6th Concertation and Consultation Workshop on Micro-Nano-Bio Convergence Systems MNBS 2012,

Special topic "Understanding the Supply Chain"

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Report

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1. Executive Summary

The 6th in a series of workshops on the development of Micro-Nano-Bio Convergence Systems, MNBS, is devoted to share the progress in this field and the opportunities and challenges ahead. Increasingly, the focus of the program and workshop is to identify and help resolve the key characteristics of projects and consortia to transform themselves into successful businerss operations. Last year therefore the focus was on commercialization of the scientifc and technological results, and this year the building of supply chains took the center stage. The setup was to give the podium to the exchange of information on the progress of science and technology in MNBS, to investigate synergies to address the issues that face the building of new value chains, and to reach common understanding on the needs of research and innovation in the supply chain.
The second day was organized by the COWIN team (FP7 CSA) who promoted a Marketplace concept as an effective instrument to foster technology transfer, to find new customers for innovative MNBS products and to build strategic partnerships and collaborations.
The program is in Annex I.
The workshop attracted over 75 participants from across Europe, who represented many running FP7 projects as well as finished FP6 projects and other stakeholders from industry and the public sector. 42% of the participants were industry related companies. For the list of participants see Annex II.

The workshop covered 5 topics, ranging from broad support activities to strengthen the field overall, to a consultation process on the develoment of the future MNBS EC program. The project presentations covered microsystems that intimately interface to body's neurological or muscular systems, systems that allow high precision surgery with minimal damage for patients, and *in vitro*, miniaturized systems for diagnosis and detection of genes, enzymes, proteins, small molecules or complete cells. These latter projects address pressing needs in healthcare, food and the environment and cover the area referred to as "lab-on-chip" devices. The MNBS technologies are in an early stage of development and will be disruptive to large existing markets, e.g in healthcare, and wil create new markets in food, environment and safety/security. While these markets will typically be large, multi billion opportunities, quantification is purely speculative due to the ealy stage of technology development.

Progress
Most projects showed good, and some impressive progress in both component and integration technology. As projects are reaching the pre-clinical or clinical trial phase, dealing with the associated ethical, regulatory and reimbursement requirements poses new challenges.
In a number of projects the transition to commercialization has started though either new business entities or by setting-up joint ventures. New challenges will be faced at this stage, especially the valley of death, the period between the market introduction of a new product and the market acceptance and take-off of serious sales growth.
Transfer of know how into real products is an area where the EU does not have a good track record, and the COWIN project (FP7, Coordination and Support Action) is quintessential to share best practices and speed up the learning process. The 1st COWIN event in diagnostic, food and beverage has successfully gathered innovation stakeholders and encourage the commercial exploitation of research projects results with concrete expressions of interest.

For system integration, one of the big technological challenges, new approaches are being experimented. Using 3D printing technology, which is being applied to an ever-increasing range of products, a variety of disparate components can be integrated smoothly, as a recently launched project team is finding out (SIMS project).
Parasites are causing a variety of tropical diseases and are spreading across the globe by worldwide travelers. Using MNBS technology it has been shown that a very compact, pocketsize device has the potential to make a diagnosis on site and treat the disease much more effectively.
Bringing users and providers of MNBS techonoly together, to improve the safety of food and beverages has the potential to identify the key areas where this large industry wil have the biggest benefits. New, exciting project proposals can help build new competences and industrial knowhow in the EU, a key ingredient of commercial success.

Consultation
The MNBS industry is about building high value-added, knowledge intensive products with high volume. As these disruptive products are always used in someone else's process, the promise of improving quality, speed and efficiency all at the same time will significantly improve the industries affected. As Europe's population grows older, the tincrease of productivity enabled by the new technology could be essential to offset the reduction of the workforce.
In parallel, the process knowledge of the device industry needs to deepen in order to integrate application knowhow with system requirements. Closer cooperation with end users is quickly increasing in importance. In healthcare, this means working with nurses, doctors, payours and institutions in close harmony to achieve the broad acceptance that is strived at. Similar requirements exist for the food and environmental industries.
Currenly there are little or no standards to simplify the develoment of key modules and speed up the growth of specific parts of the value chain. The introduction of develoment tools (project Corrallia) is an excellent start, but more needs to happen in the area of standardization.
Some participants called for subsidizing more stages of development. Although this idea is enticing, subsidies can be addictive. When the risks are high and success is far away, commercial capital providers are reluctant to privide funding and subsidies can be effective. As soon as sufficient proof-of-performance exists, subsidies should be diminished and stopped, and professional, risk-taking fund providers should take over. For MNBS this means limiting subsidies to proof-of-principle.

2. Workshop Objectives

This workshop, the 6th in a series of workshops on the development of Micro-Nano-Bio Convergence Systems, MNBS, is building on the progress of many projects and the previous workshops. Its overriding purpose is to identify and help resolve the constraints that have hindered the technological breakthroughs of European scientists to become market successes. A key vehicle in this process is the synchronization of a large number of key players in a nascent and complex supply chain with strong interdependencies and sometimes diverging, goals. While the 5-th MNBS workshop had the road to commercialization as the central theme, this year the supply chain took center stage. The specific objectives of 6-th MNBS workshop were:

- to encourage the diffusion and exchange of information on the development of science and technology
- to identify synergies and possible collaborations to tackle critical issues covering the full value chain from R&D to exploitation
- to reach common understanding of the steps in the supply chain for different types of applications, and the needs and problems in the area of research and innovation of the stakeholders of the elements of the supply chain

3. Introduction

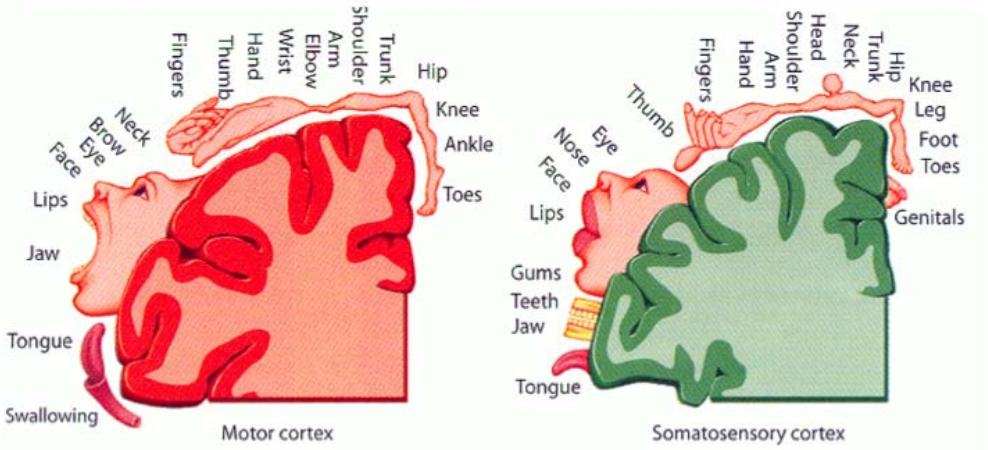
Worldwide, scientific and technological research to develop, manufacture and sell systems that employ nano- and micro-structures is at the forefront of economical competition. The class of devices that combine biological functionality with the ubiquitously sharing of information through networks receives particular attention. A wave of new materials, processes and technologies is being researched that enable highly integrated, miniaturized and compact systems to be assembled. The fruits of these efforts can be used in many areas, such as biomedicine, transport, telecommunications, the food chain, safety, the environment, smart textile and others.

