

Participarea Romaniei in platforme tehnologice europene de interes pentru domeniul nanotehnologiilor.

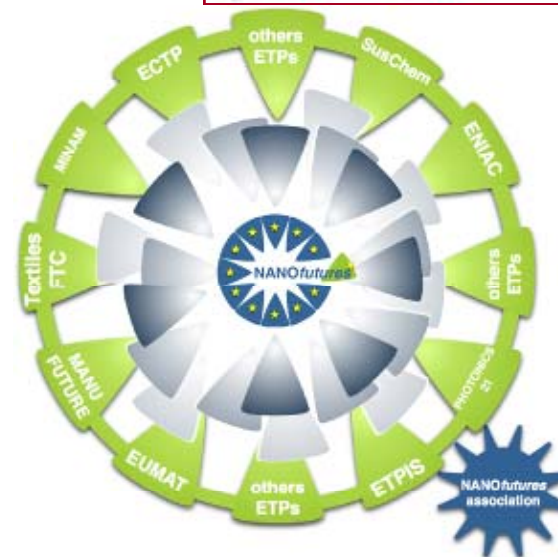
Studiu de caz – PTE nanomedicina

Claudia Roman
INCD pentru Microtehnologie IMT-Bucuresti
(claudia.roman@imt.ro)

- European initiative for sustainable development by
Nanotechnologies **NANOFUTURES**



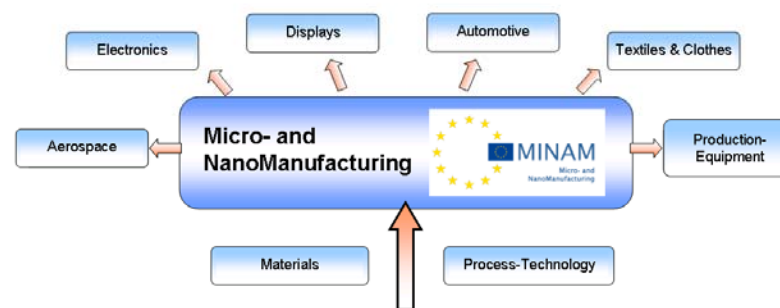
<http://www.nanofutures.eu/>



- Platforma tehnologica europeana pentru Micro si
Nanofabricatie **MINAM**



<http://www.minamwebportal.eu>



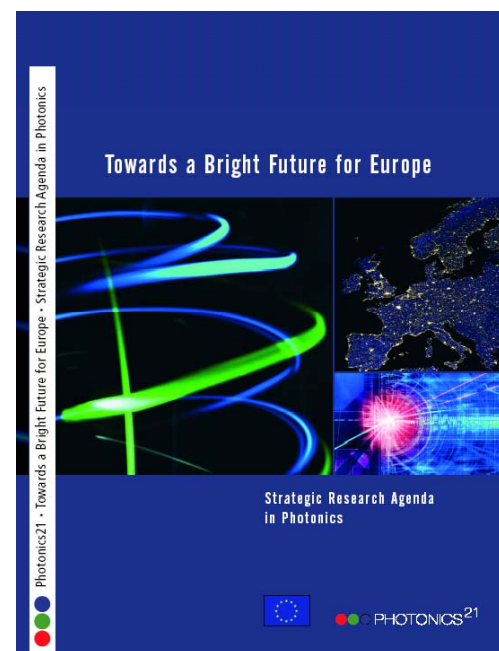
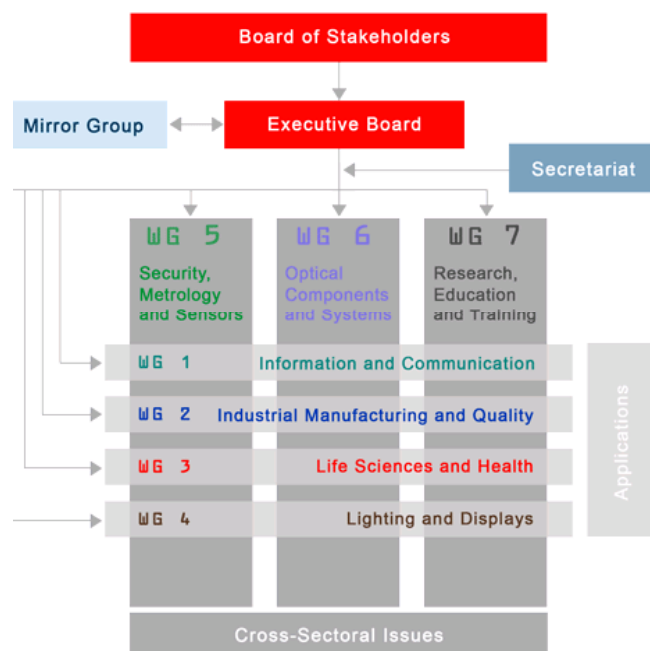
Membri din Romania:

- INCD pentru Microtehnologie IMT-Bucuresti
- INCD pentru Inginerie Electrica - Cercetari Avansate - INCDIE ICPE-CA
- Universitatea din Craiova - Facultatea de inginerie si managementul sistemelor tehnologice; Facultatea de Automatica, Calculatoare si Electronica
- Universitatea Tehnica Iasi
- Universitatea Tehnica Cluj-Napoca
- Microelectronica S. A.

