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NANO NET

NEWSLETTER

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TABLE OF CONTENTS

Editorial

News

- [BioNanoNet welcomes its new members](#)
- [NanoCommons 1st call for Transnational Access is online](#)

BioNanoNet member presentations

- [NORGANOID](#)

Recent scientific publications of BNN association members

BioNanoNet project presentations

- [New H2020 project Gov4Nano kicked-off](#)

Member contributions

- [A graphene implant overcomes the technical barriers to detect brain activity at extremely low frequencies](#) (*CIBER-BBN*)
- [How do you make proteins?](#) (*Graz University of Technology*)
- [Novel Laser Technology for Microchip-Size Chemical Sensors](#) (*Technische Universität Wien*)
- [Researchers lay foundation for smart contrast medium](#) (*Graz University of Technology*)
- [Success story - Runner Up Flotherm® ΔTJ award for the Materials Center Leoben](#) (*Materials Center Leoben*)
- [Survey about Nanomaterials – Nan-O-Style Project](#) (*University of Salzburg*)
- [Test tubes and crochet needles](#) (*Graz University of Technology*)
- [Tools of the trade: super-fast electrons](#) (*Graz University of Technology*)
- [Viennese Scientists develop promising new type of polymers](#) (*Technische Universität Wien*)
- [What do nanosafety experts think?](#) (*University of Salzburg*)

- [Where does this contamination come from?](#) (*Technische Universität Wien*)

Retrospect

- [Brokerage event on key enabling technologies](#), 31st of January 2019, Venice, Italy
- [EU INDUSTRY Days 2019](#), 5th – 6th of February 2019, Brussels, Belgium
- [Open NanoScience Congress \(ONSC\)](#), 26th of February 2019, Salzburg, Austria
- [BioNanoNet Networking & Call Matchmaking Event](#), 27th of February 2019, Vienna, Austria
- [1st Austrian Microfluidics Initiative Symposium & Rare Disease Day](#), 28th of February 2019, Vienna, Austria
- [EUFEPS Annual Meeting 2019](#), 6th – 8th of March 2019, Frankfurt, Germany

Conference calendar

- [BioNanoNet events](#)
- [BioNanoNet on-site-events](#)
- [BioNanoNet Member-Event-Notifications](#)

Finally

Editorial - *Contemporary issues from the network*

Dear Ladies and Gentlemen,

the year 2019 will become a year with a lot of news for BNN. EU-projects came to successful end (INSPIRED, Hi-Response), new projects started ([Gov4Nano](#), PRIME) and several proposals have been submitted in January already. Furthermore, new partner organizations joined our network and contribute to the strength of the community!

The core of BNN networking efforts is continuously contributing to strategic developments on regional, national and European level. We like to highlight the following important steps based on the requests coming from our members during the past strategy meetings:

- **Nutrition & health:** together with numerous experts in these areas, a [concept paper](#) (German language only!) was developed and could be submitted to Styrian government, mentioning the high potential of science and research in that fields and proposing to create a dedicated funding scheme. Great thanks to all colleagues who already sent support letters. We continue collecting support, thus, if you evaluate it an important initiative, we invite you to join the group of supporters by sending a [support letter](#) to the BNN-team.
- **SusChem-Strategic Innovation and Research Agenda (SIRA):** in our role as national technology platform SusChem-AT, BNN contributes to and involves Austrian experts into the development of the SusChem-SIRA. Lots of activities and discussions will go on in the first half of 2019 to finalize this document which will then be useful in the process of shaping the new European Framework Horizon Europe. Please [contact us](#) if you are interested in contributing to “fill gaps” in the SIRA, and save the date for the [SIRA workshop](#) (16 – 17 May 2019).
- **BNN-Strategy 2020+:** respecting changing environment in Europe, BNN identified the need to prepare the network for upcoming challenges. During September 2018 strategy meeting, the association requested to prepare a strategy to make BNN fit for the future as a sustainable, strong network for our members. The concept was discussed during the general assembly in February 2019, which started the process of defining BNN’s core pillars: “Health & Safety (including NanoSafety, Nanotoxicology, NanoMedicine)”, “Enabling Technologies”, and “Data & Sustainability”. By this, BNN will be well prepared for future challenges to be able to continue providing the best possible support for our members.

Sincerely,
BioNanoNet-Team

[Click here to return to the table of contents](#)

BioNanoNet News

New BioNanoNet members

BioNanoNet is pleased to welcome its new members:

[NORGANOID - Enhancing Future Neurosciences](#) (Austria)



NORGANOID is a [standard BioNanoNet member](#).

NORGANOID is a start-up that is supported by the high tech incubator Science Park Graz. They are currently working on a device for engineering brain organoids and screening drugs more efficiently.

The research areas and field of interest include 3D Organ-On-Chip Solutions with emphasis on:

- Human Stem Cell Technology
- Brain Degeneration
- Microfluidic Systems
- Nano Solutions

[website](#)

[University of Natural Resources and Life Science Vienna \(BOKU\), Department of Water-Atmosphere-Environment, Institute of Waste Management](#) (Austria)



The Institute of Waste Management of BOKU is a [standard BioNanoNet member](#).

Within the scope of the BOKU - areas of competence Soil - Ecosystems and Water - Climate - Environment, the Institute of Waste Management generates innovative programs, methods, and procedures for

- closing of natural and anthropogenic cycles
- proper low-emission treatment of waste materials
- monitoring and remediation of environmental damages
- sustainable integration of ultimately landfilled waste materials in the cultural landscape

[website](#)

SITEX 45 SRL (Romania)



SITEX 45 SRL is an [extraordinary BioNanoNet member](#).

SITEX 45 is an industrial SME with R&D activity, industry oriented, deeply involved since 1992 in following activities:

- R&D prototyping and manufacturing of microelectronics and optoelectronics devices, sensors and nanosensors arrays, actuators and transducers, microsystems as MEMS & MOEMS for Chemical and environmental monitoring, acoustic, optical and biomedical sensors.
- R&D of micro & nanotechnologies applications for new materials processing and development of innovative products by unconventional technologies applications.
- Design and engineering, prototyping and microproduction for sensors and micro/nanosystems MST/NST by new materials applications including nanostructured as bio-compatible and multifunctional thin films.
- MEMS/MOEMS and sensors packaging technologies and applications.
- Smart systems integration applications, including Wireless System Networks WSN for custom or semicustom projects.
- RFID`s and systems being main supplier of Romanian market with RFID products, cards and smart tags.

[website](#)

MJR PharmJet GmbH (Germany)



MJR PharmJET is an [extraordinary BioNanoNet member](#).

MJR PharmJet is a provider of analytical and formulation development services for pharmaceuticals with a special focus on the low soluble substances. We are your reliable partner for development of all dosage forms including solid, liquid and semi solids.

MJR PharmJet ensures solution for your formulation challenges with innovative technologies, where we combine our expertise with high quality standards. Thanks to our wide range of services we accompany the whole way from conceptual approach over development to manufacturing.

[website](#)

[Click here to return to the table of contents](#)

NanoCommons 1st Call for Transnational Access is online



The NanoCommons Transnational Access (TA) is the ability of nanosafety Researchers from industry, academia and regulatory bodies to access the state-of-the-art NanoCommons expertise free of charge and take advantage of the NanoCommons services, facilities and knowledge to advance their work, solve problems and take their research to the next level.

NanoCommons is designed to provide innovative solutions for *data mining, harmonisation, utilisation and re-utilisation*, including incorporation of a range of modelling and decision support tools that require organised high-quality datasets on which to run, provided via an Open Access, federated Knowledge Commons platform. Access to the platform and the supporting tools will be provided to the nanosafety community and its broadest set of stakeholders (enterprise, regulators, insurance and society broadly) via **funded calls for Transnational Access**, as well as development of demonstration User case studies targeting the key stakeholders (academia, industry, regulators).

The **1st TA call** is already [online](#) (1st February – 31st March 2019). Do not miss the chance of getting the support and full knowledge from the NanoCommons' TA technical experts and gain:

- Access to the latest protocols and best practices for nanomaterials physicochemical characterisation for safety assessment.
- Access to associated data capture templates fully annotated to community agreed ontologies and integrated with databases and repositories

The BNN-members [Allergy-Cancer-BioNano Research Centre of the University of Salzburg](#), [Novamechanics](#), [University College Dublin - School of Physics, Science Centre](#) as well as BioNanoNet itself are consortium partners in NanoCommons and will be happy to assist you if any further is needed. From BNN-Team, Beatriz is your contact – please do not hesitate to [contact](#) her. For more information, please download the [NanoCommons brochure](#), the [Transnational Access flyer](#) or consult the [project website](#).



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731032.

[Click here to return to the table of contents](#)

BioNanoNet *member presentation*

NORGANOID

NORGANOID

Enhancing Future Neurosciences



NORGANOID is a startup that was founded in January 2019 by Charlotte Ohonin. The overall motivation driving the project is the demand for human disease models to address unanswered key questions related to the treatment of brain disorders. To achieve this and enhance translational medicine and drug discovery, the start-up concentrates on the derivation of brain organoids from stem cells using a microfluidic device.

Currently, NORGANOID is working on the first prototype of an advanced 3D brain-on-chip and is supported by the high-tech incubator Science Park Graz.

Tissue engineering using microfluidics

Microfluidic devices intended for performing and manipulating human cell cultures at microscopic scale are known as organ-on-chips. Organ-on-chips are made up of bio-compatible materials and govern chambers where different cells can be kept to reconstruct the units of human organs. Linked to these chambers is a network of channels through which fluids containing chemicals such as nutrients are distributed. Shifting macroscopic cell culture to a microscopic level enables researchers to gain new insights into cell and organ function that would be difficult to obtain with traditional culturing methods. In this context, the inclusion of computational analysis and non-invasive biosensing platforms into organ-on-chip systems also grows in importance, as it allows close examination of physiology and micro environments in real time.

There is great promise in organ-on-chip technology to overcome the limitations of human disease models in pre-clinical drug research, as it enables more accurate predictions of drug testing results, while at the same time drastically reducing the costs associated with the process.