These fast technology developments are also at the heart of the explosive growth in Life Sciences, which is leading to an everincreasing understanding of life at the sub-cellular and molecular level. By bringing these parallel developments to healthcare, ultrafast and sensitive systems can be developed to diagnose diseases with high accuracy and speed, and to support and improve body functions, or to replace lost functionality. Such systems will help to diagnose and treat the world's major and orphan diseases with better outcomes and at lower costs than previously deemed possible. It could make a substantial contribution to bring healthcare expenditures under control and increase its productivity. At 10% of the world's GDP and continuously surpassing GDP growth, governments around the world are struggling to provide high quality healthcare at affordable costs to their citizens[1,2].
For example, in diagnostics highly integrated, compact devices are developed, so-called point-

[1] Economist Intelligence Unit,The future of healthcare in Europe The future of healthcare in Europe, 2011

[2] Price Waterhouse Coopers, HealthCast , 2010

of-care products or POCs that incorporate lab-on-a-chip ("LOC") technologies, to achieve integration of the hitherto separate processes of sample preparation, separation, amplification and analysis. New therapeutic devices are envisioned that are implanted to support body functions or organs that are weakened by disease or lost through amputation, or allow high precise surgical interventions to minimize damage to surrounding tissue. Such new products could reduce the severity and mortality of the world's most severe diseases such as heart attacks and failure, stroke, cancer, neurodegenerative and infectious disease.



The "plasticity" of the brain allows for new therapies

Time critical diagnostics information can be obtained more rapidly at the point-of-care or point-of-diagnosis, and treatment monitoring with immediate feedback becomes more feasible, e.g. for bacterial or viral infections. Also, more personalized treatment becomes possible by measuring the patient's genetic predisposition to side effects and response. With the quickly diminishing cost of sequencing a complete human genome to below €4000[3] this year, new monitoring devices will promote and improve patient follow up, thus addressing the limited caregiver resources, the growth in chronic diseases driven by aging and lifestyle, and healthcare's budget constraints. Such less intrusive, miniaturized and hassle free devices with enhanced patient acceptability will reduced the risk of social exclusion and improve patient support at home.

Therapeutic devices will allow surgical interventions that today are not possible or lead to serious impairment, e.g. in diseases such as prostate cancer or afflictions of the nervous systems. Other devices envisioned are implantable biochips and autonomous on-body biosensors, which allow continuous monitoring of body functions, networked to the outside world through wearable textile. Projects that are supported in the MNBS program develop:

- Robotic systems for highly precise surgery
- Neuro-interfacing implantable devices that treat phantom limb pain, restore motor functions or intervene in the cardiovascular system
- Lab-on-a-chip systems employing a variety of technologies for sample handling, separation and identification for both body fluids and food
- Improved diagnostic transducers and transponders
- Detection and identification of circulating cancer cells
- Devices for a new imaging principle
- New sensors, body area networks and biomedical informatics

[3] Ernst & Young, Global Life Sciences Report 2012

The technology developed in the MNBS program can also be applied to other areas such as the food chain and environmental analysis. Assuring safe and high quality food requires protection against bioterrorist attacks and contamination by biological agents such as bacteria and parasites, as well as toxins and chemicals. The current analytical tools to perform the

Food allergies affect 8% of Europe's children and are cumbersome to identify.
The current process involves a series of markings on a child's back (left picture) to identify the allergen(s). Right picture shows the results. A simple blood prick followed by the analysis in a Point-of-Care device would be a big improvement (project Positive).

required analysis are either not portable or too complex for field use (HPLC, LC and GC), lack sensitivity (ELISA) or are too time consuming (molecular and microbiological tests). The need for smart, rapid-testing and compact platforms such as developed in the MNBS program is thus clearly established[4].

4. MNBS Workshop, presentations and discussion

The 6th annual Concertation and Consultation workshop on Micro-Nano-Bio Convergence Systems, MNBS, was held in Athens, Greece, on May 3 and 4, 2012. The event was organizedby the European Commission and the National Center for Scientific Research Demokritos in Athens, Greece. Demokritos also hosted the meeting. The meeting's 75 participants were offered a two-day program with progress presentations on individual projects, invited presentations from external key stakeholders, a consultation discussion and summary, as well as sessions organized by COWIN on the commercialization of the scientific and technological research.
The program and the list of participants can be found as Annexes I and II.

4.1 Welcome and Opening

Ioannis Raptis, Imel NCSR Demokritos, opened the meeting and introduced the professional and social programs. Nikos Kanellopoulos, NCSR Demokritos Director, gave a tour d'horizon of the institution. Founded as a research institute on the peaceful applications of nuclear energy with US support in 1961 by the Greek Atomic Energy Commission, it became autonomous in 1985. Today, NCSR "Demokritos" stimulates cross-disciplinary research, both at national and

[4] L.M.L.Nollet, F. Toldra, Advances in Food Diagnostics, Blackwell Publishing, 2007

international level through 8 Institutes, which cover a wide range of fields and perform research as well as educational duties. Areas of research include nanotechnology, microsystems, integrated telecommunications and informatics technology systems, modern technologies for cultural heritage, control of environmental pollutants, nuclear technology and radiation protection, accelerative systems technologies and detector devices, generation and characterization of innovative materials, bioactive molecules, natural products and biotechnology, medicines and diagnostics technologies, telemedicine. Over the 50 years of its existence, NCSR "Demokritos" become the leading research institute in Greece and creates 25% of all Greek scientific publications.

Andreas Lymberis, European Commission, DG Connect, Micro-systems, welcomed the participants and gave a succint overview of the MNBS program and developments ahead. Home in the EU's Digital Agenda and with a bright future of breakthroughs solutions in many of Europe's key societal challenges, MNBS integrates nano-bio technologies with ICT. The application areas cover a broad range, from healthcare, healthy ageing, and food and water quality to the environment and national security. In order to develop it's full potential a common understanding of R&D and innovation needs to established, and a shared vision of the market success. Also a full value chain is to be developed, and all of this in a structured dialgue between the stakeholders. This workshop is part of the dialogue and will focus on value chain development and on bridging the innovation gap.

Panayiota Petrou, NCSR Demokritos, introduced the MNBS work that takes place in Greece. Four research, 5 academic institutes and 4 companies are active in this field across Greece. The multitude of projects cover a broad spectrum of applications, such as the diagnosis of cancer, cardiac and other diseases, DNA-mutation linking to disease, food and water analysis, new materials development and novel material design strategies. To achieve this a host of technologies and components are developed, including integrated optical, protein-based, cell-based, acoustic and capacitive biosensors, DNA arrays, metaloxide microcolumns, microfluidics and integrated devices. Some of the projects were presented during the meeting.

Andreas Lymberis, European Commission, DG Connect, Micro-systems, reviewed past and future of the MNBS program and outlined how it would fit in the FP8 program and EU's strategy towards 2020. MNBS is area where major scientific and technological fields converge, i.e. microsystems & smart system integration, ICT for Health, eInclusion and FET, and nano technologies. It is coupled with the Technology Platforms EPoSS, NanoMEdicine and Nanomaterials & processes, and covers personal health systems, virtual human physiology and the integration of neurological systems with ICT. As a program, it fits very well the EU's 2020 priorities, i.e. tackling societal challenges, creating industrial leadership and building excellence in the science base.
MNBS has become a strong cluster, with 41 FP6 &FP7 projects and € 171 mln of funding. A third of the participants are SMEs, and the projects cover a broad range of applications such as medical diagnostics, health monitoring, minimally invasive surgery, neurological therapy, environment protection, food and beverage safety and quality control. Most projects are developing devices that can be orders of magnitude smaller, lighter and at lower cost, and thus hold the promise of disruptive innovation in all these fields. As is well known, disruptive innovations face new adoption cycles, and have to cross the valley of death, the period

between proven product performance and sufficient market demand to finance a company's growth. To cross this chasm is a major business issue and one in which the EU needs to improve it success rate. The field is new to the world and the industry is in an early stage of development, and hence additional effort is needed to increase the chance of success. To this end the COWIN program has been designed to support young companies and SMEs to improve their business planning and execution process in these early markets. Some member states are providing specific funding, e.g. the UK will set aside £80 mln as bridging money.
Since health, aging & wellness and food security are highly ranked on the EU's political agenda, MNBS is well positioned to deliver a significant contribution.

