an impact.

One of the approaches under development uses nanoparticles (for example perfluorocarbons) to act as a carrier system. Contrast agents such as Technetium-99m are attached to such carriers and targeted to specific tissues through linkage to molecules such as ligands or antibodies that bind proteins on the cell surface (see Figure 3). Through this specific targeting system only the desired cells and tissues are "marked" with the contrast agent (e.g. newly developing blood vessels). Through advances in genomics and proteomics technology more of these tissue-specific markers are being identified, allowing discrimination between more and more tissue-types, and diseased and healthy tissue.

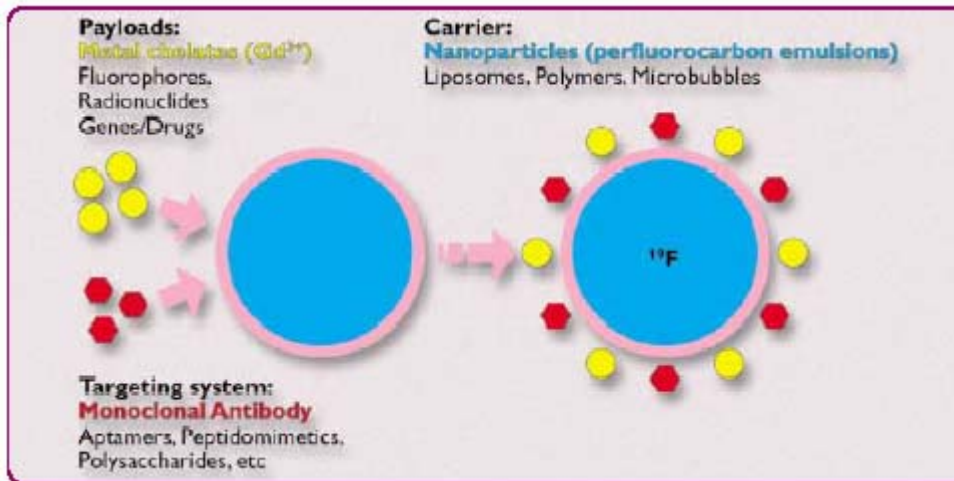


Figure 3: Targeted contrast agents based on nanoparticle technology. The core consists of perfluorocarbon compounds. This example has a payload of  $Gd^{3+}$  chelates and antibodies. Other payloads can be fluorophores, radionuclides, genes or drugs.  
Source:

[www.medical.philips.com/main/news/assets/docs/medicamundi/mm\\_vol47\\_no1/08\\_lanza.pdf](http://www.medical.philips.com/main/news/assets/docs/medicamundi/mm_vol47_no1/08_lanza.pdf)

For magnetic resonance imaging (MRI) other nanoparticles are being investigated: fullerenes are cages of carbon atoms (also known as “Bucky-balls”) that can be filled with other atoms or molecules (such as gadolinium<sup>2</sup>). By using holmium instead of gadolinium the fullerenes can be used as x-ray contrast agents. Fullerenes can be chemically modified on their exterior so that they are for example made soluble in water and targeted to specific cell-types (see also Figure 4).

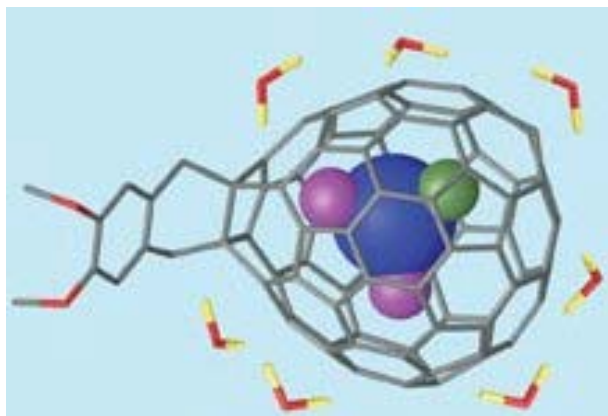


Figure 4: Water-soluble contrast agent being developed for magnetic resonance imaging encapsulates two gadolinium metal atoms (purple) and one scandium metal atom (green) that are attached to a central nitrogen atom (blue). The molecule's tail (grey and red) makes the cage water-soluble. Water molecules (red and yellow Vs) surround the molecule.  
(Source: <http://www.sciencenews.org/20020713/bob10.asp>).

This research is still in its infancy, however animal experiments have shown that such nanoparticles can bind to and allow the visualisation of early stage blood clot formation. Further investigations have indicated their applicability in

the diagnosis of angiogenesis and cancer metastases ([www.azonano.com/details.asp?ArticleID=965](http://www.azonano.com/details.asp?ArticleID=965)).

## 2.3.4 Metrology

### 2.3.4.1 Scanning Probe Microscopes

Microscopy has been a medium for diagnostics for a long time. Optical microscopes have been in use since 1609. More recent developments include scanning electron microscopes (SEM), which were developed in 1960s. Both can generate two-dimensional images of an object's surface, with a magnification as great as 1,000x for an optical microscope, and as large as 100,000x for an electron microscope. They are mostly used to compare tissue or blood samples with healthy material.

Both kinds of microscopes have in common that the sample must be prepared (drying, staining, embedding in resin, sputtering with an electrical conductive layer etc). Apart from the manual labour involved, the processing of the sample can lead to cellular changes and only dead material can be scanned.

In the early 1980s the development of the scanning tunnelling microscope (STM) set a milestone in metrology: 5,000,000 times magnification was now possible. In 1990 IBM used an atomic force microscope (AFM) to move 35 Xenon atoms around and spell "IBM". The STM and AFM are members of the scanning probe microscopes (SPM) family.

An AFM uses an atomically fine tip on a cantilever (Figure 5), to characterize surface properties of a sample. As the tip is moved across the sample, the force interactions between the tip and the sample surface are measured. These movements draw a three dimensional picture of the sample surface. As only the atomic forces are sensed (e.g. Van der Waals, magnetic or capillary forces) it is also possible to measure non-conducting



Figure 5: The tip of an AFM. Adapted from Mirkin et al. [www.chem.nwu.edu/~mkngrp/dippen.html](http://www.chem.nwu.edu/~mkngrp/dippen.html)

samples as opposed to SEM/STM (Scanning Tunnelling Microscopes require an electric current between the tip and the sample to make measurements). This can be done both in non-contact mode (to reduce the risk of damaging the surface being measured) and contact mode where the ease by which the probe glides across a surface, is a measure of the surface "friction". By lightly pushing the tip against the sample surface, it is possible to measure how hard this is. This can be done in many different environments such as fluid, air, vacuum, special gas, low or high temperatures etc. As there is no need for a vacuum or an electron beam (as with the STM) even living cells and whole organisms can be measured.

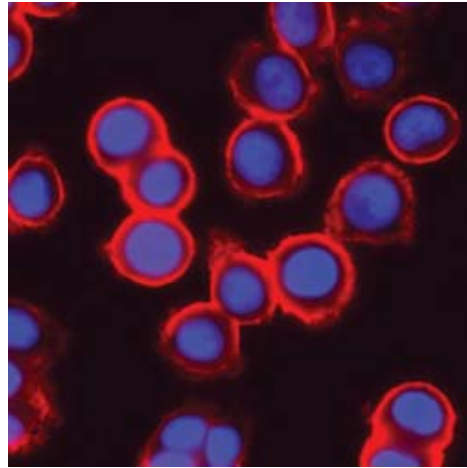
The AFM can measure the binding forces between DNA nucleotide bases and so enables us to understand mechanisms within single cells. For example, retroviruses penetrate cells and then integrate their genetic material with that of the cell. Presently, we can observe these activities on a macroscopic scale, but in many cases we do not understand how they work or why they work. The AFM offers the potential to dissect these events and is therefore a versatile tool and one of the most important ones in nanotechnology<sup>3</sup>.

#### 2.3.4.2 Quantum Dots

Nanotechnology can also enhance optical analytic methods such as microscopy through quantum dots. Quantum dots are nanometre scale particles that are composed of a few hundred to a few thousand atoms of cadmium selenide for example. They absorb light, and then re-emit the light at a different wavelength. Although other organic and inorganic materials exhibit this phenomenon i.e. fluorescence, quantum dots closely fit the profile of an ideal fluorophore: bright, non-photobleaching with narrow, symmetric emission spectra, and have multiple resolvable colours that can be excited simultaneously using a single excitation wavelength.



Quantum dots can operate in a liquid environment and therefore can be applied to biological imaging (Figure 6). The semiconductor particles that are being investigated for biological imaging are generally made of a cadmium selenide core surrounded by a shell of zinc sulphide. When illuminated, the quantum dot emits a particular colour: smaller dots fluoresce at shorter wavelengths, such as blue, while larger dots emit longer wavelengths, like red<sup>4</sup>.



*Figure 6: Red light-emitting quantum dots tag proteins on the surfaces of breast cancer cells, while a conventional blue dye stains the cells' nuclei. (Source: Quantum Dot Corp.*

*[www.sciencenews.org/20030215/bob10.asp](http://www.sciencenews.org/20030215/bob10.asp)).*

Quantum dots have significant advantages over earlier technologies: researchers can view typically no more than three colours at once with traditional fluorescence labelling, using proteins, such as green fluorescent protein, or organic dyes, such as rhodamine. Each of the fluorophores must first be excited with a specific wavelength of light that can block the emitted colour of other fluorophores in the experiment.

To overcome this problem, researchers can mark multiple proteins in a cell with several different colours, photograph them at different times, and then superimpose the pictures. Alternatively one protein can be tagged with one fluorophore in one cell and another with a different fluorophore in a similar cell. Another limitation of conventional fluorophores is their short life span, generally a few hours.

In contrast quantum dots offer fluorescence that is stable for days to months and potentially thousands of different fluorescent "signatures" can be created. In addition to the Qdot Corporation, companies such as Nanoco and Nanosolutions GmbH are developing Quantum dots as diagnostic tools.

### 2.3.4.3 Surface Plasmon Resonance

Surface Plasmon Resonance (SPR) is a technique to measure biomolecular interactions in real-time without the use of labels. SPR is an electron charge density wave phenomenon that occurs at the surface of a metallic film when light is reflected under specific conditions. SPR is altered by the binding of molecules to the opposite side of the film from the reflected light (Figure 7). This allows the detection of molecular interactions without the use of labels.

The target is immobilized to the sensor surface, while the sample to be investigated is free in solution and passed over the surface through a channel. When both interact with each other, the refractive index of the surface changes and can be measured. This method is extremely sensitive and can detect single molecules. It is not limited to protein-protein interactions but all kinds of interactions between molecules can be measured. Examples are DNA-protein, lipid-protein and protein-plastic surfaces.

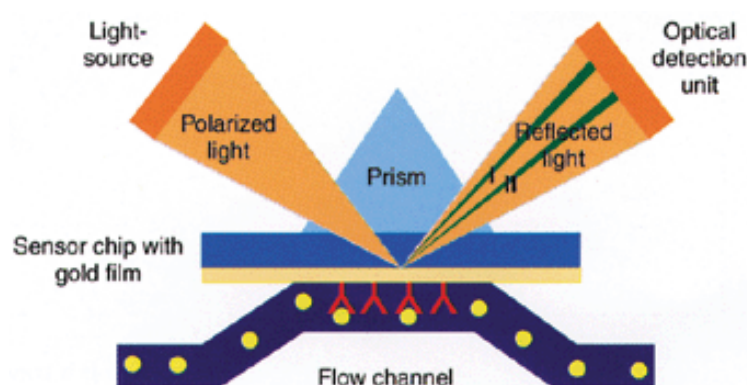


Figure 7: Principle of SPR

### 3 European Initiatives

Today, most European countries have projects or initiatives that are sponsored by the EU. These include the European Framework Programmes (FP) that are designed to strengthen and expand research and development in Europe. With a budget of EUR 1,300 million for 2002-2006, the NMP priority under FP6 was conceived to promote the transition towards knowledge-based products and services through breakthroughs in new applicable knowledge and long-term RTD. The NMP priority supports research projects in the area of "Nanotechnology and nanosciences, knowledge-based multifunctional materials and new production processes and devices" ([www.cordis.lu/fp6/activities.htm](http://www.cordis.lu/fp6/activities.htm)). For further information please visit <http://www.cordis.lu/nanotechnology>.

A number of networks and centres of excellence have been established in Europe both at the national and pan-European level. Nanotechnology activities in Europe are supported by the European Commission through the Framework Programmes. Some of the main priority areas are as follows:

- Nano-biotechnology related to genomics, proteomics
- Biochip development
- Diagnostics and therapeutic tools
- Micro-nano technologies
- Applications in health, industry, environment
- Nano-biotechnologies
- Applications in areas such as health, chemistry, energy and environment

The main projects funded under FP6 that involve nanoanalytical and diagnostic tools and techniques for biological systems are:

The European Network of Excellence FRONTIERS is directed at instrumentation for the manufacturing and analysis of single molecules, individual nanostructures and 2-3D architectures of them, and aims at establishing leadership in research and innovation on behalf of life sciences related nanotechnology. The focus is on analysis and manipulation of the bio environment. The Frontiers network consists of twelve top-level nanotechnology research institutes and integrates 192 researchers. Organizer is Prof. Reinhoudt, MESA Research Institute, Enschede, Netherlands.

The Network of Excellence NANO2LIFE is focused on the understanding of the nanoscale interface between biological and non-biological entities and its applications, e.g. for novel sensor technologies. Coordinator is Prof. Boisseau, CEA Paris, France.

Nanospecific aspects are covered by some projects in the framework of a Nanobiotechnology programme (<http://www.nanobio.de/>). Projects include using AFM for the analysis of ion channels in the inner ear, the use of a force sensor on DNA bases, and the use of magneto-resistive Biochips.

CellPROM (<http://www.cellprom.net/>), which stands for "Cell Programming by nanoscaled devices", is the largest Integrated Project within the thematic priority of Nanobiotechnologies of the 6th Framework Programme of the European Commission. It unites 27 academic and industrial researchers from 12 countries for a period of four years to achieve its main objective of non-invasive "reprogramming" of individual cells on an industrial scale.

There are also a number of national and international networks established:

<a href="http://www.biochipnet.de">www.biochipnet.de</a>	Link to over 345 companies and 134 institutions worldwide.
<a href="http://www.diagnostic-arrays.com">www.diagnostic-arrays.com</a>	Diagnostic microbial microarray projects
<a href="http://www-leti.cea.fr/uk/index-uk.htm">http://www-leti.cea.fr/uk/index-uk.htm</a>	Laboratoire d'Electronique de Technologie de l'Information, Biochips
<a href="http://www.labonachip.org.uk">www.labonachip.org.uk</a>	The Laboratory on a Chip Consortium
<a href="http://www.rsc.org/is/journals/current/loc/locpub.htm">www.rsc.org/is/journals/current/loc/locpub.htm</a>	The journal "Lab on a Chip", the Royal Society of Chemistry
<a href="http://www.chemsoc.org/networks/locn/">www.chemsoc.org/networks/locn/</a>	UK-based LOC network.
<a href="http://www.biochem.mpg.de/mnphys">www.biochem.mpg.de/mnphys</a>	Cell chip with neurones.
<a href="http://www.microfluidiccentre.com">www.microfluidiccentre.com</a>	Support to European organizations involved in microfluidics.
<a href="http://www.foodsensor.org/">http://www.foodsensor.org/</a>	Network as a forum to discuss needs and opportunities for new sensor technology.
<a href="http://www.kompetenznetze.de/navi/en/root.html">www.kompetenznetze.de/navi/en/root.html</a>	Networks of competence

Figure 8 summarises the results of this report. The total numbers of organizations (both private and public-funded) that are using or developing analytical and diagnostic tools or techniques that make use of nanotechnology advances are shown for each European country.

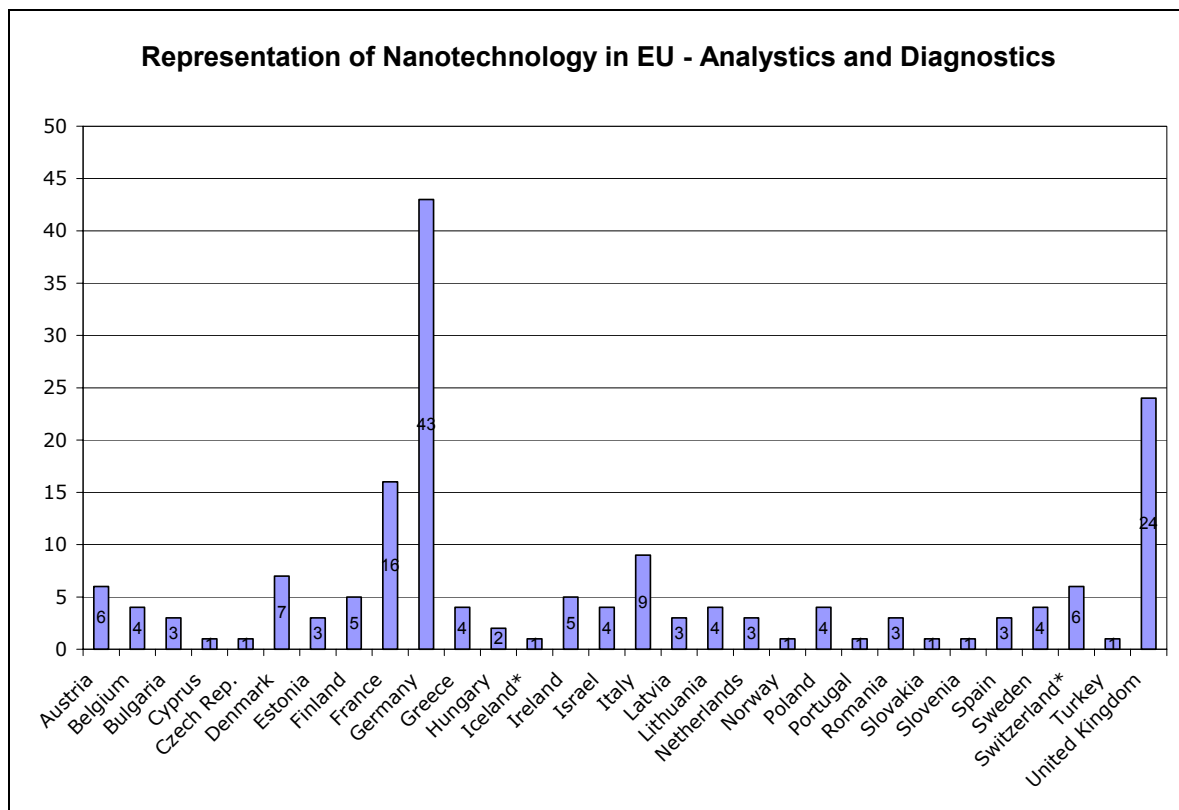


Fig.8: Number of analytic and diagnostic companies and academic Institutes in Europe.

In May 2004, ten new states became members of the EU: Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, the Slovak Republic and Slovenia. There are another four applicants waiting for membership: Bulgaria, Croatia, Romania and Turkey. Not all of these countries have strong nanotechnology programmes and many of those that do are not actively pursuing developments of relevance to this report. However, where this is the case other appropriate information of relevance is included. This report also includes associated states to the EU: Iceland, Norway, Switzerland, Liechtenstein, and Israel, which have special trade agreements with the EU.

## 4 Austria

In Austria the work programme of the Federal government provides for a number of far-reaching reforms for the areas of science, research and technology. The Austrian Council has launched a number of initiatives to develop; strengthen and promote emerging technology fields for the future and a Nanotechnology programme has been included.

European integration has contributed significantly to international groups using Austria's advantage as a location. Currently, about 21 percent of research expenditure in Austria is financed from abroad, in particular by European enterprises, which have chosen Austria as their research location.

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Turnover in €:		Staff in 2004:	

### Organization focus:

The Department for Proteomics undertakes studies in tracer and bioanalysis, protein analysis by means of nano-coupling methods, and clinical diagnosis of extremely small sample volumes. The Institute's own laboratory develops new methods of analysis and materials specifically for these demands in human research.

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<b>Universität für Bodenkultur Wien Zentrum für Nanobiotechnologie</b>			
<b>Contact/CEO</b>		Prof. Dr. Uwe B. Sleytr	
Gregor Mendelstr.33 1180 Vienna <b>Tel.</b> +43 1 47654 2200 <b>Fax.</b> +43 1 4789112		<b>Email:</b> <a href="mailto:ultra@boku.ac.at">ultra@boku.ac.at</a> <b>Web:</b> <a href="http://www.biotec.boku.ac.at/332.html?&amp;L=1">www.biotec.boku.ac.at/332.html?&amp;L=1</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

The research activities at the Institute for Nanobiotechnology are focused on molecular nanotechnology, nanobiotechnology and biomimetics. Projects include:

- nanoscaled immunotherapeutics
- genetically engineered self-assembly systems
- nanoarray coated virus like particles
- functional protein arrays
- Biomimetic membranes
- nanocapsules
- glycosylated nanoarrays

<b>ARC Seibersdorf research GmbH, Department of Biotechnology</b>			
<b>Contact/CEO</b>		Dr. Claudia Preininger	
2444 Seibersdorf <b>Tel.</b> +43 50 550 3527 <b>Fax.</b> +43 50 550 3444		<b>Email:</b> <a href="mailto:claudia.preininger@arcs.ac.at">claudia.preininger@arcs.ac.at</a> <b>Web:</b> <a href="http://www.arcs.ac.at/ul/ulb">http://www.arcs.ac.at/ul/ulb</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

The ARC Seibersdorf research GmbH at Seibersdorf is part of Austria's largest non-university establishment engaged in applied research and development. The main working fields of the department of biotechnology are genome analysis, gene detection, and functional genomics for food biosafety, ecosystem and plant breeding issues. Biochip technology and bioinformatics are central to the strategic research programme. The department develops low and medium density biochips for application in functional genomics of plants, in vitro toxicology, environmental research and diagnostics. The nano-related interests are the development of reactive chip - and biosensor surfaces based on functional hydrogels, hyperbranched architectures and photosensitive polymers. Polymer matrices on gold-coated chips (nanofilms or self-assembled layers) and gold particles in porous materials are going to be tested as fluorescence enhancers.

<b>University of Linz, Institute for Biophysics</b>			
<b>Contact/CEO</b>		Peter Hinterdorfer	
Altenbergerstr. 69 4040 Linz <b>Tel.</b> +43 732 2468 9265 <b>Fax.</b> +43 732 2468 9280		<b>Email:</b> <a href="mailto:peter.hinterdorfer@jku.at">peter.hinterdorfer@jku.at</a> <b>Web:</b> <a href="http://at22.bphys.uni-linz.ac.at/">http://at22.bphys.uni-linz.ac.at/</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Development of high-resolution imaging and bio-sensoring of proteins and membranes on the single molecule level using force microscopy. Future nano-related applications will include design of functional structures and chips, and various read-out and screening strategies.

<b>University of Vienna, Biochemistry</b>			
<b>Contact/CEO</b>			
Dr. Bohrgasse 9 1030 Vienna <b>Tel.</b> +43 1 4277 52801 <b>Fax.</b> 43 1 4277 9528		<b>Email:</b> <a href="mailto:eh@abc.univie.ac.at">eh@abc.univie.ac.at</a> <b>Web:</b> <a href="http://www.at.embnet.org/bmz/ord1.htm">www.at.embnet.org/bmz/ord1.htm</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Specific research areas include studies of gene expression, stress regulation and signal transduction, investigations of structure-function relationships in proteins, protein engineering, development of biosensors for different processes, and studies of organelle biogenesis.

<b>Vienna University of Technology, Institute of Industrial Electronics and Material Science (IEMW)</b>			
<b>Contact/CEO</b>			
Gusshausstrasse 27/366 1090 Wien <b>Tel.</b> +43 1 58801 36664 <b>Fax.</b>		<b>Email:</b> <a href="mailto:vlelekoop@iemw.tuwien.ac.at">vlelekoop@iemw.tuwien.ac.at</a> <b>Web:</b> <a href="http://www.iemw.tuwien.ac.at">http://www.iemw.tuwien.ac.at</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Research in the areas of industrial electronics, sensors, actuators, biomedical engineering, material science for electrical engineering, microelectronics. The institute has two groups (chairs) that are involved in nanoscience and -technology: the Industrial Sensor Systems (ISS) group and the Material Science (MS) group. ISS focuses on sensors and actuators for nano-applications, on nanofluidics and on devices for biological cell research. The MS group concentrates on magnetic nanostructures for high-density data storage and on magnetic actuators.



## 5 Belgium

Despite its size Belgium has initiated significant nanotechnology efforts, based on its educational culture of integration and networking. Belgium has no overall federal nanotechnology programme as technology policy is decentralized to the regional governments, though the Fond National de la Recherche Scientifique / Nationaal Fonds voor Wetenschappelijk (FNRS/NFWO) who contribute approximately €1million per year.

<b>University of Namur</b>			
<b>Contact/CEO</b>		José Remacle	
Rue de Bruxelles, 61 5000 Namur <b>Tel.</b> +32 817 24123 <b>Fax.</b> +32 817 24135		<b>Email:</b> <a href="mailto:jose.remacle@fundp.ac.be">jose.remacle@fundp.ac.be</a> <b>Web:</b> <a href="http://www.fundp.ac.be/urbc/dnarray/contact.html">www.fundp.ac.be/urbc/dnarray/contact.html</a>	
Turnover in €:	2 million €	Staff in 2004:	50

### Organization focus:

- Some of the University's research fields are
- Nano and micro metal particles for molecular detection
  - Detection of microarrays by electronic signal
  - Development of a DNA microarray to follow up the gene expression in adipose tissue in murine models of atherosclerosis.
  - Development of biochips for the GMO detection.
  - Microarray to monitor gene expression in breast tumours.
  - Development of an automatic system for molecular diagnostic by microfluidic manipulations and electric detection.
  - Side effects detection of drug candidate on microarray.
  - Development of a biochip for the identification of pathogenic bacteria in food.
  - Development of a biochip for the identification of nosocomial pneumonia.
  - Automatic system for molecular diagnostic by microfluidic manipulations and electric detection.
  - Development of a biochip for the selection of diseases resistant pigs.

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<b>IMEC</b>			
<b>Contact/CEO</b>		Chris Van Hoof	
Kapeldreef 75 3001 Leuven <b>Tel.</b> +32 16 281815 <b>Fax.</b> +32 16 22 94 00		<b>Email:</b> <a href="mailto:Chris.VanHoof@imec.be">Chris.VanHoof@imec.be</a> <b>Web:</b> <a href="http://www.imec.be/">http://www.imec.be/</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Research of industrial needs in the areas of microelectronics, nanotechnology, design methods and technologies for ICT systems. Biosensors, neurons on a chip, functional surfaces etc.