Applying the biological potential of induced pluripotent stem cells to human brain diseases models

Human induced pluripotent stem cells (iPSC) are reprogrammed somatic cells derived from a variety of cell populations, including leucocytes, neurons and fibroblasts. They share common characteristics with embryonic stem cells, since both bear the innate competence of giving rise to different cell types that are found in human organs. iPSC are essential to research when it comes to unveiling key mechanisms involved in the formation of complex diseases. Besides bi-dimensional (2D) cell differentiation using iPSC, organoids have been gaining in prominence, especially in recent years. These self-organizing 3D structures imitate the in vivo arrangement and connectivity of cell populations within a specific tissue and are therefore organ-like. Engineered 3D human brain organoids can be cultured for several months and therefore provide a strong argument for investigating not only how the human central nervous system (CNS) develops, but also how dysfunctions occur. Furthermore, they are a suitable tool for modeling human brain disorders and as such provide an alternative to the conventional use of animals in pre-clinical research. Given that animal studies are prone to misinterpretation, as they fail to display human physiology, this is another great advantage for the use of 3D human brain organoids. All in all, the cutting-edge technology NORGANOID is developing has the potential to help discover and identify drug targets for CNS burdens in a more reliable way than commonly used methods. There is also a realistic possibility of successful clinical trials leaning on neural organoids in pre-clinical research. Using brain organoids based on iPSC from patients also opens an entirely new way of predicting the onset of inherited diseases. Drugs can be developed faster and there is a great chance for personalizing therapies and providing more effective, targeted medication in the future.

Our goal

We aim to create a device for biomedical research and pharmaceutical industry with the capacity of ensuring long-term brain organoid culture using human iPSC. Our device is intended for application in the very early stages of pre-clinics. To achieve this goal, we are addressing the challenges that come along with the practical and technical implementation of 3D brain-on-chip, including the reproducibility of functional neural organoids and the standardization of the system for high-content screening. Our vision is to translate the mentioned emerging technologies in a way that will lead to significant improvements in research

on brain diseases, thus enabling scientists to find curing treatments faster and in a more efficient way.

The team



From the left to the right: Katarina Krug, BSc (business developer), Charlotte Ohonin, founder (molecular biologist), Yannick Willeit, BSc (hardware developer)

© Norganoid

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[Click here to return to the table of contents](#)

Publications

Recent scientific publications of BNN association members

Period 2018

BioNanoNet

Schimpel, C., Resch, S., Flament, G., Carlander, D., Vaquero, C., Bustero, I., & Falk, A. (2018). A methodology on how to create a real-life relevant risk profile for a given nano-material. *Journal of Chemical Health and Safety*, 25(1), 12-23. DOI: [10.1016/j.jchas.2017.06.002](https://doi.org/10.1016/j.jchas.2017.06.002)

CIBER-BBN

Masvidal-Codina E., Illa X., Dasilva M., Bonaccini Calia A., Dgragojević T., Vidal-Rosas E., Prats-Alfonso E., Martínez-Aguilar J., De la Cruz JM., Garcia-Cortadella R., Godignon P., Rius G., Camassa A., Del Corro E., Bousquets J., Hébert C., Durduran T., Villa R., Sanchez-Vives MV., Garrido JA., and Guimerà-Brunet A. (2019): High-resolution mapping of infraslow cortical brain activity enabled by graphene microtransistors. *Nature Materials* 18, 280–288. <https://doi.org/10.1038/s41563-018-0249-4>

Dey P., Fabri-Faja N., Calvo-Lozano., Terborg R., Belushkin A., Yesilkoy F., Fábrega A., Ruiz-Rodriguez JC., Ferrer R., González-López JJ., Estévez MC., Altug H., Pruneri V., and Lechuga LM. (2019): Label-free Bacteria Quantification in Blood Plasma by a Bioprinted Microarray Based Interferometric Point-of-Care Device. *ACS Sens.*, 4 (1), 52–60. from <https://pubs.acs.org/doi/10.1021/acssensors.8b00789>

Di Dominico A., Carola G., Calatayud C., Pons-Espinal M., Muñoz JP., Richaud-Patin Y., Fernandez-Carasa I., Gut M., Faella A., Parameswaran J., Soriano J., Ferrer I., Tolosa E., Zorzano A., Cuervo AM., Raya A., Cosiglio A. (2019): Patient-Specific iPSC-Derived Astrocytes Contribute to Non-Cell-Autonomous Neurodegeneration in Parkinson's Disease. *Stem Cell Reports*. 12 (2), 213-229. <https://doi.org/10.1016/j.stemcr.2018.12.011>

Medical University of Graz, Institute of Biophysics

Lehofer, B., Golub, M., Kornmueller, K., Kriechbaum, M., Martinez, N., Nagy, G., Kohlbrecher, J., Amenitsch, H., Peters, J. and Prassl, R. (2018): High Hydrostatic Pressure Induces a Lipid Phase Transition and Molecular Rearrangements in Low-Density Lipoprotein Nanoparticles. *Particle & particle systems characterization: measurement and description of particle properties and behavior in powders and other disperse systems*. **35**

Matuszak, J., Dorfler, P., Lyer, S., Unterweger, H., Juenet, M., Chauvierre, C., Alaarg, A., Franke, D., Almer, G., Texier, I., Metselaar, J. M., Prassl, R., Alexiou, C., Mangge, H.,

Letourneur, D. and Cicha, I. (2018): Comparative analysis of nanosystems' effects on human endothelial and monocytic cell functions. *Nanotoxicology*, 1-18

Leithner, K., Triebel, A., Trotsmuller, M., Hinteregger, B., Leko, P., Wieser, B. I., Grasmann, G., Bertsch, A. L., Zullig, T., Stacher, E., Valli, A., Prassl, R., Olschewski, A., Harris, A. L., Kofeler, H. C., Olschewski, H. and Hrzenjak, A. (2018): The glycerol backbone of phospholipids derives from noncarbohydrate precursors in starved lung cancer cells. *Proc Natl Acad Sci U S A*. **115**, 6225-6230

Kornmueller, K., Lehofer, B., Leitinger, G., Amenitsch, H. and Prassl, R. (2018): Peptide self-assembly into lamellar phases and the formation of lipid-peptide nanostructures. *Nano research*. **11**, 913-928

Teubl, B. J., Stojkovic, B., Docter, D., Pritz, E., Leitinger, G., Poberaj, I., Prassl, R., Stauber, R. H., Frohlich, E., Khinast, J. G. and Roblegg, E. (2018): The effect of saliva on the fate of nanoparticles. *Clinical oral investigations*. **22**, 929-940

Juch, H., Nikitina, L., Reimann, S., Gauster, M., Dohr, G., Obermayer-Pietsch, B., Hoch, D., Kornmueller, K. and Haag, R. (2018): Dendritic polyglycerol nanoparticles show charge dependent bio-distribution in early human placental explants and reduce hCG secretion. *Nanotoxicology*. **12**, 90-103

[Click here to return to the table of contents](#)

BioNanoNet *project presentations*

New H2020 project Gov4Nano kicked-off

“Implementation of Risk Governance: meeting the needs of nanotechnology”



From 4th to 6th March of 2019, the new H2020 project Gov4Nano was officially kicked-off in The Hague, Netherlands. The project coordinators from the National Institute for Public Health and the Environment of the Netherlands (RIVM) organised an interactive kick-off meeting, including open space discussions on all work packages, to exchange ideas and give the project a flying start.

The Gov4Nano project will develop the first implementation of a future-proof operational Nano Risk Governance Model (NRGM) that addresses the needs of the transdisciplinary field and innovative (and key enabling) character of nanotechnology.

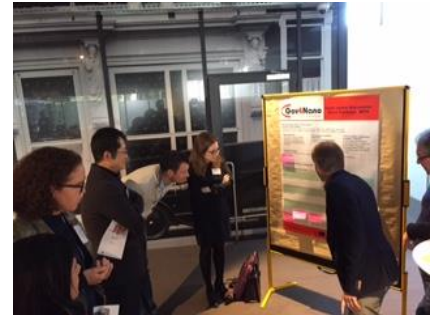
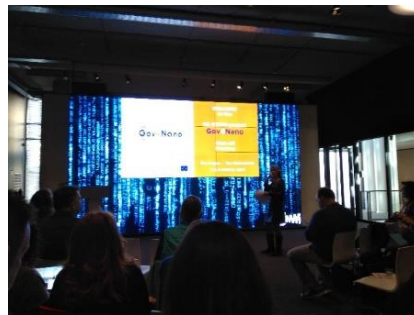
- It will explore the potential added value of upcoming tools and approaches such as Findable, Accessible, Interoperable and Re-usable (FAIR) databases, data-hackathons, blockchain technology and implementation of Safe-by-Design to achieve adaptive and resilient risk governance.
- It will support consensus building, prioritization and harmonization of practices amongst stakeholders, with a focus on key aspects for risk governance of nanotechnologies, including risk assessment, risk management, risk perception and risk communication, risk-benefit evaluation, and risk-transfer and the societal desirability of nanotechnology applications.
- It will include knowledge management and data management, efficiently executed through stakeholder involvement.

Moreover, Gov4Nano aims to identify, analyse and understand stakeholder needs when it comes to possible risks and how to deal with them. This will allow the evaluation of the im-

pact of stakeholder engagement activities (e.g., informative workshops, training, dialogues, etc.) on public acceptance of nanotechnologies. BioNanoNet leads different activities to understand, how risk perception on nanotechnologies is formed in civil society and (re-)insurance industry. Specific focus will be given to dedicated training sessions as well as education and out-of-the-box thinking activities, in order to elaborate how training and education can help non-experts to build their own unbiased opinion. Another task of BioNanoNet is the creation and maintenance of the Gov4Nano webpage.

From the BioNanoNet Association, the Department of Environmental Geosciences of the University of Vienna, EMPA and TEMAS AG from Zurich, Switzerland, are part of the consortium. The project duration is four years, thus, Gov4Nano will run until December 2022.

For further information on Gov4Nano, its aims and activities, please visit the official project's webpage: www.gov4nano.eu/



*Impressions of the Gov4Nano kick-off meeting at the Museum for Communication in The Hague, Netherlands.
© RIVM & BioNanoNet*



Gov4Nano has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No 814401.