- Platforma tehnologica europeana pentru fotonica **PHOTONICS 21**



<http://www.photonics21.org>



Membri din Romania:

- INCD pentru Microtehnologie IMT-Bucuresti
- INCD pentru Fizica Laserilor, Plasmei si Radiatiei
- INCD pentru Optoelectronica INOE 2000
- Universitatea Politehnica Bucuresti
- Universitatea Bucuresti, Facultatea de fizica
- SC Optoelectronica SA



Quality control with
white light LED detectors
© Siemens

- Platforma tehnologica europeana pentru nanoelectronica **ENIAC**



<http://www.eniac.eu>

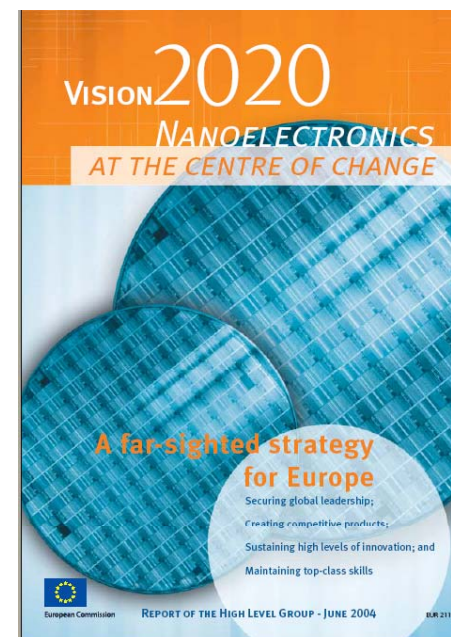
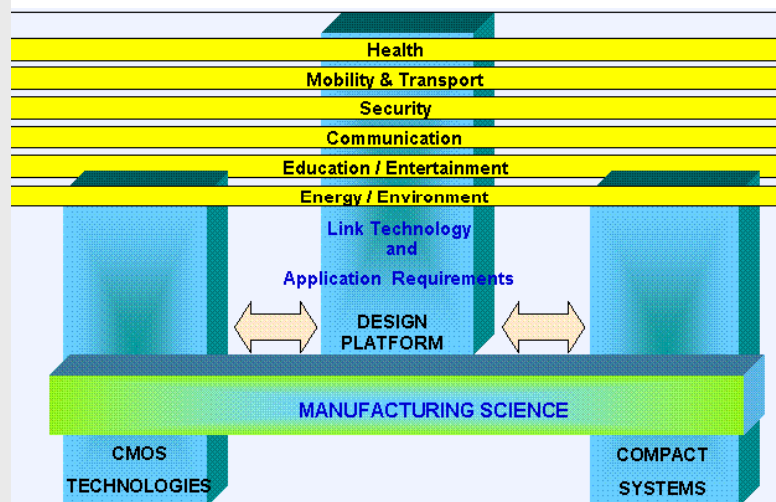
Membri din Romania:

- INCD pentru Microtehnologie IMT-Bucuresti

ENIAC Joint Undertaking (JU) – parteneriat public-privat

- lansarea anuala a unor **competitii de proiecte**

Basic principles of the ENIAC JTI:
Strong link to application domains of the
ENIAC Strategic Research Agenda



- Platforma tehnologica europeana pentru integrarea sistemelor inteligente **EPoSS**



<http://www.smart-systems-integration.org>

Membri din Romania:

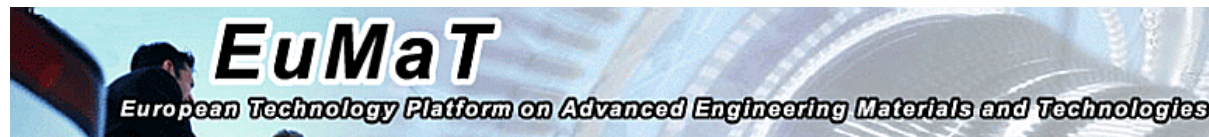
- INCD pentru Microtehnologie IMT-Bucuresti

- platforma organizeaza cel putin o **conferinta anuala** si **intalniri pentru formarea de consortii**

- Grupurile de lucru -

Automotive	Aerospace	Medical Technologies	Communications for Smart Devices	Security	Key Technologies
 > Electric Vehicle > Energy efficiency > Driver assistance > Autonomous sensors > Smart actuation > HMI > Wireless communication	 > Structural monitoring > Communication/networks > Safety functionalities > RF solutions	 > Health & in-vivo monitoring > Assisted therapy > In-vitro diagnostics > Assisting the independence of living	 > Machine-to-machine communications > Internet of Things > RFID > Sensors & actuators networks > Power management	 > Biometric technologies > Infrastructure security > Safety	 > Materials & processes > Micro-Nano-Bio integration > Device & system level packaging > Design tools & methodologies > Reliability

- Platforma tehnologica europeana Advanced Engineering Materials and Technologies **EuMaT**

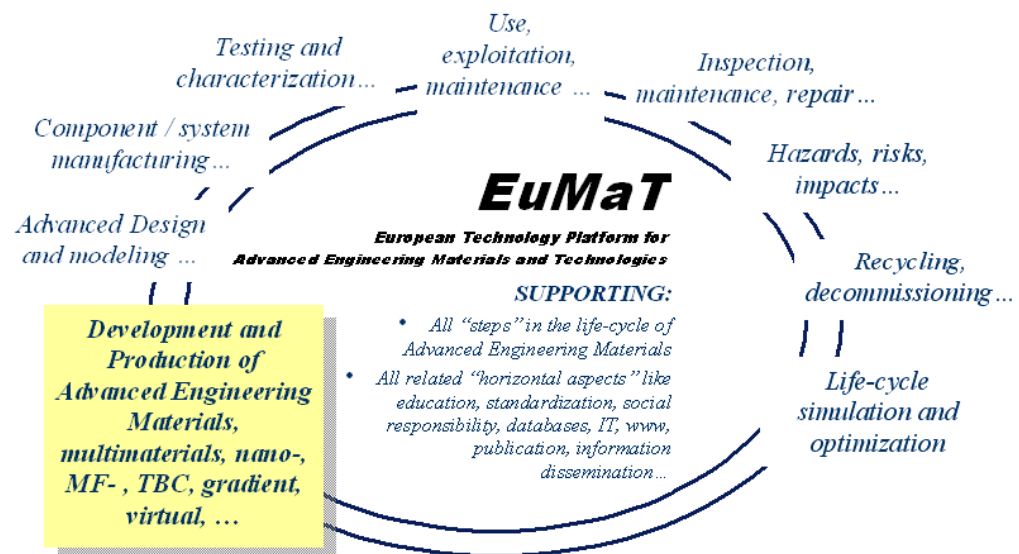


<http://www.eumat.org>

- Working group **“Nanomaterials and Nano-Assembled Materials”**

Membri din Romania:

- INCD pentru Inginerie Electrica - Cercetari Avansate - INCDIE ICPE-CA
- in **Mirror Group Romania**



- Platforma tehnologica europeana **INDUSTRIAL SAFETY**

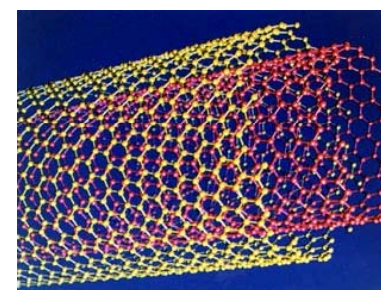


<http://www.industrialsafety-tp.org>

- Focus group **"Nanosafety - Safety related to nanotechnology"**

Membri din Romania:

- INCD pentru Tehnologii Criogenice si Izotopice - ICSI Ramnicu Valcea
- INCD pentru Energie ICEMENERG
- INCD pentru protectia muncii "Alexandru Darabont"
- Centrul pentru Servicii de Radiocomunicatii
- SC IPA - CIFATT Craiova
- S.C. Active Soft S.R.L.

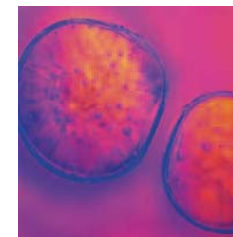


- Platforma tehnologica europeana **Nanomedicine**

<http://www.etp-nanomedicine.eu>

Nanomedicina, aplicarea nanotehnologiei in domeniul sanatatii, reprezinta o arie deosebit de complexa a **nanotehnologiei**, implicand utilizarea simultana a cunostintelor din mai multe domenii si discipline stiintifice, cum ar fi cercetarea din zona medicala si fizica, biologia si matematica sau stiintele ingineresti si imunologia.

Prin **exploatarea proprietatilor fizice, chimice si biologice imbunatatite ale materialelor la scara nanometrica**, **nanomedicina** ofera o perspectiva pozitiva pentru gasirea unor tratamente mai eficiente si mai putin costisitoare pentru pacienti.



*Isolated stem cells, magnification
© Fidia Advanced Biopolymers*

PTE Nanomedicina s-a format la initiativa unor grupuri din industrie si cu participarea Comisiei Europene.

PTE Nanomedicina asigura coordonarea eforturilor comune din cercetare ale membrilor platformei si faciliteaza comunicarea intre participanti din industrie, IMM-uri, mediul academic, institute de cercetare, clinici si pacienti.

- Organizarea de conferinte anuale si intalniri pentru formare consortii

Ex.:

- ETP Nanomedicine General Assembly and Forum 2010, Milano, Italia

- Proposers' day, Berlin, Aprilie 2010

- peste 80 participanti

- informatii despre call-uri FP7 si EuroNanoMed ERANet



Bertrand Loubaton - ETPN Chairman,
Proposers' day



Euronanomed ERA-NET

<http://www.euronanomed.net>

- Lansarea anuala competitii de proiecte

Participarea Romaniei:

- **Call 1 (2009) –**

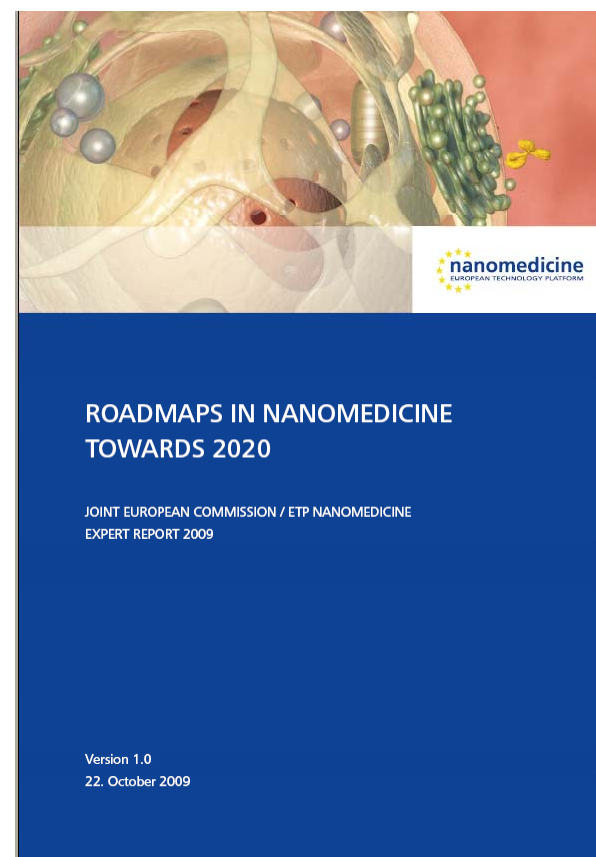
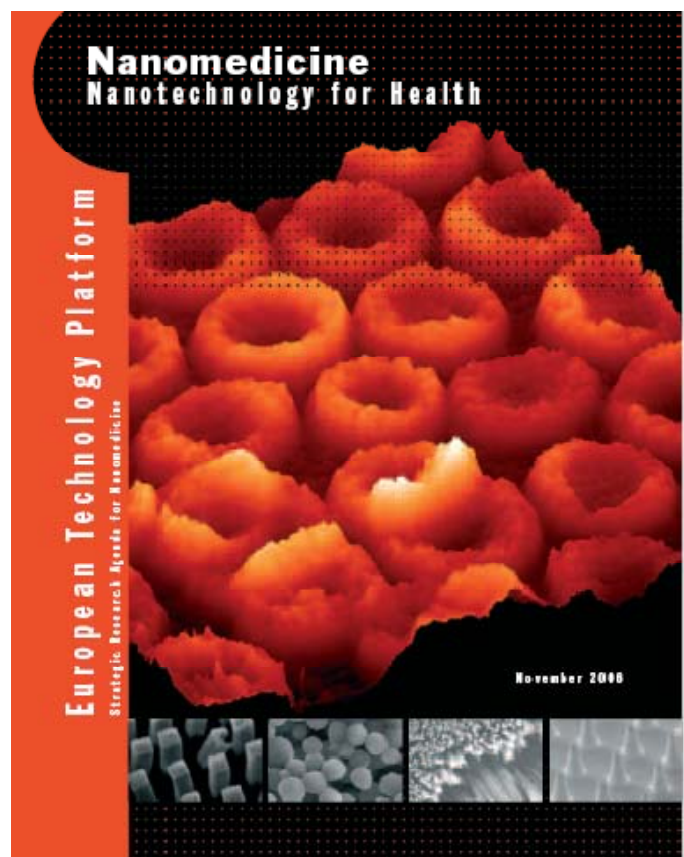
- **Call 2 (2010): 3 proiecte castigatoare**