<b>Eppendorf Array Technologies SA</b>			
<b>Contact/CEO</b>		José Remacle	
Rue du Séminaire 20 5000 Namur <b>Tel.</b> +32 817 25613 <b>Fax.</b> +32 817 25615		<b>Email:</b> <a href="mailto:remacle.j@eppendorf.be">remacle.j@eppendorf.be</a> <b>Web:</b> <a href="http://www.eppendorf.com/eat/en/">http://www.eppendorf.com/eat/en/</a>	
Turnover in €:	3.5 million €	Staff in 2004:	40

**Organization focus:**

Development of arrays and the appropriate instruments: incubators, reagents, scanners and software for the assays of arrays in colorimetry based on the use of Siverquant enhancement method. Development of a DNA microarray to follow up gene expression in human liver, in rat brain, in mouse liver. Detection of candidate drug side effects on microarrays. Automatic system for molecular diagnostics by microfluidic manipulations.

<b>Euroscreen</b>		Founded 1994	
<b>Contact/CEO</b>		Pierre Nokin	
47, Rue Adrienne Bolland 6041 Gosselies <b>Tel.</b> +32 2 529 00 11 <b>Fax.</b> +32 2 529 00 19		<b>Email:</b> <a href="mailto:info@euroscreen.be">info@euroscreen.be</a> <b>Web:</b> <a href="http://www.euroscreen.be">http://www.euroscreen.be</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Spin-off of the Brussels University School of Medicine. Collaborating with Nanosyn on small molecule libraries designed for discovery research being conducted with Euroscreen's collection of cloned G-protein coupled receptors. The company aim to turn the large number of characterized and orphan G-protein coupled receptors they have identified using PCR homology cloning into validated targets for drug discovery. Euroscreen has developed a broad technology base to functionally characterize these orphan receptors.

**Collaborations:**

Solvay, Merck & Co., Nanosyn and UCB. Licensing agreements have also been set up with Brussels University, the University of Georgia Research Foundation, the University of Toronto and the University of Virginia Patent Foundation. Euroscreen is also collaborating with Hamamatsu regarding the further development of the AequoScreen™ screening platform for HTS laboratories.

## 6 Bulgaria

Bulgaria is preparing for accession to the European Union in 2007. Like many other countries Bulgaria was part of the Soviet Bloc and is strong in research in general. Among the government priorities are Communications and High Technologies. There is the National Centre on Nanotechnology in Sofia (<http://www.bas.bg/nano/>), which is a national centre for excellence in nanoscience and nanotechnology for both the academic community and manufacturing industries. The main focus at the moment is on nanomaterials and electronics.

<b>National Centre on Nanotechnology</b>		Founded 1999	
<b>Contact/CEO</b>		Prof. R. Kotsilkova	
Acad. G. Bonchev Street, Block 10 1113 Sofia <b>Tel.</b> +359 2 718 182 <b>Fax.</b> +359 2 722-544		<b>Email:</b> <a href="mailto:kotsil@bgcict.acad.bg">kotsil@bgcict.acad.bg</a> <b>Web:</b> <a href="http://www.bas.bg/nano/">http://www.bas.bg/nano/</a>	
Turnover in €:		Staff in 2004:	

### Organization focus:

New materials are developed by means of specific molecular design for producing nanoparticles applicable in medicine, agriculture, and ecology. Nano- and micro dimensional bioactive polymer systems are explored in order to produce novel medical materials for controlled drug release.

<b>Institute of Polymers</b>			
<b>Contact/CEO</b>		Iliya Rashkov	
Bulgarian Academy of Sciences Acad. G. Bonchev Str., Block 103-A 1113 Sofia <b>Tel.</b> +359 2 979 34 68 <b>Fax.</b>		<b>Email:</b> <a href="mailto:rashkov@polymer.bas.bg">rashkov@polymer.bas.bg</a> <b>Web:</b> <a href="http://www.polymer.bas.bg/">http://www.polymer.bas.bg/</a>	
Turnover in €:		Staff in 2004:	

### Organization focus:

Development of novel biocompatible and/or biodegradable polymeric materials, stimuli-responsive hydrogels, films, micro- and nanostructured materials. Polymeric composites for guided bone regeneration or for wound healing based on biocompatible and biodegradable polymers are being developed. Creation of novel nano-sized materials with specialty properties. Linear or cyclic polyethers have been grafted on fullerenes C60 and C70. Recently, the antitumoral effect of fullerene-core polyoxyethylene star-polymers has been announced.

<b>Innovative Solutions</b>	Founded 2001		
<b>Contact/CEO</b>	Kamen Nikolov		
6, Kestenova Gora Str. 1404 Sofia <b>Tel.</b> +359 88 9513374 <b>Fax.</b> +359 2 8664259	<b>Email:</b> <a href="mailto:info@budgetsensors.com">info@budgetsensors.com</a> <b>Web:</b> <a href="http://www.budgetsensors.com/">http://www.budgetsensors.com/</a>		
Turnover in €:		Staff in 2004:	

#### **Organization focus:**

The product range features different AFM probes for various measuring modes: dynamic, force modulation and contact mode. The new Conductive AFM probes have been introduced. New AFM probe types are under development.

## **7 Croatia**

Croatia's national science and research programme for 1996 to 2000 defined a number of specific and general priorities within six scientific fields: natural sciences, technical sciences, biomedicine, biotechnology, social sciences and humanities. However, the EC has indicated that the programme was never fully implemented, and has suggested that priorities should be redefined 'in a more rational and systematic manner.'

Progress has been made in diversifying the sources of research funding in the country, so that in addition to the MSES budget (€18.5 million in 2002), resources are also made available by regional authorities, municipalities, private companies and other legal entities. Nevertheless nanotechnology is not yet established in Croatia ([www.cordis.lu/national\\_service/en/candidate\\_countries](http://www.cordis.lu/national_service/en/candidate_countries)).

## **8 Cyprus**

The New Industrial Policy (adopted in June 1999) includes the installation of incubators and the establishment of a new Centre for Applied research. Existing research centres are the institute of Neurology and Genetics, the agricultural research institute, the University of Cyprus including some research centres and a newly established Polytechnic School. The government plans to invest €204,000 in high technology development projects in start-up

companies, up to two years. There is no national programme for funding dedicated to nanotechnology; however some nano research is being performed in Universities.

<b>Department of Biological Sciences University of Cyprus</b>			
<b>Contact/CEO</b>		Niovi Santama	
University of Cyprus 75 Kallipoleos St., P.O. Box 20537 1678 Nicosia <b>Tel.</b> +357 2289 2884 <b>Fax.</b> +357 2289 2881		<b>Email:</b> <a href="mailto:santama@ucy.ac.cy">santama@ucy.ac.cy</a> <b>Web:</b> <a href="http://www.ucy.ac.cy/biology/">http://www.ucy.ac.cy/biology/</a>	
Turnover in €:		Staff in 2004:	

#### **Organization focus:**

Research in the laboratory analyses the function of molecular motors in mammalian neurons. Work focuses on the kinesin-like superfamily of microtubule-based motor proteins. The aim is to contribute to the understanding of motor neuron disease, the elucidation of the molecular mechanism that leads to cell death, the identification of putative therapeutic targets and the design of patient molecular diagnostics.

#### **Collaborations:**

In the framework of these three projects, the laboratory has respective collaborations with an EU-funded network of 7 laboratories in 5 European countries, the University of Dundee, the Hellenic National Research Institute, the University of Singapore and the Cyprus Institute of Neurology and Genetics.

## **9 Czech Republic**

The Czech government aims its innovation policy mainly at industrial R&D to make national industries more efficient and competitive. Government support is targeted to the metallurgical, textiles, engineering and defence industries, with no national nanotechnology research programme. The agency Czechinvest aims to attract foreign investment to the Czech Republic, and hosts a website including practical information. Research in electron microscopy and metrology are the best established.

Generally, as with other Eastern European countries, nanotechnology is still a young industry even though there are companies that have been working in this field under Soviet leadership for many years. The main sectors are nanoelectronics, material sciences and nanoparticles.

<b>University of South Bohemia Institute of Physical Biology</b>			
<b>Contact/CEO</b>		Dr Dalibor Stys	
Zamek 136 37333 Nové Hradý <b>Tel.</b> +420 386 361259 <b>Fax.</b> +420 386 361219		<b>Email:</b> <a href="mailto:stys@jcu.cz">stys@jcu.cz</a> <b>Web:</b> <a href="http://www.greentech.cz/">http://www.greentech.cz/</a>	
Turnover in €:		Staff in 2004:	

### **Organization focus:**

The institute aims to study biological objects by physical means, engages in development, fabrication and application of physical biology and biotechnology. Applications include biomedicine, agriculture and biotechnology:

#### Biomedicine

- diagnostic imaging techniques
- search for bactericides, fungicides etc.

#### Agriculture and food industry

- early detection of diseases and infections
- precision agriculture biotechnology
- new methods of cultivation of algae

## **10 Denmark**

It is estimated that by 2010 the Danish micro-industry will have a turnover of about 1.3 billion Euros in micro and nanotechnologies. Of direct relevance to this report is Medicon Valley, which is an association of universities and other partners that aims to help the medical and biotechnology industry to communicate with universities. This is the fourth or fifth major region in medical and biotechnology in Europe. Nanotechnology research is funded by the Ministry of Research (Research Council) and by the Ministry of Industry, with emphasis on collaboration between industry and universities and other research centres.

<b>Interdisciplinary Nanoscience Centre (iNANO)</b>			
<b>Contact/CEO</b>		Flemming Besenbacher	
University of Aarhus Ny Munkegade, Building 520 8000 Aarhus C <b>Tel.</b> +45 8942 3604 <b>Fax.</b> +45 8612 0740		<b>Email:</b> <a href="mailto:fbe@inano.dk">fbe@inano.dk</a> <b>Web:</b> <a href="http://www.inano.dk/sw174.asp">www.inano.dk/sw174.asp</a>	
Turnover in €:		Staff in 2004:	

### Organization focus:

iNANO - interdisciplinary Nanoscience Centre for the University of Aarhus and Aalborg University constitutes an interdisciplinary research and educational effort with the long term goal of merging nano-scale biology, chemistry and physics into a new scientific discipline: Nanoscience.

Department of Bio-nanotechnology:

- Protein, amino acid, nucleic acid and cell adsorption on surfaces
- Functionalization of surfaces by self-assembled monolayers (SAMs)
- Binding forces of biomolecules to surfaces
- Structure and function of biological macromolecules
- Membrane proteins, molecule pores, and pumps studied by XRD/NMR
- Synthesis of biomimetic nanodevices for enzymatic/catalytic reactions
- Characterization of nucleic acids by AFM
- Drug delivery nano-particles
- Nano-motors
- Biosensors

Department Nanoscale Materials design:

- Molecular assemblies (self-assembly, supramolecular chemistry)
- Molecular Beam Epitaxial (MBE) growth of semiconductor nanostructures
- Physical Vapor Deposition (PVD) growth of nanophase materials
- Nanocontact printing of Self-Assembled Monolayers (SAM's)
- Nanoembossing
- Nanolithography (colloidal, e-beam, dip-pen local anodic oxidation)
- DNA-directed assembly

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<b>MIC – Department of Micro and Nanotechnology</b>		Founded 1990	
<b>Contact/CEO</b>			
Building 345 east 2800 Kongens Lyngby <b>Tel.</b> +45 4525 5700 <b>Fax.</b> +45 4588 7762		<b>Email:</b> <a href="mailto:mic@mic.dtu.dk">mic@mic.dtu.dk</a> <b>Web:</b> <a href="http://www.mic.dtu.dk/">http://www.mic.dtu.dk/</a>	
Turnover in €:		Staff in 2004:	

### **Organization focus:**

MIC – Department of Micro and Nanotechnology does research in many NT-fields:  
Bio-Array  
Lab-on-a-chip lasers and nanoimprint lithography  
MEMS Activities  
Bioprobes  
Microfluidics Theory and Simulation  
Cell Particle Handling

### **Collaborations:**

Major national and EU-funded R & D projects:  
CFM: Microinstrument centre supporting Ph.D. students, funded by Thomas B. Thrige foundation.  
DABIC: National competence centre developing advanced instrumentation platform for biotechnology  
EU scientific networks: Mic is part of the European networks NANOFAB (nanofabrication) ATOMS (nanolithography) NanoMass (cantilever-based mass sensor) and Saneme (molecular electronics).  
Frame program: MIC is involved in three nationally funded collaborative framework programmes in nanoscale electrochemistry, micro total analysis systems and silicon wafer bonding.  
FREJA: National program for Female Researchers in Joint Action, supporting project on microprobes as biosensors.  
HITACK: Industrialisation of microsystems, in particular silicon microphones for hearing aids, in collaboration with Danish company Microtronic (EU funded).  
IMMUNALYZE: Microsystems for groundwater analysis, in collaboration with biotech company Exiqon and other Danish research institutes.  
JOULE: MIC is contributing semiconductor technology know-how to two European projects on single-crystal silicon solar-cell development projects within the EU Joule programme (EU funded) .  
MicroChem: A collaboration with Danish firm Danfoss, and several other European institutes and companies, to develop microsensors for monitoring waste and drinking water quality (EU funded)  
NORMIC: Network including Norwegian company SensoNor and other European partners, offering services for prototyping, testing and qualification of microsystems (EU funded).  
Rapid Screening: Development of detection for Campylobacteria in poultry, in collaboration with Danish Poultry Meat Association  
SeSiBON: Consortium focussed on silicon wafer bonding for sensor encapsulation, including Danish company Danfoss as well as Norwegian firm SensoNor and Finnish firm Okmetic (EU funded).  
SUM: Consortium of Three Danish companies and technology service institute Delta, collaborating on prototype fabrication at MIC.  
Talent: Four national Talent Projects have been awarded to MIC researchers (one new in 2000) in molecular electronics, integration of optical detection with microliquid systems, cell sorting, and nanoscale tweezers.



<b>Nano-Science Centre</b>		Founded 2001	
<b>Contact/CEO</b>		Prof. Thomas Bjørnholm	
H.C. Ørsted Institutet Universitetsparken 5, Bygning D 2100 København Ø <b>Tel.</b> +45 353 21835 <b>Fax.</b> + 45 353 20460		<b>Email:</b> <a href="mailto:tb@nano.ku.dk">tb@nano.ku.dk</a> <b>Web:</b> <a href="http://www.nano.ku.dk/default.asp">www.nano.ku.dk/default.asp</a>	
Turnover in €:		Staff in 2004:	

### Organization focus:

Research in the Nano-Science Centre involves self-organizing structures on the nanometre scale. The results are used to study and manipulate biological nanosystems and to create novel nanoarchitectures with unique structural, electronic, optical and magnetic properties. Specific research areas include bionanotechnology and self-assembling molecular electronics.

### Collaborations:

EU programs (Sawphoton, DISCEL, Nanomol) and Danish Research Councils MIC (F. Grey et al.) Nano- and Microtechnology.  
NOVO-Nordisk A/S (A. Svendsen and T. H. Callisen et al.) Bio-Nanotechnology.  
DFM (J. C. Petersen et al.) Organic Non-linear Optics.  
Risø (K. Kjær et al.) Synchrotron X-ray Studies.  
MPIP- Mainz (K. Müllen et al.) Organic Synthesis and Self-Assembly.  
Carnegie Mellon University (R. D. McCullough et al.) Organic Synthesis and Self-Assembly.  
University of Texas at Austin (J. T. Mcdevitt et al.) Organic/ High Tc Superconductor Assemblies  
University of Liverpool (M. Brust) Gold nanoparticles  
Chalmers Technical University (S. Kubatkin) Single electron single molecule devices  
Partners in the EU programs DISCEL (Growth) & NANOMOL (IST)

<b>Centre for Atomic-scale Materials Physics</b>			
<b>Contact/CEO</b>			
Technical University of Denmark - Department of Physycs - Building 307 2800 Lyngby <b>Tel.</b> +45 4525 3175 <b>Fax.</b> +45 4593 2399		<b>Email:</b> <a href="mailto:norskov@fysik.dtu.dk">norskov@fysik.dtu.dk</a> <b>Web:</b> <a href="http://www.fysik.dtu.dk/more.php?id=21_0_5_0_M22">www.fysik.dtu.dk/more.php?id=21_0_5_0_M22</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Research on nano-structured materials. Linking the fundamental description of materials properties at the nano-scale to materials properties, designing of nano-materials with interesting functional properties. Main focus is on metallic systems and functional properties of interest include electrical properties, magnetic properties, chemical (catalytic) properties and mechanical properties. Involved with training a large number of doctoral and postdoctoral students.

<b>Risø National Laboratory</b>			
<b>Contact/CEO</b>			
Frederiksborgvej 399 P.O. 49 4000 Roskilde <b>Tel.</b> +45 4677 4677 <b>Fax.</b> +45 4677 5688		<b>Email:</b> <a href="mailto:risoe@risoe.dk">risoe@risoe.dk</a> <b>Web:</b> <a href="http://www.risoe.dk/pol/ResAct/resact.htm">www.risoe.dk/pol/ResAct/resact.htm</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Performing analytical studies on surfaces for biocompatibility, drug delivery systems and biosensors. Applications of structured surfaces for biological and medical purposes, lab-on-a-chip for diagnostic analyses of blood and urine.

<b>Cantion A/S</b>		Founded 1994	
<b>Contact/CEO</b>		Christian Kjaer	
Ørsteds Plads, Bldg. 347 2800 Lyngby, Copenhagen <b>Tel.</b> +45 4525 6425 <b>Fax.</b> +45 4525 6419		<b>Email:</b> <a href="mailto:mk@cantion.com">mk@cantion.com</a> <b>Web:</b> <a href="http://www.cantion.com/">http://www.cantion.com/</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Cantion is specialized in label free and real-time detection of molecules and the interaction of molecules. Cantion's biochip (CANTI-4) can detect several molecules in parallel under the control of a readout system (C-BOX). Applications of the technology are ranging from gas sensors for the detection of plastic explosives over liquid based sensors for DNA and protein studies to detection of microorganisms. Another focus is on the bio-interaction analyses such as DNA hybridization, protein-protein interactions and related molecular interactions.

<b>LiPlasome Pharma A/S</b>	Founded 2001		
<b>Contact/CEO</b>	Kent Jørgensen, PhD		
Technical University of Denmark Building 207 2800 Lyngby <b>Tel.</b> +45 4525 2458 <b>Fax.</b> +45 4588 3136	<b>Email:</b> <a href="mailto:jorgense@liplasome.com">jorgense@liplasome.com</a> <b>Web:</b> <a href="http://www.liplasome.com/">http://www.liplasome.com/</a>		
Turnover in €:		Staff in 2004:	

### Organization focus:

LiPlasome Pharma is a biotechnology company which was established in 2001 and is developing and commercializing novel drug delivery platforms that can be used for targeted transport of anticancer drugs. The company is located within the Campus of the Technical University of Denmark near Copenhagen in the Medicin Valley region. LiPlasome Pharma's proprietary drug delivery technology represents a spin-off from fundamental research carried out by the founders of the company over the last decade.

## 11 Estonia

Estonia is one of the Baltic States, with a population of 1.4m inhabitants. In 2001, the Estonian parliament adopted a Research and Development Strategy 2001–06 'Knowledge Based Estonia'

([www.tan.ee/tan/en/doc/Documents/1018442944.46/Estonian%20R%26D%20strategy.pdf](http://www.tan.ee/tan/en/doc/Documents/1018442944.46/Estonian%20R%26D%20strategy.pdf)). This strategy focuses R&D on three strategic areas:

information society technologies, biomedicine, materials and nanotechnologies.

Universities are the main centres for generating new knowledge, but minor institutes and research and development centres can also benefit from public sector investment in R&D.

<b>Maico Metrics</b>	Founded 1992		
<b>Contact/CEO</b>	Indrek Reimand		
39 Aardla Str. 50110 Tartu <b>Tel.</b> +372 514 8720 <b>Fax.</b>	<b>Email:</b> <a href="mailto:info@maicometrics.ee">info@maicometrics.ee</a> <b>Web:</b> <a href="http://www.maicometrics.ee">www.maicometrics.ee</a>		
Turnover in €:		Staff in 2004:	

**Organization focus:**

Maico Metrics is a spin-off company of Tartu University. The company is mainly focussed on production of AFMs at a competitive price.

<b>MikroMasch Eesti Ltd.</b>			
<b>Contact/CEO</b>		Director Pavel Kudensky	
Narva Mnt. 13 10151 Tallinn <b>Tel.</b> +372 61 43 117 <b>Fax.</b> +372 61 43 118		<b>Email:</b> <a href="mailto:pavelk@MikroMasch.com">pavelk@MikroMasch.com</a> <b>Web:</b> <a href="http://www.mikromasch.com">http://www.mikromasch.com</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

MikroMasch produces SPM probes for various applications:

- Thin conductive coatings for electric measurements
- Magnetic coatings for MFM
- Chemically inert coatings for biology and electrochemistry

<b>TorroSen</b>		Founded 1999	
<b>Contact/CEO</b>			
TorroSen OÜ Jakobi 2-223 Tartu 51014 <b>Tel.</b> +372 7 375 167 <b>Fax.</b> +372 7 375 264		<b>Email:</b> <a href="mailto:toonika@ut.ee">toonika@ut.ee</a> <b>Web:</b> <a href="http://www.hot.ee/torrosen/index.html">www.hot.ee/torrosen/index.html</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

TorroSen is a spin-off company, commercializing the new technology of biosensors. The enterprise is among the first spin-off companies of Tartu University, which were established after the commencement of the university spin-off program for the commercialization of innovative university technologies.

## 12 Finland

In Finland, the focus for nanotechnology is on IT applications, biodiagnostics, catalyst technology and sensors. Finland invested in a national nanotechnology programme 1997-1999, and is continuing nanotechnology-based research within several more general programmes. The needs of Finland's industry, including mobile telephone producers, are the drivers of research. TEKES (National Technology Agency of Finland, [www.tekes.fi/eng/](http://www.tekes.fi/eng/)) and the Academy of Finland (<http://www.aka.fi/>) fund the main part of nanotechnology research in Finland. In particular, today's Finnish nanotechnology research focuses on five themes: self organized structures; functional nanoparticles; nanoelectronics; nanobiology, and biomaterials for information processing.

<b>VTT Medical Biotechnology</b>		Founded 2002	
<b>Contact/CEO</b>		Prof. Olli Kallioniemi	
VTT Biotechnology, Medical Biotechnology Itäinen Pitkätatu 4, Turku <b>Tel.</b> +358 2 478 8600 <b>Fax.</b> +358 2 478 8601		<b>Email:</b> <a href="mailto:oli.kallioniemi@vtt.fi">oli.kallioniemi@vtt.fi</a> <b>Web:</b> <a href="http://sysbio.vtt.fi/index_ra.htm">http://sysbio.vtt.fi/index_ra.htm</a>	
Turnover in €:		Staff in 2004:	22

### Organization focus:

VTT Medical Biotechnology develops and applies biochip technologies in the following areas:

Proteomics and immunotechnology: developing and applying quantitative antibody-based fluorescent array technologies with modern proteomics technologies and mass spectrometry.

Cell microarrays: novel cell-based array strategies with high-throughput functional analyses of cells exposed to e.g. small-molecule compounds, antibodies, nucleic acids. Development of lab-on-a-chip.

<b>Biogenon Ltd.</b>			
<b>Contact/CEO</b>		Tommi Vaskivuo	
Kaitoväylä 1 90570 Oulu <b>Tel.</b> +358 8 343460 <b>Fax.</b> +358 8 343490		<b>Email:</b> <a href="mailto:tommi.vaskivuo@biogenon.com">tommi.vaskivuo@biogenon.com</a> <b>Web:</b> <a href="http://www.biogenon.com/">http://www.biogenon.com/</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Biogenon Ltd. is a nanobiotechnology company specializing in development and manufacture of biological sensors. The company has developed an innovative ultra sensitive biosensor that is capable of label free detection of biological molecules (proteins, DNA/RNA, lipids and pharmacological molecules).

<b>Bio- and Nanopolymers Research Group</b>			
<b>Contact/CEO</b>		Jukka Seppälä (Leader)	
Helsinki University of Technology Laboratory of Polymer Technology P.O. Box 6100 02015 HUT <b>Tel.</b> +358 9 451 2614 <b>Fax.</b> +358 9 451 2622		<b>Email:</b> <a href="mailto:jukka.seppala@hut.fi">jukka.seppala@hut.fi</a> <b>Web:</b> <a href="http://bionanopolymers.hut.fi/">http://bionanopolymers.hut.fi/</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Production of controlled nanoscale polymer structures for purposes of releasing active substances and for tissue reinforcement. Products for the healing of hard tissues and (several medical and dental applications), to control the healing of tissues, or as extra cellular matrices for growing tissue.

<b>Laboratory of Biomedical Engineering</b>			
<b>Contact/CEO</b>		Prof. Jukka Seppälä	
Helsinki University of Technology Rakentajanaukio 2 C 02150 Espoo <b>Tel.</b> +358 9 451 2614 <b>Fax.</b> +358 9 451 2622		<b>Email:</b> <a href="mailto:Jukka.seppala@hut.fi">Jukka.seppala@hut.fi</a> <b>Web:</b> <a href="http://biomed.hut.fi/contact.html">http://biomed.hut.fi/contact.html</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:****Electro- and Magnetocardiography:**

Development of non-invasive high-resolution cardiac mapping techniques, measurements, signal processing and mathematical modelling of bioelectric phenomena in the heart.

**Biomedical Image Processing:**

Methods for segmentation of different tissue types and functional areas in biomedical volume images, as well as for generation of computational image based models, and for visualization and combination of images from different modalities are developed.

**Cellular Level Biophysics:**

Mechanisms of electrical signalling on molecular level are studied in photoreceptors and controlled drug release methods are developed.

**BioMag:**

Versatile bioelectromagnetic studies are carried out. In addition to magnetocardiography and magnetoencephalography, also functional MRI and computerized magnetic brain simulation combined with simultaneous EEG are in use.