[Click here to return to the table of contents](#)

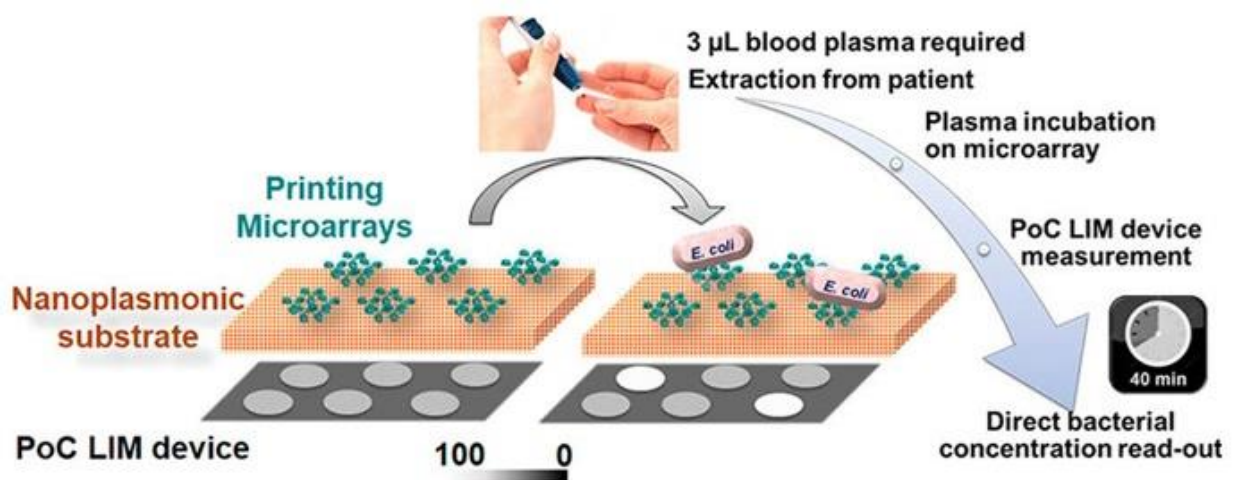
BioNanoNet Member Contributions**Contribution of CIBER-BBN**The logo for CIBER-BBN and ISCIII. 'ciber-bbn' is written in a lowercase, sans-serif font with 'ciber' in blue and 'bbn' in red. 'isciïï' is written in a lowercase, sans-serif font in blue.

A graphene implant overcomes the technical barriers to detect brain activity at extremely low frequencies

The knowledge we have about the human brain grows exponentially, but even so there are big and small questions that remain to be answered. The research community has used electrode guides for decades to detect electrical activity in the brain, mapping the activity of different regions to know their signals when everything is working correctly, as well as when something is failing. Until now these electrodes have only been able to detect the activity above a certain frequency threshold. A new technology developed by researcher of CIBER-BBN, together with the Catalan Institute of Nanotechnology and Nanotechnology (ICN2) and the Institut d'Investigacions Biomèdiques August Pi i Sunyer (IDIBAPS) overcomes this technical limitation, making accessible the large volume of information that is under 0.1 Hz at the same time that it facilitates the design of future brain-computer interfaces.

In addition, the use of graphene in the manufacture of this new architecture means that the resulting implant can incorporate many more points of detection than a standard electrode guide, while being sufficiently thin and flexible to be able to be applied over large areas of the cortex without causing rejection or interfering with the normal functioning of the brain. The result is an unprecedented mapping of low frequency brain activity where crucial information is found about different events that take place in the brain, such as the onset and progression of an epileptic seizure. For neurologists this means that they will finally have access to more subtle signals of the brain. Prof. Matthew Walker, of University College London and a global specialist in clinical epilepsy, has stated that this breakthrough technology has the potential to change the way in which electrical activity in the brain is measured and visualized. It will offer an unprecedented understanding of where and how attacks begin and end, enabling new approaches to the diagnosis and treatment of epilepsy. The details of the technological advances (patent pending) that have made these implants possible can be found in Nature Materials, with Eduard Masvidal Codina of the IMB-CNM. The contribution of this institute was led by the CIBER-BBN researcher Anton Guimerà Brunet.

New point of care device for rapid and sensitive detection of bacteria and its use at hospital setting.



The Group of Nanobiosensors and Bioanalytical Applications, led by Laura M. Lechuga at ICN2//CIBER-BBN has developed a portable and autonomous device based on optical interferometry that, when used with specialized nanoplasmonic, can detect directly bacterial cells of the patient's blood plasma.

The new method developed could respond to the clinical demand of a rapid, sensitive, direct and affordable method for the detection of bacteria, useful for tests in the hospital or as a clinical point of care device. This would be very useful in infections that require a rapid and accurate diagnosis such as sepsis where the chances of survival can decrease between 7 and 8% for each hour in which the infection is not treated or the ambulatory or postoperative patients suspected of bacterial infections. The device would allow testing of bacteria in the patient's bed and by non-expert personnel and have a strong impact on the orientation of rapid medical decisions through various clinical scenarios. The researchers' approach in this work paves the way for modern diagnostics that can be implemented at the points of care of clinical environments for the detection of pathogens.

World Cancer Day 2019: research for better diagnosis and therapy of different types of cancer.

Within CIBER-BBN the work of many of its researchers tries to propose innovative solutions for the diagnosis and treatment of different types of cancer. On the World Cancer Day CIBER-BBN wanted to specially highlight and thank the work of all those who help, from the

research, to fight this disease. Among the most relevant initiatives/results from the last months that were presented simultaneously in different events, across Spain, are:

- The **creation of the spin-off “Nanoligent”** (www.nanoligent.com) by CIBER-BBN researchers. This company develops a nanomedicine, first in the world in its category, that blocks metastatic spread, the main cause of death in cancer patients.
- **CIBER-BBN** (CIBER of Bioengineering, Biomaterials and Nanomedicine) and **CIBERONC** (CIBER of Oncology) **launch three collaborative projects to offer solutions to clinical needs in oncology** through innovations such as nano-devices, 3D culture strategies, phototherapy and drug release. The three projects will be focused on: i) the physical properties that the extracellular matrix contributes to the progression and treatment of tumors such as neuroblastoma, ii) cancer immunotherapy seeking to study the role of immune cells with a more efficient system for obtaining T cells, controlling the immune response that can be generated by inoculating artificial lymph nodes and iii) to develop a disruptive technology to address a fundamental problem in any photodynamic therapy that is the difficulty in getting the light source to deep-seated lesions that are difficult to access and that can be applied to one of the tumor types with the highest mortality, this is pancreatic cancer.

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[Click here to return to the table of contents](#)

How do you make proteins?

NAWI Graz graduate Gustav Oberdorfer produces artificial proteins and has received an ERC Starting Grant for his work.



Filtering mercury and binding glyphosate: Gustav Oberdorfer is on the trail of new proteins with astonishing properties. © TUGraz

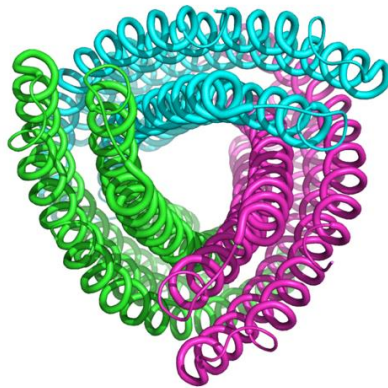
Green, pink and turquoise party streamers dance across Gustav Oberdorfer's screen, tracing more and more new shapes. But what look like cheerful decorations are actually complex models of amino acids, intertwined in a seemingly endless range of combinations. Since February 2018, Oberdorfer has been a university assistant at TU Graz's Institute of Biochemistry, where he designs proteins using simulation software. What we can see on-screen at the moment is a program called Rosetta calculating folds in an amino acid chain.

Protein folding

Proteins consist of chains of amino acids. Folded into one another, they create the structure of a protein, which often determines its function. Amino acid chains fold to make the structure with the lowest amount of free energy. But in order to find that structure, researchers must analyse countless variants of different types of folding on a computer. "If a protein had to try out all of the possible combinations during the folding process, it would take longer than the time for which our universe has existed," Oberdorfer explains. Known as the protein folding problem, this means that predicting protein structures, let alone designing them, has long been a purely theoretical question.

However, a number of parallel developments have rapidly accelerated the pace of research in recent years. "We have more processing power available, the algorithms used in the

simulation programs are getting better all the time, and the synthetic DNA fragments used to produce artificial proteins in the lab are becoming cheaper – they can even be manufactured using a process similar to inkjet printing,” says Oberdorfer enthusiastically. “Now we can carry out large-scale testing of synthetic proteins. For instance, researchers can search specifically for a protein that binds the influenza virus.” So computer-aided protein design has opened up new approaches to solving biotechnological and biomedical problems.



Not a party streamer, but the structure of an amino acid chain.

Oberdorfer’s dissertation was about amino acid chains and folding. He took part in a project that investigated the way in which bacteria produce the antibiotic nikkomycin. This happens in part thanks to the protein NikO – and it was the young researcher who identified the protein’s structure. Oberdorfer sees his current work as the logical next step: “Structural biology and protein design are two sides of the same coin.”

Filters and cavities

At the moment, Gustav Oberdorfer is heading up two research projects at TU Graz. As part of an Austrian Science Fund (FWF) project, the hunt is on for non-naturally occurring protein structures with cavities in their centres. These can serve as a filter and could be used to remove toxic substances such as mercury from water, for instance.

The NAWI Graz graduate’s second project was awarded a prestigious ERC Starting Grant by the European Commission. Together with his team, Oberdorfer aims to produce proteins with cavities that can bind a specific small molecule and subsequently catalyse a reaction. “We don’t just want to answer a particular question, but develop a general method that can be used to produce such proteins,” Oberdorfer emphasises. “We’ll see whether we can do that or not. Maybe there isn’t even an answer to this question, but we’ll never know if we

don't try." His team is looking at specific applications, one of which involves trying to bind and break down the pesticide glyphosate.

At work, the 36-year-old splits his time between the office – designing proteins on the computer – and the lab, where he tests artificial proteins. The latter is the most important aspect for him, "because up to that point, everything is just a theoretical construct."

