



Bio-inspired Chemical Innovations

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@ECRN Project Council; 2nd Meeting

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BioNanoNet

BIO
NANONET

Your Key to the Austrian Research Community

Focus areas:

1. Nanotoxicology
2. Health, Safety and Nanomedicine
3. Sensor Technologies

BioNanoNet additionally offers

- Regulatory and standardization expertise

Nanotechnology for Chemical Enterprises – NANOFORCE

- foster the innovative nanotechnology-sector networks across Europe to carry out researches on nanomaterials.

BioNanoNet Projects:

nano
FORCE

EURO
nanotox

MEDICAL
SENSOR
SOLUTIONS

NANO
PRODEX

nano
HEALTH



NANOREG

nano
diode

BioNanoNet

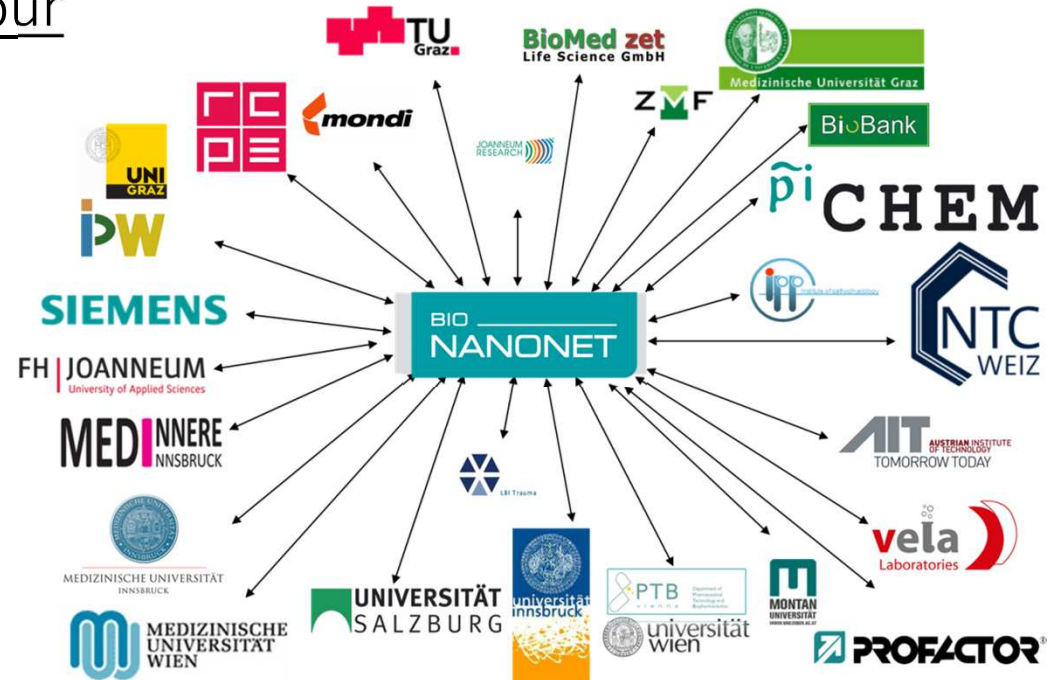
BIO
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Your Key to the Austrian Research Community

33 scientific institutes, focussed on special thematic fields

Scientific expertise offered by our members

1. Molecular Imaging
2. Drug delivery
3. Molecular targeting
4. Nanotoxicology
5. Biobanking
6. Biosensors



Additional ECRN action fields

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- Simple fabrication/contactless measurement/miniaturization
- Process analytical technologies

Framework – Project ideas

- **BICAT – Bioinspired Chemical Innovations**



BICAT - framework

ECRN focus areas addressed:

1. **Bio-based** / hybrid economy / carbon capture and usage
2. **Innovation-to-market** projects
3. **Chemical** infrastructure / production site utilities
4. **Simple fabrication/contactless measurement/miniaturization**
5. **Process analytical technologies**