<b>University of Jyvaskyla</b>			
<b>Contact/CEO</b>		Jussi Toppari	
Department of Physics University of Jyväskylä P.O. Box 35 (YFL) 40014 Finland <b>Tel.</b> +358 14 260 2381 <b>Fax.</b> +358 14 260 2351		<b>Email:</b> <a href="mailto:jussi.toppari@phys.jyu.fi">jussi.toppari@phys.jyu.fi</a> <b>Web:</b> <a href="http://www.phys.jyu.fi/research/electronics/index.html">www.phys.jyu.fi/research/electronics/index.html</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Development of a nanoscale sensor, which electrically monitors the forming of double helix structure between two separated gold electrodes. This DNA sensor has applications in biological and medical analysis and it can also be used for studying the conductivity of DNA giving essential information related to its potential use as a component of future electronics.

## 13 France

In France most of the research in nanotechnology is done by Minatec based at CEA Leti. The focus is in microsystems, nanoelectronics, biotechnology and transferring this knowledge into commercial appliances, but France appears to be one of the three strongest countries in analytics and diagnostics.

Since 1999, the French government has been trying to centralise the selection of micro and nanotechnology R&D projects, as well as materials R&D including nanostructured materials with the result that in recent years, micro and nanotechnology research centres of competence have been established. The Research and Technological Innovation Networks (RRIT, [www.telecom.gouv.fr/reseaux/body.htm](http://www.telecom.gouv.fr/reseaux/body.htm)) was created by the Ministry of Research and Technology and the French Research Network in Micro and Nano Technologies (RMNT, <http://www.rmnt.org/EN/index.html>) in 1999 with 10 million euros/year funding.

<b>Laboratory for Photonics and Nanostructures</b>			
<b>Contact/CEO</b>		Chen Yong	
LPN- CNRS Site Alcatel de Marcoussis Route de Nozay <b>Tel.</b> +33 1 69 63 61 21 <b>Fax.</b>		<b>Email:</b> <a href="mailto:Yong.Chen@lpn.cnrs.fr">Yong.Chen@lpn.cnrs.fr</a> <b>Web:</b> <a href="http://www.lpn.cnrs.fr/en/">http://www.lpn.cnrs.fr/en/</a>	
Turnover in €:		Staff in 2004:	

### Organization focus:

This new development emerged recently through the interaction of nanotechnology and biology. Realization of functionalized integrated circuits like nanostructured arrays, micro-channels, tanks, valves, pumps, microelectrodes. Devices with original and innovating architectures are designed for handling complex fluids in confined media. Fabrication of these objects mainly in the field of lithography. This activity is open to close collaborations with other laboratories active in these fields.

- Nanofabrication
- Microfluidic devices
- Applications in biology



<b>Université de Lyon, Laboratoire d'électronique, nanotechnologies, capteurs (LENAC)</b>			
<b>Contact/CEO</b>		Michel PITAVAL	
1 LENAC Bâtiment 203 La Doua 43, bd du 11 novembre 1918 69622 Villeurbanne <b>Tel.</b> +33 04 72 44 83 31 <b>Fax.</b> +33 04 72 43 27 40		<b>Email:</b> <a href="mailto:michel.pitaval@lenac.univ-lyon1.fr">michel.pitaval@lenac.univ-lyon1.fr</a> <b>Web:</b> <a href="http://www.univ-lyon1.fr">http://www.univ-lyon1.fr</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

The research activity of the LENAC laboratory deals with the study of sensors and devices of separation for the analysis of molecules in very small volumes of liquids. The laboratory works with microsystems development of handling and analysis of biological samples. Application fields: Chemistry, biochemistry, pharmacology, health, food processing. Research themes:

- Electronics
- Captors
- Microfluidics
- Microsystems et analysis of biological molecules
- Micro RMN
- Optical detectors

<b>Université de technologie de Troyes, Laboratoire de Nanotechnologie et d'Instrumentation Optique (LNIO)</b>			
<b>Contact/CEO</b>		Mr Pascal ROYER	
Université de technologie de Troyes 12 Rue Marie Curie BP 2060 10 010 Troyes <b>Tel.</b> +33 3 25 71 56 64 <b>Fax.</b> +33 3 25 71 56 75		<b>Email:</b> <a href="mailto:pascal.royer@utt.fr">pascal.royer@utt.fr</a> <b>Web:</b> <a href="http://www-lnio.utt.fr/">http://www-lnio.utt.fr/</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

The LNIO studies the physical phenomena of the near field optics and develops different apertureless Scanning Near Field Optical Microscopy (SNOM). These configurations are applied to several applications:

- Optical near field spectroscopy : fluorescence (DNA biochips), Raman (carbon nanotubes), surface plasmon on metallic nanoparticles for biochemical sensors (application to the biological field)
- Nanophotolithography on polymer and phase change materials (lithography and optical memories applications)
- Local nano-characterization of optoelectronic components and photonic structures

<b>Ecole Nationale Supérieure d'Électrochimie et d'Électrométallurgie de Grenoble</b>	Founded 1995		
<b>Contact/CEO</b>	Eric VIEIL		
LEPMI - ENSEEG, 1130 rue de la Piscine, Domaine Universitaire, BP 75 - Cedex 38402 Saint-Martin-d'Hères <b>Tel.</b> +33 476 82 66 98 <b>Fax.</b> +33 476 82 67 77	<b>Email:</b> <a href="mailto:Eric.Vieil@lepmi.inpg.fr">Eric.Vieil@lepmi.inpg.fr</a> <b>Web:</b> <a href="http://www.inpg.fr/LEPMI/LEPMI.html">http://www.inpg.fr/LEPMI/LEPMI.html</a>		
Turnover in €:		Staff in 2004:	

### Organization focus:

Some of the research themes are

- ionic transfers and electrochemical sensors (the use of ionic conductive ceramics as a sensitive element for chemical sensors (gas or ions), electrochemical and raman measurements).
- electrochemical and bioelectrochemical engineering (biosensors, cementation, removal processes...)

<b>Laboratoire Multicouches Nanométriques (LMN), site d'Evry Val d'Essonne</b>			
<b>Contact/CEO</b>	Philippe Houdy		
Bâtiment des Sciences Rue du Père Jarlan 91025 EVRY <b>Tel.</b> +33 1 69 47 76 66 <b>Fax.</b> +33 1 69 47 80 26	<b>Email:</b> <a href="mailto:Philippe.Houdy@bp.univ-evry.fr">Philippe.Houdy@bp.univ-evry.fr</a> <b>Web:</b> <a href="http://www.univ-evry.fr/labos/lmn">http://www.univ-evry.fr/labos/lmn</a>		
Turnover in €:		Staff in 2004:	

### Organization focus:

The LMN (Université d'Évry) deals with the structural elaboration, characterisation and analysis of the physical properties of multi-layers nanomaterials. Research themes:

- quantum dots
- nano-optics (optical devices)
- nano-magnetism & electronics (electronic biochips, molecular devices)

<b>Institut de Pharmacologie et de Biologie Structurale</b>			
<b>Contact/CEO</b>		Prof. Dr. Mathias Winterhalter	
205, route de Narbonne 31077 TOULOUSE Cedex <b>Tel.</b> +33 561 335822 <b>Fax.</b> +33 561 335886		<b>Email:</b> <a href="mailto:winter@ipbs.fr">winter@ipbs.fr</a> <b>Web:</b> <a href="http://www.ipbs.fr">http://www.ipbs.fr</a>	
Turnover in €:		Staff in 2004:	

### Organization focus:

Formulation of polymeric artificial nanocapsules. Functionalizing nanocapsules by coating the surface with active sites or inserting them into the wall. One possible direction is to cover them with lipid membranes providing an artificial cell. Using natural proteins already optimised by nature for specific tasks and if necessary.

<b>LAAS – CNRS</b>			
<b>Contact/CEO</b>			
7, avenue of Colonel Roche 31077 Toulouse Cedex <b>Tel.</b> +33 5 61 33 62 00 <b>Fax.</b> +33 5 61 55 35 77		<b>Email:</b> <a href="mailto:laas-contact@laas.fr">laas-contact@laas.fr</a> <b>Web:</b> <a href="http://www.laas.fr">http://www.laas.fr</a>	
Turnover in €:		Staff in 2004:	

### Organization focus:

Combining of nanodevices and nano-tools with biomolecules (DNA and proteins) by deposition of biological solutions on surfaces with high spatial control and without denaturation and the integrated detection on a wafer of specific bio molecular hybridizations for advanced biochips.

<b>Cea-Leti</b>			
<b>Contact/CEO</b>		Pierre Puget	
17 Rue des Martyrs 38054 Grenoble Cedex <b>Tel.</b> +33 4 38783245 <b>Fax.</b> +33 4 38785164		<b>Email:</b> <a href="mailto:pierre.puget@cea.fr">pierre.puget@cea.fr</a> <b>Web:</b> <a href="http://www-leti.cea.fr/uk/index-uk.htm">www-leti.cea.fr/uk/index-uk.htm</a>	
Turnover in €:		Staff in 2004:	

### Organization focus:

CEA does extensive research in micro-fluidics, biochips and lab-on-chips, biological and medical imaging, functionalizing surfaces etc.

<b>ADEMTECH SAS</b>		Founded 2000	
<b>Contact/CEO</b>		Philippe Gorria	
Parc Scientifique Unitec 1 4 Allée du Doyen Georges Brus 33600 Pessac <b>Tel.</b> +33 5 57 02 02 00 <b>Fax.</b> +33 5 57 02 02 06		<b>Email:</b> <a href="mailto:gorria@ademtech.com">gorria@ademtech.com</a> <b>Web:</b> <a href="http://www.ademtech.com/en/home.htm">www.ademtech.com/en/home.htm</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Ademtech manufactures magnetic calibrated micro beads for biomedical diagnostic and life sciences. These micro beads are based on a proprietary technology that was initiated at the Centre National de la Recherche Scientifique (CNRS) in France available in different sizes specially designed for magnetic separations, applied to in-vitro diagnostic, molecular biology or Life Science research and development.

<b>Flamel Technologies S.A.</b>			
<b>Contact/CEO</b>		Gérard Soula, Ph.D., M.B.A.	
33 avenue du Dr. Georges Levy 69693 Venissieux Cedex <b>Tel.</b> +33 472 783 434 <b>Fax.</b> +33 472 783 435		<b>Email:</b> <a href="mailto:soula@flamel.com">soula@flamel.com</a> <b>Web:</b> <a href="http://www.flamel.com/indexen.htm">www.flamel.com/indexen.htm</a>	
Turnover in €:	Operating revenue grew to \$25.3 million	Staff in 2004:	

**Organization focus:**

Flamel produces delivery systems for small molecule and protein drugs, providing tailored solutions to the biotech and pharmaceutical industries for controlled-release delivery of drugs. The company has invented two innovative polymer-based technologies (nanoparticles) that allow improvements in the therapeutic characteristics, safety profile and patient compliance of many drugs.

**Collaborations:**

Flamel has partnership agreements with major pharmaceutical companies: Biovail USA, Merck & Co., GlaxoSmithKline, Bristol-Myers Squibb

<b>Luminy Biotech Entreprises</b>		Founded 1999	
<b>Contact/CEO</b>		Vincent Fert	
Case 923 163 Avenue de Luminy 13009 Marseille <b>Tel.</b> +33 4 91 293090 <b>Fax.</b> +33 4 91 293099		<b>Email:</b> <a href="mailto:fert@ipsogen.com">fert@ipsogen.com</a> <b>Web:</b> <a href="http://www.ipsogen.com/accueil2.php">www.ipsogen.com/accueil2.php</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Ipsogen provides oncologists and researchers with an approach to molecular cancer profiling:

- Molecular diagnostic tools for cancer profiling
- Associated information systems and prognostic aids
- Patented gene expression signatures for each tumour type
- Sample collections stored and annotated over long periods of time in a certified environment

Ipsogen produces also ultra-sensitive discovery biochips:

The high sensitivity of the biochips are capable of measuring the expression of at least 500,000 cells. The biochips also feature a large collection of arrayed genes, represented by sequence verified cDNAs.

**Collaborations:**

New partners will have access to Ipsogen discovery tools and will contribute to the building of Ipsogen cancer gene expression signatures.

<b>Nanobiogene-Belfort Technopôle</b>	Founded 2000		
<b>Contact/CEO</b>	Moussa Hoummady		
6 avenue des usines 90 000 Belfort <b>Tel.</b> +33 3 84 28 94 36 <b>Fax.</b> +33 3 84 28 30 39	<b>Email:</b> <a href="mailto:Mhoummady@aol.com">Mhoummady@aol.com</a> <b>Web:</b> <a href="http://www.nanobiogene.com/">http://www.nanobiogene.com/</a>		
Turnover in €:		Staff in 2004:	

**Organization focus:**

Nanobiogene™ is a nano-engineering and nano-instrumentation company specialised in micro and nanofluidics, biochips and miniaturisation technologies. The company develops, manufactures and commercialises innovative laboratory equipment including liquid handling for the precise distribution of nano-volumes of reagents. In the near-term, the company is focusing its activities on micro and nanofluidic instrumentation spotting tools involved in biochip manufacturability.

**Collaborations:**

Nanobiogene™ benefits from the support of key partners including, the EFS (National Blood Transfusion Centre), the Evry Genopole®, the CNRS (French National Centre for Scientific Research). Nanobiogene™ is entering into commercial partnerships to expand its distribution network and to better serve its customers and markets of genomics, proteomics, drug development, disposable kits/assays.

<b>Nanobiotix</b>	Founded 2003		
<b>Contact/CEO</b>	Laurent Levy		
Prologue Biotech Rue Pierre et Marie Curie - BP27/01 31319 Labege Cedex <b>Tel.</b> +33 6 23 38 28 62 <b>Fax.</b> +33 5 61 28 70 01	<b>Email:</b> <a href="mailto:laurent.levy@nanobiotix.com">laurent.levy@nanobiotix.com</a> <b>Web:</b> <a href="http://www.nanobiotix.com/">http://www.nanobiotix.com/</a>		
Turnover in €:		Staff in 2004:	

### Organization focus:

Nanobiotix is dedicated to finding new treatments for cancer based on the combined application of nanotechnologies and biotechnologies. Nanobiotix currently develops NanoBiodrugs that are targeting abnormal cells and destroying them through the controlled generation of physical or chemical reactions triggered by external activation.

### Collaborations:

Institute for Lasers, Photonics and Biophotonics;  
State University of New York, Buffalo USA.  
Institut de Pharmacologie et de Biologie Structurale,  
CNRS, Toulouse France.  
Ecoles des Mines de Paris, France.  
International University Bremen, Germany.

<b>Spinelix</b>	Founded 2000		
<b>Contact/CEO</b>	Prof Mario Caria (CEO)		
Biopole Clermont Limagne 63360 Saint Beauzire <b>Tel.</b> +33 473 644349 <b>Fax.</b> +33 473 339452	<b>Email:</b> <a href="mailto:mario.caria@spinelix.com">mario.caria@spinelix.com</a> <b>Web:</b> <a href="http://www.spinelix.com/index.htm">www.spinelix.com/index.htm</a>		
Turnover in €:		Staff in 2004:	

### Organization focus:

The company activity is in research and development in the MEMS Division and the Bio-chemicals Division.

#### MEMS DIVISION:

Applications: biological analysis; protein micro-arrays; DNA micro-arrays; capillary electrophoresis detection; sequencing. Tagged and untagged molecule detection.

Sensors, ASIC readout, image acquisition systems, assembled MEMS.

#### BIOCHEMICALS DIVISION:

Conception, preparation and handling of biochemical gels. Spinelix can control the size and the behaviour of the molecules for self-assembly materials at the nanometre scale, modifying electrical and biological functionality of the support molecules and the biological targets. Applications:

- UV transparent Gel matrix
- Gel matrix for filtration
- Gel matrix for storage
- Micro-capillary support

<b>NanOpTec: Lyon Nano-Opto-Technology Centre</b>			
<b>Contact/CEO</b>		Dr. Jacquier Bernard	
Bâtiment Alfred Kastler 69622 Villeurbanne Cedex <b>Tel.</b> +33 472 448336 <b>Fax.</b> +33 472 431130		<b>Email:</b> <a href="mailto:jacquier@pcml.univ-lyon1.fr">jacquier@pcml.univ-lyon1.fr</a> <b>Web:</b> <a href="http://nanoptec.univ-lyon1.fr">http://nanoptec.univ-lyon1.fr</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

The centre groups local expertise in fabrication of nanostructured materials (clusters, self-organised nanomaterials, quantum dots, BIP's...), ultimate characterisation methods (scanning near field optical microspectroscopies) and advanced technologies (optical interconnections, threshold free laser, nanosystems in biology).

<b>Indicia Biotechnology</b>		Founded 1998	
<b>Contact/CEO</b>		Stéphane LEGASTELOIS	
33, avenue de la Californie 69600 Oullins <b>Tel.</b> +33 472 39 14 92 <b>Fax.</b> +33 472 39 16 01		<b>Email:</b> <a href="mailto:infos@indicia.fr">infos@indicia.fr</a> <b>Web:</b> <a href="http://www.indicia.fr">http://www.indicia.fr</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

With expertise in the design and the manufacture of protein-activated microspheres and particle-based diagnostic kits Indicia Biotechnology offers:

- coated microspheres including superparamagnetic, fluorescent, coloured and white latexes.
- custom-made particles and particle-base kits for research and diagnostic uses, including proprietary rapid test technologies.
- manual to fully integrated immuno-magnetic solutions dedicated to separation.
- selection and concentration of multiple analytes in various biological and environmental samples.

## 14 Germany

There is strong federal government support for nanotechnology in Germany, and funding for nanotechnology priority research has risen steadily since 1998. The Fraunhofer Institute and many other universities and SMEs are involved in nanotechnology. Biotechnology and nanoelectronics received the largest increase in support in the last two years.

In 2000, the German Federal Ministry of Education and Research (BMBF) launched a funding programme called 'Nanobiotechnology' (NB) dedicated to the funding of multidisciplinary research projects related to the following issues:

- Development of analytical and characterization processes with resolution in the nanometre range
- Establishment of manipulation techniques for biological and functionally analogous biochemical objects
- Development of reaction techniques for the analysis of structure–activity relationship
- Use of biological self-assembly mechanisms for the development of functional layers and surfaces
- Design and application of cellular and molecular tools and machines

NanoTruck is an initiative of the German Federal Ministry for Education and Research and presents existing nanotechnology applications and explains their technological backgrounds ([www.nanotruck.net/index.htm](http://www.nanotruck.net/index.htm)).

The Network of Excellence for Chemical Nanomaterials – CC-NanoChem ([www.cc-nanochem.de/](http://www.cc-nanochem.de/)) – is the central German network for the development and application of new kinds of high-tech materials based on nanotechnology. It was founded in 1999 as one of six Federal German Centres of Excellence and is coordinated by the Leibniz Institute for New Materials (INM), Saarbrücken (seat of the head office) with its 200 employees.



BIOMEDTEC Franken e.V., ([www.biomedtec-franken.de/eng/starteng.htm](http://www.biomedtec-franken.de/eng/starteng.htm)) is a network-triangle of the Universities of Bayreuth, Erlangen-Nürnberg and Würzburg, as well as the strong pharmaceutical and medical technology industry in Franconia. The State of Bavaria in conjunction with the Franconian district-governments and city halls support this network with more than 130 million US\$.

Another competence network is Nanobionet (<http://nanobionet.de/eng.htm>). This aims to develop applications of nanobiotechnology, e.g. for pharmacy, new medicine, artificial photosynthesis, antibacterial coatings, functional textiles. Universities and fifty companies in the regions Saarland, Rhein-Hessen, and Pfalz, in South West Germany are collaborating in it.

The Münster Bioanalysis Society is a network of business, science and government ([www.bioanalytik-muenster.de/indexcpo\\_en.php?start=aboutus](http://www.bioanalytik-muenster.de/indexcpo_en.php?start=aboutus)) around nano-bioanalytics in the region of Münster.

<b>CeNTech, Centre for NanoTechnology, University of Münster</b>			
<b>Contact/CEO</b>		Dr. Tilman Schäffer	
Gievenbecker Weg 11 48149 Münster <b>Tel.</b> +49 251 8363834 <b>Fax.</b> +49 251 8333602		<b>Email:</b> <a href="mailto:tilman.schaeffer@uni-muenster.de">tilman.schaeffer@uni-muenster.de</a> <b>Web:</b> <a href="http://bioforce.centech.de">http://bioforce.centech.de</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Imaging dynamic interactions between single biomolecules in real-time with the atomic force microscope. A further goal is to deduce properties of cellular, sub-cellular and molecular structures from the measurement of their mechanical material properties using force spectroscopy. Organizing organic molecules into ordered structures by Langmuir-Blodgett (LB) technique as well as the subtle self-assembly (SA) technique usually involving chemical bonds with the substrate.

<b>Centre of Nanoscience, Ludwig-Maximilians-Universität München</b>			
<b>Contact/CEO</b>		Almudena Munoz Javier	
Amalienstraße 54 80799 München <b>Tel.</b> +49 89 21801439 <b>Fax.</b> +49 89 21802050		<b>Email:</b> <a href="mailto:Almudena.munoz@physik.uni-muenchen.de">Almudena.munoz@physik.uni-muenchen.de</a> <b>Web:</b> <a href="http://www.biophysik.physik.uni-muenchen.de/">www.biophysik.physik.uni-muenchen.de/</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Conjugation of Au-nanoparticles with DNA. For optical investigations of the quenching of fluorophores on gold surfaces the distance between the fluorophore and the gold is controlled by using DNA of different length as a spacer between fluorophore and gold. Gold nanoparticles were incubated with DNA that is functionalized at one side with the fluorophore and at the other side with a thiol-group that can bind to gold.

<b>Institut für Angewandte Physik, Universität Tübingen</b>			
<b>Contact/CEO</b>		Dieter P. Kern	
Auf der Morgenstelle 10 72076 Tübingen <b>Tel.</b> +49 7071 29 72999 <b>Fax.</b> +49 7071 29 5400		<b>Email:</b> <a href="mailto:dieter.kern@uni-tuebingen.de">dieter.kern@uni-tuebingen.de</a> <b>Web:</b> <a href="http://www.nanobio.de/bmbfsymposium/zeigen.php3?id=135">www.nanobio.de/bmbfsymposium/zeigen.php3?id=135</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Project: controlled synthesis of short DNA chains on metallic nanostructures with plasmon resonance (SPR). A goal of this project is the controlled synthesis of short DN branch ranks on metallic nano-structures. A special attention is with the project on possible biomedical applications. Efficient biochemical mechanisms and reactions on the carrier substrates are to be developed under utilization of special characteristics of nano-structures, which permit a economical and flexible mass production.

<b>Universität Potsdam, Analytische Biochemie</b>			
<b>Contact/CEO</b>		Prof. Dr. Frieder Scheller	
Karl-Liebknecht-Str. 24-25 14476 Golm <b>Tel.</b> +49 331 977 5120 <b>Fax.</b> +49 331 977 5050		<b>Email:</b> <a href="mailto:fschell@rz.uni-potsdam.de">fschell@rz.uni-potsdam.de</a> <b>Web:</b> <a href="http://www.bio.uni-potsdam.de/profess.htm">http://www.bio.uni-potsdam.de/profess.htm</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

The research activities at the Chair of Analytical Biochemistry are focused on the following basic biochemical investigations:

- enzyme-based sensors
- DNA-based sensors
- enzymatic signal amplification
- development and design of immunoassays

<b>Universitätsklinikum Tübingen - Zentrum für Zahn-, Mund- und Kieferheilkunde</b>			
<b>Contact/CEO</b>		Prof. Dr. Jürgen Geis-Gerstorfer	
Sektion 'Medizinische Werkstoffkunde & Technologie' Osianderstr. 2-8 72076 Tübingen <b>Tel.</b> +49 7071 2983996 <b>Fax.</b> +49 7071 295775		<b>Email:</b> <a href="mailto:juergen.geis-gerstorfer@uni-tuebingen.de">juergen.geis-gerstorfer@uni-tuebingen.de</a> <b>Web:</b> <a href="http://www.medizin.uni-tuebingen.de/zzmk/mwt/html/forschung.html">www.medizin.uni-tuebingen.de/zzmk/mwt/html/forschung.html</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

The Department of Medical Materials and Technology is engaged in the field of dental materials and technology, both in research and education. Interdisciplinary cooperations focus on the testing and development of dental materials and technologies in particular, but also on interactions with the biological field. The spectrum covers physico-chemical, biological and clinical aspects of materials and technologies:

- production of nano-powders by means of sol gel technology
- modification and optimization of implant surfaces
- non-adhesive layers
- investigation of the influence of cell biology and growth behaviour by micro structuring of implant surfaces
- preparation and characterisation of composite coatings from nano-hydroxyl apatite collagen on titanium implants oxidized anodically.

<b>Institute for Diagnostic and Interventional Radiology, University Hospital Jena</b>			
<b>Contact/CEO</b>		PD Dr. Ingrid Hilger	
Bachstraße 18 07740 Jena <b>Tel.</b> +49 364 19325921 <b>Fax.</b>		<b>Email:</b> <a href="mailto:ingrid.hilger@med.uni-jena.de">ingrid.hilger@med.uni-jena.de</a> <b>Web:</b> <a href="http://www.med.uni-jena.de/idir/institution/html/wissenschaftliche_mitarbeiter_33.html">www.med.uni-jena.de/idir/institution/html/wissenschaftliche_mitarbeiter_33.html</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Subject of research are magnetic nanoparticles for the treatment of tumours by magnetic heating. The accumulation of a magnetic material in the tumour region and the exposure of the whole area to an alternating magnetic field was proposed to eliminate the tumour by absorbing the energy of the magnetic field and converting it into heat.

<b>Institute of Biochemistry, Biocentre Goethe-Universität Frankfurt</b>			
<b>Contact/CEO</b>		Prof. Dr. Robert Tampé	
Marie Curie Straße 9 60439 Frankfurt <b>Tel.</b> +49 69 79829475 <b>Fax.</b> +49 69 79829495		<b>Email:</b> <a href="mailto:tampe@em.uni-frankfurt.de">tampe@em.uni-frankfurt.de</a> <b>Web:</b> <a href="http://www.biochem.uni-frankfurt.de/tampe/index.html">www.biochem.uni-frankfurt.de/tampe/index.html</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Switchable biochemical tweezers for molecular organisation and manipulation of proteins in nanodimensions, nano-tools, single molecule analysis, nanobiotechnology, antigen processing and presentation. Biochemical tweezers can be used for organizing proteins on the molecular level both in solution and on solid phase surfaces, for handling and manipulating proteins on the nanoscale level. Another field of interest is the characterization of different surfaces by TIRF as a complementary method to AFM.