Hans-Peter Dauben, German Agency for Health Technology Assessment, shared his insight in how to get approval and reimbursement in medical applications. These processes are well known to be potentially very lengthy and thus prohibitive for under-financed companies. The best way to minimize these processes is to work with the agencies as early as possible, since a proper understanding by the agencies speed up the approval cycle will. Since there are 27 national healthcare systems, reimbursement rules differ across the EU. Approval though is done on an European level, but additional approval criteria may exist in the member states. He explained the path to market and described the essence of the 2 processes. In Healthcare at least three customer types exist, i.e. the patient and citizen, the healthcare provider – physician, nurse, technician, and management – and the payour, the government and insurance company. Across Europe the trend is towards patient centricity, which means that the patient must see the benefit of the device too.
The regulatory process asks for evidence on two questions: is your product safe, and does it lead a better patient outcome than the current method. The reimbursement process varies across member states, and is different for other countries too, such as the US – the largest market in the world, but with differences between its states. It is also more political and changes over time as countries change governments and implement cost containment processes. What is same across countries is that evidence is required for medical impact; the difference is in which evidence and how much of it is required, and how the cost impact of the product is judged. The process to assess the fitness for purpose of a product for a specific medical goal is called Healthcare Technology Assessment, HTA, and a network exist across Europe to improve this process. More details were given in the talk details on how the regulatory process works.

Thanos Demiris, Micro2gen, introduced Corallia LoC project, which deals with microelectronic components for Lab-on-Chip instruments in molecular diagnostics for genetics and environmental applcations. The market for biochips and microarrays for molecular diagnosis is expected to grow at 17% from a more than $ 2 bln market size in 2010. As currently most "Lab-on-Chip" or LoC systems are developed using in-house tools there are significant opportunities for companies offering development tools. This is exactly what the Corallia project is about. The advantages for LoC develpers are more re-use, faster development times and shorter time-to-market, and the availability of ready-for-use modules and components. This would help the industry to develop faster and at lower cost. The Corallla system will essentially have 3 main modules, i.e. a PC with flexible software with a visual programming interface, ready to use control and readout hardware, and support for all typical sensors and actuators on the market in in addition to innovative solution. The concept for the new, innovative solution latter has been developed in the FP7 CDMEDICS project and offers various

advantages over existing control mechanisms. The system will be validated by designing a LoC to identify a specific mutant of a common cancer gene in order to evaluate treatment options.

4.2 Coordination & Supporting Activities

In this session three EC coordination & support activities (CSA) are discussed that cover broad topics.

Since Health is already well on the map as an application area for MNBS, the identification of opportunities in food is the subject of a project (FoodMicroSystems) that brings together the smart systems R&D world in Europe with the food and beverage industry to increase the safety and quality of food and beverages. This is to be accomplished by the cooperation between suppliers and users of such microsystems. This is needed, as the use of such microsystems is largely underdeveloped in the food industry. The result of the project will be a report describing the potential for the food industry, and roadmaps describing how to get there. Five reports will be issued that detail the segments in this market, i.e. meat, dairy products, beer and wine, fruits and vegetables and the packaging hereof. After 8 months the project is well underway.

Two other CSA projects aim to improve our understanding of what's going on in smart systems in Europe. IRISS is building a thorough understanding of Europe's smart systems technology community, with the aim to better understand users' needs and build better plans for the future. COWIN strives to improve the business planning and commercialization of the R&D results to create value for the industry and its users, and to improve the EU's competitveness.

4.3. Microsystems interacting with the body

The projects in this session are about developing and intimately integrating man-made smart, miniaturised systems with the human body, or to repair body functions with a minimum of damage to the surrounding tissue, especially blood vessels and nerves.
In the case of paralysis by an injured spinal cord, efforts are ongoing to bypass the injured junction and stimulate new neuron creation. NEUWalk project pioneers a new approach in which the information of the motor cortex is interpreted and used to drive the neurons of the spine directly through an implanted smart device and wireless connections. This approach could be applied to restore spine function, but also to treat other diseases, such as late-stage Parkinson where deep brain implants have proven benefits. The NEUWalk solution would not only enable an unmatched improvement of quality-of-life, but also reduce the cost per patient to society significantly.
Phantom limb pain, i.e. pain in a limb that is no longer there, is known to occur in 50-80% of the people that have lost a limb. There are currently no long-term effective treatments known for this affliction, which aggrevates the disability of patients affected and deepens the loss of quality of life. It is probably caused by uncoordinated information sent by the transected nerve, which the brain is unable to sensibly interpret. The hypothesis at the heart of the TIME project states, that by stimulating the affected nerves, the brain could adjust to the new situation. TIME therefore aims to develop a smart system that will send (soothing?) sensory feeback to the brain. The system will generate multi-channel micro-stimulations to the nerve

stump of an amputee volunteer, to manipulate his/her phantom limb sensations, paving the way for using the neuro-modulation as a treatment for phantom limb pain.
With increasing age, the walls of a blood vessel can locally expand and become increasingly thinner as blood is continuously pressing against the same wall section. If such an aneurysm develops in the lower part of the aorta, a rupture of the vessel's wall will lead to massive hemorrhage followed by death. Preventive treatment against such an event involves the placement of an endovascular graft, and is done increasingly minimally invasive under image guidance. If this graft or stent does not fit well enough, leakage around the graft can occur. Therefore the Heart-e-Gel project aims to use the properties of so-called electro-active polymer hydrogels for closing, filling or sealing vessels. The fact that the volume of this class of material is electrically tunable makes it very attractive for this purpose.
ARAKNES' goal is to set new standards for minimally invasive surgery by developing a novel platform for scarless, high–precision robotic surgery,. It aims to outperform labaroscopic interventions by being scarless and by being less invasive and more efficient with current robot procedures. It aims to be versatile, effective and accurate, user friendly and safe by employing micro-robotics devices and advanced navigation systems. It will allow a new class of surgical procedures, which will benefit patients, the healthcare system and the payour community.

Progress and main achievements

- In its second year, NEUWalk showed its first system for human use, which can be adapted to other neurological applications as welll, and started the procedure to get ethical permission for primate testing and risk failure management.
- The first system was applied to a volunteering healthy person in the TIME project. This psychophysical platform was designed for testing purposes and performed well. For the next stage a first patient will be selected for the first experimental procedure in Rome.
- A novel polymer gel showed promising swelling results, and a first generation electronic control platform and electrode (?) prototypes were developed. Also a supply chain strategy and complete project plan, including clinical testing and market entry, were developed for Heart-e-Gel, and a patent was filed.
- The Sprint robotic platform has been applied with success in 2 pre-clinical, in-vivo procedures, and the results presented at an internaitional meeting for gastrointestinal and endoscopic surgeons (ARAKNES). A new external manipulator, a research platform, new sets of sensors and readout optical modules were developed in parallel.

Main challenges

- For NEUWalk, the next challenge is to get all the agreements for first testing on primates, folowed by the first human.
- In the case of TIME, dealing with the changing Italian ethical codes is causing a delay and may affect the testing protocols as well.
- For Heart-e-Gel, in addition to show that the method actually works in living beings, the next challenge is to provide the evidence that a new compound and delivery system will be safe for patients.
- For Araknes, as the project will be finished by the end of 2012, the challenge is to bring

project results closer to the market. To this end a joint venture is being prepared to attract investors and prepare the market introduction plan.