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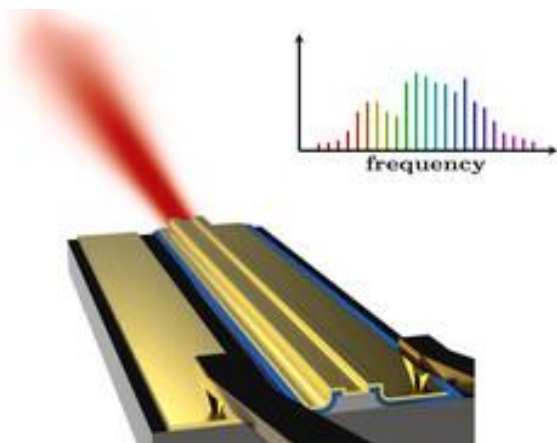
[Click here to return to the table of contents](#)

Novel Laser Technology for Microchip-Size Chemical Sensors

"Frequency combs" are optimally suited for chemical sensors. A revolutionary technology developed at TU Wien (Vienna) now produces these laser frequencies in a much easier and more robust way.

Most lasers have only one color. All the photons it emits have exactly the same wavelength. However, there are also lasers whose light is more complicated. If it consists of many different frequencies, with equal intervals in between, just like the teeth of a comb, it is referred to as a "frequency comb". Frequency combs are perfect for detecting a variety of chemical substances.

At TU Wien (Vienna), this special type of laser light is now used to enable chemical analysis on tiny spaces – it is a millimeter-format chemistry lab. With this new patent-pending technology, frequency combs can be created on a single chip in a very simple and robust manner. This work has now been presented in the journal "Nature Photonics".



The laser emits light with very special spectral properties

A comb with a Nobel Prize

Frequency combs have been around for years. In 2005, the Nobel Prize for Physics was awarded for this. "The exciting thing about them is that it is relatively easy to build a spectrometer with two frequency combs," explains Benedikt Schwarz, who heads the research

project. "It is possible to make use of beats between different frequencies, similar to those that occur in acoustics, if you listen to two different tones with similar frequency. We use this new method, because it does not require any moving parts and allows us to develop a miniature chemistry lab on a millimetre scale."

At the Vienna University of Technology, frequency combs are produced with quantum cascade lasers. These special lasers are semiconductor structures that consist of many different layers. When electrical current is sent through the structure, the laser emits light in the infrared range. The properties of the light can be controlled by tuning the geometry of the layer structure.

"With the help of an electrical signal of a specific frequency, we can control our quantum cascade lasers and make them emit a series of light frequencies, which are all coupled together," says Johannes Hillbrand, first author of the publication. The phenomenon is reminiscent of swings on a rocking frame – instead of pushing individual swings, one can make the scaffolding wobble at the right frequency, causing all the swings to oscillate in certain coupled patterns. "The big advantage of our technology is the robustness of the frequency comb," says Benedikt Schwarz. Without this technique, the lasers are extremely sensitive to disturbances, which are unavoidable outside the lab - such as temperature fluctuations, or reflections that send some of the light back into the laser. "Our technology can be realized with very little effort and is therefore perfect for practical applications even in difficult environments. Basically, the components we need can be found in every mobile phone", says Schwarz.

The molecular fingerprint

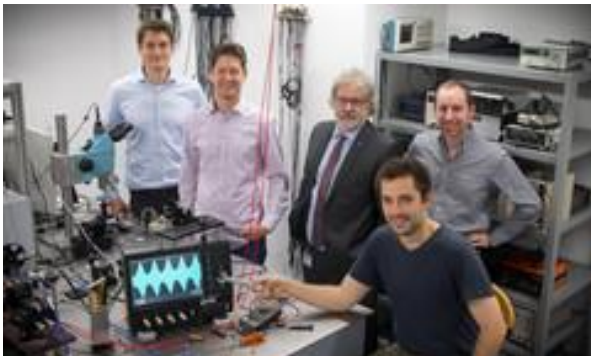
The fact that the quantum cascade laser generates a frequency comb in the infrared range is crucial, because many of the most important molecules can best be detected by light in this frequency range. "Various air pollutants, but also biomolecules, which play an important role in medical diagnostics, absorb very specific infrared light frequencies. This is often referred to as the optical fingerprint of the molecule," explains Johannes Hillbrand. "So, when we measure, which infrared frequencies are absorbed by a gas sample, we can tell exactly which substances it contains."

Measurements in the microchip

"Because of its robustness, our system has a decisive advantage over all other frequency comb technologies: it can be easily miniaturized," says Benedikt Schwarz. "We do not need lens systems, no moving parts and no optical isolators, the necessary structures are tiny. The entire measuring system can be accommodated on a chip in millimeter format."

This results in spectacular application ideas: one could place the chip on a drone and measure air pollutants. Chips glued to the wall could search for traces of explosive substances in buildings. The chips could be used in medical equipment to detect diseases by analyzing chemicals in the respiratory air.

The new technology has already been patented. "Other research teams are already highly interested in our system. We hope that it will soon be used not only in academic research, but also in everyday applications," says Benedikt Schwarz.



Benedikt Schwarz, Aaron Maxwell Andrews, Gottfried Strasser, Johannes Hillbrand, Hermann Detz (left to right) © TU Wien

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[Click here to return to the table of contents](#)

Researchers lay foundation for smart contrast medium

Under the leadership of TU Graz, an international research team has developed a contrast medium concept for MRI, promising unprecedented features in medical imaging.



Stefan Spirk, Andreas Petrovic and Hermann Scharfetter from Graz University of Technology laid the foundation for a new, innovative contrast medium; © Lunghammer - TU Graz

Molecular imaging techniques are playing an increasingly important role in medical diagnostics and developing new treatment methods. An interdisciplinary team of researchers from the fields of chemistry, material sciences, biomedicine, quantum physics and toxicology has managed to develop the foundations for a novel contrast medium for MRI in the framework of the FET Open EU excellence programme. Molecular changes in the human body could thus become detectable by MRI and the treatment of diseases such as cancer, Alzheimer's and heart diseases could become improved and elucidated.

Basic idea

In MRI (magnetic resonance imaging), the nuclei of hydrogen atoms in tissues are subjected to a high-frequency magnetic field. In this way they produce weak signals in the receiving coils which can be processed into images. 'Our basic idea was to send molecules with quadrupole nuclei into the tissue and through the interaction between hydrogen nuclei and these quadrupole nuclei to modify the classical NMR signal,' explains Hermann Scharfetter,

professor at TU Graz's Institute of Medical Engineering and head of the international working group. Strictly speaking, the researchers pursued the aim of changing the decay of the signal over time – also known as quadrupole-relaxation enhancement (QRE). Scharfetter: 'We believed that by using this principle we were not only using the distribution of the contrast medium to better depict the organs, but were also able to prove molecular changes brought about by the sensitivity of QRE on the chemical environment, so that we basically have the ability to switch the contrast on or off.'

Proof of the effect

After three years of research in the framework of the CONQUER FET Open project, Scharfetter and his team have now achieved a breakthrough in groundbreaking features in medical imaging. The novel contrast medium was able to be developed to the point that the explored effect can be used with the field strengths of standard MRI scanners. 'We continue to measure the NMR signal of the hydrogen nuclei, but change the relaxation through the interaction with the quadrupole nuclei and thus the contrast. To do this, we only had to modify a standard MRI scanner in such a way that we were able to slightly shift the magnetic field in order to switch the contrast on or off. The results have been published in the high impact journal Physical Review Letters X and an EU patent applied for.

Starting shot for new possibilities in clinical investigation

The hoped-for results came about with chemical compounds of the element bismuth. Many bismuth compounds have favourable quadrupole resonance frequencies which lie close to the magnetic fields of clinical MRI scanners. Furthermore, bismuth shows a strong coupling with hydrogen nuclei and is occasionally used in medicine. Further investigations have to be carried out to ensure that the contrast medium can be clinically deployed, as Scharfetter explains: 'In the future, we have to design special nano particles which, on the one hand, contain bismuth components, and on the other hand, can be well distributed in the human body without any side-effects and health risks. But a lot of chemical synthesis has to be carried out beforehand. Our results, however, form a basic building block for a "smart" contrast medium.

Cooperation partners

At TU Graz: Institute of Medical Engineering (Lead), Institute of Inorganic Chemistry, Institute for Chemistry and Technology of Materials; furthermore NAWI Graz, the Center for

Medical Research of the Medical University of Graz, University of Warmia and Mazury (Poland), University of Maribor (Slovenia), University of Umea (Sweden)

This project is anchored in the Fields of Expertise “Human & Biotechnology” and “Advanced Materials Science” two of the five research foci of Graz University of Technology. Further information on the research can also be found in the article New contrast agents for magnetic resonance on Planet Research.

Information

The CONQUER research project has been funded to the amount of 2.5 million euros through the FET Open funding framework in the context of the Horizon2020 EU programme. FET Open is reserved for unconventional, new research ideas at an early stage which aim at breakthroughs for new technologies.

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[Click here to return to the table of contents](#)

Contribution of Materials Center Leoben (MCL)



Success Story - Runner Up Flotherm® Δ TJ Award for the Materials Center Leoben



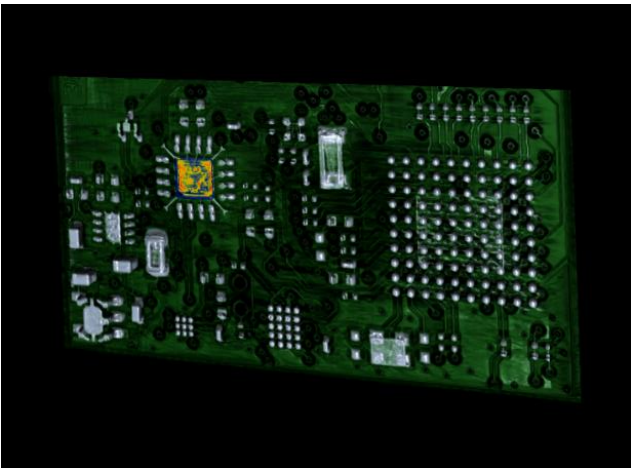
The winners of the Runner Up Flotherm® Δ TJ Award 2018 with their work “A closer look at solder joints”: Julien Magnien, Lisa Mitterhuber, Katrin Fladischer, Elke Kraker, Jördis Rosc und Daniel Ginter. © MCL

The Runner Up Flotherm® Δ TJ Award 2018 goes to the team of the “Materials for Microelectronic” department at the Materials Center Leoben Forschung GmbH. In the award-winning work - “A closer look at solder joints” - investigates the solder joints influence on the heat dissipation in microelectronic systems.