<b>Physikalisches Institut der Universität Münster</b>			
<b>Contact/CEO</b>		H.F. Arlinghaus	
Wilhelm-Klemm-Str. 10 48149 Münster <b>Tel.</b> +49 251 8339064 <b>Fax.</b>		<b>Email:</b> <a href="mailto:hearlin@uni-muenster.de">hearlin@uni-muenster.de</a> <b>Web:</b> <a href="http://www.nanobio.de/dna.html">www.nanobio.de/dna.html</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Development of a DNA diagnostic method that uses peptide nucleic acids (PNA) biosensor chips to detect unlabeled DNAs. With this technique it is possible to detect attomole amounts of DNAs.

**Collaborations:**

Physikalisches Institut der Universität Münster  
Wilhelm-Klemm-Str. 10, D-48149 Münster, Germany  
Functional Genome Analysis, Deutsches Krebsforschungszentrum  
Im Neuheimer Feld 506, D-69120 Heidelberg, Germany

<b>Physik-Fakultät der Universität Bielefeld</b>			
<b>Contact/CEO</b>		H. Brückl	
Universitätsstr. 25 33615 Bielefeld <b>Tel.</b> +49 521 1065412 <b>Fax.</b>		<b>Email:</b> <a href="mailto:brueckl@physik.uni-bielefeld.de">brueckl@physik.uni-bielefeld.de</a> <b>Web:</b> <a href="http://www.nanobio.de/bmbfsymposium/zeigen.php3?id=120">www.nanobio.de/bmbfsymposium/zeigen.php3?id=120</a>	
Turnover in €:		Staff in 2004:	

### Organization focus:

Full electronic biochip for detection of DNA without fluorescent markers. They have demonstrated the applicability and functionality of giant magneto resistance (GMR) sensors for detecting magnetic markers. Hybridization experiments have shown that the magneto resistive biosensor can detect complex DNA with a length of about one thousand base pairs down to a concentration of 10 pg/l. A direct comparison of the magneto resistive and fluorescent detection methods has shown that the magneto-resistive biosensor is superior to standard fluorescent detection at low concentrations.

<b>NMI Natural and Medical Science Institute, University of Tuebingen</b>			
<b>Contact/CEO</b>		Dr. Martin Stelzle	
Markwiesenstr. 55 72770 Reutlingen <b>Tel.</b> +49 7121 5153 075 <b>Fax.</b>		<b>Email:</b> <a href="mailto:stelzle@nmi.de">stelzle@nmi.de</a> <b>Web:</b> <a href="http://www.nmi.de">http://www.nmi.de</a>	
Turnover in €:		Staff in 2004:	

### Organization focus:

The NMI uses modern bioanalytical tools, methods and technologies within research projects. The R+D activities focus on:

- Pharma and Biotechnology
- Biomedical Technology (biosensors, electrophoresis)
- Surface and interface technology

<b>Universität Dortmund, FB Chemie, Biologisch-Chemische Mikrostrukturtechnik</b>			
<b>Contact/CEO</b>		Prof. Dr. Christof M. Niemeyer	
Otto-Hahn-Str.6 44227 Dortmund <b>Tel.</b> +49 231 755 7080 <b>Fax.</b> +49 231 755 7082		<b>Email:</b> <a href="mailto:cmn@chemie.uni-dortmund.de">cmn@chemie.uni-dortmund.de</a> <b>Web:</b> <a href="http://www.chemie.uni-dortmund.de/groups/niemeyer/index.html">http://www.chemie.uni-dortmund.de/groups/niemeyer/index.html</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Generating functional biometallic nanostructures capable of specifically recognizing surface features, self assembly of branched and circular DNA-protein nanostructures, which can be applied as soft materials calibration standards for AFM, the DNA-directed assembly of enzymes, leading to novel synthetic catalysts, and the biofunctionalization of metal and semiconductor nanoparticles to generate advanced hybrid compounds for materials science and biomedical diagnostics.

<b>Institut für Anorganische Chemie</b>			
<b>Contact/CEO</b>		Prof. Dr. U. Simon	
Professor-Pirlet-Str. 1 52074 Aachen <b>Tel.</b> +49 241 80 94644 <b>Fax.</b>		<b>Email:</b> <a href="mailto:ulrich.simon@ac.rwth-aachen.de">ulrich.simon@ac.rwth-aachen.de</a> <b>Web:</b> <a href="http://www.rwth-aachen.de/ac/Ww/ac/index-e.html">www.rwth-aachen.de/ac/Ww/ac/index-e.html</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

The Institute for Inorganic Chemistry is a centre of fundamental research in the fields of organometallic chemistry, solid-state chemistry, and nano-structured materials, using site selective 1d arrangement of gold nanoparticles on DNA to form metallic nanowires.

<b>Fraunhofer-Institut für Biomedizinische Technik IBMT - Microarray &amp; Biotechnologie</b>		Founded 1987	
<b>Contact/CEO</b>		Dr. Eva Ehrentreich-Förster	
A.-Scheunert-Allee 114-116 14558 Nuthetal <b>Tel.</b> +49 33 20088 350 <b>Fax.</b> +49 33 20088 452		<b>Email:</b> <a href="mailto:eva.ehrentreich@ibmt.fraunhofer.de">eva.ehrentreich@ibmt.fraunhofer.de</a> <b>Web:</b> <a href="http://www.ibmt.fhg.de/ibmt3ambtmolekularmikro_e.html">www.ibmt.fhg.de/ibmt3ambtmolekularmikro_e.html</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

The Microarrays & Biochip Technology group develops structured surfaces in the dimension of  $\mu\text{m}$  for adsorptive and covalent coupling of biochemical components. Various application-specific dispensing technologies are used: Contact-free methods like ink-jet, semi-contact techniques like silica capillary printing and contact-mode methods. Different immobilization methods, both covalent and adsorptive, are available. The detection of the resulting patterns is done photometrically or by fluorescence labelling. Production of custom-made DNA- and protein-chips, different prepared surfaces enabling the coupling of a various amount of binders and surfaces presenting a varying number of chemical and biochemical functions (biochips for highly parallel analysis of biomolecular interactions), with the current focus being the production of custom-made DNA-chips for experimental use. A biosensor method was developed enabling the label-free detection of hormones in whole-blood with extremely low nonspecific binding of blood components.

<b>Fraunhofer-Institut für Biomedizinische Technik IBMT - Molecular Bioanalytical Chemistry &amp; Bioelectronics</b>	Founded 1987		
<b>Contact/CEO</b>	Prof. Dr. Frank Bier		
A.-Scheunert-Allee 114-116 14558 Nuthetal <b>Tel.</b> +49 33 2008 8378 <b>Fax.</b> +49 33 2008 8452	<b>Email:</b> <a href="mailto:frank.bier@ibmt.fraunhofer.de">frank.bier@ibmt.fraunhofer.de</a> <b>Web:</b> <a href="http://www.ibmt.fhg.de/ibmt3ambtmolekular_e.html">www.ibmt.fhg.de/ibmt3ambtmolekular_e.html</a>		
Turnover in €:		Staff in 2004:	

**Organization focus:**

The Department of Molecular Bioanalytical Chemistry and Bioelectronics specializes in customized biochip solutions. Products offered are microarrays, custom-made detection systems and innovative bioinformatics tools based on optical and electrochemical biosensors and transducers with integrated detection and microfluidic components. These form the basis of point-of-care systems for medical diagnostics, patient monitoring and environmental control. The nanobiotechnology group designs and immobilizes specific biomolecules as building blocks for ordered structures at the nanometre scale and offers a variety of innovative molecular biological services.

<b>Fraunhofer-Institut für Biomedizinische Technik IBMT – Nanobiotechnologie</b>			
<b>Contact/CEO</b>	Dr. Markus von Nickisch-Rosenegk		
A.-Scheunert-Allee 114-116 14558 Nuthetal <b>Tel.</b> +49 332 0088207 <b>Fax.</b> +49 332 0088452	<b>Email:</b> <a href="mailto:nickisch@ibmt.fhg.de">nickisch@ibmt.fhg.de</a> <b>Web:</b> <a href="http://www.ibmt.fhg.de/ibmt3ambtmolekularno_e.html">www.ibmt.fhg.de/ibmt3ambtmolekularno_e.html</a>		
Turnover in €:		Staff in 2004:	

**Organization focus:**

The group Nanobiotechnology deals with the development of surface structures in a nanometre scale using biomolecules. Applications could be suitable in the sense of fundamental research (nanoarrays, biosensors) as well as the development of space saving memory-elements.

A variety of possibilities are applied to immobilize double and single stranded nucleic acids as well as polypeptides and complete and functional proteins on microchips and optical fibre surfaces. These methods are suitable for in vitro testing in nanometre scales and for developing defined nanometre structures using these molecules itself regarding the self-assembling potential of nucleic acids.

Furthermore the group provides other molecular biological services, as there are: DNA-extractions, PCR applications, pro- and eucaryotic expression, development of biological assays (e.g. in vitro effects of hormone receptors) and the development of strategies to immobilize nucleic acids.

<b>Max Planck Institute of Microstructure Physics</b>		Founded 1992	
<b>Contact/CEO</b>		Ulrike Rehn	
Weinberg 2 06120 Halle <b>Tel.</b> +49 345 5582978 <b>Fax.</b> +49 345 5511223		<b>Email:</b> <a href="mailto:rehn@mpi-halle.de">rehn@mpi-halle.de</a> <b>Web:</b> <a href="http://www.mpi-halle.mpg.de/index.html">www.mpi-halle.mpg.de/index.html</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Research of noble metal nanowires and ordered porous materials for biological applications. By combination of different replicated metal wires and different surface designs, the wires can be used as biomarkers if they consist of a sequence of optically distinguishable metals parts. DNA and proteins could be linked to these wires, so that they are marked.

**Collaborations:**

A joint German-French research association in the field of magnetic thin films called "Laboratoire Européen Associé" (LEA) and collaboration based on an official agreement in the area of wafer bonding technology between the Research Centre of Advanced Science and Technology (RCAST) at the University of Tokyo and the Max Planck Institute in Halle. In September 1997 an annual Fall School of Materials Science and Electron Microscopy was established to further scientific relations with young scientists in Middle and East Europe and in the New Independent States of the former Soviet Union.



<b>Centre for Nanostructure Technology and Molecular Biology</b>			
<b>Contact/CEO</b>		Prof. Dr. Christiane Ziegler	
Erwin-Schrödinger-Str. Geb. 56 67663 Kaiserslautern <b>Tel.</b> +49 631 205 2855 <b>Fax.</b> +49 631 205 2854		<b>Email:</b> <a href="mailto:cz@physik.uni-kl.de">mailto:cz@physik.uni-kl.de</a> <b>Web:</b> <a href="http://www.nbz.uni-kl.de/index2_e.htm">http://www.nbz.uni-kl.de/index2_e.htm</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Nano analysis of organic structures, nano-bio analysis: miniaturized analytical systems for bio-molecules, development of mass-sensitive nanosensors (cantilever-sensors).

<b>Bayer AG</b>			
<b>Contact/CEO</b>		Ute Bode (Communications Editorial Team)	
Block W 11 51368 Leverkusen <b>Tel.</b> +49 21 430 58992 <b>Fax.</b> +49 21 430 71985		<b>Email:</b> <a href="mailto:ute.bode.ub@bayer-ag.de">ute.bode.ub@bayer-ag.de</a> <b>Web:</b> <a href="http://www.research.bayer.com/contact_us/page1367.htm">www.research.bayer.com/contact_us/page1367.htm</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Research and development of nanoparticles, especially quantum dots and fluorescent dyes for diagnostic applications.

<b>Carl Zeiss NTS GmbH</b>			
<b>Contact/CEO</b>			
Carl Zeiss-Str. 56 73447 Oberkochen <b>Tel.</b> +49 7364 2044 88 <b>Fax.</b> +49 7364 2043 43		<b>Email:</b> <a href="mailto:info-nts@smt.zeiss.com">info-nts@smt.zeiss.com</a> <b>Web:</b> <a href="http://www.smt.zeiss.com/C12567B0003C017A/?Open">www.smt.zeiss.com/C12567B0003C017A/?Open</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Manufacture of scanning electron microscopes (SEM) and transmission electron microscopes (TEM).

<b>Capsulation NanoScience AG</b>		Founded 2000	
<b>Contact/CEO</b>		Dr. Andreas Voigt	
Volmerstraße 7b 12489 Berlin <b>Tel.</b> +49 30 63923600 <b>Fax.</b> +49 30 63923601		<b>Email:</b> <a href="mailto:info@capsulation.com">info@capsulation.com</a> <b>Web:</b> <a href="http://www.capsulation.com/">http://www.capsulation.com/</a>	
Turnover in €:	500,000	Staff in 2004:	15

### Organization focus:

Creating innovative, highly specialized products by applying a unique technology to existing and emerging needs in life science developments. The company owned technology (layer-by-layer) is a tool for making unique multifunctional nano- and micron-sized capsules. Functionally designed and custom-made for a variety of pharmaceutical and non-pharmaceutical purposes, which not only allow the development of a variety of advanced drug-delivery products, but can also be applied to other types of products, such as foodstuffs and food ingredients, nutraceuticals, diagnostics, biosensors, enzyme catalysts, etc.

### Collaborations:

Co-operation agreements and research contracts with Bayer AG, Gelita, Octoplus, SCA Hygiene Products GmbH, and several undisclosed partners. Additional joint research projects with research groups in Germany, The Netherlands and New Zealand.

<b>chemicell GmbH</b>		Founded 1999	
<b>Contact/CEO</b>		Christian Bergemann	
Wartburgstrasse 6 10823 Berlin <b>Tel.</b> +49 30 2141481 <b>Fax.</b> +49 30 2142230		<b>Email:</b> <a href="mailto:chemicell@aol.com">chemicell@aol.com</a> <b>Web:</b> <a href="http://www.chemicell.com/products/1/index.html">www.chemicell.com/products/1/index.html</a>	
Turnover in €:		Staff in 2004:	

### Organization focus:

Biomagnetic separation for separating magnetic micro or nanospheres by magnetic forces together with bioaffine ligands, i.g antibodies or proteins with a high affinity to the target. The targets can be cells, bacteria or DNA/RNA. The special advantages of magnetic separation techniques are the fast and simple handling of a sample vial and the opportunity to deal with large sample volumes. Products like transMAG, magnetofection, and SiMAG-T - silica beads with a nonporous matrix complete the productline. Special field of application for this bead type are DNA/RNS extraction and immobilisation of small bioaffine ligands.

<b>CLONDIAG chip technologies GmbH</b>	Founded 1998	
<b>Contact/CEO</b>	n/a	
Loebstedter Str. 103-105 07749 Jena <b>Tel.</b> +49 364 159470 <b>Fax.</b> +49 364 1594720	<b>Email:</b> <a href="mailto:clondiag@clondiag.com">clondiag@clondiag.com</a> <b>Web:</b> <a href="http://www.clondiag.com/index.php">www.clondiag.com/index.php</a>	
Turnover in €:	Staff in 2004:	40

### Organization focus:

Developing integrated, miniaturized devices for use in biological and medical analysis like Assay Processor (which enables target amplification and target identification on the spot), LOC. Developments at CLONDIAG cover a broad range of proprietary technologies including:

- Micro Probe Arrays
- Substrates for Immobilization
- Microfluidics
- Systems Integration and Systems Manufacturing
- Target Detection

<b>eBiochip Systems GmbH</b>	Founded 2000	
<b>Contact/CEO</b>	Dr. Thomas Grunwald	
Fraunhoferstrasse 1 25524 Itzehoe <b>Tel.</b> +49 4821 174210 <b>Fax.</b> +49 4821 174251	<b>Email:</b> <a href="mailto:grunwald@ebiochip.com">grunwald@ebiochip.com</a> <b>Web:</b> <a href="http://www.ebiochip.com/">http://www.ebiochip.com/</a>	
Turnover in €:	Staff in 2004:	

### Organization focus:

eBiochip Systems develops and produces biosensor systems based on silicon-made electrical biochips. The electrical detection principle enables the construction of portable and highly sensitive biosensor systems. Biomolecules like DNA, proteins or small molecules can be targeted. The flexible biosensor platform can be adapted to a variety of assay formats using magnetic particles or microarray biochips for multi-parallel detection.

eBiochip Systems GmbH offers services in:

- Development of customized electronics for biosensor devices.
- Software development for user interfaces, data evaluation and visualisation.
- Loading of sensor arrays with nucleic acid or protein affinity binding probes (on-demand spotting).
- Arraying the biointerface and adapting it to analytical applications (surface chemistry).
- Design and manufacturing of custom made ultramicroelectrode arrays in Si-technology.
- Processing of polymeric microfluidic structures on biochips in wafer technology.
- Packaging of chips and integration into fluidic systems.
- Adaptation of fluidic components (e.g. mixers, flow cells) to customers needs.

<b>Evotec Technologies</b>	Founded 1993		
<b>Contact/CEO</b>	Prof. Dr. Carsten Claussen		
Merowingerplatz 1a 40225 Düsseldorf <b>Tel.</b> +49 405 60810 <b>Fax.</b> +49 405 6081488	<b>Email:</b> <a href="mailto:contact@evotec-technologies.com">contact@evotec-technologies.com</a> <b>Web:</b> <a href="http://www.evotec-technologies.com/">www.evotec-technologies.com/</a>		
Turnover in €:		Staff in 2004:	

### Organization focus:

The application portfolio covers drug discovery, high throughput screening, high throughput biology, genotyping and SNP analysis, cell biology and more. The company provides integration of hardware, software and bioware modules, combining technologies for measurement, miniaturisation and automation. The EVOscreen™ concept uses Evotec's proprietary confocal detection and nano liquid handling technology combined with state of the art automation technology. This technology and the in house drug discovery experience has lead to solutions developed to fulfil the needs from assay development, ultra high throughput screening to hit profiling. Using confocal optics, submicroliter miniaturization is accomplished without any loss of signal quality. The highly focused confocal optics reduces the detection volume to one femtoliter.

### Collaborations:

EVOsolution is built as a consortium of two leading partners, Evotec Technologies GmbH and Sysmelec SA together with Fraunhofer IPA as consultant.

<b>GfE Medizintechnik GmbH</b>			
<b>Contact/CEO</b>	Annette Becker		
Höfener Strasse 45 90431 Nürnberg <b>Tel.</b> +49 911 9315 601 <b>Fax.</b> +49 911 9315 650	<b>Email:</b> <a href="mailto:gfe.medizintechnik@gfe-online.de">gfe.medizintechnik@gfe-online.de</a> <b>Web:</b> <a href="http://www.gfe-online.de/opencms/opencms/gfe/en/mt/index.html">http://www.gfe-online.de/opencms/opencms/gfe/en/mt/index.html</a>		
Turnover in €:		Staff in 2004:	

### Organization focus:

This young and innovative company develops, manufactures and distributes titanium-coated human implants of synthetic materials. With the help of nanotechnology, synthetic materials can be coated with covalent layers of titanium, iridium and silver. In this new composite material, the plastic substrate is given a very thin coating of titanium, only a few atomic layers thick. This titanium layer is so thin that it remains as flexible as the plastic. The titanium atoms are chemically bound to the plastic, so that the layer cannot be detached. This technique has for the first time combined the advantages of both implant materials: the excellent physiological tolerance of titanium and the natural flexibility of plastic. A decisive advantage of titanization is that body tissues are only in contact with the biocompatible titanium.

<b>INM - Institute for New Materials</b>		Founded 1990	
<b>Contact/CEO</b>		Prof. Dr. Helmut Schmidt	
Im Stadtwald - Geb. 43 66123 Saarbruecken <b>Tel.</b> +49 681 9300313 <b>Fax.</b> +49 681 9300 223		<b>Email:</b> <a href="mailto:schmidt@inm-gmbh.de">schmidt@inm-gmbh.de</a> <b>Web:</b> <a href="http://www.inm-gmbh.de/htdocs/home/frame_en.htm">http://www.inm-gmbh.de/htdocs/home/frame_en.htm</a>	
Turnover in €:	Budget investments: 15mill.	Staff in 2004:	

### Organization focus:

Research centre for particle synthesis and the technological implementation of nanoparticles into industrial innovations. Nanoparticles for function layers, catalyzers, polymer/nanocomposites, microsystem technology (microinjection molding) sensors, membranes. Magnetic particles for imaging e.g.

### Collaborations:

The INM is involved in a series of European cooperations. The Leibniz Association (<http://www.wgl.de/extern/englisch/index.html>) is a merger of currently 80 German research institutions having different aims, whose basic financing is covered 50% by the Federal Government for reasons of national interest. The Leibniz Institutes are distributed throughout all Federal Länder.

<b>JenLab GmbH</b>		Founded 1999	
<b>Contact/CEO</b>		Dr. Peter Fischer	
Schillerstr. 1 07745 JENA <b>Tel.</b> +49 364 1470501 <b>Fax.</b> +49 364 1470543		<b>Email:</b> <a href="mailto:info@jenlab.de">info@jenlab.de</a> <b>Web:</b> <a href="http://www.jenlab.de/index.html">www.jenlab.de/index.html</a>	
Turnover in €:		Staff in 2004:	

### Organization focus:

Primary goals of the company are the development and the establishment of bioinstrumentation based on Femtosecond Laser Technology for biotechnology, cell biology and medicine. Another field of expertise is sequence specific cutting of DNA with laser absorption on nano particles, nano cutting, dissection of chromosomes, enzyme markers, auto-fluorescence skin, world-smallest cut size (85 nm).

<b>NanoPharm AG</b>		Founded 2000	
<b>Contact/CEO</b>		Prof. Dr. Bernhard Sabel	
Leipziger Str. 44 39120 Magdeburg <b>Tel.</b> +49 391 6117330 <b>Fax.</b> +49 391 6117101		<b>Email:</b> <a href="mailto:info@nanoparticles.info">info@nanoparticles.info</a> <b>Web:</b> <a href="http://www.nanopharm.de/index.htm">www.nanopharm.de/index.htm</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

NanoPharm AG offers the NANODEL™-technology to the pharmaceutical and biotechnical industry to solve problems in drug delivery, to bind their drugs to the nanoparticles. NanoPharm carries out binding studies.

**Collaborations:**

NanoPharm AG works in close cooperation with other Universities, such as the University of Frankfurt.

<b>Nanosolutions GmbH</b>	Founded 2000		
<b>Contact/CEO</b>	Dr. Stephan Haubold		
Schnackenburgallee 149 22525 Hamburg <b>Tel.</b> +49 40 5488010 <b>Fax.</b> +49 40 54880110	<b>Email:</b> <a href="mailto:haubold@nano-solutions.de">haubold@nano-solutions.de</a> <b>Web:</b> <a href="http://www.nano-solutions.de/en/index.html">www.nano-solutions.de/en/index.html</a>		
Turnover in €:		Staff in 2004:	

**Organization focus:**

Preparing of nanoparticles for combination with bio-molecules as specific fluorescent marker substances in medical diagnostics. Currently, Nanosolutions is developing a concept for such a marker in collaboration with Bayer AG.

**Collaborations:**

Bayer AG: development of fluorescent marker substances for bio-labelling  
LAT-Suhl: functional layers  
IFAM Bremen: three dimensional graded functional devices with local control of material composition by rapid prototyping  
University of Melbourne: surface modification of REN®-X  
Innovationsstiftung Hamburg: development of new UV-B nanophosphors  
University of Hamburg: synthesis of new nanoparticle systems

<b>novosom AG</b>	Founded 1999		
<b>Contact/CEO</b>	Steffen Panzner		
Weinbergweg 22 06120 Halle <b>Tel.</b> +49 345 5559 845 <b>Fax.</b>	<b>Email:</b> <a href="mailto:steffen.panzner@novosom.com">steffen.panzner@novosom.com</a> <b>Web:</b> <a href="http://www.novosom.de/">http://www.novosom.de/</a>		
Turnover in €:		Staff in 2004:	

**Organization focus:**

Novosom provides solutions for the delivery of nucleic acids and proteins. All three of the products and technologies are now preclinically proven. Novosom SMARTICLES® liposomes enable the targeted, therapeutic delivery of RNAi and antisense molecules, allowing pharmaceutical researchers to turn these research tools into effective drugs. Using SMARTICLES® technology, Novosom has demonstrated targeted delivery for inflammatory indications. In stark contrast, Novosom's CAGICLES® provide means for the sustained and burst-free release of proteins or peptides, offering a drug delivery profile for novel biotherapeutics as well as for the emerging generation of biogenerics.

<b>PlasmaChem GmbH</b>	Founded 1993		
<b>Contact/CEO</b>	Dr. Alexey Kalachev		
Rudower Chaussee 29 12489 Berlin-Adlershof <b>Tel.</b> +49 3063 926313 <b>Fax.</b> +49 3063 926314	<b>Email:</b> <a href="mailto:Plasmachem@t-online.de">Plasmachem@t-online.de</a> <b>Web:</b> <a href="http://www.plasmachem.com/">http://www.plasmachem.com/</a>		
Turnover in €:		Staff in 2004:	

**Organization focus:**

Production of new cardio-implants (BioDiamond) with biocompatible nano-layered DLC-coating that serves also as effective barrier against leakage of heavy metal ions (such as ions of Cr, Ni, Mo) from surgical stainless steel 316L.

Present R&D activity of Plasmachem GmbH is concentrated on following points:

- Nano-luminograph (new invented analytical technology)
- DNA-chip
- Development of new generations of bioactive (drug eluting/healing) cardio-implant
- "Stents" with delivery system made with assistance of nano-technology and plasma technology.
- Development of new pharmaceutical nano-suspensions (nano-drugs).

Together with Humboldt University of Berlin PlasmaChem has developed new approach to arrange precisely the polynucleotides (DNA) molecules on atomically flat surfaces. PlasmaChem supposes to use this invention for manufacturing of multi-array molecular DNA-Chip for direct spectroscopic sequencing of human genome. The new practical approach was developed for constructing of single molecular chip where single macromolecules like DNA are arranged in a solid-state array and can be directly analyzed by nano-scanning/nano-spectroscopic facilities.

**Collaborations:**

Humboldt University of Berlin  
Siemens AG  
PlasmaChem is originator of several successfully performed national German (DVG) and international (BriteEuram/Brussels) projects.