Short term goal within ECRN:

→ Install a bio-oriented chemical experts group (end of 2014)

Medium term goals:

- Apply for a European project in Spring 2015
- Bring together several regions to put regional funding into BICAT-projects
- Positioning of topics into H2020

BICAT – Projectidea(s) (1/3)

Challenges:

- **the production of high valued materials**
- **CO₂ is an increasing problem BUT also an ubiquitous resource for biotechnological production processes**
- **increasing demand on plastic materials**
- smart surfaces, biodegradable materials, biosensors

BICAT – Projectideas (2/3)

Solutions to be addressed within a project application:

A) Biopolyesters from CO₂ and H₂

- biopolymers shall be produced in a highly efficient way via special bacteria
- modify the “raw polymer” e.g. for packaging, control of biodegradability, etc.
- adopted production technologies (film-extrusion, injection molding, nano-/micro-particles, microcapsules, etc.)

B) Biopolyesters via photoprocesses

- photo-reactor
- CO₂ is used as the carbon-source
- produce additional high valued materials useful in high-tech organo-electronic applications

BICAT (3/3)

Further ideas to be addressed within project applications:

C) Structured cellulose-based thinfilm bioanalytical devices

- structured cellulose (and other biopolymer) based sensors
- Bioanalytical devices (lateral flow assays, modified electrodes, microfluidic devices, MEMS, NEMS, LoC, sample preparation, etc.)

D) Optical chemical sensors for monitoring bioprocesses (PAT) to support the production of bioinspired materials

- Multi-parameter monitoring and control of biocatalytic processes and fermenters (Oxygen, pH, CO₂, Glucose, Ammonia, Ions)
- Miniaturized autonomous (Wireless, battery, footprint 20x20x20 mm) read-out devices
- Improved Usability (calibration free, resistance towards sterilisation, long-term stability,
- Large scale production of sensor materials, e.g. for food packaging
- Microfluidic systems and microreactors with integrated sensors

Key Players - AT



- JOANNEUM RESEARCH Forschungsgesellschaft mbH
- AIT – Austrian Institute of Technology GmbH
- Graz University of Technology
- Karl Franzens University Graz
- MontanUniversity Leoben
- ...



Key Players Expertise - AT

- Strain modification, optimization of enzymes and microorganisms
- engineering of bioprocesses, **continuous fermentation processes** in tubular and cascade reactor systems
- biodegradation processes, **conversion of bioenergy**
- cellulose films and related biopolymers for their **application in organic electronics and optical devices**
- various patterning methods, especially **photolithographic techniques** are utilized in order to achieve 2D- and 3D patterns with resolutions in the micrometer- and sub micrometer range
- immobilization and detection of DNA on hydrophilic cellulose
- targeted immobilization of proteins
- production of hydrophilic **low fouling surfaces**, surface functionalisation (biocompatible; bacteriocid)

Key Players Expertise - AT

- **PAT - process analytical technologies**
- Mix- and measure systems
- Functionalised nanoparticle (core-shell, magnetic)
- **Innovative surface-treatments** (diamond-Like carbon, Graphen, transparent conductive oxides)
- Production of indicator colours (O₂, CO₂, pH, amins, ions, etc.)
- Up-conversion-colours for security-applications
- Optical readers, **optical Polymer-Materials**, Photopolymers, Piezoelectric materials
- Development of **chemical sensors and biosensors, sensor dyes**, sensor polymers, **read-out instruments**, miniaturisation
- **Medical (bio-)sensors**, wound dressings and tissue engineering; methods of shaping of polymers and **surface functionalization for new sensor materials**

Parameters and Application fields

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Optical chemical sensor for

Medical
Diagnostics

Temperatur

Na **pO₂** **K**

pCO₂ **pH**

NH₃ **Glucose**



Packaging



Processanalytics
Biotechnology



Environmental analyses
Marine research

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