Takeways

- By designing a system in a generalized way, more applications can be developed at lower cost and faster than by a dedicated design.
- Preparing for the ethical and regulatory procedures cannot start early enough, as it allows decision makers to familarize themselves with new technology and potential ethical dilemmas. It might also flag changes on the regulatory side, which could otherwise cause unforeseen delays.
- New materials can solve medical challenges, which hitherto could not be addressed.
- Project plans with specific goals and good execution can build the basis of new ventures, where different sets of challenges await the new entities.

4.4 Microsystems interacting with bacteria and cells

A variety of diseases are caused by infections, i.e. bacteria, viruses or parasites. In tropical diseases for example, the identification of the pathogenic organism and the immuno response are needed to diagnose the affliction and to differentiate between acute and chronic condition. In such diseases a one step, low cost diagnosis can make the difference between life and death. Once extinct tropical diseases, moreover, are re-occurring in the western world through intercontinental travel. For other dieseas, e.g. cancer, cells circulating in the body can give complementary or more specific information on organ pathologies.
In the case of cancer, the identification of tumour cells circulating in the blood will not only reveal the presence of disease, but could also pinpoint the affected organ. As the occurrence of these cells is in the ppm range and even lower, very sensitive detection mechansisms are required to allow accurate diagnosis.
Pushing the limits even further, through single cell manipulation and analysis the knowledge of pathological processes and impact of therapeutic strategies can be investigated in detail. This is of specific interest for research in areas such as pharmaceutics, stem cells, cancer and tissue engineering. The projects ProdiTrodi, Miracle and PASCA deal with these challenges.

Progress and main achievements

- For Chagas disease, one of the deadliest tropical diseases, a pocket-sized cartridge has been developed that allows for full diagnosis. The results achieved by a close intercontinental cooperation between a European and a Brazilian team have been presented and discussed. A novel detection device had to be invented to characterize the protozoan parasite Trypanosoma cruzei. The cartridge integrates sample preparation with microfluidics and a new, nanotube-based detection principle.
- To identify circulating cancer cells, the Miracle project, made big strides in its starting year. The first version of an active sieve was designed and cancer cells were retained. A chip to detect 21 breast cancer markers was manufactured and tested well. Several types of nanoelectrodes for new assays were investigated, and the microfluidic system was integrated in one module. Also, preparations for the exploitation have started and the

results were communicated broadly.

- The PASCA project delivered within one year the first prototype analyzer, which allows for drop-on-demand single cell printing and label-free optical detection. It has been shown that cells can be printed on any position, and viability of the principle was proven for a range of cells such as yeast, fibroblasts and keratinocytes.

Main challenges

- The challenges ahead are typical for new medical devices: the long regulatory path, risks in the industrialization of the demonstrator prototype and patient investors. The lack of standards was noted as an additional risk. In addition, for the treatment of tropical diseases project funding has to be obtained from donor countries or charitable programs such as the Bill and Melinda Gates Foundation's Global Health Program.
- For Miracle the system integration and clinical validation, as well as mapping the path through the approval process, pose the next hurdles.
- In single cell printing, combinaing a number of technologies is the next step to improve the sorting of cells. Also, chosing the right business model and attracting investors is high on the list. Finding some stunning applications in cell analysis would help significantly.

Take-aways

- PodiTrodi proves that it is possible to develop a pocket size, dedicated pathogen diagnosis and assessment test for use in tropical areas.
- Proper planning and execution in addition to the availability of the right competences and good team spirit means progress can be swift. The two cell analysis projects bear witness to this principle.
- In order to minimize discrepancies and misunderstandings, it was found to be essential to structure the set of specifications in levels, and in the appropriate context and language of biology, physics, electronics, software and system.
- Making prototype products available to third parties is an axcellent way to speed up the learing and improvement process, as well as a strong lever for new applications and publications.
- Continuous and consistent communication of progress results pave the path to recognition and help to create a community of potential, high profile first customers.
- These learnings may well apply to many other MNBS projects.

4.5 Lab-on-a-chip

In this session projects are presented that aim for prototype devices of portable diagnostic systems, with a small footprint and lower costs. Samples can be taken from one of the body 's fluids, which can be collected at much smaller quantities than current central lab equipment require. The diagnosis can be done immediately after sample taking, in the presence of the patient and nurse of physician, and with the outcome availability in minutes rather than days. A huge and continuously growing body of knowledge exist on biomarkers for diseases and afflictions.

Applications in the food industry and environmental monitoring are also abound, with the possibility of occasional, intermittent or semi-continuous analysis. Different integration, chip processing and detection technologies are employed to these ends. Amongst these is the effort to produce a complete miniaturized system by combining various printing technologies. Reports on the projects LabonFoil, PYTHIA, Positive, SIMS, ARROW and CD-Medics were given. Obviously, these projects are not all in the same phase and thus will differ in achievements and challenges.

Progress and main achievements

- Three LabCard readers have been manufactured, calibrated and verified. Biological tests were successful and the systems have been farmed out to partners' sites. 150 more biological tests were developed, and applications for food and the environment were developed in the Labonfoil project. In addition, it was announced that POC Microsystems was established as the company to commercialize the results of the LabonFoil project.
- Broadband Mach-Zehnder interferometry overcomes the limitations of the single wavelength version. Thus multi-analyte detection becomes possible, as shown on samples of mouse-IgG and biotinylated BSA as well as on total PSA in integrated chips, in the pico molar range. Further improvements are possible with on-chip spectral analysis (PYTHIA).
- The Positive project showed evidence that for the analysis of food allergens a nanoporous substrate with filtration membranes is capable of extracting plasma from whole blood samples on a chip.
- In the SIMS project various printing technologies, a biosensor for hydrogen peroxide, a prototype display, components for a battery and organic circuit components have been designed and integrated.
- In ARROW an automated system has been designed that offers high resolution and high sensitivity in sample analysis, by reducing the size of all modules in a complete mass spectrometer based system.
- Finishing the session for the CD-Medics it was shown how a complete system has been designed to test for the gene mutations that lead to Celiac disease, an autoimmune affliction that can have severe consequences and is largely mis- or under diagnosed. A setup for post project commercialization has been completed.

Main Challenges

- Unmet needs are to be identified and quantified, and the search for the killer application is on.
- Different approval paths need to be mapped for the 3 application areas: food, healthcare and the environment. Healthcare is the most demanding one in terms of evidence to be provided, and by addressing less challenging markets first the industrial and design learning curves can be explored more readily.
- The stability of the molecular probe is often an issue, as is the calibration process, since for biological reagents even batch-to-batch differences occur from the same supplier. There is a need for reference and other standards. Also, the occurrence of frequent miscommunications between biologists, chemists, phycicists and the medical

profession needs to be structurally solved.

- The migration of prototype biochips from special purpose fabrication to mass-production technologies as used in Si foundries continues to pose a major challenge.

Take-aways

- Again, good teamwork helps to both avoid and quickly address any misunderstandings or execution delays that are bound to occur.
- Direct spectral analysis of analytes offer high specificity as well as sensitivity.
- Many projects are proving that the scientific and technological knowhow exists in a number of places across Europe to create a new industry.
- The supply chain for these products for clinical applications is complex and is obviously in its early stage. The use of standards between the various modules would simplify this and speed up the innovation of modules and products. It would also improve the stability of the individual modules. Together this would speed up the early growth phase, and eventually the maturity of this nascent industry.
- New companies can also be spun out to focus on the commercialization of a new compound or technology (e.g. Mercenelabs, from the Positive project).
- Early on in the planning process, workflow considerations and manufacturing requirements need to be taken into account. The ease of sample taking, the toolset for doing so and injection into the device play an important role in the acceptance in the targeted industries as well as the differentiation between suppliers.