We encounter microelectronics in our daily life, waking up with the alarm on our smart phone, checking the news on a tablet, going to work with the car and working there on a laptop etc. All of these devices contain microelectronic components, making the devices “more intelligent” and their operation faster and more efficient. These microelectronic components produce heat under operation, this heat can hamper the performance and reduce the lifetime of the device. The focus of the award-winning work of the Materials Center Leoben was to look how interconnects influence the heat dissipation of this devices.

To minimize thermal problems, the evaluation of the thermal behavior and the heat dissipation optimization are crucial. The generated heat leads to a temperature gradient within the

microelectronic component. Via heat conduction the generated heat is transported away from the interconnects through the printed circuit board. The quality of the interconnects, like the amount of voids and the porosity in the solder joints, is essential for the quality of the heat dissipation and hence for the temperature of the microelectronic device. As the temperature of the component rises the lifetime of the component shortens. At the Materials Center Leoben, the thermal design of the interconnects was evaluated and hence the systems can be optimized to avoid heat from harming the device and to improve the performance.



Thermal hot spot of a printed circuit board

The miniaturization trend in the microelectronic industry lifts the thermal optimization onto a higher level. The reduction of package size and interconnection distance makes it more difficult to extract heat. Hence, every part of a microelectronic system - ranging from the printed circuit board to the wafer-level components - must be designed to optimize the heat dissipation. For this optimization the knowledge of the devices' thermophysical properties is essential.

Nowadays, microelectronic components have dimensions in the nanometer to micrometer scale and consist of multiple thin-film layers. Conventional metrologies for bulk materials are usually unable to characterize their thermophysical properties and to measure the heat flux across this length scales. Special metrologies, working in the time scales of nano-/picoseconds are required like the Time Domain Thermoreflectance (TDTR). This measurement technique is performed at the Materials Center Leoben since 2018.

The TDTR is a laser-based heating and sensing method to measure the thermophysical properties of thin films and their thermal interface resistance. It is based on the principle of thermoreflectance, allowing the detection of the thermal response of the heating event by

monitoring the reflectance change. The understanding of the heat transport in the nanometer thin layers offers more insight in the generated heat and the temperature rise of the microelectronic system.

The goal of the Materials Center Leoben is to improve the thermal design of the microelectronic system, increase their lifetime and to make them more efficient.

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[Click here to return to the table of contents](#)

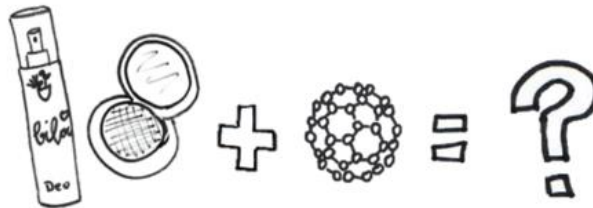
Contribution of University of Salzburg



Survey about Nanomaterials – Nan-O-Style Project

Nanotechnology has long made its way into our everyday lives with its fantastic effects. Starting with the salt at the table, which no longer clumps, and the new socks that no longer mellow, to drugs that work exactly where they should. But what thinks the common citizen of this future technology?

With the [Sparkling Science Project „Nan-O-Style“](#), 8 Austrian schools are working together with scientists from the University of Salzburg, Allergy-Cancer-BioNano-Research Center, which is BNN-member. The aim of the project is to uncover new, previously unknown interactions between modern lifestyle products and nanomaterials. Are there any unwanted interactions, and does this change the properties of the products?



In addition, new interactive ways of communicating nanotechnology have been developed and tested in a cross-curricular setup. Various information and training materials are publicly available on the [webpage of the project](#). Further to investigating the interaction between modern lifestyle products and nanomaterials in everyday products, knowledge and attitudes to nanotechnology in the population are surveyed with the help of an [online-questionnaire](#) (in German only). Please, fill in the survey in order to get more feedback for the project outcomes.

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[Click here to return to the table of contents](#)

Contribution of Graz University of Technology



Test tubes and crochet needles

Professionally speaking, chemist **Beate Steller** can look back on a successful year: she received several awards. At home, the 26-year-old prefers a quiet life and sees herself as “a bit of a granny”.



Beate Steller works at the laboratory in Stremayrgasse in Graz. The only constant in her day-to-day work: she turns on a vacuum pump (shown back right) in the morning and turns it off again in the evening. Apart from that, she spends her time on a wide variety of tasks. © Lunghammer – TU Graz

“I really can’t complain about the past year,” says Beate Steller with a grin. The 26-year-old researcher often smiles when she talks about her work in the brightly-lit laboratory in Graz’s Stremayrgasse. In 2018 she won several plaudits from the Austrian Academy of Sciences (ÖAW) for her research into inorganic chemistry: her master’s thesis won the Otto Vogl Award, which comes with prize money of EUR 5,000, and the Academy is supporting her dissertation with a DOC Fellowship.

“My work is incredibly leading-edge,” she says, leaning casually on a lab box containing a stack of cables, pipes and test tubes. A member of the Institute of Inorganic Chemistry, she works on model compounds which she uses to observe reactions on the surfaces of inorganic materials. “Observing surface reactions is really difficult, because there are no analytical methods available,” she explains. “So we have to use molecular models dissolved into solutions and observe them instead.” These insights are especially important when it comes to semiconducting metals, which are used to produce the majority of electronic components. “You can only optimise and enhance the materials if you understand these reactions,” she points out.

Professor Roland Fischer of the Institute of Inorganic Chemistry supervised her master's thesis, and is now supervising her dissertation. "Beate has chosen an exceptionally complex topic for her doctorate. A whole series of starting compounds for the molecular model compounds need to be represented – some of them for the first time – and then we have to carry out research into new means of synthesis to create cluster compounds. A sufficient quantity then need to be represented so that we can analyse the model reactions. You often experience setbacks and frustration. But thanks to her skill and enthusiasm for experiments, Beate is making good progress," commented Professor Fischer.



*Beate Steller creates model compounds with which she can observe reactions on material surfaces.
© Lunghammer - TU Graz*

Master's and doctoral students at TU Graz enjoyed a particularly successful 2018. Among others, Christina Granitz won the Johann Puch Automotive-Award; Martin Goldberger and Andreas Hackl received an FSI scholarship; Imre Karacsonyi and Florian Arnold took the Railway Engineering Award, while Gerald Feichtinger and Johann Waldauf won research prizes from Österreichs Energie Forschung & Innovation. Daniel Gruss was presented with the Gesellschaft für Informatik (GI) Dissertation Award, the ACM SIGSAC Doctoral Dissertation Award and the 2018 Heinz Zemanek Prize. He also won a grant from the Forum Technik und Gesellschaft, alongside Niels Buchhold, Johanna Pirker, Moritz Lipp, Michael Schwarz and Christoph Haudum.

Ahead of the times

Born in Upper Austria, Beate Steller carries out cutting-edge research. But in her free time she prefers to take things more easily. “I like baking, do a lot of cooking and also needle-work,” she explains with a smile. “Inside I’m a bit of a granny.” Above all, she has a passion for crocheting and sewing. Her most adventurous pastime is hiking in the mountains.

A native of Wels, she attended the Wirtschaftskundliche Realgymnasium der Franziskanerinnen – a grammar school focusing on business and economics – in Vöcklabruck; in her time it was an all-girls school, Steller tells us. After passing her school-leaving exams in 2011, Beate moved to Graz – now her adopted home. “Graz is big enough so there’s always something going on, but it’s also not too big, so you don’t feel lost.” She finished her bachelor’s degree in chemistry in 2014, followed by her master’s in 2017. During her studies Steller worked in a lab in England for six weeks, and she also spent a short time in the USA. “It was useful to get to know different approaches to chemistry and see how things work in a different lab,” she explains.

TU Graz offers [bachelor’s](#) and [master’s degrees](#) in chemistry. Both programmes are part of NAWI Graz, a partnership between TU Graz and the University of Graz.

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Beate Gabriele STELLER

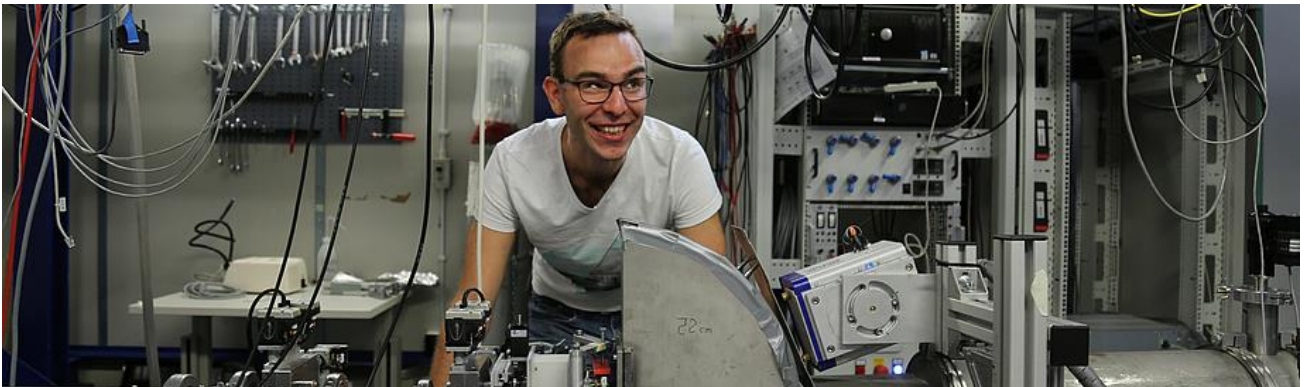
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[Click here to return to the table of contents](#)

Tools of the trade: super-fast electrons

Max Burian uses bright light to look deep into the core of matter. He works in a silver laboratory container next to the Elettra synchrotron particle accelerator in Trieste, Italy.



Max Burian with the centrepiece of his laboratory container in Trieste. There is only a vacuum inside the metal pipe in front of him, but when the beamline is switched on, high-frequency light is fired onto a material sample, revealing its nano-level structures. © Baustädter – TU Graz

In the silver office container, not even the chairs dare to make a squeak. Sitting on the nervy seat, Max Burian is looking at two small computer monitors. All around him, everything is quiet – a far cry from the concentrated flurry of activity of the past few minutes.