▪ **1 proiect coordonat de Institutul de Biologie si Patologie Celulara “Nicolae Simionescu” al Academiei Romane**

- “Nanoparticles designed to target chemokine-related inflammatory processes in vascular diseases and cancer metastasis and implementation of a biosensor to diagnose these disorders”

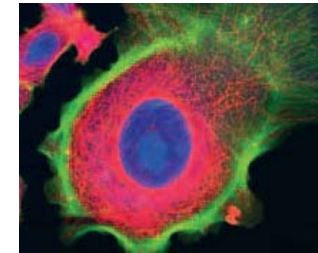
▪ **2 proiecte in parteneriat**

- **Call 3 – lansare ianuarie 2011**



Cele trei directii prioritare identificate de PTE Nanomedicina:

- **diagnosticarea cu ajutorul nanotehnologiilor**
(inclusiv imagistica medicala)
- **administrarea si eliberarea controlata a medicamentelor**
- **medicina regenerativa**



*Confocal Fluorescence Microscopy:
multi-stained human cancer cells
© G. M. J. Segers-Nolten, V. Subramaniam,
University of Twente*

Este foarte important ca toate cercetarile in nanomedicina sa aiba ca punct de plecare necesitatile pacientilor.

Cercetarile in acest domeniu permit o intelegere mai aprofundata a functionarii corpului uman la nivel molecular si nanometric si ofera **posibilitatea de prevenire si diagnosticare timpurie a bolilor**, precum si **imbunatatirea metodelor de tratament si monitorizare**.

Astfel, **nanomedicina** are un impact pozitiv la nivelul intregii societati prin cresterea calitatii vietii si a duratei de viata.

Participarea institutiilor din Romania la activitati legate de Platforma Tehnologica Europeana (PTE) Nanomedicina

Cele mai active institutii – membre si in Platforma nationala de Colaborare in Nanomedicina “RCP-NANOMED”:

- **INCD pentru Microtehnologie IMT-Bucuresti** – *membru al PTE Nanomedicina si reprezentant al Romaniei in Mirror Group; coordonator “RCP-NANOMED”*
- **INCD pentru Metale Neferoase si Rare** - *membru al PTE Nanomedicina*
- **Institutul de Chimie Fizica „Ilie Murgulescu” al Academiei Romane** – *membru al PTE Nanomedicina*
- **INCD in Domeniul Patologiei si Stiintelor Biomedicale “Victor Babes”**
- **Institutul de Chimie Macromoleculara “Petru Poni” Iasi**
- **INCD pentru Fizica Tehnica Iasi**
- **INCD pentru Inginerie Electrica - INCDIE ICPE-CA**

Activitati:

- participarea membrilor din Romania la **Conferintele organizate de PTE Nanomedicina, Adunari generale si sedintele grupurilor de lucru ale platformei**

- **prezentarea ofertelor de colaborare** din partea colectivelor de cercetare din institutele mentionate cu scopul de a creste vizibilitatea in exterior a entitatilor din Romania active in nanomedicina si atragerea partenerilor interesati de colaborare in domeniu ⇒ participarea la propuneri de proiecte europene

- **brosura in limba engleza**, editata de IMT-Bucuresti si actualizata periodic transmisa cu ocazia participarilor la evenimentele PTE Nanomedicina
- sunt prezentate cele mai noi rezultate in domeniul nanomedicinei obtinute de colectivele de cercetare, domeniile de interes, echipamentele specifice de ultima generatie, proiecte semnificative

Romania in the ETP Nanomedicine mirror group:
National contact point for the ETP NANOMEDICINE in Romania - Prof. Dan Dascalescu (dascalescu@nano-link.ro)
National Institute for R&D in Microtechnologies, IMT-Bucharest, Romania

Romanian organizations in ETP Nanomedicine (http://www.minatouch.ro/nanomedicine)