4.6 Concertation and cluster activities

The purpose of this session was to consider how the MNBS group can best move forward.
The discussion centered around 4 major topics, i.e.

- What are the priorities for MNBS cluster
- How does the MNBS program contribute to European competitiveness
- How can the program be improved
- The need to converge on topics and get results in the next 5 years

In the discussion various points were raised and are summarized below:

- Most important for the European economy is the value-added; the cost of a product is not a good criterion to judge that. Striving for low cost is obviously always important, because price has a big influence on volume and thus also on value-added. In MNBS projects value added is high because of the knowledge intensity.
- MNBS products are largely aimed at professional use and need to fit in professional processes, such as a surgical operation or food quality monitoring. Therefore the cost of a product is one factor in the buying decision, but the gain in productivity, turnaround time and cost of the new process, enabled by the MNBS-product, are more important
- Reduce the level specificity of the calls for proposals and bring focus here, and at the same time increase the demands on the quality of the proposals
- There are many directions for research; there could be more eye for the application and demonstrators to be build; give the industry a larger voice in the choice
- The issue of standardization was raised, by posing the question whether the community could agree on what should be standardized. Pros and cons mentioned:

- It is not easy to exchange information on standardization
- It was remarked that standards do not innovate
- Others felt standards make sense
- It was also noted that standards actually can help to get new products accepted

This part of the meeting was closed with the observation that under the Horizon 2020 program the emphasis will be completely on innovation and business in focus areas.

5. Consultation on future challenges and needs

Here the views of two European Technology Platforms (ETPs) that are relevant to MNBS were presented, a concertation discussion on cluster issues took place and the consultation workshop was held. The latter was structured along 6 topics that deal with the match between the MNBS programs and the EU's objectives and external communication.
This session was chaired and facilitated by Andreas Lymberis and Javier Bonal from the European Commission.

5.1 Inputs from ETPS EPoSS and Nanomedicine

- The *EPoSS ETP* has set up a so called "Applied MNBS" working group to address the fragmentation in the industry and to facilitate communication with national authorities, endusers and other EU research communities. Also the initiation of collaborative networking, roadmap development and standardization are high on the EPoSS list. There is excellent agreement on the application areas of MNBS. From an industry analysis clear recommendations have been formulated and key drivers for the healthcare system and the industry have been identified. The neurological as well as the mobile health markets have been earmarked as especially promising for breakthrough products.
- An overview of the activities of the *ETP Nanomedicine* was presented and the relationship between the nanoworld and medicine was explained. The potential for early diagnosis and treatment in order to avoid debilitating or potentially lethal diseases is the big promise of Nanomedicine. The transformation of current healthcare systems, where the incentives are on treatment, to one with the focus on disease prevention is a major societal goal, which can only happen if the many actors join forces. The ETP recognizes diagnostics, treatment and regenerative medicine as the main working groups. Services to its members, the role of think tank, the federation of the community and support to the EC are its main tasks. An action plan has been developed that aims to improve the translation of research results into clinical practice.

5.2 Consultation Workshop: Future R&D and Innovation

In this workshop a number of questions were raised and plenary discussed.

1. *Which of the research areas of MNBS are well in line with the objectives of the European Union for 2020 (EU2020: to become a smart, sustainable and inclusive economy)?*
Rationale: the research programs of the European Commission are tools to achieve the political objectives of the European Union. Whether or not a field of research will be part of

Horizon 2020, and the allocation of budgets between the fields is determined by how these areas are perceived to contribute to these objectives. The selection process will be made more specific after the drafting of the future work programs. The number of fields competing for budget is high. For any field it must be made specific how its topics and objectives will contribute to the objective of the EU. If successful, a budget, proportional to the importance of the area, will be allocated in Horizon2020 program. The buzzwords are smart, sustainable, inclusive and society.

The following ideas were shared:

- Personalized medicine and the companion diagnostics. Big Pharma is changing, e.g. GSK, and is realizing that diagnostics is key to personalized medicine. The MNBS community needs to build a bridge to these companies.
- It was observed that the majority of the healthcare costs are caused by chronic disease, and that innovation was direly needed here. Clearly that would be a worthwhile focus area.
- Neuro-simulation would qualify as a field of research
- Healthcare is likely to be delivered in small communities, where e-health and telemedicine plus the sensors will play an important role. Data management cannot be left to the local doctors.
- As baby-boomer nurses and physicians will retire massively in the coming years, raising professional productivity is the key issue for maintaining the current level of healthcare. Empowering and authorizing patients with smart devices to manage their own health is likely to be the best answer.
- Food, or more precisely the imbalances and overdose in food are recognized as a major cause of illness. This should be covered by smart systems as well.

2. Which of the research areas of MNBS can create growth and jobs in Europe?
Rationale: the European economy should be competitive, generate economic growth and create jobs to achieve the objectives of EU2020. Theoretically R&D and innovation would contribute to those objectives. However, there are many examples of technologies initially developed in Europe but currently exploited in other parts of the world. For this reason, the technologies to be supported should be those that due to their characteristics and the characteristics of the European economy are more likely to contribute to Europe's objectives.

The following observations were made:

- There is broad agreement that SMEs create the lion's share of jobs. In the US there is a strong incentive to start your own company, as you will be bought if successful by large US enterprises. In Europe this is not the case.
- In Europe SMEs are afraid of big companies, and do not like to work with them.
- As focus areas converging technologies, materials, smart systems integration and manufacturing equipment are good areas for Europe.
- SMEs should be enticed to participate more in open innovation.
- Regional clusters of companies with a variety of technologies for similar markets have a proven track record of success and job creation.
- Solution based calls: one could choose an application area and write calls to solve the problems in such an area, irrespective of the technology. The Commission has recognized this and has set up an effort to bring down the internal walls

- New ways to structure consortia should be looked at.

3. Which of the research areas of MNBS could be more efficiently supported at the European level, rather than at national level?
Rationale: European projects are intrinsically difficult to manage because the partners are in different countries with different cultures and languages. For this reason the European funding should be dedicated to projects of which the potential impact would be much higher if the research is done in European projects.

- Among the suggestions were:
  - Look at the total value added and the potential for value creation in Europe (a study is expected to report on this)
  - Ask for more innovation, look for proposals which are really innovative
  - Focus on areas where cross European projects have a better chance and larger impact
  - Put more emphasis on the likely business models for a successful project and include application validation
  - Ask for real disruptive innovations and exploratory work, avoid me-too research
  - Look more at rare
  - Fund projects that are too large to do nationally
  - Reward high risk and high reward studies
  - Fund projects that exploit centres of excellence of a number of member states
  - Fund European projects because you want people to cross borders and build more cross-national understanding, appreciation and friendship
  - Look at projects which empower nurse practitioners in order to shift medical tasks away from physicians, which lowers costs in the healthcare system and in education

4. At what level of the value chain should the MNBS research be supported in Horizon 2020, taking in consideration the actual degree of maturities of the different technologies?
Rationale: it takes at least 7 years for an initial research idea to mature enough to be attractive to the industry or venture capital. Unfortunately the typical duration of a European research project is 3 or 4 years and no immediate changes are foreseen. For future work programs we will need to decide which point of the value chain should be the target.

