



02/2021

NEWSLETTER



Our vision

is to shape the European hightech ecosystem to secure a sustainable and prosperous society.

Table of contents

EDITORIAL	5
BIONANONET NEWS	6
New BioNanoNet Members	6
BIONANONET MEMBER PRESENTATIONS	7
BDI-BioEnergy International GmbH	7
Norner AS	10
RECENT SCIENTIFIC PUBLICATIONS OF BIONANONET ASSOCIATION MEMBERS	13
INISS-nano – concept paper published	20
PROJECT PRESENTATIONS	21
EU H2020 FET Open project BreadCell	21
EU H2020 FET Open project DeDNAed	23
EU H2020 project DIAGONAL	25
EU H2020 MSCA ITN project DIRNANO	28
PROJECT UPDATES	31
ACEnano holds its final stakeholder event	31
Online SPARQL access to WikiPathway and AOP-Wiki Webinar	33
SbD4Nano first year's progress & achievements	35
Cutting-edge science within the pharmaceutical open-innovation test bed PHOENIX	37
First developments of SABYDOMA's technology – new audio-visual materials online	40

BIONANONET MEMBER CONTRIBUTIONS

41

The need to determine the therapeutic window of novel targeted anticancer nanomedicines	41
CIBER-BBN researcher Prof. Luis Liz Marzán receives the 2021 Lilly Foundation for Preclinical Biomedical Research Award	43
It takes some heat to form ice	44
Materials research says yes to wood	46
Institute for Medical Research & Occupational Health participating in the RiskGONE Horizon 2020 project	49
Collection and analysis of sensitive health data and data protection are reconcilable	51
Using human telemetry to understand cognitive and emotional states for daily activity improvement	53
NanoSolveIT H2020 project makes freely available a library of critical characteristics for 69 engineered nanomaterials	55
Open toxicogenomic data project improves our knowledge for nanomaterials toxicity	57
PAYER Group invests in the Styrian Technology & Innovation Center	59
Nanoparticles: The complex rhythm of chemistry	61
Tracking down the tiniest of forces: how T cells detect invaders	62
New biochip technology for pharma research	66
SolarCircle project	69
Production of bio-based resols from structure-defined lignin oligomers (LignoWert)	71

BNN RETROSPECT

73

1 st Stakeholders' workshop on Safe and Sustainable-by-Design criteria	73
Forum on nanosafety: 'From lab to society'	74
Online QSAR Modelling Hackathon by Easy Access to Jaqpot: Deploy your model as a web service in a few minutes	76
InterNanoPoland2021 conference	78
1 st NanoSyn2-Joint Meeting & 18 th nanoNET-Austria Meeting	80
EuroNanoForum 2021 and NSC Satellite Event – Nanosafety projects show their collaboration	81
MIE prediction tool webinar	84
Global Innovation Summit	87
1 st BioNanoNet Gold Member Webinar	88
IMAGINE21 – be the change	89
Nanosafety Training School: from basic science to risk governance	91
3 rd Think Tank – Life Sciences in Digital Change - “New business models in life sciences”	94

EVENTS

96

BNN events & BNN co-organized events	96
Member events	96

FINALLY

98

Editorial

CONTEMPORARY ISSUES FROM THE NETWORK

Dear Ladies and Gentlemen,

the second quarter of 2021 made us super-busy with supporting our BioNanoNet members with member support activities: access to expertise and infrastructure of the BioNanoNet R&D&I network as well as multidisciplinary knowledge exchange with international experts are very good examples for the strength of the network. Both aspects have been supported by the actions in terms of representation within international thematic initiatives and are continuous engagement in events. Thus, we have put efforts into boosting visibility of our members' expertise by organizing the first [Gold members webinar](#), the [Members Welcome Webinars](#) and by co-organizing sessions at relevant web-conferences, i.e. [InterNanoPoland](#), [NSC-Event and booths at EuroNanoForum](#), [Global Innovation Summit](#), and [IMAGINE21](#). All these efforts support our members to get in touch with potential collaborators across the globe, initiating new projects and cooperation.