<b>Scil Technology GmbH</b>		Founded 1999	
<b>Contact/CEO</b>		Irina Staatz-Granzer	
Fraunhoferstraße 15 82152 Martinsried <b>Tel.</b> +49 89 8565 1944 <b>Fax.</b>		<b>Email:</b> <a href="mailto:i.staatz@scil.com">i.staatz@scil.com</a> <b>Web:</b> <a href="http://www.scil.com/index.html">www.scil.com/index.html</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Developing of new and effective protein-based products in the area of local tissue regeneration, with the primary focus on bone and cartilage repair. The coating of proteins onto surfaces (biomaterials such as ceramics, metals, organic and inorganic polymers). R&D at Scil Technology is devoted to innovative therapeutics in tissue regeneration with matrix-based protein drugs, i.e. products consisting of proteins combined with biomaterials.

<b>SusTech GmbH &amp; Co.</b>			
<b>Contact/CEO</b>		Dr. Stefano Levi	
Petersenstr. 20 64287 Darmstadt <b>Tel.</b> +49 6151 167084 <b>Fax.</b> +49 6151 167081		<b>Email:</b> <a href="mailto:stefano.levi@sustech.de">stefano.levi@sustech.de</a> <b>Web:</b> <a href="http://www.sustech.de/engl.%20finale_Homepage/index.htm">www.sustech.de/engl. %20finale_Homepage/index.htm</a>	
Turnover in €:		Staff in 2004:	28

**Organization focus:**

SusTech Darmstadt is a centre of competence for nanotechnology and materials for sustainable technology. Developing of products for the treatment of surfaces to repel water, oil, dirt and microbes on the basis of fluoropolymer composites and also on the StarPEG technology developed at SusTech Darmstadt. This technology offers a valuable platform for applications in analytics, biomedical technology and healthcare. Also SusTech Darmstadt develops nanoparticles in various forms for special applications like transparent sunscreens or adhesives with nanoantennas . Examples of special interest are the biominerals teeth and bones are formed of. The bioanalogous composites, developed by SusTech Darmstadt on the basis of nano-apatite, stand out due to their bioactive properties. Applications in the area of dental hygiene and for dental implants and bones.

**Collaborations:**

Cooperations with both, globally operating industries as well as small and medium-sized companies, which enables the fast conversion of innovative ideas into economically usable products and processes.



<b>Advalytix AG</b>			
<b>Contact/CEO</b>		Astrid Kirchhoff	
Eugen-Sänger-Str. 53.0 85649 Brunnthal <b>Tel.</b> +49 8962 836682 <b>Fax.</b> +49 8962 836611		<b>Email:</b> <a href="mailto:Kirchhoff@Advalytix.de">Kirchhoff@Advalytix.de</a> <b>Web:</b> <a href="http://www.advalytix.de/">http://www.advalytix.de/</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Development of electronic control of chemical reactions on the surface of a biochip with nanopumps, utilizing so-called surface acoustic waves (SAW) generated by applying radio-frequency electric pulses to the chips. Piezoelectric solids deform if an electric field is applied to them. Rapid changes of such electric fields generated with an appropriate transducer are efficiently converted into a 'nanoquake on a chip'.

<b>Graffinity Pharmaceuticals AG</b>			
<b>Contact/CEO</b>		Dr Klaus Schollmeier	
Im Neuenheimer Feld 518 - 519 69120 Heidelberg <b>Tel.</b> +49 6221 6510175 <b>Fax.</b> +49 6221 6510111		<b>Email:</b> <a href="mailto:office@graffinity.com">office@graffinity.com</a> <b>Web:</b> <a href="http://www.graffinity.com/englisch/e_frames/kontakt.html">http://www.graffinity.com/englisch/e_frames/kontakt.html</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

High-throughput, label-free screening of fragment and displayed-fragment micro-arrays on its proprietary SPR platform, allows it to rapidly identify novel drug fragments and binary molecules as ligands for a biomolecular target. Ability to detect even weakest affinities between ligand and target by SPR and low protein consumption.

<b>CAESAR Research Centre</b>			
<b>Contact/CEO</b>			
Ludwig-Erhard-Allee 2 53175 Bonn <b>Tel.</b> +49 228 9656 0 <b>Fax.</b> +49 228 9656 111		<b>Email:</b> <a href="mailto:office@caesar.de">office@caesar.de</a> <b>Web:</b> <a href="http://www.caesar.de/693.0.html">www.caesar.de/693.0.html</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Research in many areas such as Biotechnology and Nanotechnology. Development of new sensor systems like acoustic wave sensors and microfluidic devices.

<b>IMM - Institut für Mikrotechnik Mainz GmbH</b>	Founded 1990		
<b>Contact/CEO</b>	Josef Heun		
Marketing/Corporate Communications Carl-Zeiss-Straße 18-20 55129 Mainz <b>Tel.</b> +49 6131 990 117 <b>Fax.</b> +49 6131 990 205	<b>Email:</b> <a href="mailto:imminfo@imm-mainz.de">imminfo@imm-mainz.de</a> <b>Web:</b> <a href="http://www.imm-mainz.de/">http://www.imm-mainz.de/</a>		
Turnover in €:		Staff in 2004:	

**Organization focus:**

Development of a great spectrum of micro- and nanodevices such as lab-on-a-chip, nanofluidics, biosensors, AFM tips.

<b>Fraunhofer-Institut für Siliziumtechnologie ISIT, Biotechnical Microsystems</b>			
<b>Contact/CEO</b>	Dr. habil. Rainer Hintsche		
Fraunhoferstraße 1 25524 Itzehoe <b>Tel.</b> +49 4821 174 221 <b>Fax.</b> +49 4821 174 251	<b>Email:</b> <a href="mailto:hintsche@isit.fhg.de">hintsche@isit.fhg.de</a> <b>Web:</b> <a href="http://www.isit.fhg.de/">http://www.isit.fhg.de/</a>		
Turnover in €:		Staff in 2004:	

**Organization focus:**

Profile/field of research:

- Electrical biochip arrays
- Glucose sensing
- Biological interface on chip
- Lab-on-a-chip
- Sensor related electronics

<b>Max Planck Institute of Molecular Cell Biology and Genetics</b>			
<b>Contact/CEO</b>		Prof. Dr. Joe Howard	
Pfotenhauerstr. 108 01307 Dresden <b>Tel.</b> +49 351 210 2500 <b>Fax.</b>		<b>Email:</b> <a href="mailto:howard@mpi-cbg.de">howard@mpi-cbg.de</a> <b>Web:</b> <a href="http://www.mpi-cbg.de/research/groups/diez/diez.html">http://www.mpi-cbg.de/research/groups/diez/diez.html</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

The group is interested in the development of novel optical techniques and their applications in cell biology and nanotechnology. In addition to utilizing advanced optical imaging techniques to answer fundamental questions in cell biology, the group also aims to use their biophysical knowledge for nanotechnological applications. It is envisioned to apply cellular machines (such as the kinesin-based biomolecular motor systems) in a synthetic, engineered environment for the generation and manipulation of nanostructures. Particular goals are the application of molecular motors for the setup of a molecular nanosorter and for the generation of DNA-based nanocircuits.

<b>Max Planck Society, Institute for Biophysical Chemistry - Department of NanoBiophotonics</b>			
<b>Contact/CEO</b>		Prof. Dr. Stefan W. Hell	
Am Fassberg 11 37077 Göttingen <b>Tel.</b> +49 551 201 1366 <b>Fax.</b> +49 551 201 1085		<b>Email:</b> <a href="mailto:shell@gwdg.de">shell@gwdg.de</a> <b>Web:</b> <a href="http://www.mpibpc.gwdg.de/abteilungen/200/">http://www.mpibpc.gwdg.de/abteilungen/200/</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

The group conceives, invents and utilizes optical microscopes and quantum dots with resolution at the nanometre scale to advance life sciences.

<b>MagnaMedics GmbH</b>			
<b>Contact/CEO</b>		Dr. D. Müller-Schulte	
Martelenberger Weg 8 52066 Aachen <b>Tel.</b> +49 241 873627 <b>Fax.</b> +49 241 874599		<b>Email:</b> <a href="mailto:info@magnameedics.de">info@magnameedics.de</a> <b>Web:</b> <a href="http://www.magnameedics.com">http://www.magnameedics.com</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Specialized in development of magnetic nanoparticles for analytics and diagnostics applications.

<b>Philips GmbH, Research</b>			
<b>Contact/CEO</b>		Dr. Thomas Jüstel	
Weisshauptstr. 2 52066 Aachen <b>Tel.</b> <b>Fax.</b>		<b>Email:</b> <a href="mailto:thomas.juestel@philips.com">thomas.juestel@philips.com</a> <b>Web:</b> <a href="http://www.philips.de/InformationCentre/NO/FArticleSummary.asp?INodeId=917&amp;channel=917&amp;channelId=N917A2293">http://www.philips.de/InformationCentre/NO/FArticleSummary.asp?INodeId=917&amp;channel=917&amp;channelId=N917A2293</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

The expertise of the group lies in the fields of fluorescent materials, nanoparticles, hybrid systems. Current projects are:

- carbon nanotubes
- nanoparticles for applications in molecular imaging
- molecular diagnostic

<b>Schering AG</b>			
<b>Contact/CEO</b>		Prof. Dr. Günter Stock	
Max-Dohrn-Straße 10 10589 Berlin <b>Tel.</b> +49 30 349 89 0 <b>Fax.</b> +49 30 349 89 111		<b>Email:</b> <a href="mailto:info@schering.de">info@schering.de</a> <b>Web:</b> <a href="http://www.schering.de">http://www.schering.de</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Schering delivers a range of imaging contrast media. The radiopharmaceuticals enable a rapid recognition of specific tissue, allowing for targeted therapy.

## 15 Greece

Funding in the area of nanotechnology comes from the General Secretariat for Research, which is the central agency for the administration of the Greek R&D and innovation ([www.cordis.lu/greece/rd.htm](http://www.cordis.lu/greece/rd.htm)). Much of research in nanotechnology is done in nanostructured films and electronics.

The Greek network NanoNeT aims to coordinate activities and services of AUTH (Aristotle University of Thessaloniki) labs and other Greek labs in nanosciences and nanotechnologies. It also aims to contact and organize events with collaborators from hi-tech industries in Greece and Europe ([www.auth.gr/nanonet/en\\_site/home\\_en.htm](http://www.auth.gr/nanonet/en_site/home_en.htm)).

<b>Aristotle University of Thessaloniki</b>			
<b>Contact/CEO</b>		Professor S. Logothetidis	
Physics Department Solid State Physics Division 54124 Thessaloniki <b>Tel.</b> +30 310 998174 <b>Fax.</b> +30 310 998390		<b>Email:</b> <a href="mailto:logot@auth.gr">logot@auth.gr</a> <b>Web:</b> <a href="http://skiathos.physics.auth.gr/thinfilmslab/">skiathos.physics.auth.gr/thinfilmslab/</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

The Laboratory for Thin Films - Nanosystems and Nanometrology (LTFN) is established at the Physics Department of Aristotle University of Thessaloniki (AUTH). LTFN programs interact with and transfer its technology to industrial users and developers. The aim of this network is the creation of a core that will coordinate the services of the laboratories of AUTH activated in the areas of Nanosciences and Nanotechnologies with scope for continuing enlargement initially inside AUTH and furthermore in the Greek area and finally the strengthening of its connections with production.

The LTFN operates also as a centre of excellence and can provide services and know how transfer to various institutions on:

- fabrication of nanomaterials and microsystems (for e.g. biomedical applications)
- thin films and coatings technology of metals, semiconductors, insulators, nitrides, oxides and polymers
- design of vacuum chambers, smart optical sensing systems (adapted to process) and non-destructive techniques
- high performance in-situ monitoring thin films growth and various processes
- non-destructive optical characterization of thin films, coatings, nano- and bulk materials

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<b>Biosensors Lab</b> <b>Department of Biology</b>	
<b>Contact/CEO</b>	Dr E. Gizeli (Ass. Professor)
University of Crete Vasilika Vouton, 71003 Heraklion-Crete <b>Tel.</b> +30 2810 394373 <b>Fax.</b> +30 2810 394408	<b>Email:</b> <a href="mailto:gizeli@biology.uoc.gr">gizeli@biology.uoc.gr</a> <b>Web:</b> <a href="http://www.imbb.forth.gr/people/gizeli/index.html">www.imbb.forth.gr/people/gizeli/index.html</a>
Turnover in €:	Staff in 2004:

**Organization focus:**

The work is based on the study of biomolecular interactions of biological and biotechnological significance by using an acoustic wave biosensor that consists of an acoustic wave device combined with a biorecognition layer. The biosensor can be applied to the real-time study of biomolecular interactions. Adsorption or desorption of mass to or from the biorecognition layer together with changes in the structure of the layer can be monitored acoustically.

<b>University of Crete Physics Department</b>			
<b>Contact/CEO</b>		Spiros H. Anastasiadis (Assoc. Prof.)	
P.O Box 2208 71003 Heraklion, Crete <b>Tel.</b> +30 2810 391466 <b>Fax.</b> +30 2810 391305		<b>Email:</b> <a href="mailto:spiros@iesl.forth.gr">spiros@iesl.forth.gr</a> <b>Web:</b> <a href="http://www.physics.uoc.gr/en/menu/applied.html">www.physics.uoc.gr/en/menu/applied.html</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

The Polymer Group utilises a variety of modern experimental techniques like neutron and X-ray reflectivity and scattering, surface and interfacial tensiometry, transmission electron microscopy, and atomic force microscopy for applications as polymer adsorption and polymer brushes; organic/inorganic hybrids; nanostructures and nanocomposites.

<b>Biomedical Sciences Research Centre «Alexander Fleming»</b>		Founded 1965	
<b>Contact/CEO</b>		George Panayotou	
34 Fleming Street, 16672 Vari <b>Tel.</b> +30 210 9655 054 <b>Fax.</b>		<b>Email:</b> <a href="mailto:G.Panayotou@fleming.gr">G.Panayotou@fleming.gr</a> <b>Web:</b> <a href="http://www.fleming.gr/proteomics.htm">www.fleming.gr/proteomics.htm</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

The Laboratory of Protein Chemistry provides a core facility for the analysis and characterization of proteins and their interactions with other biomolecules. A nanospray source was obtained for the analysis of peptides at low levels obtained from 2-D gels. Peptides are separated with a specialized nano-HPLC system, using flow rates at the nanolitre range and very small diameter columns. Another instrument of the facility is a Surface Plasmon Resonance biosensor (BIAcore 3000) for the analysis of macromolecular interactions.

## 16 Hungary

The Hungarian government's innovation policy is part of the National Development plan, and its objectives include support for the application of generic technology and the establishment of cooperative research centres involving academic and industrial partners. The board for Scientific and Technology Policy and the Advisory Body for Scientific Matters advise the government on science policy.

<b>Institute of Biophysics Biological Research Centre</b>			
<b>Contact/CEO</b>		Prof. Pál Ormos	
Temesvári krt. 62 6726 Szeged <b>Tel.</b> +36 62 599 613 <b>Fax.</b>		<b>Email:</b> <a href="mailto:pali@nucleus.szbk.u-szeged.hu">pali@nucleus.szbk.u-szeged.hu</a> <b>Web:</b> <a href="http://www.szbk.u-szeged.hu/modules.php?name=Sections&amp;op=respro&amp;inst_id=1">http://www.szbk.u-szeged.hu/modules.php?name=Sections&amp;op=respro&amp;inst_id=1</a>	
Turnover in €:		Staff in 2004:	

### Organization focus:

The research of this relatively large group covers the physical aspects of biological systems from basic research to applications: dynamics and structure-function relation of biological macromolecules, energy transduction of membrane proteins, human biophysics as well as optoelectronic application of chromoproteins, nanobio-technology.

<b>ComGenex</b>			
<b>Contact/CEO</b>		Dr Lazlo Üрге	
Bem rakpart 33-34 1027 Budapest <b>Tel.</b> +36 1 214 2306 <b>Fax.</b> +36 1 214 2310		<b>Email:</b> <a href="mailto:info@comgenex.hu">info@comgenex.hu</a> <b>Web:</b> <a href="http://www.comgenex.com">http://www.comgenex.com</a>	
Turnover in €:		Staff in 2004:	

### Organization focus:

ComGenex has developed microfluidics chips used for diverse purposes in drug discovery, like synthesis, purification, and high-throughput screening. ComGenex provides special compound sets for the development of chemical microarrays.



## 17 Iceland

Iceland is an associated country to the EU. There have been some major changes in Icelandic industry over the past few years. Innovation has been stimulated primarily by a more liberal business climate and rapid progress in science and technology, particularly in information and communication technology. There are a number of companies involved in the life sciences, and the nanotechnology sector is still growing.

<b>IceTec Technological Institute of Iceland</b>			
<b>Contact/CEO</b>			
Keldnaholti 112 Reykjavik <b>Tel.</b> +354 570 7100 <b>Fax.</b> +354 570 7100		<b>Email:</b> <a href="mailto:info@iti.is">info@iti.is</a> <b>Web:</b> <a href="http://www.iti.is/default1.asp?Id=1059">www.iti.is/default1.asp?Id=1059</a>	
Turnover in €:		Staff in 2004:	

### **Organization focus:**

IceTec strengthens the Icelandic economy through applied research in biotechnology, materials and production technology, food technology and environmental issues. At the moment no specific nanotechnology project is mentioned.

## 18 Ireland

Since 1999, the Irish government has been investing in a nanotechnology research infrastructure, mainly in the National Microelectronics Research Centre in Cork (NMRC), but also in Dublin-based University groups, especially Trinity College. The NMRC has international standing as a nanoresearch facility and the European Commission funds access to it for foreign visitors. Ireland is also the home of some significant nanotechnology start-ups such as Ntera. Several multinational companies with an Irish base are progressing in nanotechnology research and development, and are being strongly supported by Enterprise Ireland (<http://www.enterprise-ireland.com/>).

<b>Department of Physics Trinity College</b>			
<b>Contact/CEO</b>		Dr Igor Shvets	
Department of Physics, Trinity College Dublin 2 <b>Tel.</b> +353 1 6081653 <b>Fax.</b> +353 1 671 1759		<b>Email:</b> <a href="mailto:ivchvets@tcd.ie">ivchvets@tcd.ie</a> <b>Web:</b> <a href="http://www.tcd.ie/Physics/?Nanotechnology/index.htm">www.tcd.ie/Physics/?Nanotechnology/index.htm</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

The nanotechnology research group is involved in research on nanofluidics instrumentation for applications in medical diagnostics and pharmaceutical industry. Research includes making microchannels in polymers using methods of lithographic micro fabrication. The chips are used for controlled transportation, mixing, and manipulation of subnanolitre volumes of fluids. The group has filed several patents in the related fields.

<b>Dept of Chemistry University College Dublin</b>			
<b>Contact/CEO</b>		Prof Donald Fitzmaurice	
Belfield Dublin 4 <b>Tel.</b> +353 1 716 2441 <b>Fax.</b> +353 1 716 2127		<b>Email:</b> <a href="mailto:donald.fitzmaurice@ucd.ie">donald.fitzmaurice@ucd.ie</a> <b>Web:</b> <a href="http://chemistry.ucd.ie/">http://chemistry.ucd.ie/</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

The Nanochemistry Group has current activities and interests in a number of basic research topics such as preparation, characterisation and self-assembly of nanocrystallites and nanostructured materials to applied research including nanocrystal drug delivery. In the future an emphasis is planned on the self-assembly of nanostructures possessing capacities for self-repair and self-replication.

<b>The National Centre for Sensor Research</b>			
<b>Contact/CEO</b>		Prof. Brian MacCraith	
Dublin City University Glasnevin Dublin 9 <b>Tel.</b> +353 1 700 8821 <b>Fax.</b> +353 1 700 8021		<b>Email:</b> <a href="mailto:brian.maccraith@dcu.ie">brian.maccraith@dcu.ie</a> <b>Web:</b> <a href="http://www.ncsr.ie/index_home.html">www.ncsr.ie/index_home.html</a>	
Turnover in €:		Staff in 2004:	130

### Organization focus:

The National Centre for Sensor Research is a large-scale, multidisciplinary, sensor research centre focused on the science and applications of chemical sensors and biosensors. The research programme of the NCSR includes both fundamental and applied projects, ranging from basic studies of molecular interactions, for example, to prototype development for industrial partners.

The application focus of the NCSR research programme is on medical diagnostics, food quality and environmental monitoring. The research structure of the NCSR focuses on:

- life-sciences and health (exploitation of novel antibody, protein and DNA markers to investigate biological interactions at the molecular level; development of highly sensitive detection approaches for the exploration of protein-protein interactions; fabrication of new optical sensors and assays for biological and medical applications.)
- nanotechnology and microsystems (in-situ visualization of biomembrane activity; biomaterials as linkers for self-assembling molecular electronics, security applications and multiplexed sensing).

### Collaborations:

The NCSR has established 3 new strategic alliances with internationally recognised centres in identified key areas of sensor R&D:

Intelligent Polymer Research Institute, University of Wollongong, Australia

[www.uow.edu.au/science/research/ipri/contents.html](http://www.uow.edu.au/science/research/ipri/contents.html)

Sensors research Laboratory, Georgia Institute of Technology, Atlanta, USA

[www.gatech.edu](http://www.gatech.edu)

VTT Electronics, Oulu, Finland [www.vtt.fi](http://www.vtt.fi)

Emerging Alliance with Cornell University Nanobiotechnology Centre

[www.nbtc.cornell.edu](http://www.nbtc.cornell.edu)

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<b>Deerac Fluidics</b>	Founded 1999		
<b>Contact/CEO</b>	Jurgen Osing		
Unit 8 Enterprise Street Pearse Street Dublin 2 <b>Tel.</b> +353 1 613 9543 <b>Fax.</b> +353 1 679 1544	<b>Email:</b> <a href="mailto:michelle@deerac.com">michelle@deerac.com</a> <b>Web:</b> <a href="http://www.deerac.com/">http://www.deerac.com/</a>		
Turnover in €:		Staff in 2004:	20

### Organization focus:

Deerac Fluidics is a global leader in the development and production of liquid handling solutions, enabling the dispensing of microlitre and nanolitre volumes of a wide range of fluids. The liquid handling systems are used for applications in genomics, drug discovery, proteomics and diagnostics.

<b>NMRC</b>	Founded 1981		
<b>Contact/CEO</b>	Dr. Gareth Redmond		
"Lee Maltings" Prospect Row Cork <b>Tel.</b> +353 21 4904177 <b>Fax.</b>	<b>Email:</b> <a href="mailto:gareth.redmond@nmrc.ie">gareth.redmond@nmrc.ie</a> <b>Web:</b> <a href="http://www.nmrc.ie/research/nanotechnology/index.html">www.nmrc.ie/research/nanotechnology/index.html</a>		
Turnover in €:		Staff in 2004:	200

### Organization focus:

Nanotechnology research at NMRC encompasses the design, synthesis, fabrication and characterisation of nanostructures and nanosystems. High-density optoelectronic integrated systems (OEIS) to exploit the ability of biomolecules to self-assemble micron scale components. Development of electronically addressable test chips, multiplexed microelectrode matrices with each electrode bearing DNA strands of programmed base sequence as platforms for the self-assembly of DNA modified optoelectronic components. Electrophoresis technology for transport of components to the electrode array has been developed. Current research focuses on optimisation of the DNA interactions necessary for component localisation and binding.

## 19 Israel

In spite of its size and severe defence constraints, Israel is an acknowledged centre of multidisciplinary technologies, with strong research capabilities, proven technological infrastructure, innovative hi-tech industry and impressive human resources. Israel works very closely with France in the area of nanotechnology and collaborates through shared workshops and the sharing of resources such as equipment and institutions. There are many companies and academic institutes involved in nanotechnology.

<b>Centre for Nanoscience and Nanotechnology</b>			
<b>Contact/CEO</b>	Dr. Inna Popov (head of the unit)		
Hebrew University of Jerusalem Jerusalem 91904 <b>Tel.</b> +972 2 6584808 <b>Fax.</b>	<b>Email:</b> <a href="mailto:innap@savion.huji.ac.il">innap@savion.huji.ac.il</a> <b>Web:</b> <a href="http://www.nanoscience.huji.ac.il/unit/index.htm">www.nanoscience.huji.ac.il/unit/index.htm</a>		
Turnover in €:		Staff in 2004:	

**Organization focus:**

The main objectives are:

- support multidisciplinary research and "hands-on" technological education at the Hebrew University.
- develop and operate user-oriented analytical facilities and to aid researchers from the University and external customers in performing a variety of characterization measurements.
- advanced equipment for electron microscopy, scanning probe microscopy, X-ray characterization, and advanced surface-chemical analysis of materials. The UNC also provides equipment needed for specimen preparation for the above characterization facilities.

<b>ILSE KATZ Centre for Meso- and Nanoscale Science and Technology</b>			
<b>Contact/CEO</b>		Prof. Baruch Horovitz	
Ben-Gurion University of the Negev Beer Sheva 84105 <b>Tel.</b> +972 8 6461748 <b>Fax.</b> +972 8 6472830		<b>Email:</b> <a href="mailto:hbaruch@bqumail.bgu.ac.il">hbaruch@bqumail.bgu.ac.il</a> <b>Web:</b> <a href="http://www.bgu.ac.il/nanocentre/Pages/Academics/Projects.html">http://www.bgu.ac.il/nanocentre/Pages/Academics/Projects.html</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Aim is to study the fundamental properties of organic, inorganic, and biologically based nanostructures using tools that enable the geometric visualization of such structures and quantitative analysis of their fundamental optical, electronic, structural, and mechanical properties. Such tools include electron, optical and scanning probe microscopes.

<b>Tel Aviv University</b>			
<b>Contact/CEO</b>		Prof. Amihay Freeman	
P.O.Box 39040 Tel Aviv 69978 <b>Tel.</b> +972 3 6409054 <b>Fax.</b> +972 3 6409054		<b>Email:</b> <a href="mailto:amihayf@post.tau.ac.il">amihayf@post.tau.ac.il</a> <b>Web:</b> <a href="http://www.nanotau.org.il/">http://www.nanotau.org.il/</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Projects at Tel Aviv University:

- Controlled metallization of protein-made nanostructures
- Enzyme-binding proteins for functional nanostructures
- Self-assembly of protein 'building-blocks' into nano protein crystals
- Protein based nanoparticles
- Screening of the protein data bank for 'building blocks' to be used in self-assembled nano-structures

<b>Do-Coop Technologies</b>		Founded 1997	
<b>Contact/CEO</b>			
Yoni Netanyahu 3B st. P.O.B. 1032 Or-Yehuda 60376 <b>Tel.</b> +972 3 5333804 <b>Fax.</b>		<b>Email:</b> <a href="mailto:info@docoop.com">info@docoop.com</a> <b>Web:</b> <a href="http://www.docoop.com/">http://www.docoop.com/</a>	
Turnover in €:		Staff in 2004:	

### **Organization focus:**

Do-Coop Technologies is a nanobiotechnology company that develops and produces water-based products for pharmaceutical, molecular biology, and medical diagnostics applications. Nanotechnology delivers products that can serve as biocatalysts, super solvents, nano-reagents, media enhancers, and buffers that will significantly improve the price-performance ratio of the customer's products.