The remarks made varied:
- Some participants felt that for new technologies, where no or only parts of a value chain exists, the whole value chain should be supported.
- Others felt that a value chain would develop itself once successful applications were proven.
- For the long lead-time in safety-related fields such as health and food, value chain development should be over a longer period than 4 years.
- In the US, venture capital companies are felt to support the development of new medical devices more than in Europe?
- Too much Government subsidies distort competition, and should therefore be aimed at the highest risk part of the development curve, where few alternative funding exist

5. *How can the communication between technology developers and the health community be improved?*

Rationale: we have the perception that technology developed in some projects / proposals or health applications are not very adapted to the need of the health community. For this reason we think the communication between both communities should be improved.

Statements participants made:

- Funding should be extended to include clinical trials, or at least partly
- Healthcare providers have very limited interest in research projects, they want to see and use products
- Companies often have medical advisory boards consisting of healthcare innovating professionals; why do project teams not use something similar
- Focus groups of medical professionals can also help to test and improve ideas
- Many universities have medical research centres as well, could not these institutes provide input
- Maybe we should consider multidisciplinary research institutes where technological and medical personnel work on the same projects

6. *Which of the MNBS technologies can contribute to the sustainability of the health systems and how?*

Rationale: the health systems of some of the member states are unsustainable due to the economic situation. In the future, event if the economic situation improves, the health systems can become unsustainable in most of the members states. One of the reasons is the increase of the average age of the population and consequently the prevalence of chronic diseases. For future work programs, it is of interest to analysis if some of the MNBS technologies can contribute to a better and more efficient (from the clinical and from the economical point of view) management of chronic diseases.

Some comments were:

- First doing a diagnosis to decide on the best medication and dose for a patient will save a lot of time, unnecessary medication and sometimes hospitalization.
- Doing the diagnosis at a family doctor' office or at home will be much cheaper than hospitals or large laboratories.
- Point-of-care testing gives much quicker turn around time and can avoid chronic disease develop to a more severe state.
- Cost savings do not only refer to a product or test cost, but the cost of a process, of which the product is part. So it has to be proven that the new process will be lower cost and better for the patient.
- The promise of personalized medicine is based on point-of-care diagnosis.

The session was wrapped-up by the rapporteur.

6. COWIN market place

The objectives of the (first) COWIN[5] market place event on Diagnostic, Food and Beverage were to:

- gather innovation stakeholders to facilitate their interactions;
- encourage the research community to consider commercial exploitation of their research results in demonstrating that opportunities exist; and
- Promote European research projects towards the industry.

Key industrial players have been invited, covering the full value chain activities relevant to FP7 MNBS projects and the "Gold Nuggets" (projects having a high potential for commercial exploitation) supported by COWIN in the field of diagnostic, food and beverage.

COWIN contributed directly to the MNBS annual forum in:

- presenting COWIN's analysis of the main challenges to bring smart systems into diagnostic, food and beverage quality and safety related markets;
- Organizing a tutorial on the added-value of a business case approach while conducting a R&D project by using concrete examples related to MNBS.

COWIN market place day was especially dedicated to encourage the exploitation of research projects' results, through one-to-one meetings, panel discussions with participation of industrial companies, and working groups. Such interaction of the research and industrial communities has led to:

- a presentation of needs and interest from the industry, and especially from industrial players who are "innovators able to launch new product" using MNBS technologies;
- A technology scouting approach from the industrials. Indeed the industrial companies who joined the event wanted to know more about European research results to identify technologies fitting with their needs and interests.

24 one-to-one meetings were organized representing 7 non-stops hour of discussions to explore exploitation of EU-funded research projects in MNBS. 3 panel discussions took place as well as 2 working groups.
In total, Cowin facilitated and delivered major services to MNBS community:

- Diffusion of best practices to drive a R&D project while considering its commercial exploitation;
- The entry of new players in the MNBS cluster community
- Identification of business opportunities for Gold Nuggets supported by COWIN
- Identification of attractive fields and applications for MNBS, based on expression of interest from industrial companies. The panel discussion and working groups has led to the following conclusions:

Medical devices are an attractive field for exploitation of MNBS research if the topic of research has a medico economic impact.

[5] http://www.cowin4u.eu/

- The management of chronic heart failure answers to a societal challenge. Miniaturization and more functions bring a key differentiation;
- Neuroscience is growing field enabling to consider new solutions for patients' treatment, but it is still very upstream. We are facing US competition. It is worth considering how neuroscience could serve European medical device companies to support their growth;
- Diagnostic is an attractive field but the largest part of the value is on the marker, not on the system. Spectrometry and imaging are alternative diagnostic approaches very attractive for MNBS;
- The financing of clinical trial is a big challenge. Only real added-value projects with proven medico economic and patient benefit will be supported by industrial or private investors.

Water and food quality is a key field of interest to exploit MNBS especially for 2 functions:

- Rapid microbiological testing
- Multi-parameters on-line testing for real-time process monitoring.

Even though opportunities exist, technology accreditation is required for most industrials to invest in a technology. Lobbying is required.
Moreover, regarding on-line testing, one need is to develop reusable microfluidic tests for on-line chemical testing. These tests could detect a variation from a reference value and trigger an alarm. Molecular diagnostic based tests are too complex (today) for real time process control, because of sample preparation and contamination aspects.

The 1st COWIN event has been very productive in terms of discussions and interactions. The industrials who took part to the event gave us a very positive feed-back. We only regret a lack of participation from the research community in the second day of the event.
However, the 1st COWIN event has demonstrated the ability of COWIN to attract industrial players to consider and assess European projects research results. The phoning campaign we have conducted to invite industrial companies has also been very positive to promote COWIN's portfolio of attractive technologies (Gold Nuggets) to more than 50 companies.

MNBS 2012: 6TH Annual Workshop on Micro-Nano-Bio Systems

An initiative of the MNBS EU Funded cluster of projects

The key meeting to drive innovation in micro and nano bio systems

Despite its eminent position as one of the world's leading forces in research, Europe has yet to become equally successful in exploiting its multi-faceted and in-depth scientific knowledge to boost the market, create new job opportunities and add to the economic growth of the continent in measurable and tangible ways.

These issues are strongly considered by the European Commission in the preparation of **the EU framework program for Research and Innovation,** Horizon 2020, the successor of the 7th Framework Program for research and development in order to strengthen the full value chain from knowledge to innovation.

The Specific Objective of the 6th Consultation and Concertation MNBS cluster Workshop are:

- ✓ To encourage the diffusion and exchange of information on the development of science and technology
- ✓ To identify synergies and possible collaborations to tackle critical issues covering the full value chain from R&D to exploitation
- ✓ To reach common understanding of the steps in the supply chain for different type of applications, and the needs in the area of research and innovation of the supply chain stakeholders.

The knowledge gained from this workshop will help to **better design and implement the forthcoming Horizon 2020.**

Towards this goal, the 2012 MNBS workshop is welcoming the **COWIN Marketplace** which is an effective instrument to foster technology transfer, find new customers for innovative Smart Systems and best strategic partnerships and collaborations.

COWIN and the COWIN Marketplace

COWIN Marketplace is dedicated to facilitate interactions and discussions between innovation stakeholders through:

- ✓ One o one meetings pre-arranged to facilitate interactions
- ✓ Working groups for efficient discussion and concrete actions

Key innovation stakeholders all along the value chain - from users, prescribers to distributors - in micro and nano biosystems will participate to this meeting in addition to partners active in research projects supported by the European Commission:

Users

- Pr François Berger, director of Clinatec, a unique research center bridging micro and nanotechnologies with clinical applications;
- Pr Pascal Leprince is an eminent cardiac surgeon from Pitie Salpetrière Hospital;
- Aurelie Longépé of the Watever Association looking for smart prosthesis dedicated to disabling people;
- Labaqua, a laboratory offering diagnosis and environmental certification.