- National Institute for R&D in Microtechnologies, IMT-Bucharest:**
Activities/projects: see the brochure "Micro- and Nanotechnologies for Bio-medical Applications" also on web at <http://www.imt.ro> and the next page of the present flyer.
- R&D National Institute for Nonferrous and Rare Metals, IMNR:**
Activities/projects within the Nanostructured Materials Laboratory <http://www.imnr.ro/nanomedicine/members.htm>.
- Advanced Technologies for the synthesis and processing of biocompatible nanocomposite powders
- Integrated technology Research Network in advanced biocompatible structures for dental implants
- Integrated technology for obtaining nanostructured biocomposites with applications in the regenerative medicine of bone tissue
- Hybrid nanostructured thin films for biosensors and biochips
- Accreditation of a laboratory for chemical-physical characterization of nano-bio materials
Contact person: Dr. Roxana Pitulescu (roxana@imnr.ro)
- "Petru Poni" Institute of Macromolecular Chemistry:**
Amphiphilic polymer aggregates in nanomedicine
Amphiphilic polymers obtained by chemical modification of water soluble macromolecules with hydrophobic groups can self-aggregate via hydrophobic associations giving rise to various nanostructures such as dense nanoparticles, hollow vesicles or micelles. These nanostructures can exist as colloidal solutions or dispersions and are able to incorporate non-polar biomolecules in the hydrophobic regions of the aggregates. A subtle balance of hydrophobic and hydrophilic components can produce a range of structures from a single linear soluble polymer. Due to the linear dependence of nanostructure hydrodynamic diameter on hydrophobic grafting density, and polymer molecular weight these parameters may be manipulated to yield nanostructures of different sizes. In the fabrication of nanomedicine, the size of the particle is a crucial controller of biodistribution. After i.v. administration, the complex polymer aggregate-biomolecule ensure an enhanced bioavailability of the biomolecule, control the time and site of its delivery.
Polymeric micelles A-B-C
Drug solubilized in hydrophobic micelle core
Binding covalently linked to hydrophobic portion of polymer chain
Copolymeric micelle with antibodies attached to hydrophobic portion of polymer molecule
Contact person: Marieta Nicheif, Dep. of Bioactive and Biocompatible Polymers ICMPP Iasi, Romania. E-mail: nichief@icmpp.ro
- Intelligent micro- and nanoparticles for the development of novel drug delivery systems and analytical tools for pharmaceuticals:**
It has been widely recognized that the constant release of drug is not the only way to maximum drug effect and minimum side reactions and the assumption used for constant release rate sometimes fails its validity for physiological conditions. To overcome this drawback, self-regulated drug delivery systems have been used as novel approaches to delivery drug as required. To achieve this drug delivery system, intelligent or stimuli-sensitive micro- and nano-spheres have been exploited as candidate material. This material has been exploited for the development of pulsatile (on-off) drug delivery systems.
Optical photomicrograph of poly (NIPAAm-co-AAm) microgels. In the swollen state in phosphate buffer at pH7.4, below the LCST value at 32 °C (L), and above the LCST value at 45 °C (R).
NIPAAm: N-isopropylacrylamide; AAam: Acrylamide, LCST = lower critical solution temperature
Contact person: Gheorghe Fandulescu and Marieta Constantina, Dep. of Bioactive and Biocompatible Polymers, ICMPP Iasi, Romania. E-mail: gheorghefandulescu@gmail.com

Romanian organizations in ETP Nanomedicine (continues)

- National Institute for R&D in Electrical Engineering, INCDE ICFE-CA:**
Activities/projects: see more details on <http://www.minatouch.ro/nanomedicine/members.htm>.
- Magnetic nanogranular composite materials with applications in malignant tumors diagnostics
- Multifunctional advanced materials doped with silver nanoparticles models of bactericidal products
Contact person: Dr. Wilhelm Kappel (kappel@icfe-ca.ro)
- Institute of Physical Chemistry of the Romanian Academy:** Activities within the Laboratory of Chemical Thermodynamics (see details on <http://www.minatouch.ro/nanomedicine/members.htm>): characterization and investigation from the energetic point of view of the advanced materials involved in the complex modern systems and the new technologies.
Contact person: Dr. Speranta Tanasescu (stanasescu@icfchim.ro)
- Other participants:**
NIRD for Technical Physics, Iasi, Romania
Giant magnetoresistance (GMR) biosensor for biomedical applications
Achievements: Design and fabrication of a GMR-based biosensor prototype for magnetic detection of biomolecules. A microdevice able to identify target biomolecules such as antibodies. The biomolecules detection is performed by using the GMR effect in glass-coated microwires, and magnetic particles as markers for target biomolecules. The detection principle is based on impedance modifications of the microwires by magnetic fringed-fields of magnetic markers.
Contact person: Prof. Horia Chiriac (hchiriac@physics.iasi.ro), INCDET-IFT Iasi, tel.: +40 232 430600, fax.: +40 232 231332.
- National Institute of Research in Pathology "Victor Babes", Bucharest, Romania**
Nanostructured polymer implants - characterisation and quantification of angiogenesis and proliferation by immunohistochemistry
Angiogenesis was quantified using the vascular endothelial markers CD34, ECGR, VEGR and proliferation using PCNA, Ki67. Immunolabelling with CD34, ECGR and VEGR reveals with accuracy the development of the vascular network in correlation with stage of the evolution. The understanding of angiogenic and proliferation process are useful for a better characterisation in oncology (nanostructured polymers).
Contact person: Dr. Cristiana Tanase, E-mail: biochim@vib.ro
Financed grant: Excellent research (RONANOMED)
Caveolin-1 expression as a possible biomarker in pancreatic cancer diagnosis
Caveolin-1 (Cav-1) function either as a tumor suppressor or as a promoter of metastasis. Our goal was to reveal the immunohistochemical expression of Cav-1 in different pancreatic tumours, in comparison with Ki67 and p53, in order to evaluate their involvement in tumour aggressiveness. Overexpression of cav-1 was correlated with: tumoral grading, proliferation markers (Ki67, p53), serum tumor markers (CEA, CA199) and angiogenic markers (VEGF, HIF-1).
Contact person: Cristiana Tanase, E-mail: biochim@vib.ro
- Institute of Biochemistry of the Romanian Academy (http://www.biochim.ro/)**
Contact person: Dr. Mihaela Trif (trif@biochim.ro)