## **20 Italy**

Italy's science and technology guidelines include priority areas for nano-technology, intelligent materials and sustainable development and climate change. Italian funding comes from the ministry of Scientific Research, the National Institute for Physics of Matter INFM and the national research council CNR. The National Research Council CNR has funded a national research programme in Nanotechnology (1998-2000), with 4m Euro government funding. This programme focused on three lines:

- 1) Nanotechnology and molecular devices for electronics;
- 2) Nanomaterials and nanodevices for the biomedical sector;
- 3) Nanostructures for other applications.

In the health sector, nanotechnology is being investigated for longer-term applications in pharmacy on chips; nanoparticles and gene therapy; surfaces for medical implants and tissues; organic silicon interfaces. Minatech is an Economic and Technological Intelligence (ETI) project looking at trends in micro and nano technologies and applications and markets for these technologies.

<b>Nanotechnology Research Group</b>			
<b>Contact/CEO</b>		Roberto Cingolani	
Via Arnesano 73100 Lecce <b>Tel.</b> +39 832 298205 <b>Fax.</b> +39 832 298238		<b>Email:</b> <a href="mailto:roberto.cingolani@unile.it">roberto.cingolani@unile.it</a> <b>Web:</b> <a href="http://www.nnl.it/nnl_new/html/divisions/06biomolecular_elect.html">http://www.nnl.it/nnl_new/html/divisions/06biomolecular_elect.html</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

The Biomolecular Electronics Division explores self-assembly and/or single molecule manipulation (bottom-up approach). Usage of mainly electron-beam lithography, advanced scanning probe methods (like UHV-low temperature STM spectroscopy) and manipulation and cross sectional AFM and STM. The basic issue is to interconnect nanopatterned inorganic substrates with self-organized biological molecules like DNA and proteins, having electron transport capability.

<b>National Research Centre on nanoStructures and bioSystems at Surfaces (S3)</b>			
<b>Contact/CEO</b>		Elisa Molinari	
via Campi 213/A 41100 Modena <b>Tel.</b> +39 5920 55284 <b>Fax.</b> +39 5937 4752		<b>Email:</b> <a href="mailto:molinari.elisa@unimore.it">molinari.elisa@unimore.it</a> <b>Web:</b> <a href="http://www.s3.infm.it/">http://www.s3.infm.it/</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

The research at S3 aims specifically at understanding and exploiting the role of surfaces and interfaces to design matter and functions at the nanoscale:

- biomolecular and cellular systems at surfaces
- molecular interactions and functional surfaces
- nanostructured magnetic surfaces and materials
- nanofabrication and high-resolution microscopy by ion and electron beams
- simulating and designing (bio)molecular interactions at surfaces
- theory of electron states and correlation at the nanoscale

<b>Institute for the Study of Nano-structured Materials (ISMN CNR)</b>			
<b>Contact/CEO</b>		Mauro Murgia	
Via P. Gobetti, 101 40129 Bologna <b>Tel.</b> +39 51 6398528 <b>Fax.</b>		<b>Email:</b> <a href="mailto:m.murgia@ism.bo.cnr.it">m.murgia@ism.bo.cnr.it</a> <b>Web:</b> <a href="http://www.ism.bo.cnr.it/home.html">www.ism.bo.cnr.it/home.html</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

The main scientific objective is the construction and study of optoelectronic and multifunctional thin film devices based on organic molecular and supramolecular systems. Scanning probe microscopy of molecular nanostructures:

- Conjugated molecular thin films: morphology, growth mechanism, surface-molecule interactions, wetting-dewetting.
- Control of order, anisotropy, spatial correlation at mesoscopic and nanometre lengthscales in molecular materials.
- Nanolithography, nanomanipulation and nanofabrication of molecular thin films by scanning probes and their integration with other lithography techniques.
- Development and construction of scanning probe microscopes dedicated to nanolithography in controlled ambient (UHV, liquid) for the fabrication of new devices and low-dimensional molecular architectures.

<b>National Enterprise for Nanoscience and Nanotechnology</b>			
<b>Contact/CEO</b>		Fabio Beltram	
Scuola Normale Superiore Piazza dei Cavalieri, 7 56126 Pisa <b>Tel.</b> +39 50 509065 <b>Fax.</b> +39 50 509295		<b>Email:</b> <a href="mailto:f.beltram@sns.it">f.beltram@sns.it</a> <b>Web:</b> <a href="http://leopardi.cmp.sns.it/mb.php">leopardi.cmp.sns.it/mb.php</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Investigation of nanoscale physics to develop nanobiotechnological tools, and nanoelectronic and photonic devices and architectures.

- Molecular modelling and spectroscopy of fluorescent proteins
- Visualization of protein trafficking and protein-protein interactions in living cells (labelled with fluorescent probes or quantum dots)

<b>Università degli Studi di Genova, Dipartimento di Fisica</b>			
<b>Contact/CEO</b>		Prof. Alessandra Gliozzi	
Via Dodecaneso 33 16146 Genova <b>Tel.</b> +39 10 3536221 <b>Fax.</b> +39 10 311066		<b>Email:</b> <a href="mailto:gliozzi@fisica.unige.it">gliozzi@fisica.unige.it</a> <b>Web:</b> <a href="http://www.infm.it/Uk/Research/Sections/B/index.php3#tematiche">http://www.infm.it/Uk/Research/Sections/B/index.php3#tematiche</a>	
Turnover in €:		Staff in 2004:	



**Organization focus:**

Getting information about natural membranes, mainly at a molecular level, on some fundamental biophysical processes such as the energetic and sensorial transduction, the neuronal communication, the mechanism of the memory. Design of biosensors and biochips. Some effort is currently put in developing advanced instrumentation in the following fields:

- absorption emission and scattering optical spectroscopy in biological systems;
- EPR and NMR spectroscopy and imaging (also in vivo);
- probe microscopy and spectroscopy for single biomolecule detection;
- high resolution fluorescence imaging in sensorial systems (Ca<sup>2+</sup> ions controlled).

<b>FONDAZIONE EL.B.A.</b>	Founded 1997		
<b>Contact/CEO</b>	Claudio Nicolini		
Via delle Testuggini snc 00134 Rome <b>Tel.</b> +39 06 57992570 <b>Fax.</b> +39 06 57992575	<b>Email:</b> <a href="mailto:fondazione@fondazione-elba.org">fondazione@fondazione-elba.org</a> <b>Web:</b> <a href="http://www.fondazione-elba.org/index.html">http://www.fondazione-elba.org/index.html</a>		
Turnover in €:		Staff in 2004:	

**Organization focus:**

Detection of thin films of biomolecules with a thermostabilization of protein structure and function up to 150°C. Of particular significance is the application to biocatalysis in cooperation with a leading pharmaceutical company (Antibioticos). The use of thin film technologies for the preparation of elements to be coupled to biosensor transducers permits to create a wide range of interchangeable elements for various applications in medicine, environment control, electronics and agroalimentary industries. Characterization of protein thin films with different methods (STM, AFM, STEM, X-Ray diffraction, ellipsometry, etc.) for the production of protein crystals.

<b>Nanotech Depositions</b>	Founded 2003		
<b>Contact/CEO</b>	Tommaso Giorgessi		
Via Schio, 81/b 36030 S. Vito di Leguzzano (VI) <b>Tel.</b> +39 34 967 60476 <b>Fax.</b>	<b>Email:</b> <a href="mailto:imngiorgessi@civen.org">imngiorgessi@civen.org</a> <b>Web:</b> <a href="http://www.civen.org/EN/">http://www.civen.org/EN/</a>		
Turnover in €:		Staff in 2004:	

**Organization focus:**

CIVEN has research projects in the areas of:

- Nanostructures for chemical and biochemical sensors.
- Nanostructured materials for protective and decorative coatings.
- Deposition of thin films of nanometric size and of thick coatings of inorganic, organic or hybrid nanocomposites.
- Construction of microarrays for genomics and proteomics research.

<b>Silicon Biosystems</b>	Founded 1999		
<b>Contact/CEO</b>	Nicolo Manaresi		
Via S. Stefano, 132 40125 Bologna <b>Tel.</b> +39 333 923 8294 <b>Fax.</b> +39 02 700 430 688	<b>Email:</b> <a href="mailto:info@siliconbiosystems.com">info@siliconbiosystems.com</a> <b>Web:</b> <a href="http://www.siliconbiosystems.com/company/index.htm">http://www.siliconbiosystems.com/company/index.htm</a>		
Turnover in €:		Staff in 2004:	

**Organization focus:**

Silicon Biosystems has developed a set of patented solutions for so-called lab-on-a-chip technologies, targeted at miniaturized cell-biology testing for the pharmaceutical research, diagnostic and food industries. It is possible to individually manage more than 100,000 cells on a single microelectronic chip, using software control and incorporating sensors to detect the results of complex experiments.

<b>Technobiochip</b>			
<b>Contact/CEO</b>	Gennaro Zona		
Via della Marina, 39 57030 Marciana Isle of Elba <b>Tel.</b> +39 0565 901250 <b>Fax.</b> +39 0565 901136	<b>Email:</b> <a href="mailto:lab@technobiochip.com">lab@technobiochip.com</a> <b>Web:</b> <a href="http://www.technobiochip.com/tb_en.htm">www.technobiochip.com/tb_en.htm</a>		
Turnover in €:		Staff in 2004:	

**Organization focus:**

Technobiochip's field of research and production:

- Biosensors and chemical sensors
- Ultra-thin (bio)organic film technologies (production of sensing elements for biosensors)

## 21 Latvia

The government adopted a national concept on R&D 1998-2010 in July 1998. This concept includes four national priorities, including the integration of national research potential into universities and the creation of two research centres of national significance: a centre of materials science and a centre of wood science and technology. A number of research priorities have also been set that aim to renew and train the research staff. The original research priorities were: organic chemistry, biomedicine and pharmacy; materials science; IT; forestry and wood science. After an evaluation, they set some

future priorities, which were more in line with the EU framework programme. These are: IT, life science and biotechnology (biomedicine and drug design); new materials and associated technologies; environmental protection.

<b>Latvian Institute of Organic Synthesis</b>		Founded 1957	
<b>Contact/CEO</b>		J. Stradins (head of dept.)	
Aizkraukles iela 21 1006 Riga <b>Tel.</b> +371 755 1822 <b>Fax.</b> +371 755 0338		<b>Email:</b> <a href="mailto:jstrad@osi.lv">jstrad@osi.lv</a> <b>Web:</b> <a href="http://www.osi.lv/strukt/strukt11.html">www.osi.lv/strukt/strukt11.html</a>	
Turnover in €:		Staff in 2004:	

#### **Organization focus:**

The laboratory investigates electronic and molecular structure of organic, organometallic and bioorganic molecules, effects of intra- and intermolecular interaction, redox properties and reactivity of various organic compounds. Elucidation of structure and conformation of Group 14 organometallic compounds, peptides, prostaglandins, heterocyclic compounds, etc. Using multinuclear NMR spectroscopy in solutions, development of new experimental approaches in multinuclear NMR spectroscopy (including ultrahigh resolution spectra). Possibly more nanotechnology in future.

<b>Biomedical Research and Study Centre (BMC)</b>		Founded 1993	
<b>Contact/CEO</b>		Zinaida Somsteine	
Ratsupites str. 1 1067 Riga <b>Tel.</b> +371 780 8202 <b>Fax.</b> +371 744 2407		<b>Email:</b> <a href="mailto:Zina@biomed.lu.lv">Zina@biomed.lu.lv</a> <b>Web:</b> <a href="http://bmc.biomed.lu.lv/">http://bmc.biomed.lu.lv/</a>	
Turnover in €:		Staff in 2004:	80

#### **Organization focus:**

The main research fields and activities of BMC at present are:

1. research of protein structure (folding, self-assembly), post-translational processing (secretion, degradation) and protein engineering, directed to creating of new technologies for vaccines, diagnostics, drug design, gene and immune therapy;
2. genotyping of infectious agents, susceptibility loci of inherited, cardiovascular, and oncological diseases for health monitoring, preventive and therapeutic medicine, introduction of nanotechnologies.

<b>Institute of Chemical Physics</b>			
<b>Contact/CEO</b>		Donats Erts (Director)	
University of Latvia 19 Rainis Boulevard 1586 Riga <b>Tel.</b> +371 7033874 <b>Fax.</b> +371 7820113		<b>Email:</b> <a href="mailto:erts@kfi.lu.lv">erts@kfi.lu.lv</a> <b>Web:</b> <a href="http://www.kfi.lu.lv/">http://www.kfi.lu.lv/</a>	
Turnover in €:		Staff in 2004:	

### **Organization focus:**

The field of research is nano-, meso- and quantum physics. Main tasks of experimental studies are investigation of new nanostructural materials, DNA immobilization on solid surfaces, visualization and conductivity measurements using AFM etc.

### **Collaborations:**

University of Estonia, University College of Cork (Ireland), Chalmers Technological University (Sweden)

## **22 Lithuania**

Lithuania is a Baltic state, with 3.5m inhabitants. The Department of Science and Higher Education of the Ministry of Education and Science and the Science Council of Lithuania are responsible for science policy. The priorities in R&D funding are being discussed, and according to minister Monkevicius, Nanotechnology and new materials are one of the five key areas of research for Lithuania. The other four are bioinformatics and biotechnology for health care and food, information and communication technologies, new energy and social-political sciences. In the capital city Vilnius, the local government is investing in five high technology projects, including 'Sunrise Valley'. This includes IT, laser technology, semiconductor optical technology, nanotechnology and environmental technology.

<b>Research Centre for Microsystems and Nanotechnology Kaunas University of Technology</b>		Founded 1999	
<b>Contact/CEO</b>		Prof. Dr. Valentinas Snitka	
Studentu 65 51369 Kaunas <b>Tel.</b> +370 37 451588 <b>Fax.</b> +370 37 451588		<b>Email:</b> <a href="mailto:vsnitka@ktu.lt">vsnitka@ktu.lt</a> <b>Web:</b> <a href="http://www.microsys.ktu.lt/">http://www.microsys.ktu.lt/</a>	
Turnover in €:		Staff in 2004:	7

### Organization focus:

Research interests:

- Development of scanning probe microscopy methods and instrumentation
- Nanostructured materials and nanomanipulation
- Precision engineering and microsystems

Research projects:

- Development of scanning near-field optical microscope (SNOM) with time-resolved spectroscopy capabilities
- Investigation of influence of the ultrasound on contact on the nanoscale
- Development of Atomic Force Microscopy (AFM) methods for imaging and measurement of different surface properties

### Collaborations:

Kiel Technical University, Materials Research Institute  
Riga Technical University  
Bristol University  
Pennsylvania State University, Materials Science&Engineering Dept.  
Bridgestone/Firestone Research

<b>Semiconductor Physics Institute</b>			
<b>Contact/CEO</b>		Algirdas Jonas Galdikas	
A. Goštauto 11 01108 Vilnius <b>Tel.</b> +370 5 261 97 59 <b>Fax.</b> +370 5 262 71 23		<b>Email:</b> <a href="mailto:spiadm@pfi.lt">spiadm@pfi.lt</a> <b>Web:</b> <a href="http://www.pfi.lt/index_e.html">http://www.pfi.lt/index_e.html</a>	
Turnover in €:		Staff in 2004:	

### Organization focus:

Development of an electronic nose which is based on the experience and facilities to develop, modify, investigate and produce the solid-state gas sensors and hybrid sensors consisting of organic based active parts and solid-state transducers. Production of arrays. Research in advanced materials and structures for chemical sensors, sensing mechanisms and detection methods with nanolayers. Possible applications in food quality control, explosives, drugs.

<b>Institute of Biochemistry</b>	Founded 1990		
<b>Contact/CEO</b>	Valdas Laurinavicius (Head of Dept)		
Mokslininkų 12 08662 Vilnius <b>Tel.</b> +370 5 272 90 68 <b>Fax.</b> +370 5 272 91 96	<b>Email:</b> <a href="mailto:ValdasL@bchi.lt">ValdasL@bchi.lt</a> <b>Web:</b> <a href="http://www.bchi.lt/biochema.htm">www.bchi.lt/biochema.htm</a>		
Turnover in €:		Staff in 2004:	

### **Organization focus:**

Production of optical biosensors based on laccase and other enzymes immobilized in solgels. These biosensors are used for the determination of aromatic amines and polyphenols at nanomolar level.

The department is also involved in structural studies of organic compounds by <sup>1</sup>H and <sup>13</sup>C NMR spectroscopy and computer modeling of molecules. Investigations of electronic structure of bioorganic compounds, application in bionanotechnology, modeling of the optimal formation of the molecules, stereostructure and other chemical properties using quantum mechanical methods are carried out.

### **Collaborations:**

The Laboratory is involved in the international grant system and maintains scientific contacts and joint projects with Lund University (Sweden), Bochum University (Germany), MOLTECH corporation (USA) and other scientific groups.

## **23 Liechtenstein**

Liechtenstein is an associated country to the EU. It has a broadly diversified economic structure with a significant emphasis on industrial production. In comparison with other national economies, Liechtenstein is more strongly industrial and less service-oriented than is generally assumed. There are a number of nanotechnology companies that focus on the field of surface coatings and optics. Liechtenstein supports financially the Interstate University of Applied Sciences of Technology Buchs, Switzerland ([www.ntb.ch/2680.html](http://www.ntb.ch/2680.html)) that performs research on lab-on-chips and nanofluidics.

## 24 Luxembourg

In May 1999 the government of Luxembourg installed a National Research Foundation which distributes R&D funds and develops national research policy ([www.fnr.lu/SIML\\_FNR/Channel/FNRen.nsf/fs\\_Root?OpenFrameset](http://www.fnr.lu/SIML_FNR/Channel/FNRen.nsf/fs_Root?OpenFrameset)). In June 2001 they published their first activity report. In the first 18 months of operation, two calls for expressions of interest were organized, for which 50 proposals were received. With these results, multi-annual research programmes have been created with focus on:

1. NANO, on innovative materials and nanotechnologies, for €6.7m
2. SANTE-BIOTECH, on biotechnology and health, for €6m

The NANO programme aims to create a European research centre in characterization of materials in the nanometre range. The materials include plastics, metals, gases, and biological tissues and cells. The Centre will acquire the necessary instruments, including SIMS (Secondary Ion Mass Spectrometry), nanomechanical surface analysis, and biocompatible measurement methods

([www.fnr.lu/SIML\\_FNR/Presentation.nsf/0/03584c2dee352342c1256cdb00540b61/\\$FILE/DescriptionProgrammeNANO.pdf](http://www.fnr.lu/SIML_FNR/Presentation.nsf/0/03584c2dee352342c1256cdb00540b61/$FILE/DescriptionProgrammeNANO.pdf)).

## 25 Malta

Malta joined the EU in May 2004. It has a relatively small labour force of ca. 160,000 citizens and its main industries are tourism, ship building and textiles. There has been no research in nanotechnology so far, but with access to EU funding it is likely that this will change in the future. Malta is involved in some FP6 projects but not specifically in analytics and diagnostics.

## 26 Netherlands

The main Dutch nanotechnology activities include the national nanotechnology research consortium NanoNed (<http://www.stw.nl/nanoned/>), and its first major programme NanoImpuls. NanoNed consists of eight leading Dutch R&D institutes that have formed a consortium to coordinate their activities and combine their strengths. The partners of NanoNed are:

- MESA+, University of Twente, Prof. David Reinhoudt
- DIMES, University of Delft, Prof. Hans Mooij
- BioMade/MSM+. University of Groningen, Prof. George Robillard
- TPD, Institute for Applied Science TNO, dr. Dick Schmidt
- University of Wageningen, Prof. Ernst Sudhölter
- Photonics Group, University of Amsterdam, Prof. Rob Zsom
- NSR/RIM, University of Nijmegen, Prof. Theo Rasing
- CNM, University of Eindhoven, Prof. Huub Salemink
- Philips Electronics, Eindhoven

The Innovative Research Programme (IOP) has some programmes related to nanotechnology, in particular precision technology, surface technology and genomics. The national research council, NWO, includes nanoscience as one of its ten strategic research areas, but has not yet dedicated substantial resources to it ([http://www.nwo.nl/nwohome.nsf/pages/NWOP\\_5SME25\\_Eng](http://www.nwo.nl/nwohome.nsf/pages/NWOP_5SME25_Eng)). Since October 2000, a number of small companies active in development and commercialization of micro and nanotechnologies have formed MINAC, the Micro and Nano Cluster.

BiOMaDe is a commercial Centre of Excellence in Molecular (or Bio-) Nanotechnology, related to the University of Groningen Biotechnology and Biomedical research institute, which functions as an incubator for start up companies (<http://www.biomade.nl/>). The research is carried out in Biomade, whereas Applied Nanosystems ([ans-bv.nl/](http://ans-bv.nl/)) is responsible for commercializing the patented results.

Currently private investment in nanotechnology is marginal. Large companies like Shell, Akzo, Unilever, and Philips did not invest a lot in microelectro-mechanical System (MEMS) research in the nineties, and this has put the



Netherlands in a weaker position for the application and commercialization of research. The emphasis is on basic research. The Netherlands is strong in MEMS research, but fares badly compared with other European countries when it comes to boasting companies that can actually produce components. Most MEMS firms in the Netherlands are small- to medium-size design firms or niche manufacturers ([www.nanotec.org.uk/evidence/Netherlands.htm](http://www.nanotec.org.uk/evidence/Netherlands.htm)).

<b>BiOMaDe Technology Foundation</b>		Founded 2000	
<b>Contact/CEO</b>		Dr. George Robillard	
Nijenborgh 4 9747 AG Groningen <b>Tel.</b> +31 50 363 43 21 <b>Fax.</b> +31 50 363 44 29		<b>Email:</b> <a href="mailto:robillard@biomade.nl">robillard@biomade.nl</a> <b>Web:</b> <a href="http://www.biomade.nl/">http://www.biomade.nl/</a>	
Turnover in €:	3.4M	Staff in 2004:	40

#### **Organization focus:**

The focus is on the design and construction of molecular systems leading to materials with applications in therapeutics, prophylactics and diagnostics:

- Addressable delivery and controlled release systems for small and large therapeutic molecules and genetic material
- Self-assembling systems for the control of solution and surface properties as well particle aggregation
- The stabilization of proteins and peptides

#### **Collaborations:**

Groningen Biomolecular Sciences and Biotechnology Institute (GBB)  
Materials Science Centre (MSC+)  
Groningen University Institute for Drug Exploration (GUIDE)

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<b>Delft University of Technology Faculty of Applied Science</b>			
<b>Contact/CEO</b>		Cees Dekker	
Section Molecular Biophysics (MB) Lorentzweg 1 2628 CJ Delft <b>Tel.</b> +31 15 278 6094 <b>Fax.</b> +31 15 278 1202		<b>Email:</b> <a href="mailto:dekker@mb.tn.tudelft.nl">dekker@mb.tn.tudelft.nl</a> <b>Web:</b> <a href="http://www.mb.tn.tudelft.nl/">http://www.mb.tn.tudelft.nl/</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

The MB group focuses on single-molecule biophysics and employs AFM, STM, magnetic/optical tweezers, and nanofabricated structures to study biomolecular systems and foster new nanotechnology. Research includes local-probe studies of single DNA and proteins; electronic properties of carbon nanotubes and nanotube biosensors; biomolecule translocation through membrane pores and nanofluidic channels; exploration of ion correlations and single-ion electrochemistry at nanoscale metallic contacts; and new bioinorganic systems such as nanotube-DNA hybrids and molecular motors on nanofabricated chips.

<b>Department of Biotechnology Kluyver Laboratory for Biotechnology</b>			
<b>Contact/CEO</b>		G M Schalkhammer	
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Turnover in €:		Staff in 2004:	

**Organization focus:**

The Analytical Biotechnology group is involved in two research themes:

- Miniaturization of analytical methods. These methods include separation and detection on small chips and discrete analyses on micro-arrays with nanoliter volumes.
- Biochemical engineering, biochips and bio-nanotechnology.

The first research theme is in particular in functional genomics and metabolic engineering of industrial microorganisms. The primary targets are the quasi real time assay of the components of fermentation media in a growing culture and the intracellular metabolite and enzyme levels in growing cells. The motivation for this type of research stems from the perceived need for reducing the amounts of sample per analysis and also for reducing the required amounts of reagents and thus cost. Long-term goal is to downscale these methods to a level where analyses on the contents of a single cell become feasible.

The second research theme has basic research lines on: functional proteomics on chip, functional genomics, pcr on chip, bio-nano-plasmon-optical devices, nano cluster, high-speed bioarraying and single molecule detection. Lines of applied research of this theme are: protein optimization by selection technologies, optimization of enzyme catalysis, artificial proteins and ligands, DNA-libraries screening and chemical catalysts optimization.

**Collaborations:**

- TU Delft, the Vienna Biocentre
- K.F. Universität Graz, Austria.

## 27 Norway

Norway is not very active in nanoanalytics and diagnostics research at the moment. Research is mainly done in the field of energy and environment. The Norwegian Research Council funds research programmes in all sciences. They also have a fellowship programme for foreign researchers who want to work for a few months at a Norwegian university, and co-ordinate Norway's participation in EU projects.

<b>Norwegian University of Science and Technology</b>			
<b>Contact/CEO</b>		Marianne Sjøholtstrand (Head of Unit)	
7491 Trondheim <b>Tel.</b> +47 73 59 50 00 <b>Fax.</b> +47 73 59 53 10		<b>Email:</b> <a href="mailto:Marianne.Sjoholtstrand@nt.ntnu.no">Marianne.Sjoholtstrand@nt.ntnu.no</a> <b>Web:</b> <a href="http://www.ntnu.no/welcome/nt.php">www.ntnu.no/welcome/nt.php</a>	
Turnover in €:		Staff in 2004:	

### Organization focus:

Research in soft nanotechnology, superparamagnetical nanoparticles, magnetic resonance (MR), ultrasound and medical biotechnology, etc.