Prescribers

- Dr Hans-Peter Dauben, Head of German Agency for Health Technology Assessment (DAHTA) & Medical Innovations,
- An insurance company

Validation partners

- Caiber, a large clinical validation platform and Clinatec

Technologists, Integrators and distributors

- Dr Jean-Pierre Gayral former Scientific Director at Beckton Dickinson;
- Christophe Bureau, Director, Strategic Innovation of Becton Dickinson represented by Claire Prummel
- Pr Bertrand Nogarede, General Manager of NOVATEM, innovative medical device company
- Obelia (group MXM) a medical device company neurosciences;
- Burkert, a leading fluid and gas management company;
- Bertin Technologies, a leading engineering company;
- Kraft food;
- Ossur, a medical device company active In prosthesis

COWIN is a support action launched under the 7th Framework Program to strengthen the European competitiveness in miniaturised smart systems. This initiative is dedicated to the commercial exploitation of advanced technologies developed in the framework of European collaborative research projects. COWIN's mission is to facilitate the take-up of advanced technologies worthy of investments, in order to capture innovation, win new markets and make a profit.

www.cowin4u.eu – Géraldine Andrieux Gustin, COWIN coordinator :

Program of the MNBS 2012 workshop

3 May 2011

Registration

08.15 – 08.45

Welcome & Opening

Chairs: *Ioannis Raptis, Imel NCSR Demokritos*
Javier Bonal, European Commission

08.45 – 09.10	Welcome speech *Nikos Kanellopoulos, NCSR Demokritos Director* *Andreas Lymberis, European Commission*
09.10 – 09.20	Overview of MicronanoBioSystems in Greece *Panayiota Petrou, NCSR 'Demokritos', EL*
09.20 – 09.40	WP2013 and Horizon 2020 *Andreas Lymberis, European Commission*
09.40 – 10.00	Criterion for reimbursement of medical technology *Hans-Peter Dauben, German Agency for Health Technology Assessment (DAHTA) & Medical Innovations, DE*
10:00-10:15	Microelectronics Components for Lab-On-Chip Instruments in Molecular Diagnostics for Genetics and Environmental Applications (Corallia Initiative) *Thanos Demiris, Micro2gen, EL*

Session 1: Supporting Activities

Chairs: *Ioannis Raptis, Imel NCSR Demokritos*
Javier Bonal, European Commission

10.15 – 10.25	Microsystems and Smart Miniaturised Systems for Food Quality and Safety Control (FoodMicroSystems) *Olivier Chartier, Euroquality , FR*
10.25 – 10.35	IRISS roadmap for MNBS *Petra Weiler, VDI/VDE Innovation + Technik GmbH, DE*
10.35 – 10.45	Converging resources to support the value creation in Europe of Microsystems and Smart Miniaturized Systems research projects (COWIN) *Géraldine ANDRIEUX, Yole Finance, FR*

10.45 – 11.00 Coffee break

Session 2: Microsystems interacting with the body

Chairs: *Sotiris Kakabakos RRP NCSR Demokritos*
Andreas Lymberis, European Commission

11.00 – 11.15	Neuroprosthetic interface systems for restoring motor functions (NEUWalk) *Peter Detemple, IMM, DE*	COWIN Marketplace
11.15 – 11.30	Transverse, Intrafascicular Multichannel Electrode system for induction of sensation and treatment of phantom limb pain in amputees (TIME). *Winnie Jensen, Aalborg University, DK*	
11.30 – 11.45	Microsystem integration based on electroactive polymer gels for cardiovascular applications (Heart-e-Gel). *Renzo Dalmolin, Sorin CRM, FR*	
11.45 – 12.00	Array of Robots Augmenting the KiNematics of Endoluminal Surgery (ARAKNES) *Selene Tognarelli, Scuola Superiore Sant'Anna, IT*	

Session 3: Microsystems interacting with bacteria and cells

Chairs: *Sotiris Kakabakos RRP NCSR Demokritos*
Andreas Lymberis, European Commission

12.00 – 12.15	Technology Platform for Point-of-Care Diagnostics for Tropical Diseases (PodiTrodi) *Joerg Nestler, BiFlow Systems GmbH, DE*	COWIN Marketplace
12.15 – 12.30	Magnetic Isolation and moleculaR Analysis of single Circulating & disseminated tumor cElls on chip (Miracle) *Herc Neves, IMEC, BE*	

12.30 – 12.45	Platform for Advanced Single Cell-Manipulation and Analysis (PASCA). *Andreas Morschhauser, Fraunhofer ENAS , DE*	

12.45 – 13.45 Lunch

Session 4: Lab on Chip

Chairs: *Sotiris Kakabakos RRP NCSR Demokritos*
Javier Bonal, European Commission

13.45 – 14.00	Laboratory Skin Patches and SmartCards based on foils and compatible with a smartphone (LabOnFoil). *Jesus Ruano, Ikerlan-IK4, ES*	
14.00 – 14.15	Monolithically Integrated Interferometric Biochips for label-free Early Detection of Human Diseases (PYTHIA) *Konstantinos Misiakos IMEL NCSR Demokritos, EL*	
14:15 – 14.30	A highly integrated and sensitive PORous Silicon based lab on a chip for multiple quantitaTIVE monitoring of Food allergies at point of care (Positive). *Daniel Hill, Universidad de Valencia, ES*	
14:30 - 14.45	Development of a Smart Integrated Miniaturised Sensor System for analytical challenges in diagnostics, industry and the environment (SIMS). *Anthony Killard, University of the West of England, UK (TBC)*	
14:45 - 15.00	Advanced interfaced microsystems Research for analysis of Real-wOrld clinical, food, environmental and Waste Samples (ARROW). *Eric Moore, Tyndall National Institute, IE*	
15:00 - 15.15	Coeliac Disease Management Monitoring and Diagnosis using Biosensors and an Integrated Chip System (CD-Medics) *Ioannis Katakis, University of Tarragona, ES*	

Session 5: Consultation and summary

Chairs: *Andreas Lymberis, European Commission*
Javier Bonal, European Commission

15.15 – 15:30	EPoSS/AMBS Working Group views of the supply chain *Renzo Dalmolin, Sorin CRM, FR* *Jesus Ruano, Ikerlan-IK4, ES*	
15.30 – 15:45	Nanomedicine ETP strategy in areas related with MNBS *Patrick Boisseau, CEA-Leti,FR*	
15:45 – 16:15	Discussion on cluster concertation issues.	
16:15 - 17:00	Consultation Workshop	
17.00 – 17.15	Summary of the consultation workshop *Paul H. Smit (Rapporteur)*	

Tutorial: Case study on building a business case for smart systems

17.15 – 18:00	**Case study on building a business case for smart systems** Be efficient - Get ready in getting access first to our webinar http://www.i-micronews.com/consult_webcast.asp?uid=96 Concrete case studies will be discussed. We will dedicate part of this tutorial to answer your questions	

SOCIAL EVENING

After the end of the MNBS meeting a guided visit at the Acropolis Museum from 18:30 to 20:00 has been arranged. After the visit, dinner will be arranged nearby.
- Visit at the Acropolis Museum: from 18:30 h. to 20:00 h.

- Dinner with view to Acropolis: from 20:15 h. to 22:30 h.