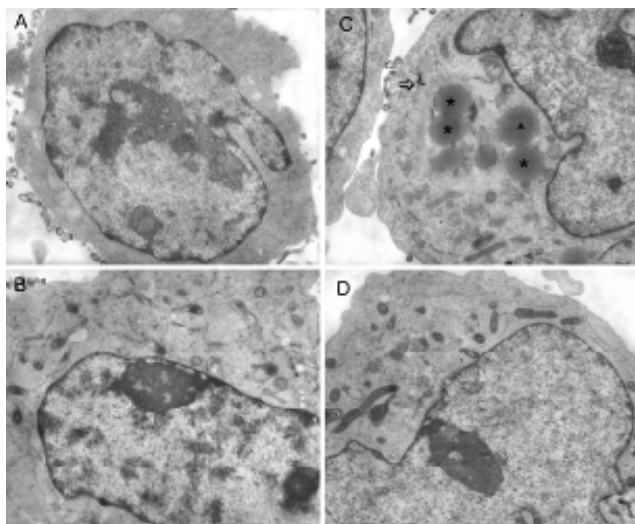
Rezultate ale unor organizatii din Romania in nanomedicina

- exemple

INCD in Domeniul Patologiei si Stiintelor Biomedicale "Victor Babes"

Nanostructuri pentru aplicatii in terapia fotodinamica

- terapia fotodinamica reprezinta un tratament alternativ pentru anumite tipuri de cancer



Fotografii TEM - A. control K562 (celule erythro-leucemie);

B – control celule K562 iradiate; C - K562 – 0.5microM TPP-C60. In citoplasma acestor celule se pot observa lipozomi si C60 PVP agregate; D- K562 iradiate - 0.5microM TPP-C60 cu mitocondrii lungi.

Rezultate publicate in "Fullerene-porphyrin nanostructures in photodynamic therapy", Carolina Constantin, Monica Neagu, Rodica-Mariana Ion, Mihaela Gherghiceanu, Crina Stavaru, "Nanomedicine", 5(2), February 2010 Pages 307-317.

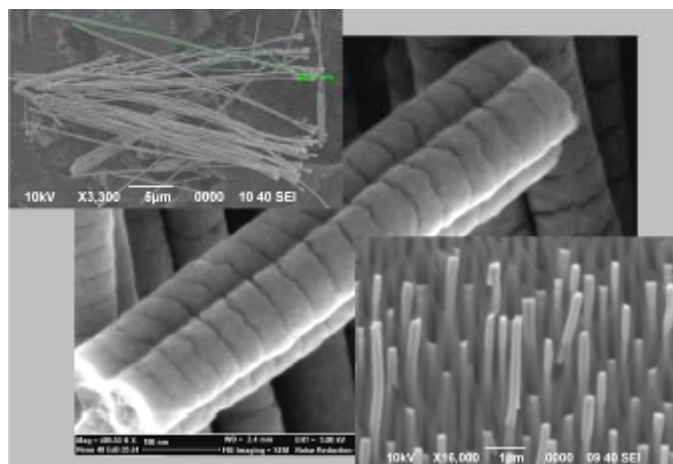
- sintetizarea unui complex tetrafenil-porfirina-polivinilpirolidona-fulerena C60 (TPP-C60)

- analiza activitatii antitumorale in vitro asupra celulelor leucemice K562

- determinarea potentialului toxicologic al fulerenei modificate si evaluarea capacitatii de agent fotosensibilizator

INCD pentru Fizica Tehnica Iasi

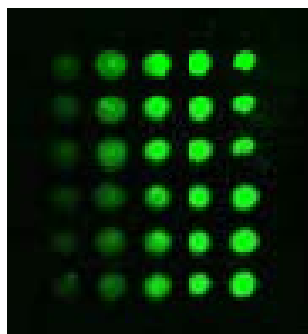
- obtinere nanofire multistrat prin depunere electrochimica pulsata
- nanofirele sunt formate din straturi magnetice alternative de Co, Ni, Fe si nemagnetice, din Au, Ag, Pt, Cu si combinatiile lor
- utilizare: ca sisteme de bio-detectie ce permit identificarea diverselor tipuri de biomolecule (inclusiv ADN) prin metode de detectie cu fluorescenta



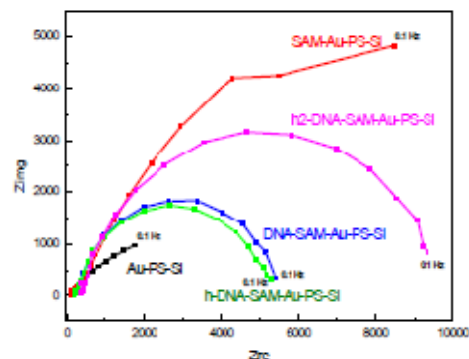
- nanofirele pot fi folosite ca suport magnetic pentru enzime, permitand manipularea magnetica in biosenzorii electrochimici

IMT-Bucuresti, Centrul de nanotehnologii

- Proiectarea si fabricarea unei platforme de biosenzori (opto)electrochimici / sistem laborator pe un chip (Dr. Mihaela Miu, mihaela.miu@imt.ro)
- Metode de detectie a biomoleculelor cu aplicatii in diagnosticare, cum ar fi: detectia HPV, diagnosticare alergii folosind tehnologia *microarray*, detectia electrochimica de proteine / ADN (Monica Simion, monica.simion@imt.ro)



Imagine scanata - ADN imobilizat marcat cu Cy3 pe siliciu poros



Detectie hibridizare ADN prin masuratori de electroimpedanta;
Curbe pentru Au/PS; tioli/Au/PS; evolutia ADN hibridizat si imobilizat