## 28 Poland

In November 2000 the Polish State Committee for Scientific Research (KBN) launched a Targeted Research Project: "Metallic, Ceramic and Organic Nanomaterials: Processing – Structure – Properties – Applications". It is aimed to stimulate research on nanomaterials, telecommunications and biotechnology.

The Institute of Electron Technology (ITE) recently established two Centres of Excellence accepted by the Minister of Science:

- CEPHONA (Physics and Technology of Photonic Nanostructures, <http://www.ite.waw.pl/cephona/index.php>)
- MANTARC (Micro- and Nanotechnology Applied Research Centre, <http://www.6pr.pl/coe/midi/data/577.html>)

<b>Technical University of Łódź Faculty of Mechanical Engineering Institute of Material Science and Engineering</b>			
<b>Contact/CEO</b>		Prof. Stanisław Mitura	
1 Stefanowskiego Str. 90-924 Łódź <b>Tel.</b> +48 42 631 2277 <b>Fax.</b>		<b>Email:</b> <a href="mailto:mitura@ck-sg.p.lodz.pl">mitura@ck-sg.p.lodz.pl</a> <b>Web:</b> <a href="http://www.p.lodz.pl/eng/index.jsp">www.p.lodz.pl/eng/index.jsp</a>	
Turnover in €:		Staff in 2004:	40

### Organization focus:

The research interest of the Centre focuses on study and production of new materials with modified surfaces, exhibiting variety of properties designed for controllable bioactivity. Present and future applications are combined with orthopedic surgery, artificial organs implantation and other biomedical implementations including new tools for surgery and for diagnostic tests. The main interest concerns of crystalline carbon synthesis at the surface of several materials widely used in medicine, i.e. medical steel, titanium and other metals, including their alloys and polymers. Synthesized by RFPACVD (radio frequency plasma activated chemical vapor deposition) crystalline carbon exhibits diamond structure with crystals of nanometre size. Aim is to modify the nanodiamond surface structure to reach the highest bio-, hemo- and thrombo-compatibility. Usage of SPR-biosensor technology, fluorescence imaging and scanning electron microscopy.

<b>Institute of Fundamental Technological Research Polish Academy of Sciences</b>			
<b>Contact/CEO</b>		Józef Joachim Telega	
21 Świętokrzyska str. 00-049 Warszawa <b>Tel.</b> +48 22 826 5129 <b>Fax.</b>		<b>Email:</b> <a href="mailto:jtelega@ippt.gov.pl">jtelega@ippt.gov.pl</a> <b>Web:</b> <a href="http://www.ippt.gov.pl/~mmazdz/biomech/biomech.htm">http://www.ippt.gov.pl/~mmazdz/biomech/biomech.htm</a>	
Turnover in €:		Staff in 2004:	

### Organization focus:

The activities fall into the multi-disciplinary area of applied and theoretical modelling and designing in biomedical and bioengineering research (bone and soft tissue biomechanics, orthopaedic biomechanics, ultrasound diagnostics in medicine).

<b>University of Gdańsk &amp; Medical University of Gdańsk</b>			
<b>Contact/CEO</b>		Prof. Andrzej C. Składanowski	
24 Kładki Str. 80-822 Gdańsk <b>Tel.</b> +48 58 349 1207 <b>Fax.</b>		<b>Email:</b> <a href="mailto:acskla@amg.gda.pl">acskla@amg.gda.pl</a> <b>Web:</b> <a href="http://www.ed.amg.gda.pl/main.html">www.ed.amg.gda.pl/main.html</a>	
Turnover in €:		Staff in 2004:	30

### Organization focus:

The Centre is focused on human, animal and plant diseases and include: identification of molecular markers and development of diagnostic and therapeutic methods in cancer diseases; development and implementation of molecular diagnostics of human viral, bacterial and protozoan diseases; development of molecular markers for detection, identification and differentiation of economically important plant pathogenic bacteria etc.

The basic research is focused on: description of novel mechanism of DNA replication regulation, the elucidation of the role of molecular chaperones in organization and function of nucleotides, development of new methods for DNA sequencing and of HPLC procedures used in genomics. The biotechnological products and services of bio-medical potential are: the purification of human and bacterial genes and proteins for scientific and commercial application, pharmacologically important secondary metabolites in medicinal plants, tissue cultures and others.

<b>NANOSAM Jagiellonian University Institute of Physics</b>			
<b>Contact/CEO</b>		Prof. Marek Szymoński	
4 Reymonta Str. 30-059 Kraków <b>Tel.</b> +48 12 632 4888 5560 <b>Fax.</b>		<b>Email:</b> <a href="mailto:szymon@castor.if.uj.edu.pl">szymon@castor.if.uj.edu.pl</a> <b>Web:</b> <a href="http://www.if.uj.edu.pl/NANOSAM/">www.if.uj.edu.pl/NANOSAM/</a>	
Turnover in €:		Staff in 2004:	

### Organization focus:

The scientific activity of the NANOSAM Centre research groups is concerned with various aspects of modern materials science and its theoretical aspects, as well as properties of nanoscopic systems and nanometre-scale modification of materials. The topics of materials research, which are related to properties of nano-size materials are focused on scanning probe methods, on the design and characterisation of functional materials with emphasis on magnetic solids and polymers, on quantum phenomena in mesoscopic systems, on manufacturing and characterisation of self-assembling structures, and on research with biomedical materials.

The particular research topics of the Centre are:

- Electronic and atomic properties of nanoscopic systems
- Nano-scale modification of surfaces
- Biological materials at nanoscale

## 29 Portugal

Nanotechnology research in Portugal is funded by the Ministry of Science. There is a Network of Excellence EXPERTISSUE (Novel Therapeutic Strategies for Tissue Engineering of Bone and Cartilage Using Second Generation Biomimetic Scaffolds) of 41 partners, and is coordinated by the University of Minho, Portugal.

<b>TECHNICAL UNIVERSITY OF LISBON</b>			
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Turnover in €:		Staff in 2004:	

### Organization focus:

Development of biochips for molecular monitoring and detection. Thin-film micro-electronic and highly sensitive magnetoresistive sensors have been used for magnetic label detection of biomolecules, through biomolecular recognition. These sensors are capable of detecting a single magnetic bead. Supermagnetic microbeads composed of nanometre-sized particles of magnetic material in a polymer matrix covered with different chemical functions can be specifically attached to the biomolecule (proteins, enzymes, monoclonal antibodies, oligonucleotides) target.

## 30 Romania

The National Institute for Research and Development in Microtechnologies (IMT, <http://www.imt.ro/MicroNanoTech>) research institute in Bucharest is the nucleus for the nanotechnology networks and programmes in the country. It also acts as a 'bridgehead' to integrate Romanian nanotechnology research into the European Research Area (ERA). The main areas of research are electronics and nanomaterials.

BIONANONET is a national network bringing together R&D, clinics, SMEs involved in biomedicine ([www.imt.ro/BIONANONET/Defaultengleza.htm](http://www.imt.ro/BIONANONET/Defaultengleza.htm)).

Research topics related to the network activity are:

- Micro and nanomaterials for biomedical applications: composites; modified polymers; newly synthesised organic and inorganic materials; new biomaterials with aimed applications
- Micro and nano(bio)technology for biomedical applications: microdevices and microsystems for biomedical investigation (microelectrodes, biosensors, microfluidics) interfacing systems to organic/biological molecules, for genetic and cellular manipulation; molecular filtration and immunoisolation; micro and nanodevices relying on molecular recognition; micro and nanodevices for active biomolecules
- Instrumentation and equipment, supporting technologies: analytical equipment and techniques; microprocessing equipment and techniques for biomedical applications

<b>RESEARCH CENTER FOR MACROMOLECULAR MATERIALS AND MEMBRANES S.A.</b>			
<b>Contact/CEO</b>		Eng. RADU Marin (Managing Director)	
S.C. CCMMM S.A. Spl. Independentei nr. 206 Sector 6 C.P. 15-143 79611 Bucharest <b>Tel.</b> +40 21 224 8350 <b>Fax.</b>		<b>Email:</b> <a href="mailto:macromol@rnc.ro">macromol@rnc.ro</a> <b>Web:</b> <a href="http://membrane.rnc.ro/Contact_us.htm">http://membrane.rnc.ro/Contact_us.htm</a>	
Turnover in €:		Staff in 2004:	

### Organization focus:

In nanoscience and nanotechnology the main research topics are: composite nanofiltration and prevaporation membranes obtained by plasma and/or interfacial polymerization; composite membranes with MCM-41 type molecular sieves inclusions for environmental protection; composite membranes obtained by the laser ablation deposition of nanoparticles on ceramic supports; preparation and characterization of inorganic membranes used in environmental protection and catalytic processes.

<b>INSTITUTE OF BIOCHEMISTRY OF THE ROMANIAN ACADEMY, MOLECULAR GLYCOBIOLOGY LABORATORY</b>			
<b>Contact/CEO</b>		Stefana Petrescu (Director)	
Splaiul Independentei 296 77700 Bucharest 17 <b>Tel.</b> +40 21 239069 <b>Fax.</b>		<b>Email:</b> <a href="mailto:Stefana.Petrescu@biochim.ro">Stefana.Petrescu@biochim.ro</a> <b>Web:</b> <a href="http://www.biochim.ro">www.biochim.ro</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

The laboratory is currently involved in the development of biotechnologies destined to cultivate living cells on nanoporous silicon and hydroxyapatite-titan. Visualization of adherent cells grown on nanomaterials by immunofluorescence microscopy has been successfully carried out.

<b>INSTITUTE OF BIOLOGY OF THE ROMANIAN ACADEMY, CENTER OF MICROBIOLOGY</b>			
<b>Contact/CEO</b>		Lucia Dumitru (Head of the Centre)	
Splaiul Independentei 296 79651 Bucharest <b>Tel.</b> +40 21 221 9202 <b>Fax.</b> +40 21 221 9071		<b>Email:</b> <a href="mailto:lucia.dumitru@ibiol.ro">lucia.dumitru@ibiol.ro</a> <b>Web:</b> <a href="http://www.ibiol.home.ro/">http://www.ibiol.home.ro/</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Expertise in nanotechnologies: biochips obtained with immobilized cyan bacteria on micro- and nano-electrodes for environment monitoring. Biomolecules (isolation and purification): proteins with enzymatic or antimicrobial activity; S-layers; ether lipids with for the construction of biosensors, new types of liposomes, etc.



## 31 Slovakia

In 2001, the Slovakian government announced new policy measures on science and research, including a new policy conception in the area of science and technology and a new act by the Slovak Academy of Sciences (SAS). This allows researchers in SAS institutes to participate in higher education. The government also announced a new Scientific and Technological Information Centre, responsible for international scientific collaborations; foresight studies and dissemination of results.

The Slovakian Academy of Sciences has established the NanoSMART Centre of Excellence in nanomaterials. Around 60 researchers from SAS institutes on Materials Research, Inorganic Chemistry, Experimental Physics, Geotechnics, Materials and Machine Mechanics, Physics, and Electrical Engineering collaborate in it. Research topics are mainly dedicated to ceramic nanocomposites and metallic materials, and their mechanical, magnetic, superconducting, semiconducting, electric properties and use in water treatment

<b>Comenius University, Faculty of Mathematics, Physics and Computer Science</b>			
<b>Contact/CEO</b>		Prof. RNDr. Tibor Hianik, DrSc.	
Department of Biophysics 842 48 Bratislava, Mlynská dolina F1 <b>Tel.</b> +421 2654 26774 <b>Fax.</b>		<b>Email:</b> <a href="mailto:hianik@fmph.uniba.sk">hianik@fmph.uniba.sk</a> <b>Web:</b> <a href="http://www.uniba.sk/mffuk/e/departments/kbchf_e.htm">http://www.uniba.sk/mffuk/e/departments/kbchf_e.htm</a>	
Turnover in €:		Staff in 2004:	

### Organization focus:

Description: Biomimetic and dendrimer films (application in biosensing for biomedical and environmental purposes, structure and physical properties of Biomimetic amphiphilic films, dendrimers as biosensors).

## 32 Slovenia

The Slovenian Science policy is integrated into the European Research Area. The Slovenian economy will be based on knowledge and technology, and the national research programme (2002) is therefore an integral part of the national development strategy. It sets some long, medium and short-term policy goals, for organizing research, and changing the priorities in funding areas of scientific research, on a very abstract level. Medium term goals include research activities; postgraduate education of R&D personnel; application of knowledge and research infrastructure. International collaborations, networking and education are also included.

SINANO is the Slovenian network on nanotechnology. The network comprises tasks related to nanomaterials, sensors based on biological molecules, and chemical processing technologies, equipment and also long term research parts. Leader of the network is Prof. Marija Kosec at Jozef Stefan Institute (<http://www.ijs.si/>).

<b>Jozef Stefan Institute</b>			
<b>Contact/CEO</b>		Prof. dr. Vito Turk	
Jamova 39 1000 Ljubljana <b>Tel.</b> +386 1 477 3900 <b>Fax.</b> +386 1 2519 385		<b>Email:</b> <a href="mailto:vito.turk@ijs.si">vito.turk@ijs.si</a> <b>Web:</b> <a href="http://www.ijs.si/ijs.html">http://www.ijs.si/ijs.html</a>	
Turnover in €:		Staff in 2004:	

### Organization focus:

Many nanotechnology projects in different departments, such as Biophysics and MRI, surface and condensed matter (<http://optlab.ijs.si/nano/nanoscience.htm>, <http://titan.ijs.si/f5/>).

## 33 Spain

The Spanish government had no specific nanotechnology funding programmes until 2003 when the Nanotechnologies, Microtechnologies and Integrated Development of Materials priority was announced as one of 11 strategic research programmes. There are a few companies and academic institutes involved in nanoanalytical and diagnostic R&D.

<b>Research Centre in Bioelectronics and Nanobioscience</b>			
<b>Contact/CEO</b>		Dr. Fausto Sanz Carrasco	
Martí i Franqués, 1 (Edifici Modular) 08028 Barcelona <b>Tel.</b> +34 93 402 1240 <b>Fax.</b> +34 93 402 1231		<b>Email:</b> <a href="mailto:fsanz@ub.edu">fsanz@ub.edu</a> . <b>Web:</b> <a href="http://www.cben.ub.es/web_eng/index.htm">www.cben.ub.es/web_eng/index.htm</a>	
Turnover in €:		Staff in 2004:	

### Organization focus:

The aim of the Centre's research is to develop and apply technologies to micro and nano scale in biophysics and bioengineering, pharmaceutical, medical technology or agricultural. Activities of the Research Centre:

- Cellular and molecular nanotechnology. Surface functionalization (chemical, mechanical or biological)
- Research of the electric and mechanical properties of cells and molecules
- Design of microelectronic devices for the handling and processing of cell and molecules in a chip (biochip/lab-on-a-chip)
- Development of biosensors for molecular detection and for the study of the cellular response to specific stimuli (resistance to pharmaceuticals, pathologic cell alterations, etc.)

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<b>Nanotec Electronica</b>			
<b>Contact/CEO</b>		Rafael Fernández	
Parque Científico de Madrid Pabellón C, campus UAM Cantoblanco 28049 Madrid <b>Tel.</b> +34 914 973 436 <b>Fax.</b> +34 914 973 437		<b>Email:</b> <a href="mailto:rafa.fernandez@nanotec.es">rafa.fernandez@nanotec.es</a> <b>Web:</b> <a href="http://www.nanotec.es/">http://www.nanotec.es/</a>	
Turnover in €:		Staff in 2004:	0

**Organization focus:**

Nanotec Electrónica is a company devoted to the design, construction and development of Scanning Probe Microscopes and Scanning Probe Microscopy control systems. It also develops the SPM image processing software WSxM.

**Collaborations:**

Nanotec USA, Alpha Contec GmbH, CMP científica, Halcyonics

<b>INSTITUTO DE MICROELECTRONICA DE MADRID</b>			
<b>Contact/CEO</b>		Prof. Fernando Briones	
C/Isaac Newton, 8 (PTM) 28760 - Tres Cantos. Madrid <b>Tel.</b> +34 91 806 07 00 <b>Fax.</b> +34 91 806 07 01		<b>Email:</b> <a href="mailto:briones@imm.cnm.csic.es">briones@imm.cnm.csic.es</a> <b>Web:</b> <a href="http://www.imm.cnm.csic.es/eprincip.htm">http://www.imm.cnm.csic.es/eprincip.htm</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Research activities of the institute:

- 1.Semiconductor nanostructures
- 2.Magnetic nanostructures
- 3.Nanofabrication and force & tunnel microscopy (AFM/STM)
- 4.Process technologies and electron lithography
- 5.Optoelectronic devices
- 6.Optical sensors
- 7.Biosensors
- 8.Analytical electron microscopy (x-ray, PEELS)

## 34 Sweden

Nanotechnology was taken up relatively early in Sweden. More than ten years ago, a research programme was initiated at the Analytical Chemistry Department of the Royal Institute of Technology (<http://www.kth.se/eng/>) that dealt with concepts related to the nanoscale. Similarly, nanostructure materials research has a long history.

Nanoscale research in Sweden is of a high standard. However, the lack of industrial interest in certain subfields has been criticized. In a national survey, a number of academics pointed out that no domestic firm is active in nanoelectronics and quantum components. A similar situation is described for

chemical and biosensors with electronic and medical applications. One scientist noted the lack of a domestic research group on chemical synthesis of nanoparticles. Industrialists also note the lack of research on biotechnologically oriented nanochemistry and clinical diagnostics. (<http://www.atip.org/ATIP/NANO/reports/atip00.038.pdf>)

<b>Nanometre Structure Consortium</b>			
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c/o Mona Hammar P.O. Box 118 221 00 Lund <b>Tel.</b> +46 46 222 7679 <b>Fax.</b> +46 46 222 3637		<b>Email:</b> <a href="mailto:lars.samuelson@ftf.lth.se">lars.samuelson@ftf.lth.se</a> <b>Web:</b> <a href="http://www.nano.ftf.lth.se/main.html?news.html">http://www.nano.ftf.lth.se/main.html?news.html</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Fabrication of nanoscaled chemically functionalized surfaces and structures combined with selective immobilization of e.g. biomolecules for different applications (e.g. biosensors) as well as for fundamental science aspects. Other projects:

- Single molecule studies
- Nanostructures for analytical applications
- Bio-NEMS

<b>Biacore International</b>		Founded 1984	
<b>Contact/CEO</b>		Dr Ulf Jönsson	
Rapskatan 7 754 50 Uppsala <b>Tel.</b> +46 18 675700 <b>Fax.</b> +46 18 150110		<b>Email:</b> <a href="mailto:norden@biacore.com">norden@biacore.com</a> <b>Web:</b> <a href="http://www.biacore.com/home.lasso">www.biacore.com/home.lasso</a>	
Turnover in €:	Sales 500 mio SKr	Staff in 2004:	

**Organization focus:**

Biacore does research in the detection and monitoring of biomolecular binding using surface plasmon resonance (SPR) technology, which allows sensitive detection of molecular interactions in real time, without the use of labels. The company develops, manufactures and markets advanced bioanalytical systems that provide real-time quantitative data on binding interactions between biomolecules. Applications include life science research, drug discovery and development applications in pharmaceutical and biotechnology sectors as well as application in food industries.

<b>Nanoxis AB</b>			
<b>Contact/CEO</b>		Ahmet Senoglu	
MC2 Building A at Chalmers 5th Floor (A527) Kemivägen 9 412 96 Gothenburg <b>Tel.</b> +46 31 772 4944 <b>Fax.</b> +46 70 232 8477		<b>Email:</b> <a href="mailto:ahmet.senoglu@nanoxis.com">ahmet.senoglu@nanoxis.com</a> <b>Web:</b> <a href="http://www.nanoxis.se/">http://www.nanoxis.se/</a>	
Turnover in €:		Staff in 2004:	10

### Organization focus:

Nanoxis AB is a nano-biotechnology company developing advanced biochips within the areas of proteomics and genetics based on unique liquid crystalline and polymeric materials in combination with proprietary nanofabrication protocols. The technology is based on self-assembly and self-organization as well as functionalities from embedded molecular entities.

Application areas are in the bioanalytical, microelectronic and materials science market segments. Design and production of compact and scalable nanofluidic and nanoelectronic circuits as well as systems for nanoscale templating and nanorobotics. Focus on platforms for separation and quantification of certain target proteins that are of central importance to pharmaceutical and biotech companies.

<b>Obducat</b>		Founded 1989	
<b>Contact/CEO</b>			
Geijersgatan 2A, P.O. Box 580 201 25 Malmö <b>Tel.</b> +46 40 36 21 00 <b>Fax.</b>		<b>Email:</b> <a href="mailto:info@obducat.com">info@obducat.com</a> <b>Web:</b> <a href="http://www.obducat.com">www.obducat.com</a>	
Turnover in €:		Staff in 2004:	

### Organization focus:

Obducat develops and supplies technologies, products, and processes for the production of advanced micro and nano structures for research and manufacturing in the areas of information storage, semiconductors, and sensor industries:

- Electron beam lithography.
- Electron-beam recorder for high-density mastering (EBR-200).
- Micro & nano lithography.
- Press equipment for print lithography, for fast replication of nano patterns.
- High-performance analytical Scanning Electron Microscopes developed and manufactured by Obducat.

## 35 Switzerland

Switzerland makes more than €20m available each year for research in nanotechnology. Thus on a per capita basis, Switzerland's commitment is the highest in the world. Even though Switzerland is not an EU member state, Swiss research groups are frequent members of EU funded RTD projects and Switzerland is also a member of the COST intergovernmental cooperation in scientific research.

The regions Lausanne/Geneva, Neuchatel and Zurich are particularly active in micro and nanotechnology, followed by Basel. Leading research institutes with an international standing are CSEM and the Paul Scherrer Institute PSI.

Collaborations are encouraged between universities, research institutes, and industry.

Switzerland is building on its expertise in instrumentation, with strong research thrusts in tips and probes for scanning microscopes, along with molecular manipulation on surfaces (at IBM Zurich); devices and sensors (at the Paul Scherrer Institute); nanoelectronics (at ETH Zurich); and self-assembly (EPF Lausanne). This is balanced by projects on novel materials, biomaterials, optical devices, nanomachining, energy storage, data storage, and environmental applications.

<b>Institute of Biochemistry, ETH Zürich</b>			
<b>Contact/CEO</b>		Klaus Ensslin	
Laboratorium für Festkörperphysik ETH Hönggerberg, HPF E 3 Schafmattstr. 16 8093 Zürich <b>Tel.</b> +41 1 633 2209 <b>Fax.</b> + 41 1 633 11 46		<b>Email:</b> <a href="mailto:ensslin@phys.ethz.ch">ensslin@phys.ethz.ch</a> <b>Web:</b> <a href="http://www.nanophys.ethz.ch/research/r8.php">www.nanophys.ethz.ch/research/r8.php</a>	
Turnover in €:		Staff in 2004:	

### Organization focus:

Research interest is in nuclear pores structure/function using atomic force microscopy (AFM).

<b>NCCR University of Basel</b>			
<b>Contact/CEO</b>		Prof. Dr. Hans-Joachim Güntherodt	
Klingelbergstrasse 82 4056 Basel <b>Tel.</b> +41 61 267 37 68 <b>Fax.</b> +41 61 267 37 95		<b>Email:</b> <a href="mailto:hans-joachim.guentherodt@unibas.ch">hans-joachim.guentherodt@unibas.ch</a> <a href="mailto:audrey.fischer@unibas.ch">audrey.fischer@unibas.ch</a> <b>Web:</b> <a href="http://www.nccr-nano.org/nccr">www.nccr-nano.org/nccr</a>	
Turnover in €:		Staff in 2004:	

### Organization focus:

Nanoscale Science as a National Centre of Competence in Research (NCCR) includes projects focusing on the following closely related areas amongst others:

- Nanomaterials ranging from biological systems, carbon-nanotubes to nanoclusters
- Impact of nanoscale science on life sciences and medicine
- Molecular machinery and nanorobotics
- Nanoscale science at the ultimate limits

A nano-biosensor device was constructed for rapid and reliable quantification of blood proteins whose concentration is diagnostic for heart attacks. As a major breakthrough, a 70-amino-acid long peptide that self-assembles into ~20nm diameter icosahedral-nanoparticles was designed and produced recombinantly, suitable for targeting drug molecules and radionuclides to specific cells or tissues.

### Collaborations:

Network partners in the network of the NCCR Nanoscale Science are:

IBM Research Laboratory Rüschlikon  
 Swiss Federal Institute of Technology Lausanne (EPFL)  
 Swiss Federal Institute of Technology Zürich (ETHZ)  
 University of Neuchâtel  
 University of Zürich  
 Swiss Centre for Electronics and Microtechnology Neuchâtel (CSEM)  
 Paul Scherrer Institute Villigen (PSI)  
 University of Applied Science Basel (FHBB)

<b>CSEM SA</b>			
<b>Contact/CEO</b>		Thomas Hinderling	
Badenerstrasse 569 P.O. Box 8048 Zürich <b>Tel.</b> +41 32 720 5657 <b>Fax.</b>		<b>Email:</b> <a href="mailto:thomas.hinderling@csem.ch">thomas.hinderling@csem.ch</a> <b>Web:</b> <a href="http://www.csem.ch/">http://www.csem.ch/</a>	
Turnover in €:	Total operating income €35 mio.	Staff in 2004:	



**Organization focus:**

CSEM's expertise in nanotechnology focuses on characterization, optics, microscopy, and surface engineering (with biomolecules in a low-temperature process). Integration of nanotechnology in microfluidics, microsystems, photonic optics and micro-optics. Also research in photobond technology, surface glycosylation, long-term bioactive layer stability, nanoscale structuring, biopatterning and arraying, production of microarray platforms.