How: Transportation from NCSR Demokritos campus to Nomismatokopio mestro station by bus will be provided. Attendants will move to the Acropolis Museum via metro
(Cost of this event is 60€ approximately)

4 May 2012 COWIN Market Place

Welcome & Opening

08.15 – 08.30	Registrations
08.30 – 08.35	Welcome by the European Commission *Andreas Lymberis, European Commission*
08.35 – 08.45	Organization of the day by COWIN team *Géraldine Andrieux Gustin, Yole Finance, COWIN coordinator*
08.45 – 09.05	Presentation of COWIN report - Main challenges to bring MST to IVD and food/beverage markets Free downloaded: http://www.cowin4u.eu/public/come-to-win/downloads/report-IVD-food *Frédéric Breussin, Yole Développement*
09.05 – 10.50	Introduction of COWIN guest and their view about MNBS (see list of COWIN guests)

10.50 – 11.00 Coffee break

11.00 – 11.45	Panel discussion: ✓ Potential value added of the current research in MNBS to IVD, food/beverage industries, medical devices ✓ Key limits today in the exploitation of smart systems in several application fields Definition of key topics for working groups
11.45 – 13.00	Working groups sessions The working groups will be dedicated to define new collaborations and projects and also proposition of recommendations to be implemented in Horizon 2020. COWIN will lead organization of the different working groups to optimize synergies

13.00 – 13.45 Lunch

13.45 – 15.00	Working groups session One o one meetings in parallel
15.00 – 15.45	Visit to NCSR-D labs

15.45 – 16.00 Coffee break

16.00 – 16.30	Presentation of conclusion of each working groups Summary of the day by COWIN's team

16.30 Closing of the 2012 MNBS meeting by Andreas Lymberis – European Commission

Annex II Participants

First Name	Last Name	Organisation	Country	Project Acronym
Herc	Neves	imec	Belgium	MIRACLE
Petra	Weiler	VDI/VDE Innovation + Technik GmbH	Germany	EPoSS and IRISS
Olivier	Chartier	EUROQUALITY	FRANCE	Food MicroSystems
Theodora	Tsapikouni	Biomedical Research Networking Centre in Bioengineering, Biomaterials and Nanomedicine, CIBER-BBN	Spain	N/A
Daniel	Hill	Universitat de Valencia	Spain	POSITIVE
Winnie	Jensen	Aalborg University	Denmark	TIME
Roberto	Rivoir	Inside Secure	France	N/A
Henk	Leeuwis	LioniX BV	Netherlands	PYTHIA
Andreas	Morschhauser	Fraunhofer Institute for Electronic Nano Systems	Germany	PodiTrodi-EU
Joerg	Nestler	BiFlow Systems GmbH	Germany	PodiTrodi
Raymond	CAMPAGNOLO	CEA-LETI-MINATEC	FRANCE	FMS
Patrick	BOISSEAU	CEA-LETI	FRANCE	ETP-Nanomedicine
Javier	Bonal	European Comission	Belgium	N/A
Philip	Butterworth	Aminol limited	United Kingdom	N/A
Wolfgang	Streule	BioFluidix GmbH	Germany	PASCA
Mr Kari	Tukkiniemi	VTT Technical Research Centre of Finland	Finland	PYTHIA
Artiza	Elosegui	Zabala Innovation Consulting S.L.	Spain	COWIN
Ioannis	Raptis	NCSR Demokritos	Greece	PYTHIA
Jerome	Mouly	COWIN	France	COWIN
Geraldine	Andrieux-Gustin	COWIN	France	COWIN
NOLWEN	BOURQUIN	OBELIA (MXM Group)	FRANCE	TIME
Ioanna	Zergioti	National Technical University of Athens	Greece	N/A
Nikolaos	Vourdas	IMEL, NCSR ""D""	Greece	N/A
George	Koordas	NCSR D	Greece	Nanotherapy
Athanasios	Demiris	micro2gen Ltd.	Greece	CD-MEDICS
Konstantinos	Misiakos	NCSR ""Demokritos""	Greece	PYTHIA
Eric	Moore	Tyndall National Institute	Ireland	Toxichip
Walter	Messina	Tyndall National Institute	Ireland	Toxichip
Ioanis	Katakis	Universitat Rovira i Virgili	Spain	CD-MEDCIS

Panagiota	Petrou	Immunoassay/Immunosensors Lab, NCSR ""Demokritos""	Greece	PYTHIA
George	Kanakaris	NTUA	Greece	AAFL
EVANGELOS	MAGNISSALIS	BioHexagon Ltd	Greece	N/A
Jesus M.	Ruano-Lopez	Ikerlan-IK4	SPAIN	LABONFOIL
IRENE	VASSILIADOU	NCSR ""DEMOKRITOS""	GREECE	N/A
Danae	Costopoulou	NCSR ""Demokritos""	Greece	N/A
RUFI	Frederic	BERKERT SAS	FRANCE	BERKERT
Sotirios	Kakabakos	NCSR ""Demokritos""	Greece	PYTHIA
Evangelia	Livaniou	National Center for Scientific Research ""Demokritos""	Greece	FOODSCAN
Renzo	DAL MOLIN	SORIN CRM	FRANCE	Heart-e-Gel
Hans-Peter	Dauben	German Agency for HTA@DIMDI (DAHTA@DIMDI)	Germany	HTA in practice
Eleni	Makarona	Institute of Microelectronics, NCSR Demokritos	Greece	PYTHIA
Paul	Smit	Agathellon	Netherlands	Rapporteur
Rιgis	Hamelin	EURIPIDES	France	COWIN
George	Nounesis	Biogenomica SA	Greece	PYTHIA
M. Adela	Yα	Labaqua, S.A.	Spain	N/A
AIMILIA	PSAROULI	NCSR ""DEMOKRITOS""	GREECE	PYTHIA
Arno	Aarts	ATLAS Neuroengineering	Belgium	N/A
Athanasia	Bourkoula	NCSR DEMOKRITOS	GREECE	PYTHIA
VARVARA	PAGKALI	NCSR Demokritos	GREECE	PYTHIA
Anett	Dr. Winkler	Kraft Foods	Germany	nanotechnology
Alkiviadis-Constantinos	Cefalas	National Hellenic Research Foundation, Theoretical and Physical Chemistry Institute	Greece	N/A
Angeliki	Tserepi	NCSR ""Demokritos""	Greece	N/A
CHRISTOS	MASTICHIADIS	NCSR ""DEMOKRITOS""	GREECE	PYTHIA
Freygardur	Thorsteinsson	Ossur hf	Iceland	MINDWALKER
Claire	Prummel	independant expert	France	N/A
Benjamin	Roussel	Yole Developpement	France	COWIN
Christian	Dahmen	University of Oldenburg	Germany	NANOMA
Marta	Pavia	CAIBER	Spain	N/A
Evangelia	Sarantopoulou	National Hellenic Research Foundation	Greece	N/A
Selene	Tognarelli	Scuola Superiore Sant'Anna	Italy	ARAKNES
Thomas	Otto	Fraunhofer ENAS	Germany	PodiTrodi
Tony	Killard	University of the West of England	UK	SIMS
Francois	Berger	Clinatec	France	N/A
Jean-Pierre	Gayral	COWIN	France	N/A
Aurelie	Longepe	Voil'Avenir	France	N/A

Frederic	Rufi	Burkert	France	N/A
Pascal	Leprince	Cardiologist	France	N/A
Bernhard	Graimann	Otto Bock Healthcare	France	N/A
Christos	Tsamis	NCSR Demokritos	Greece	MEMSENSE
Andreas	Lymberis	European Commission	Belgium	N/A
Michailia	Angelopoulou	NCSR DEMOKRITOS	GREECE	PYTHIA
Anastasios	Economou	University of Arhens	Greece	N/A
Elisavet	Liakata	Hellenic Pasteur Institute	Greece	N/A
Dimitrios	Kontziampasis	N.C.S.R. ""Demokritos""	Greece	N/A
Evangelos	Gogolides	NCSR Demokritos	GREECE	NanoPlasma
George	Kokkoris	Institute of Microelectronics, NCSR Demokritos	Greece	N/A
Alexandros	Salapatas	NCSR 'Demokritos'	Greece	PYTHIA