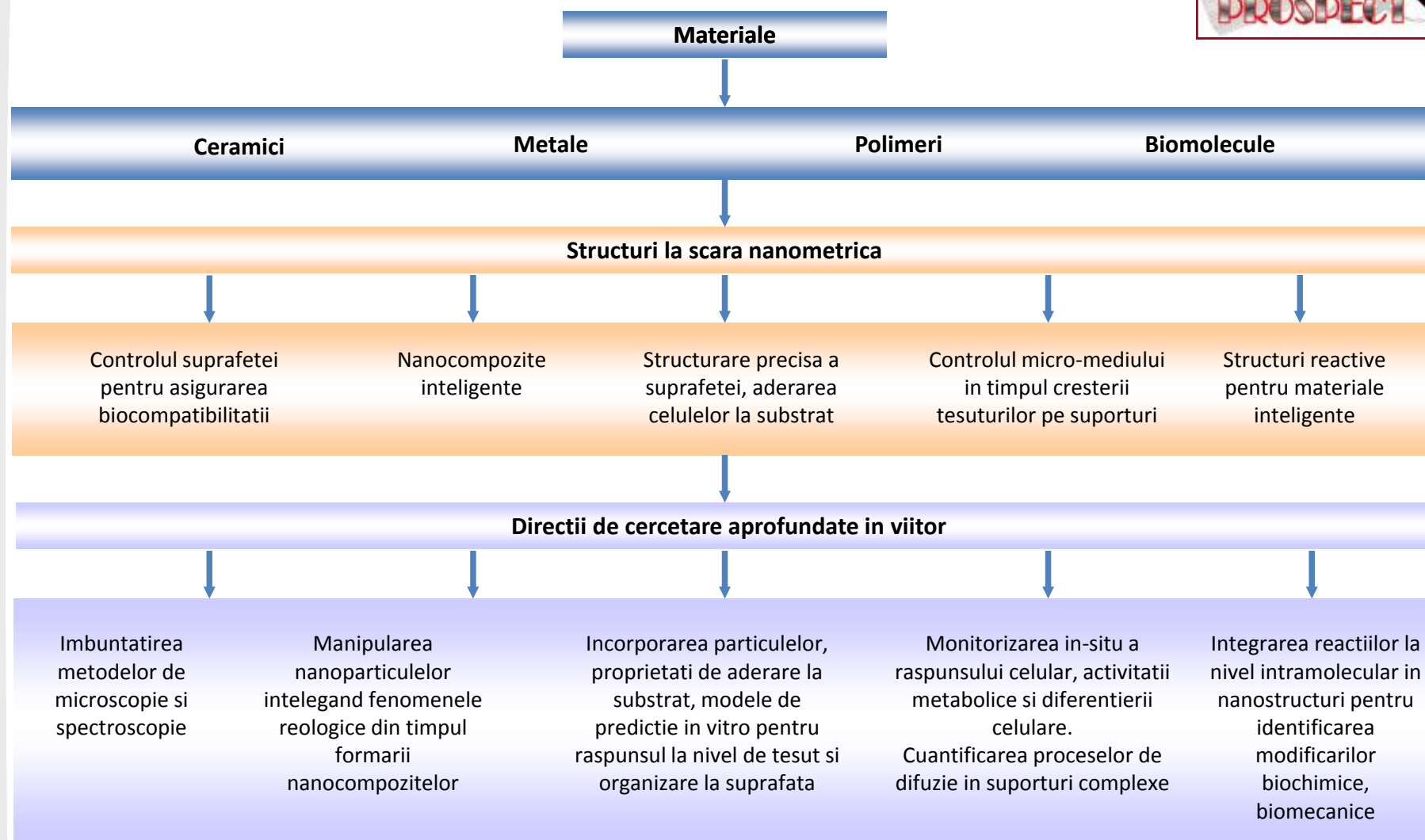


Prepararea unui slide pentru detectia proteinei C cu ajutorul Microplotter-ului



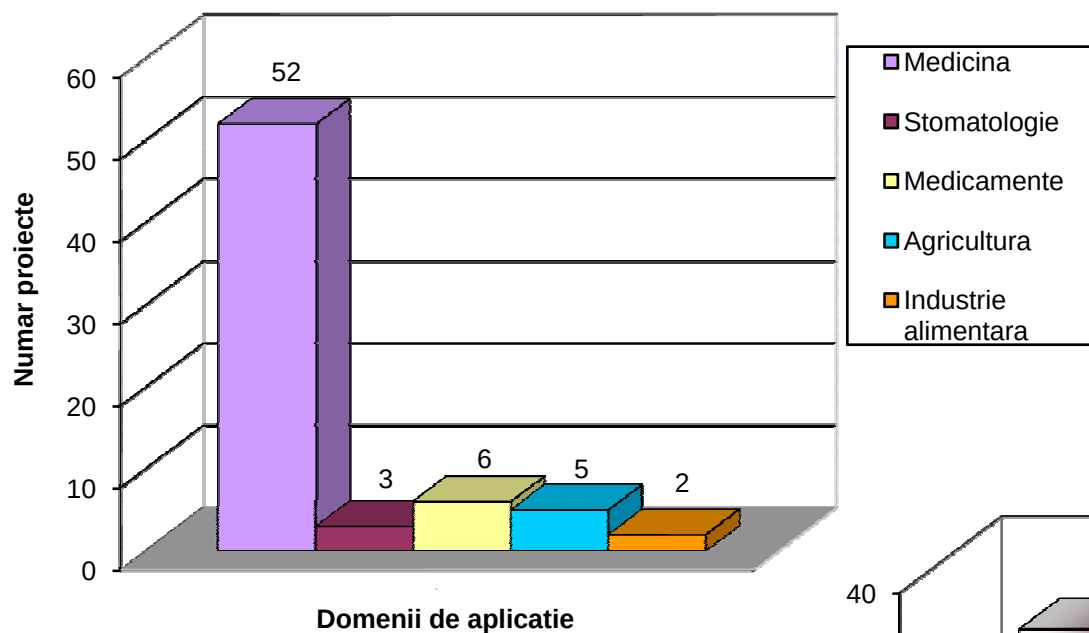
Bio-nanosisteme

- Medicina
- Stomatologie
- Medicamente
- Cosmetica
- Agricultura
- Industrie alimentara
- Nanosisteme naturale (de ex. lemn, biomasa etc.)