But let's rewind a bit first: the office chair is getting a break as Max Burian is bent over some equipment in the laboratory section of the container. He is preparing a material sample on the beamline, which will shortly fire high-intensity light through the sample. The beamline is a metal pipe that only contains a vacuum. In a few moments, though, when Max presses the big red button on the wall, he will have to move fast. He has precisely 30 seconds to safely negotiate the two steps to the office part of the container and close the thick metal door that separates the beamline from his desk. Once the 30 seconds are up, the connecting hatch can be opened to the storage ring, where electrons whizz around in circles at almost the speed of light, giving off high-intensity light. The researcher uses this light to study the structure of a small material sample in a silver tube. "We rarely do things at a leisurely pace here," says Max with a twinkle in his eye. He analyses a wide variety of samples: organic molecules, salt crystals and combined systems – basically anything, as long as it has a nanostructure.

A synchrotron is a particle accelerator in which electrons move at close to the speed of light and emit light as a result. Researchers conduct this light in what are known as beamlines in order to carry out experiments on various organic and inorganic materials. An in-depth article on the functions of a synchrotron and the Elettra Synchrotrone Trieste research facility is available at [Planet research](#). TU Graz teamed up with the Italian facility in 2012 and operates two beamlines.

TU Graz team based in Graz and Trieste

Max deftly makes it up the steps and is back at his desk. The office chair is pressed back into service. He is surrounded by the rest of the team. You could hear a pin drop as they wait for the data to come through. 30-year-old Burian is part of a four-strong team from TU Graz's [Institute of Inorganic Chemistry](#) working in the field laboratory at the synchrotron facility in Trieste. Heinz Amenitsch, the head of the research group, works with Burian on the SAXS beamline, where they mainly investigate reaction processes at high time resolutions. Benedetta Marmiroli and Barbara Sartori create structures to minute scales on the DXRL beamline. Besides TU Graz, another 26 research teams from across Europe, specialising in a wide range of test methods, operate beamlines. "We're like a small family here, the atmosphere is good," Burian says. And that seems to be essential, as the scientists are busy carrying out detailed research during the day, and often into the night, in a circular room packed with research equipment at the heart of the building.

An experiment becomes a long-term partnership

Born in Burgenland, Burian launched his scientific career at the University of Leoben, where he first used scattering as an investigative method. "I had to work the hardest on this topic – it was the most difficult one for me," Max comments. "So I stuck with it." During a joint experiment with the TU Graz team, the then student met gifted scattering expert Heinz Amenitsch. And the first experiment they conducted together grew into a long-term partnership. After completing his doctorate in Trieste, Max is now part of the team working on the SAXS beamline.

From the office container to a fish restaurant

The researcher now lives in an apartment he owns close to the centre of the Italian port city. Trieste is a great place to live – and after work, the seaside is just a short trip away. Weather permitting, Max sometimes heads for the city's beaches in the early afternoon. It's

all about recharging your batteries when you have the time, because the next night shift is probably just around the corner.

This evening, the scientists meet up in a fish restaurant. “Restaurants in Trieste come in various price categories,” Burian explains with a grin. “We call a EUR 30 meal the ‘gateway drug’. If you don’t eat fish regularly, you’ll be satisfied here. You can have a really good meal for EUR 50. And from EUR 70 upwards, you can eat like a gourmet.” On this particular evening, they choose the gateway drug for their guests at the Montecarlo restaurant on Via S. Marco: antipasti from the buffet, a primo of stuffed pasta and grilled salmon for secondo, with tiramisu for dessert – all served under a tent roof with electric heaters to protect against the chilly autumn evening air.

After dinner, it’s back up the hill overlooking Trieste where the synchrotron is located. They have no choice with the current experiment. “We have to be flexible. We can’t just stop taking measurements and start work again the next day,” Burian points out. Above all, they have to adapt to customers’ schedules and research requirements, which often allow only a few days for experiments at the synchrotron. Scientists come from research facilities all over Europe to make use of the powerful light source and work on their own projects. “I spend about 30 percent of my time preparing and managing experiments for others, 30 percent on my own research and 40 percent on maintenance and enhancing the beamline,” says Burian. “We really invest a lot of time in providing effective support to visiting researchers – that’s our USP. And of course, that involves going out for dinner, like this evening,” he laughs.

But now concentration is the order of the day once more: the data from the experiment have arrived and the evaluation can begin. Max Burian steps into the office container, where he will work long into the night. And his awestruck office chair will soon fall silent again.

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[Click here to return to the table of contents](#)

Viennese Scientists develop promising new type of polymers

S-PPV polymers are suitable for use in a wide range of applications, from solar cells through to medicine but, until recently, they were almost impossible to produce. Now, a new synthetic method has been patented.

Organic polymers can nowadays be found in solar cells, sensors, LEDs and in many other technical applications. One specific type of polymers – known as S-PPVs – were previously regarded as promising in theory but were almost impossible to produce from a technical perspective. After many years of work, a team from TU Wien has now managed to identify a new chemical synthesis process for the production of S-PPVs. This production process has now been patented.

Sulphur instead of oxygen

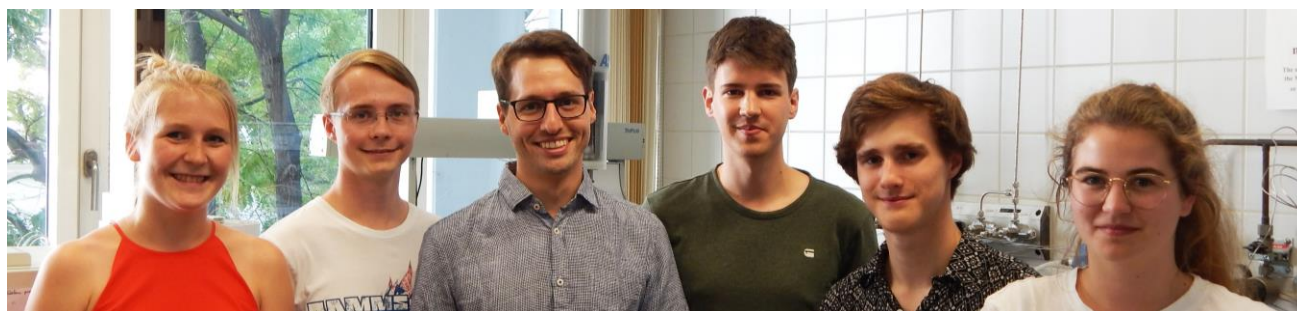
“PPVs are polymers that have superb technological properties”, says Florian Glöcklhofer from the Institute of Applied Synthetic Chemistry at TU Wien. “They conduct electrical current and interact with light in such a way that they are of great interest for use in solar cells or LEDs”. They have a long, solid hydrocarbon structure to which certain side groups are attached. By choosing different side groups, it is possible to set the electronic properties of the material. Until now, O-PPVs have been used for this; these are PPVs whose side groups are linked to the rest of the polymer via an oxygen atom. “If it is possible to replace oxygen side groups with sulphur side groups, this creates a new polymer, an S-PPV, which has significantly improved properties”, says Florian Glöcklhofer. “We knew that this could lead to improvements in the transport of electrical current and that this would significantly improve overall stability of the polymer.” Experienced colleagues sought to dissuade Glöcklhofer from attempting to produce these S-PPVs. “It was believed to be too difficult”, explains Glöcklhofer. Nevertheless, he decided to push ahead with the project and it soon became apparent that this would be indeed a complicated challenge. “It was important for us to develop a synthesising method that was both simple and low-cost, with as few synthesis steps as possible, and without the need for expensive special catalysts”, stresses Florian Glöcklhofer. “Ultimately, we want to produce materials that can be used in industrial

applications. And S-PPV can only be commercially successful if the production costs do not exceed a certain level.” After four years of hard work, and numerous bitter setbacks, the team finally succeeded in discovering a reliable, straightforward method for producing S-PPVs. Suitable monomers are manufactured with the help of microwave radiation. These are polymerised and the side groups can then be further modified. “It works amazingly well”, says Glöcklhofer. “The reaction takes place within seconds. The colour changes during the process, so you can see it as it happens.”

Patented technology

The new synthesis method has now been patented with the help of TU Wien’s Research and Transfer Support. Florian Glöcklhofer is extremely confident about the commercial success of the discovery: “It is a simple synthetic method for a new, highly promising group of polymers. The synthesis uses inexpensive base materials and does not require any palladium catalysts or similar expensive interim steps. The method can be scaled up for industrial quantities, is easily reproducible and delivers a product that not only boasts improved electronic properties, but also improved stability”, says Glöcklhofer. Additionally, S-PPVs are also relatively non-toxic and biocompatible, making them excellent candidates for use in medical applications. The team from TU Wien worked on the project together with a research group from Imperial College London, where Glöcklhofer recently took up a Marie Skłodowska-Curie Fellowship funded by the European Commission.

Original publication: [Rimmele et al., Thioalkyl- and Sulfone-Substituted Poly\(p-Phenylene Vinylene\)s, Polymer Chemistry](#)



Team: Alina Buchner, Klaus Ableidinger, Florian Glöcklhofer, Michael Taubländer, Jonathan Prinz, Martina Rimmele
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[Click here to return to the table of contents](#)

What do nanosafety experts think?

The US-EU NanoEHS Communities of Research (CoR) are a platform for European and US colleagues to collaboratively identify and address key research needs through community-led activities (<https://us-eu.org/>). In discussions during the regular meetings, participants have identified a need to get a more objective overview of the field of nanosafety research. Of course, the bulk of information is available in the literature, on project websites, in database or on communication platforms like the NanoSafety Cluster. However, neither opinions nor expectations about the future are included there, and both may be of interest.

The CoR Human Toxicity has performed between September 2017 and January 2018 a survey among nanosafety experts about the state of investigation in their field. There were 84 respondents and more would have been better, but considering the survey fatigue, that everybody feels, it is quite OK. The results have now been published in *J Nanopart Res* (2018) 20: 335. <https://doi.org/10.1007/s11051-018-4434-9>. The full set of data is included as supplementary data to this publication. The plan is to repeat this survey every few years, to get a feeling for the development of the field.

Consider the data from the first survey as a source for your next grant application! (Hint: You win either way. Either your research is fully in the line with the main concerns of experts, or you are investigating an important but so far neglected field of research.)