**Collaborations:**

IMT (Institute of Microtechnology of Neuchâtel University)  
Léti (Laboratoire d'Electronique, de Technologie et d'Instrumentation, CEA, Grenoble, France). EPFL (Swiss Federal Institute of Technology, Lausanne)

<b>DiagnoSwiss S.A.</b>	Founded 1999		
<b>Contact/CEO</b>			
Rte de l'Ile-au-Bois 2 C/o Cimo S.A. – CP 1870 Monthey <b>Tel.</b> +41 24 4714900 <b>Fax.</b> +41 24 4714901	<b>Email:</b> <a href="mailto:info@diagnoswiss.com">info@diagnoswiss.com</a> <b>Web:</b> <a href="http://www.diagnoswiss.com/index.html">www.diagnoswiss.com/index.html</a>		
Turnover in €:		Staff in 2004:	

**Organization focus:**

DiagnoSwiss provides technical solutions for fast diagnosis and prognosis as well as for target proteins identification. Developing of disposable polymer  $\mu$ -chips and gel electrophoresis equipment for protein purification. Also planning for large-scale protein screening in proteomics. The core technology relies on protein analysis with microfabricated separation methods and affinity assays, and creates high-throughput proteomics platforms in the microtiter-plate format.

<b>University of Zürich, Institute for Physical Chemistry</b>			
<b>Contact/CEO</b>	Prof. Dr. Stefan Seeger		
Winterthurerstar. 190 8057 Zuerich <b>Tel.</b> +41 1 63 54451 <b>Fax.</b> +41 1 63 56813	<b>Email:</b> <a href="mailto:sseeger@pci.unizh.ch">sseeger@pci.unizh.ch</a> <b>Web:</b> <a href="http://pciwww.unizh.ch/pci/seeger/index.html">http://pciwww.unizh.ch/pci/seeger/index.html</a>		
Turnover in €:		Staff in 2004:	

**Organization focus:**

Techniques and equipment:

- Contact angle goniometre
- Confocal single molecule detection
- Total internal reflection single molecule detection
- Fluorescent and absorption spectroscopy
- Optical tweezers and laser ablation

<b>IBM Zurich, Nanoscale Science</b>			
<b>Contact/CEO</b>		Christoph Gerber	
Säumerstrasse 4 8803 Rüschlikon Zurich <b>Tel.</b> +41 1 724 8645 <b>Fax.</b> +41 1 724 8958		<b>Email:</b> <a href="mailto:ge@zurich.ibm.com">ge@zurich.ibm.com</a> <b>Web:</b> <a href="http://www.zurich.ibm.com/st/nanoscienc&lt;br/&gt;e/index.html">http://www.zurich.ibm.com/st/nanoscienc e/index.html</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Areas of Research at IBM Zurich:

- Cantilever sensors
- Chemical AFM
- Magnetic resonance imaging
- Dynamic force microscopy
- Nanoscale integrated circuits
- STM on organic materials
- Ultrathin magnetic structures

## 36 Turkey

Turkey is an EU candidate country of around 65 million inhabitants. The Supreme Board of Science and Technology is the highest authority determining the national science policy in Turkey. TUBITAK, the Scientific and Technical Research Council, advises on this policy and funds and coordinates research. There are several national research centres subordinated to TUBITAK: The Marmara Research Centre consists of five institutes including Information Technologies Research, Energy Systems and Environmental Research, Materials and Chemical Technologies Research, Food Science and Technologies Research, and Earth and Marine Sciences Research. Important advances have been made in Turkey in recent years as to the productivity of science and technology.

<b>Institute of Biomedical Engineering Bogazici University</b>			
<b>Contact/CEO</b>			
Bebek 80815 Istanbul <b>Tel.</b> +90 212 358 15 40 <b>Fax.</b> +90 212 257 50 30		<b>Email:</b> <a href="mailto:atilgan@prc.bme.boun.edu.tr">atilgan@prc.bme.boun.edu.tr</a> <b>Web:</b> <a href="http://www.bme.boun.edu.tr/">http://www.bme.boun.edu.tr/</a>	
Turnover in €:		Staff in 2004:	

### **Organization focus:**

Development of high technology medical equipment and biological instrumentation, and devising new and efficient methods for physiological measurements, medical data processing and analysis, developing prosthetic materials and artificial organs. Research projects focus on robotics and biocybernetics, biomedical signal and image processing, solid-state physics and microelectronics.

## **37 United Kingdom**

The UK had an early interest in nanotechnology, with a Department of Trade and Industry (DTI) National Nanotechnology Initiative (NION) announced in 1986, followed in 1988 by a four-year LINK Nanotechnology programme. The final tranche of funding for LINK projects was handed over in 1996. After this time there was no national strategy for nanotechnology in the UK, although dispersed research involving nanoscale science continued to be funded. In 1997, the Institute of Nanotechnology, a registered charity, was established to fill the gap act as a focus of interest in nanotechnology throughout the UK. The Institute grew out of the Centre for Nanotechnology, which had received a small amount of funding under NION to raise awareness of nanotechnology and its applications.

The IRC (Interdisciplinary Research Collaborations) in Nanobiotechnology is headed by University of Oxford with the Universities of Glasgow and York, and the National Institute for Medical Research. This collaboration also involves links with the Universities of Cambridge, Nottingham and Southampton. The Consortium is directed by Professor John Ryan, who is the Head of Condensed Matter Physics and of the Physics Department. The Glasgow group, led by Professor Jon Cooper with a team of six other academics, seeks to combine expertise in nanotechnology, lab-on-a-chip, and biosensors in order to develop

a series of extremely sensitive tools for biologists that will enable them to manipulate and measure single biological molecules. The other group focuses on the fabrication and organization of molecular structures, molecular materials for electronics and photonics, self-assembly approaches to well-defined structures, including the investigation of fibril structures in proteins and polypeptides and controlled cell growth from substrates for tissue engineering and the creation of natural biosensors.

Generally the UK, as the fourth largest industrial nation in the world is much involved in nanotechnology, especially in semiconductor, thin-film coatings, nano-electrical systems and surface technology. In the field of analytics and diagnostics in comparison to other EU countries, the UK appears to be second in place next to Germany, but the government's nanotechnology initiative will seek to further support this development.

<b>Department of Physics and Astronomy University College London</b>			
<b>Contact/CEO</b>		Quentin Pankhurst	
Gower Street London WC1E 6BT <b>Tel.</b> +44 207 6793514 <b>Fax.</b> +44 207 3807145		<b>Email:</b> <a href="mailto:q.pankhurst@ucl.ac.uk">q.pankhurst@ucl.ac.uk</a> <b>Web:</b> <a href="http://www.london-nano.ucl.ac.uk/lcn/index2.htm">http://www.london-nano.ucl.ac.uk/lcn/index2.htm</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

- Research at the institute comprises:
- Experiments on tips and chips
  - Fabrication research
  - Nanobiology
  - Nanofabrication and nanocharacterisation facilities
  - Nanofluids
  - Nanomagnetism
  - Nanoscale electronic devices

<b>Advanced Materials Research Institute, University of Northumbria</b>	Founded 1999		
<b>Contact/CEO</b>	Professor Santu Datta		
School of Engineering E001 Ellison Building Newcastle upon Tyne NE1 8ST <b>Tel.</b> +44 191 227 3636 <b>Fax.</b> +44 191 227 3598	<b>Email:</b> <a href="mailto:psantu.datta@unn.ac.uk">psantu.datta@unn.ac.uk</a> <b>Web:</b> <a href="http://amri.unn.ac.uk/biotechnology.asp">http://amri.unn.ac.uk/biotechnology.asp</a>		
Turnover in €:		Staff in 2004:	

### Organization focus:

Multi-disciplinary research centreing on design of new materials and surfaces.

Research embraces:

- Intermetallics
- Nano-scales
- Bio-materials

In the biotechnological area:

- Stent coatings
- Radiel capitel coatings
- Scalpel improvement
- DLC hip prosthesis

<b>Cambridge University Nanoscience Centre</b>			
<b>Contact/CEO</b>	Dr Paul Barker		
Department of Chemistry Lensfield Road Cambridge CB2 1EW <b>Tel.</b> +44 1223 763096 <b>Fax.</b>	<b>Email:</b> <a href="mailto:pxb@mrc-lmb.cam.ac.uk">pxb@mrc-lmb.cam.ac.uk</a> <b>Web:</b> <a href="http://www.nanoscience.cam.ac.uk/centre/research/index.html">http://www.nanoscience.cam.ac.uk/centre/research/index.html</a>		
Turnover in €:		Staff in 2004:	

### Organization focus:

Interests are design and engineering of proteins for use in functional nanostructures, including:

- Porphyrim binding proteins for biological molecular wires.
- Crystal binding proteins for solid-state lattice recognition and positioning.
- Fluorescent proteins for optoelectronic applications.
- Conformational switches for biochemical transistors

<b>Centre for Nanoscale Science University of Liverpool</b>			
<b>Contact/CEO</b>		Dr Richard Cosstick	
Department of Chemistry Oxford Street Liverpool L69 7ZD <b>Tel.</b> +44 151 794 3514 <b>Fax.</b> +44 151 794 3588		<b>Email:</b> <a href="mailto:rcosstic@liv.ac.uk">rcosstic@liv.ac.uk</a> <b>Web:</b> <a href="http://www.liv.ac.uk/nano/">http://www.liv.ac.uk/nano/</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Research in the material aspects of nanotechnology and nanoparticles. The centre includes the departments of chemistry, physics, biological sciences and engineering (electrical and materials). The activities of the centre are focussed on nanoscale materials and devices (optical, magnetic, electronic and sensors) and on bioanalytical applications of nanotechnology.

**Collaborations:**

School of Biological Sciences, The University of Liverpool.

<b>Nottingham University Nanoscience Group</b>			
<b>Contact/CEO</b>		Dr. Chris Mellor	
University of Nottingham University Park Nottingham NG7 2RD <b>Tel.</b> +44 115 9515147 <b>Fax.</b>		<b>Email:</b> <a href="mailto:Chris.Mellor@nottingham.ac.uk">Chris.Mellor@nottingham.ac.uk</a> <b>Web:</b> <a href="http://www.nottingham.ac.uk/~ppzstm/biosystems.htm">http://www.nottingham.ac.uk/~ppzstm/biosystems.htm</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

This new area of research within the Nanoscience group centres on the use of scanning probe techniques (in particular, scanning capacitance microscopy) and electric force microscopy (EFM) to correlate the structural and electrical properties of cell membranes and biomolecules at the nanometre scale.

<b>Department of Pharmacy University of Bradford</b>			
<b>Contact/CEO</b>		Nick Blagden	
Richmond Building Bradford, West Yorkshire BD7 1DP <b>Tel.</b> +44 1274 234765 <b>Fax.</b>		<b>Email:</b> <a href="mailto:n.blagden@brad.ac.uk">n.blagden@brad.ac.uk</a> <b>Web:</b> <a href="http://www.brad.ac.uk/acad/lifesci/pharmacy/research/R-D-delivery.php">http://www.brad.ac.uk/acad/lifesci/pharmacy/research/R-D-delivery.php</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

The Drug Delivery Group does research in nanotechnology through particle design and crystal engineering in addition to expertise in formulation and pharmaceutical materials science and transdermal drug delivery. Currently being conducted is a project in stealth particles, particles that are fabricated nano-sized and coated with surfactants and phospholipids with the relevant functionality to allow them to attach to specific cells and fool the immune response that they are resident in.

<b>University of Bath</b>			
<b>Contact/CEO</b>		Dr. Toby Jenkins	
Department of Chemistry University of Bath Bath BA2 7AY <b>Tel.</b> +44 1225 386118 <b>Fax.</b> +44 1225 386231		<b>Email:</b> <a href="mailto:a.t.a.jenkins@bath.ac.uk">a.t.a.jenkins@bath.ac.uk</a> <b>Web:</b> <a href="http://www.bath.ac.uk/chemistry/jenkins/">www.bath.ac.uk/chemistry/jenkins/</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Research is concerned with making and studying thin, functionally active films on solid substrates such as gold or silicon. Purpose is to create a 'bridge' between electronics and biological systems. For example, to put model cell membranes onto electrodes that have similar characteristics as natural biological membranes.

<b>School of Engineering Mechanical Engineering</b>			
<b>Contact/CEO</b>		Prof. David Hukins	
University of Birmingham Edgbaston, Birmingham B15 2TT <b>Tel.</b> +44 121 414 3543 <b>Fax.</b> +44 121 414 3958		<b>Email:</b> <a href="mailto:D.W.Hukins@bham.ac.uk">D.W.Hukins@bham.ac.uk</a> <b>Web:</b> <a href="http://www.bioeng.bham.ac.uk/research.htm">www.bioeng.bham.ac.uk/research.htm</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Research with applications in bio-medical engineering:

- micro-engineering and nanotechnology
- tissue engineering

Medical imaging and infomatics:

- magnetic resonance imaging
- healthcare infomatics
- bioinfomatics

<b>Centre for Nanoscale Science &amp; Technology</b>			
<b>Contact/CEO</b>		Prof. K. J. Snowdon	
University of Newcastle upon Tyne Newcastle upon Tyne NE1 7RU <b>Tel.</b> +44 191 222 7362 <b>Fax.</b> +44 191 222 7361		<b>Email:</b> <a href="mailto:k.j.snowdon@ncl.ac.uk">k.j.snowdon@ncl.ac.uk</a> <b>Web:</b> <a href="http://nanocentre.ncl.ac.uk/">http://nanocentre.ncl.ac.uk/</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Established programmes in biosensors, electronic devices, functional thin films, nano-fabrication and materials engineering. Emerging research programmes include genetic diagnostics and drug delivery systems. The Medical and Engineering Faculties also have programmes developing biological, chemical and drug sensors, MEMS devices and advanced electronic devices, representing a mix of macro-, micro- and nano-scale technologies.

<b>Institute of Bioscience and Technology</b>			
<b>Contact/CEO</b>		David Cullen	
Cranfield University Silsoe MK45 4DT <b>Tel.</b> +44 1525 863168 <b>Fax.</b> +44 1525 863080		<b>Email:</b> <a href="mailto:d.cullen@cranfield.ac.uk">d.cullen@cranfield.ac.uk</a> <b>Web:</b> <a href="http://www.cranfield.ac.uk/ibst/">http://www.cranfield.ac.uk/ibst/</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Bio-analytical devices e.g. biosensor arrays, biosensing interfaces. Study of the interaction of biomolecules with nanostructured interfaces. Design and use of biomimetic systems



<b>University of Nottingham</b>			
<b>Contact/CEO</b>		Saul Tendler	
School of Pharmaceutical Sciences Nottingham NG7 2RD <b>Tel.</b> +44 115 9515063 <b>Fax.</b> +44 115 9515110		<b>Email:</b> <a href="mailto:Saul.Tendler@nottingham.ac.uk">Saul.Tendler@nottingham.ac.uk</a> <b>Web:</b> <a href="http://pharm6.pharm.nottingham.ac.uk/">http://pharm6.pharm.nottingham.ac.uk/</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Basic and applied research in the molecular sciences, with an emphasis on the structure, behaviour and interaction of molecules and polymer systems. With experimental studies developing of novel computational methods for the study of molecular interactions and image analysis. Biomolecular and biopolymer patterns for drug discovery, biosensors and bioengineering. Usage of SPR, SPM.

<b>University of Ulster, faculty of Engineering and Built Environment</b>			
<b>Contact/CEO</b>		Jad McLaughlin	
Shore Road Newtownabbey BT37 0QB <b>Tel.</b> +44 28 90368933 <b>Fax.</b>		<b>Email:</b> <a href="mailto:jad.mclaughlin@ulst.ac.uk">jad.mclaughlin@ulst.ac.uk</a> <b>Web:</b> <a href="http://www.ulst.ac.uk/">http://www.ulst.ac.uk/</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Nano-sensors and bio-chip based devices using micro-spectrophotometers/micro-electrode; self assembled bio-selective fluids and surface modification techniques. LB and sol gel deposition on nanostructured wave-guides for SPR sensor applications. Biosurfaces: protein/lipid attachment mechanisms and the prevention at a molecular level with functionalised coatings, immobilisation of bioselective fluids on atomically controlled thin film structures. AFM probe analysis of inter-atomic forces between bio-fluids and surfaces.

<b>National Physical Laboratory</b>			
<b>Contact/CEO</b>		Stuart Windsor	
Queens Road Teddington, Middlesex TW11 0LW <b>Tel.</b> +44 208 943 7085 <b>Fax.</b> +44 208 614 0531		<b>Email:</b> <a href="mailto:stuart.windsor@npl.co.uk">stuart.windsor@npl.co.uk</a> <b>Web:</b> <a href="http://www.npl.co.uk/biotech/index.html">www.npl.co.uk/biotech/index.html</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Research areas are mainly:

- the measurements for biotechnology program
- fluorescence standards & quantum dots
- validation of fluorescence measurements for the biosciences
- development of single molecule detection methods
- evaluation of the comparability and complementarity of protein characterisation methods
- bio-express (overcoming barriers to the exploitation of biotechnology through pre-normative research)
- beacon (biopharmaceutical effective analysis consortium for drug quality, performance and behaviour)

<b>RegenTec Limited</b>			
<b>Contact/CEO</b>		Dr. Robin Quirk	
Pharmaceutical Sciences Building University Park Nottingham NG7 2RD <b>Tel.</b> +44 115 951 4291 <b>Fax.</b> +44 115 951 4136		<b>Email:</b> <a href="mailto:rquirk@regentec.net">rquirk@regentec.net</a> <b>Web:</b> <a href="http://www.regentec.net">www.regentec.net</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

RegenTec is an independent research company emerging from the tissue-engineering group at The University of Nottingham and working within the emerging field of tissue engineering. The aim of tissue engineering is to create biological substitutes for the replacement or restoration of tissue function lost through failure or disease. This goal requires a combination of scientific approaches ranging from materials science, drug delivery and cellular biology.

<b>Central Research Laboratories Ltd</b>		Founded 1928	
<b>Contact/CEO</b>		Julie Deacon	
Dawley Road Hayes, Middlesex UB3 1HH <b>Tel.</b> +44 181 848 6586 <b>Fax.</b> +44 181 848 6442		<b>Email:</b> <a href="mailto:jdeacon@crl.co.uk">jdeacon@crl.co.uk</a> <b>Web:</b> <a href="http://www.crl.co.uk/">http://www.crl.co.uk/</a>	
Turnover in €:		Staff in 2004:	140

**Organization focus:**

Major application is doctors' surgery diagnosis and point of care monitoring and testing. Possible fields of applications:

- environmental (water quality testing and pollution monitoring).
- food testing (food identification and quality; food hygiene (microbiological testing); intelligent food packaging).
- clinical chemistry (veterinary; point of care; e.g. high throughput, multi-tests)
- immunodiagnosics (e.g. drugs of abuse testing, ambulatory cardiac monitoring; home pregnancy testing; e.g. hormone function, therapeutic drug monitoring; high throughput screening (e.g. compound screening against a pharmaceutical target).
- DNA diagnostics (DNA chip for early detection of AIDS/HIV in the doctor office; high throughput sample screening for blood banks).
- genomics (population screening; drug target identification, clinical trial classification; individual screening; point of care risk analysis and drug prescription).

<b>Liquids Research Limited</b>		Founded 1990	
<b>Contact/CEO</b>			
Mentec Technology Centre Deiniol Road, Bangor Gwynedd, Wales LL57 2UP <b>Tel.</b> +44 1248 352204 <b>Fax.</b>		<b>Email:</b> <a href="mailto:info@liquidsresearch.co.uk">info@liquidsresearch.co.uk</a> <b>Web:</b> <a href="http://www.liquidsresearch.com">www.liquidsresearch.com</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Liquids Research Limited manufactures magnetic liquids, ferrofluids, magnetic inks, magnetorheological fluids and bioseparation, leading research projects covering the fundamental aspects of these materials and other fields also based on fine magnetic particles.

<b>Malvern Instruments Ltd.</b>		Founded 1975	
<b>Contact/CEO</b>			
Enigma Business Park Groveswood Road Malvern, Worcestershire WR14 1XZ <b>Tel.</b> +44 1684 892456 <b>Fax.</b> +44 1684 892789		<b>Email:</b> <a href="mailto:roberts@malvern.co.uk">roberts@malvern.co.uk</a> <b>Web:</b> <a href="http://www.malvern.co.uk/home/index.htm">www.malvern.co.uk/home/index.htm</a>	
Turnover in €:		Staff in 2004:	

**Organization focus:**

Supplier of instrumentation systems that apply advanced technologies for the characterization of particle and material properties with following technologies: laser diffraction, image analysis, zeta potential, static and dynamic light scattering and strain and stress controlled rheometry.

### Collaborations:

Malvern is open to approaches from other companies seeking particle characterization solutions as a component of other systems.

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<b>Nanoco</b>	Founded 2001		
<b>Contact/CEO</b>	Dr. David Glover		
48 Grafton Street Manchester M13 9XX <b>Tel.</b> +44 161 606 7254 <b>Fax.</b> +44 161 606 7300	<b>Email:</b> <a href="mailto:david.glover@nanoco.biz">david.glover@nanoco.biz</a> <b>Web:</b> <a href="http://www.nanoco.biz/">http://www.nanoco.biz/</a>		
Turnover in €:		Staff in 2004:	

### Organization focus:

Nanoco commercializes unique, proprietary and widely-patented methods of synthesizing quantum dots. Experience in areas for high performance monodispersed nanoparticles including:

- Authentication tagging: specialty dyes, polymers, etc.
  - Healthcare and life science: bio probes, screening, etc.
  - Electronics: photo voltaics, storage, LEDs, etc
- 

<b>Oxford Gene Technology IP Ltd</b>	Founded 1995		
<b>Contact/CEO</b>	Dr Andrew Millar		
The Hirsch Building Begbroke Business & Science Park Sandy Lane Yarnton, Oxford OX5 1PF <b>Tel.</b> +44 1865 405 100 <b>Fax.</b> +44 1865 405 120	<b>Email:</b> <a href="mailto:andy.millar@ogt.co.uk">andy.millar@ogt.co.uk</a> <b>Web:</b> <a href="http://www.ogt.co.uk/">http://www.ogt.co.uk/</a>		
Turnover in €:		Staff in 2004:	

### Organization focus:

Oxford Gene Technology (OGT, known for the Southern Array) is working in microarray technology and 'molecular tools' that can be used to boost the power of biological research. Manufacture and use of DNA microarrays in genetic and genomic research. Developing of using ink jet in situ synthesis (ijiss) technology.

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<b>pSiMedica Limited</b>		Founded 2000	
<b>Contact/CEO</b>		Roger Aston	
Malvern Hills Science Park Geraldine Road Malvern WR14 3SZ <b>Tel.</b> +44 1684 585300 <b>Fax.</b> +44 1684 585357		<b>Email:</b> <a href="mailto:aston@psimedica.co.uk">aston@psimedica.co.uk</a> <b>Web:</b> <a href="http://www.psimedica.co.uk/welcome.html">www.psimedica.co.uk/welcome.html</a>	
Turnover in €:		Staff in 2004:	

### Organization focus:

pSiMedica Limited exploits the potential of biosilicon, a new proprietary biomaterial based on nanostructured porous silicon. BioSilicon™ is a biocompatible and biodegradable, low cost form of the semiconductor silicon that has a broad range of applications in medicine offering unparalleled diversity. Focusing on the development of BioSilicon™ for the controlled release of therapeutic agents. Further applications of the technology range from orthopaedics and tissue engineering to diagnostics. First clinical assessments of BioSilicon™ will be in the delivery of radioisotopes and cytotoxic agents for brachytherapy.

### Collaborations:

pSiMedica's two main investors are QinetiQ Limited (formerly The Defence Evaluation and Research Agency - DERA) and pSivida Limited.

<b>SKYEPHARMA PLC</b>			
<b>Contact/CEO</b>			
SKYEPHARMA PLC 105 Piccadilly London W1J 7NJ <b>Tel.</b> +44 207 491 1777 <b>Fax.</b> +44 207 491 3338		<b>Email:</b> <a href="mailto:A.Francis@skyepharma.ch">A.Francis@skyepharma.ch</a> <b>Web:</b> <a href="http://www.skyepharma.com/about_skyepharma.html">http://www.skyepharma.com/about_skyepharma.html</a>	
Turnover in €:		Staff in 2004:	

### Organization focus:

SkyePharma's field of expertise is a range of drug delivery technologies. Five major "platform" technologies: oral, injectable, topical, inhalation and enhanced solubility, combining the established pre-clinical, clinical and regulatory expertise with the capability to formulate and manufacture drugs, both for clinical studies and commercial sale.

<b>Solexa Limited</b>	Founded 1998		
<b>Contact/CEO</b>	Tony Smith		
Chesterford Research Park Little Chesterford Nr Salfron Walden, Essex CB10 1XL <b>Tel.</b> +44 1799 532300 <b>Fax.</b> +44 1799 532301	<b>Email:</b> <a href="mailto:tony.smith@solexa.com">tony.smith@solexa.com</a> <b>Web:</b> <a href="http://www.solexa.com">http://www.solexa.com</a>		
Turnover in €:		Staff in 2004:	

### Organization focus:

Spinout from University of Cambridge, Dept of Chemistry. Business mission is the analysis of genetic variation on a whole genome scale, by development of a rapid and cost effective DNA re-sequencing system. Markets addressed are initially in research (academic and e.g. pharma industry) and in future in consumer healthcare and diagnostics.

<b>XstalBio Limited</b>			
<b>Contact/CEO</b>	Dr Marie Claire Parker		
Joseph Black Building University Avenue Glasgow G12 8QQ <b>Tel.</b> +44 141 330 3298 <b>Fax.</b> +44 141 330 4888	<b>Email:</b> <a href="mailto:m.c.parker@xstalbio.com">m.c.parker@xstalbio.com</a> <b>Web:</b> <a href="http://www.xstalbio.com">www.xstalbio.com</a>		
Turnover in €:		Staff in 2004:	

### Organization focus:

XstalBio is a drug delivery and biomolecule stabilisation company specialising in advanced formulations of therapeutic proteins, enzymes, vaccines, peptides and nucleic acids. Coating of biomolecules onto water-soluble microcrystals, suitable for administration by pulmonary, parenteral, and nasal routes. Protein coated microcrystals (PCMC) have applications in drug delivery, diagnostics and biocatalysis and the core carrier can be made from a wide range of pharmaceutically acceptable compounds.

### Collaborations:

XstalBio is interested in partnership for co-development of patent protected biomolecule drug formulations.

<sup>1</sup> Kataoka, D.E., Troian, S.M. *Nature* **402** (1999) 794.

<sup>2</sup> Rice University, <http://dacnet.rice.edu/Depts/IBB/Directory/index.cfm?FDSID=440>

<sup>3</sup> [http://www.pacificnano.com/nanotechnology\\_single.html](http://www.pacificnano.com/nanotechnology_single.html)

<sup>4</sup> <http://www.qdots.com/live/render/content.asp?id=44>