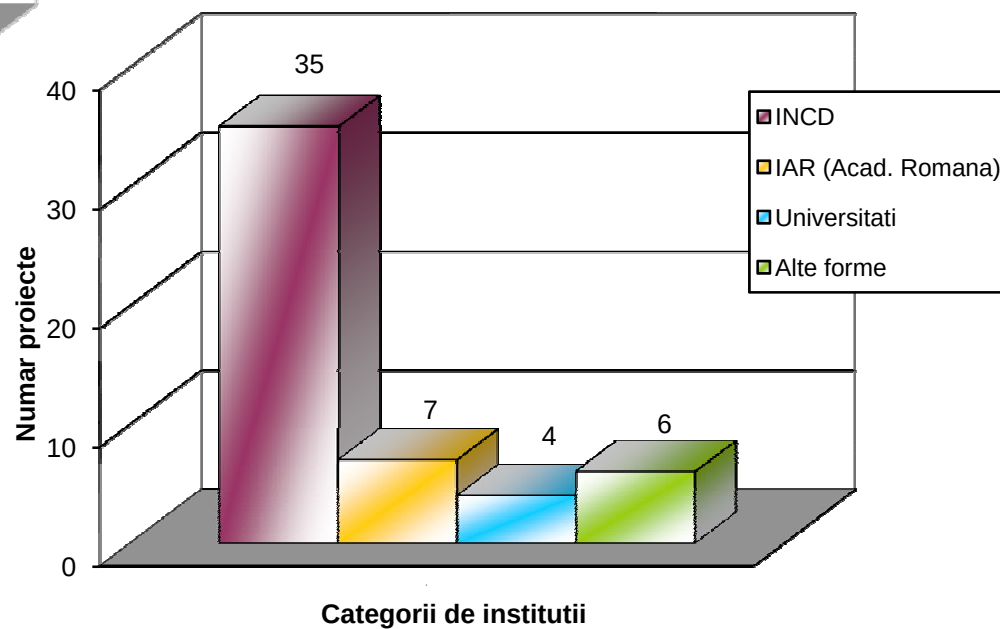
Strategii in nano-inginerie si stabilirea unor tematici pentru aplicatii practice, conform "Genesys White Paper - A new european partnership between nanomaterials science & nanotechnology and synchrotron radiation and neutron facilities", Chapter 5.3 Bio-nanosystems
 Editors: H. Dosch, M.H. Van de Voorde, Max-Planck Institute for Metals Research.

Proiecte nationale nano-bio

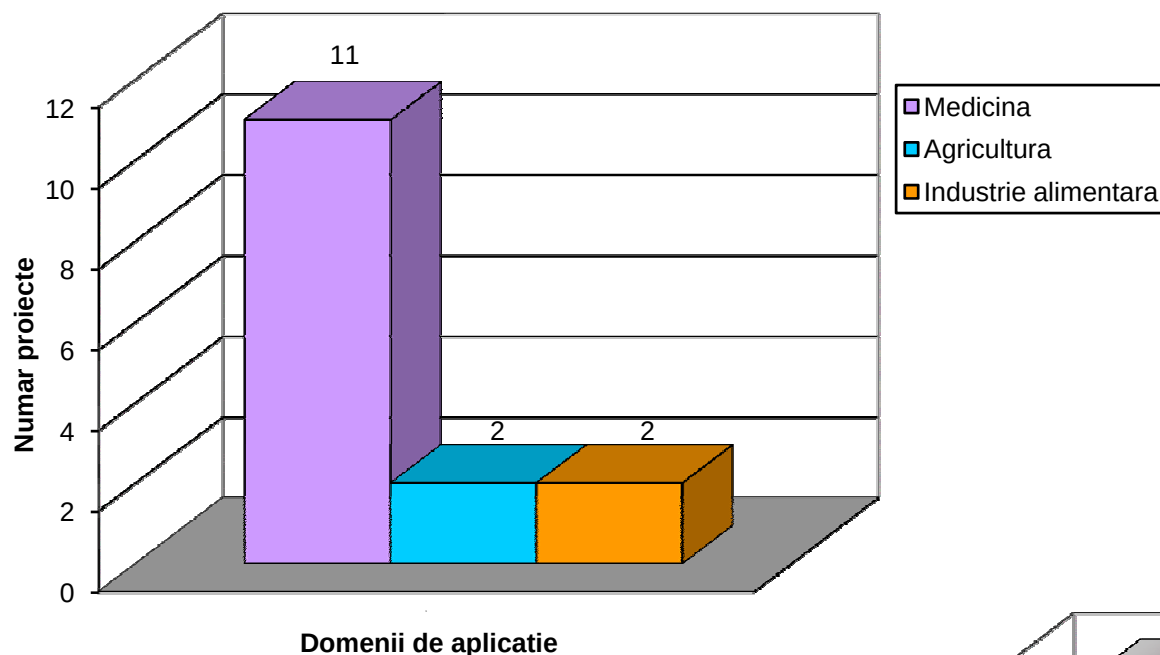


**Implicarea organizatiilor din Romania
in proiecte nationale desfasurate
incepand cu anul 2007, cu aplicatii in
domeniul "nano-bio"
- conform inregistrarilor in chestionarul
electronic Nanoprospect**

Proiecte cu aplicatii in Medicina



Proiecte internationale_nano-bio



Implicarea organizatiilor din Romania in proiecte internationale (FP7, COST, MNT-ERA NET, EuroNanomed, bilaterale) desfasurate incepand cu anul 2007, cu aplicatii in domeniul "nano-bio" - conform inregistrarilor in chestionarul electronic Nanoprospect

Proiecte cu aplicatii in Medicina