So, here is a tongue-in-cheek analysis what you (as the average nanosafety expert from our survey) do and what you think about some nanosafety issues:

You come from the field of toxicology, medicine or pharmacology and you study the inhalation pathway. You use both free and agglomerated/aggregated nanomaterials, you use chemical and physical testing along with in vitro/in vivo testing and you look mainly for reactive oxygen species. Most likely, you work on paint or coatings (but that is a narrow squeeze) and you are really undecided about how to deport dose in your experiments: mg/kg body weight, mg/l blood and mg/m³ are all favorites. You either determine the dose range for your experiments in orders of magnitude until effects are seen or you select dose based upon reported concentrations – it is really strange how undecided you are on the

dose question. However, you do use NOAEL to find a “threshold” dose and you think that the most urgent issue in nanosafety is to establish standard methods for toxicity testing.

While this analysis is not to be taken too serious, some relevant issues can be identified based on the survey results. Future versions of the survey will be modified to allow a more in depth analysis. If you have suggestions please send them to the authors.

Acknowledgements: We thank all our colleagues who have responded to the survey; the U.S. National Nanotechnology Coordination Office, the U.S. National Nanotechnology Initiative, and the European Commission, who bring together NanoEHS researchers in the Communities of Research for the US-EU dialogue. AD acknowledges funding from the European Union’s Horizon 2020 Research and Innovation Programme, under the Grant Agreements No 723623 (EC4SafeNano), No 671881 (PANDORA), No 731032 (Nano-Commons), No 812661 (ENDONANO) and No 814530 (NANORIGO).

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[Click here to return to the table of contents](#)

Where does this contamination come from?

When bodies of water become polluted, it is important to find the cause as quickly and as economically as possible. To this end, TU Wien has now developed a new, DNA-based rapid testing procedure.

Water contamination is one of the world's major health risks. In order to swiftly resolve the problem in the event of faecal contamination, it is vital that the cause is identified as quickly as possible: is it contamination from agriculture? Or waste water from sewage?

Researchers at TU Wien have developed a simple method for detecting water contamination from ruminants directly at source, using a simple DNA test. Information on the underlying technology was recently published in the specialist journal 'Nature – Scientific Reports'.

DNA tests

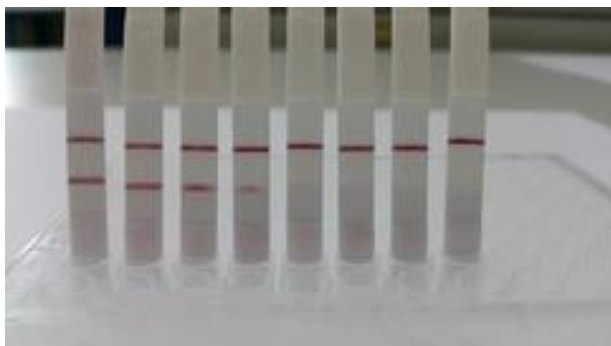
Methods for detecting the source of faecal water contamination using DNA have existed for some time. However, these methods were complicated, expensive and time consuming, requiring samples to be taken and then sent to a laboratory for genetic analysis. "Certain bacteria are only found in the faeces of very specific species of animal. When analysing DNA samples of these bacteria, you can pinpoint exactly which creatures are the source of the contamination," explains Georg Reischer from the Institute of Chemical Engineering at TU Wien. "There are, for example, bacteria which are commonly found in the intestinal microbiome of ruminants. If this type of DNA is found in a water sample, it is highly likely that the contamination originated from grazing cattle."

The idea of developing a simple testing procedure based on this method was developed at TU Wien a number of years ago. However, adapting the detection method so that it would work and could be carried out quickly and reliably was not so easy, particularly without specialised biotechnological knowledge.

Now, however, the technology has been perfected and published in a scientific journal and is set for market launch in the form of a simple testing device. "The bacteria are destroyed, the DNA is amplified in a targeted manner and then detected using a simple strip, much like

a pregnancy test,” says Georg Reischer. “Fundamentally, this technology is applicable to many different bacteria and viruses, but for now we are concentrating on the detection of dangerous microbes in water, this being a particularly widespread problem.”

The technology was developed by TU Wien in partnership with the Department of Agrobiotechnology, IFA-Tulln at the University of Natural Resources and Life Sciences, Vienna and within the framework of the Inter-University Cooperation Centre Water and Health. The next step in this process will be to develop a prototype; we are currently still searching for a suitable industry partner to collaborate with. The measurement device is expected to cost a few hundred euros.



Test results: Two red stripes show that there is a contamination. © TU Wien



Synthetic gold nanoparticles (left) with DNA-detector (right). © TU Wien

Original publication: [Kolm et al., Nature Scientific Reports, volume 9, Article number: 393 \(2019\)](#)

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[Click here to return to the table of contents](#)

BioNanoNet *retrospect*

Brokerage event on key enabling technologies

31st of January 2019, Venice, Italy



The BROKERAGE EVENT ON KEY ENABLING TECHNOLOGIES took place on 31st of January, 2019, in Venice, Italy. Entrepreneurs and key enabling technologies providers had the unique possibility to meet together and find valuable collaboration opportunities to exploit innovation potentialities. The event offered companies the opportunity to meet representatives of EU leading applied research organizations and technology enterprises in pre-arranged b2b meetings. Research providers, moreover, had the double chance to present their innovative technologies to SMEs' representatives and to find synergetic collaborations with other research players active in the field of key enabling technologies.

As side event, a visit at the Legnaro National Laboratories of the Italian Institute of Nuclear Physics (INFN) was organised for registered participants. This included a session of presentations of the technologies from the ongoing research programs and a visit to the laboratories.

The event was part of the KETGATE project activities and was organised in cooperation with Enterprise Europe Network.

BNN represented its members during the brokerage event, participating in the b2b meetings.

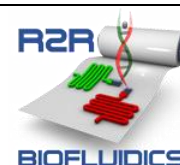


This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement n° 646260.



[Click here to return to the table of contents](#)

EU INDUSTRY Days 2019



5th – 6th of February 2019, Brussels, Belgium

EU Industry Days 2019 focused on key industrial challenges such as sustainability, digitalisation, investment and globalisation. The event, on 5th – 6th of February, demonstrated how EU industrial policy benefits European citizens and provided input for future policy making.

EU Industry Days gathered around 1,800 participants from across Europe and beyond, including stakeholders representing industry, trade unions, national and regional authorities, and civil society.

BNN represented its members during both days of the networking event.

Find more information on the event including recorded sessions and the opening speech by Jean-Claude Juncker, President of the European Commission at <https://ec.europa.eu>.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement n° 646260.

[Click here to return to the table of contents](#)

Open NanoScience Congress (ONSC)

26th of February 2019, Salzburg, Austria



The Open NanoScience Congress (ONSC) is an international scientific congress on Nano-technology and Nanosciences for the general public and took place on February 26th in Salzburg. Students from the Sparkling Science project "Nan-O-Style" actively participated in the congress by presenting their work in chaired poster session titled "Nano-Research Spotlights". The programme included several keynote lectures by invited experts who gave insights into current research projects at the University of Salzburg. Another focus was a “nano exhibition” with hands-on stations and a practical demonstration of a nanoparticle measurement instrument.



Impressions from the Open NanoScience Congress in Salzburg. Top left: Univ.-Prof. Dr. Albert Duschl (organizer of the Open NanoScience Congress and coordinator of the “Nan-O-Style” project). © Universität Salzburg (NaWi-AV-Studio)

BioNanoNet participated in the conference as an exhibitor, introducing that nanotechnology is present in a wide variety of products in our everyday lives (from clothing to special paints/sprays to medical applications) to the students/pupils and congress attendees. By playing the Nanorama-Loft quiz, students/pupils could slip into the role of "Nano Sherlock Holmes", where they could discover numerous everyday nano products. Every product comes up with a question and they had the chance to test their "nano knowledge".

There was also a lively participation in the voting for the best school contribution at ONSC. The winners (Gymnasium Ort, Gmunden, Upper Austria) are going to visit the largest technology museum in the world in Munich and will get a guided tour through the local nano exhibition.

[Click here to return to the table of contents](#)

BioNanoNet Networking & Call Matchmaking Event



27th of February 2019, Technische Universität Wien, Austria

The BioNanoNet Networking & Call Matchmaking event took place on 27th of February 2019 in the premises of the University of Technology Vienna attracting more than 40 participants.

The BioNanoNet Networking event was opened with a welcome speech given by Johannes Fröhlich, Vice Rector for Research and Innovation of the University of Technology Vienna. The meeting was scientifically started with three keynote lectures from the host organization: Gerhard Schütz from Institute of Applied Physics talked about „Superresolution microscopy images – what they tell us and what they don’t”. Florian Rudroff from the Institute of Applied Synthetic Chemistry spoke about “Inspired by Nature, complemented by Chemistry – Novel strategies for the synthesis of high value products” and last but not least Silvan Schmid from the Institute of Sensor and Actuator Systems gave a presentation on “Nano-mechanical single-molecule analysis”.

Based on a pre-selection some H2020 call topics have been identified as the core topics for the Call Matchmaking session. Those were shortly presented in the pitch session, followed by discussions in small groups about initial project ideas, the roles they would like to take, and their specific expertise and requests for further partners for their consortium.

The continuous growth of the network enables expanding the thematic horizon of BioNanoNet to the benefit of our members and thus supporting research and development activities in different branches.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731032.



Impressions from the event:



pictures © BioNanoNet

[Click here to return to the table of contents](#)

1st Austrian Microfluidics Initiative Symposium & Rare Disease Day

AUSTRIAN
MICROFLUIDICS
INITIATIVE



SMART4FABRY

28th of February 2019, Technische Universität Wien, Austria

In close cooperation, Technical University Vienna, Graz University of Technology, University of Salzburg and BioNanoNet organised the 1st Austrian Microfluidics Initiative (AMI) Symposium on 28th of February 2019 at the Technischen Universität Wien.

The scientific sessions with key note lectures demonstrated the strength of the Austrian Microfluidics community to more than 90, both national and international, participants from academy to industry.

The event was officially opened by Vice-rector Univ.-Prof. DI Dr. Johannes Fröhlich (Technische Universität Wien), Dr. Peter Ertl (Technische Universität Wien), Dr. Torsten Mayr (Graz University of Technology), Dr. Günter Lepperdinger (University of Salzburg), and Andreas Falk, MSc (BioNanoNet).

The event introduced key players of/to the Austrian microfluidic community with established competences in modelling, manufacturing, and miniaturizing fluidic analysis as well as implementing functional microfluidic processes. The forum targeted to initiate communication between industrial devices manufacturers, biotech/diagnostic companies, non-academic research organizations, academic researchers and medical professionals as well as funding agencies and governmental representatives.

In the course of the event, activities of RARE DISEASE DAY 2019 were presented to the audience to discuss application possibilities of microfluidic technologies in the field of rare diseases, to facilitate interaction between microfluidics experts and medical experts, and to raise awareness on rare diseases among the AMI community. The presentations in this session included Smart4Fabry project (presented by CIBER-BBN and Nanomol Technologies) and the CISTEM project (presented by BeOnChip S.L.). Both, CISTEM (oriented on

developing heart on a chip for investigating Duchenne muscular dystrophy) and Smart4Fabry project (on Fabry disease) are projects focused on a Rare Disease.

A panel discussion on challenges and future directions of microfluidics in Austria concluded the series of talks and completed the event.

The goal of the Austrian Microfluidics Initiative is to (a) promote scientific collaborations between industry and academia, (b) support technology transfer activities, and (c) review future scientific challenges. Please visit www.microfluidicsaustria.at for further information.

Impressions from the event:



pictures © BioNanoNet



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement n° 720942.

 Bundesministerium
Bildung, Wissenschaft
und Forschung

 Bundesministerium
Verkehr, Innovation
und Technologie

[Click here to return to the table of contents](#)

EUFEPS Annual Meeting 2019

"Personalized Medicines, Targeted Therapies, Precision Drug Delivery"



SMART⁴FABRY



6th – 8th of March 2019, Frankfurt am Main, Germany

From 6th to 8th March 2019, the Annual Meeting of the European Federation for Pharmaceutical Sciences (EUFEPS) took place at Goethe-University's "Campus Riedberg" in the North of Frankfurt, Germany, hosted by the new EUFEPS President and Conference Chair Prof. Dr. Dieter Steinhilber. The EUFEPS Annual Meeting brought together people from all over the world who are involved in pharmaceutical sciences in order to exchange results, experiences and information, and to build communication and collaboration at regional and global scale. A broad range of sessions for oral and poster presentations covered important aspects of current pharmaceutical research. The event provided scientific sessions on the following topics:

- Oncology
- NBCDs, nanomedicines and nanosimilars
- Biomarkers for personalized medicines
- Targeted drug delivery and age-appropriate formulations
- Personalized medicine outside of oncology
- Analytical technologies
- Veterinary medicines
- Regulatory science
- Novel drugs (EFMC)
- Systems pharmacology, pharmacogenetics research and implementation

- dermatopharmacy
- Process analytical control

Highly interesting key note lectures, oral presentations and poster presentations by international researchers and scientists, engineers, students and practitioners in the field of Pharmaceutical Sciences showcased current, emerging and future trends in pharmaceutical sciences and medicine.

BioNanoNet participated the conference and contributed a poster presentation on the H2020 project Smart-4-Fabry, addressing the following topic:

“Novel Lipid-based Nanoformulation for Treatment of Fabry Disease”, *S. Resch, C. Schimpel, N. Ventosa, T. Birngruber, A. Falk.*

BioNanoNet members Priv.-Doz. Dr. Frank Sinner from JOANNEUM RESEARCH – HEALTH and Prof. Dr. Johannes Khinast from RCPE gave insights into their latest research activities. The next EUFEPS Annual Meeting will take place from 15th to 17th June 2020 in Gothenburg, Sweden.



Smart-4-Fabry has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No 720942.

[Click here to return to the table of contents](#)

BioNanoNet *conference calendar*

BioNanoNet events

BioNanoNet Annual Forum 2019

When? 10 September 2019

Where? Salzburg, Austria

Save the date! More information coming soon.

BioNanoNet on site events

1st Interprofessional Education Nano Training School

When? 25 – 29 March 2019

Where? Venice, Italy

For more information visit the [BioNanoNet website](#).

8th Annual NIA Symposium

When? 27 March 2019

Where? Brussels, Belgium

For more information visit the [BioNanoNet website](#).

2nd THINK TANK - Life Sciences im digitalen Wandel

When? 2 April 2019

Where? Graz, Austria

For more information visit the [BioNanoNet website](#).

REFINE 1st conference on regulation of Nanomedicines

When? 3 – 4 April 2019

Where? Amsterdam, Netherlands

For more information visit the [BioNanoNet website](#).

1st Nano2Clinic Training School

When? 8 – 11 April 2019

Where? Trieste, Italy

For more information visit the [BioNanoNet website](#).

BioNanoMed - 10th International Congress Nanotechnology in Biology & Medicine

When? 15 – 17 April 2019

Where? Graz, Austria

BioNanoMed 2019 provides a forum for researchers, engineers, students and practitioners from Natural Sciences, Medical Sciences and Engineering as well as from educational, governmental and non-governmental institutions to discuss current, emerging and future trends of the converging fields of nanotechnology, biotechnology and medicine. Exciting lectures and invited talks given by leading international scientists as well as poster presentations offer delegates an excellent opportunity to discuss pioneering developments and to initiate cooperation projects.

Topics:

- Nanomaterials for Medicine
- Nanotechnology in Medical Diagnostics and Therapy
- Pharmaceutical Nanotechnology in Research and Development
- Nanotechnology in Cancer and Immunotherapy
- Nano-enabled Microfluidics and high-throughput Technologies

BioNanoNet members get a 10% discount on registration fee. Please register by sending an email to office@bionanonet.at until 10th of April 2019 by the latest!

For more information please visit www.bionanomed.at.

Workshop: Chemical Leasing: NACHHALTIGE GESCHÄFTSMODELLE für die Chemische Industrie und deren Kunden

When? 24 April 2019

Where? Vienna, Austria

For more information visit the [BioNanoNet website](#).

BioCHIP conference

When? 7 – 8 May 2019

Where? Berlin, Germany

For more information visit the [BioNanoNet website](#).

SusChem-SIRA workshop

When? 16 - 17 May 2019

Where? Brussels, Belgium

For more information visit the [BioNanoNet website](#).

EuroNanoForum

When? 12 – 14 June 2019

Where? Bucharest, Romania

For more information visit the [BioNanoNet website](#).

NanoMed Europe

When? 17 – 19 June 2019

Where? Braga, Portugal

For more information visit the [BioNanoNet website](#).

International Particle Toxicology Conference

When? 11 – 13 September 2019

Where? Salzburg, Austria

For more information visit the [BioNanoNet website](#).

For all events visit our [BioNanoNet website](#)!

BioNanoNet Member-Event-Notifications



From patient data to services. What can one generate from such data? What is currently possible with AI for imaging? What predictions for patients can be made with AI? What needs to be considered? Startups and companies talk about current topics about Patient Data as a service, but also safety issues should not be ignored.

<https://letscluster.com/patient-data-humans-as-information-nodes/>



Augmented Reality and AI supported image processing have already surpassing their infancy and are starting to show their revolutionary potential. Discover the usefulness of AI in radiology and see how virtual reality can enable the training of medical practitioners in specially constructed scenarios. Find out about the value of Augmented Reality in situations where you need extended information about the patient on the operation table.

<https://letscluster.com/advanced-medical-imaging/>



2nd THINKTANK
Life Sciences im digitalen Wandel

02.04.2019 15:00 - 19:00
LKH Seminarraumzentrum, Seminarraum 224

<https://www.humantechnology.at/de/aktuelles/termine/veranstaltung/175/>

ZWT Easter Breakfast – Breakfast meets Network

8 April 2019, 08:30 – 10:00, Cafe Medicus, Neue Stiftingtalstraße 2, 8010 Graz

We.Live.Network! In cooperation with ZWT, the HTS Cluster organizes the second networking event 2019 in the Medical Science City. After 5-minute keynote speeches, networking while coffee and breakfast is the focus of this new event-series. Join us and get to know the stakeholders of Medical Science City Graz.

<https://www.humantechnology.at/de/aktuelles/termine/veranstaltung/179/>

INNOlounge 4.0: The culture of innovation and networks in the age of digitalisation

10 April 2019, 16:00 - 19:00, Murinsel, Graz

How important is a culture of innovation to create new ideas and how is it possible to get motivation for a „new kind of thinking“? What role do innovation-promoting companies and networks play in the times of digitalisation?

<https://www.humantechnology.at/de/aktuelles/termine/veranstaltung/180/>



FAST FORWARD 4 U @acib

„Join us and get an insight in
THE AUSTRIAN CENTRE OF
INDUSTRIAL
BIOTECHNOLOGY“

07th of May 2019, 3 pm

7 May 2019, 16:00, TU Graz, Petersgasse 14, 8010 Graz

acib is an international competence centre, developing new, environmentally friendly, economically and technically advanced processes for the biotechnological, pharmaceutical and chemical industry – all of them modelled on nature. acib is bridging the gap between academic research and producing industry. acib and their partner organisations translate scientific results into concrete processes and products by using scientific know-how, academic infrastructure or industrial networks. acib is a hub of industrial biotechnology with several national and international scientific partners with Graz University of Technology (TUG) as one of the most important. Together, acib and TUG open their doors, to allow a glance behind highly recognised research in nearly all fields of industrial biotechnology.

<https://www.humantechnology.at/de/aktuelles/termine/veranstaltung/167/>

Contact:

Human.technology Styria GmbH
Julia Pirkenau
julia.pirkenau@human.technology.at
www.humantechnology.at

[Click here to return to the table of contents](#)

Finally

We hope you enjoyed our BioNanoNet newsletter!
Please do not hesitate to contact us if you would like to give us
any suggestions or feedback!

Our next BioNanoNet newsletter will be published in June 2019.

BioNanoNet partners are welcome to send their contributions until 11th of June 2019!

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Your BioNanoNet team

from the left ...

Christa Schimpel, Beatriz Alfaro Serrano, Susanne Resch, Andreas Falk, Gabriele Katz, Christine Halbedel, Angelika Halbedl-Herrich, Simone Jagersbacher and Nikolaus Ladenhauf

The BioNanoNet team wishes you

*Happy
Easter!*

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[Click here to return to the table of contents](#)