Furthermore, and to certain extent a logical follow-up of the above mentioned work, our activities included the support to prepare Horizon Europe proposals, bring the association members into such consortia, and by this to generate as well as maximize the impact of science and research results.

On the global and cross sectoral side, the further shaping of the International Network Initiative on Safe and Sustainable nanotechnology [INISS-nano](#) is one of our activities supported by the NanoSyn2-project, hence, paving the way from national activities towards international collaboration. The commenting phase for INISS-nano has now started, hence we are looking forward to receive comments along the summer time. Another work items are the Safe Innovation Approach as well as the further work on SSbD, to which BNN contributes within several projects and international actions (e. g. OECD-WPMN, PARC, NanoSafety Cluster, INISS-nano, etc.). This will become visible also during the BioNanoNet Annual Forum & BNN Networking session, which will be held on September 16th. More details will be available soon, thus, we kindly invite you to book your calendar already and to welcome you in Graz or via the web (as we plan to do it in hybrid mode).

We wish you a sunny, relaxing summertime and are looking forward to see you soon!

Andreas & the BNN-team

[→ TABLE OF CONTENTS](#)

BioNanoNet News

NEW BIONANONET MEMBERS

We are happy to welcome our new extraordinary BioNanoNet member:

SEVEN PAST NINE

Seven Past Nine (Slovenia)

Data stewardship and solutions for life sciences

We develop data and information solutions for academic and commercial research. We are experts in designing, collecting, organizing and presenting data and offer a unique combination of technical and scientific expertise to build data management solutions that don't compromise on project requirements.

For more details visit sevenpastnine.com

We are happy to welcome our new standard BioNanoNet member:



PYROSCIENCE GmbH (Austria)

Optical Sensors for pH, Oxygen, and Temperature

PyroScience is one of the world's leading manufacturers of state-of-the-art optical pH, oxygen, and temperature sensor technology for industrial and scientific applications. We offer plug-and-play solutions for laboratory and underwater usage. Furthermore, PyroScience provides smart OEM solutions for industrial customers.

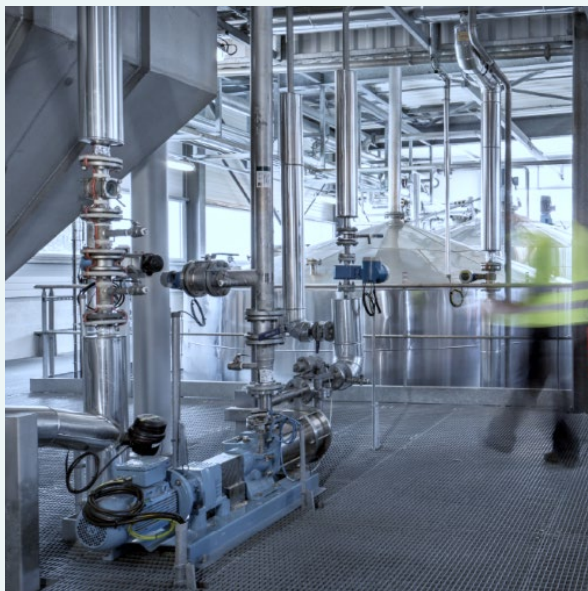
For more details visit www.pyroscience.com

[→ TABLE OF CONTENTS](#)

BioNanoNet member presentations

BDI-BIOENERGY INTERNATIONAL GMBH

GREENTECH SOLUTIONS



Knowledge center for chemical process development

Since its foundation in 1996, the Styrian Company BDI-BioEnergy International GmbH has been developing resource-saving technologies for the upgrading of residual and waste products from industry and commerce. Following the slogan develop.design.build, the company sets new standards in terms of innovative strength, technological leadership, product quality and cost-effectiveness.

BDI acts as the missing link between process idea and turnkey production plant. As a reliable partner, BDI takes care of all crucial stages in a project. The newly established GreenTech Solution (GTS) department functions as knowledge center for chemical process development. It is a full-service engineering and consulting division of BDI-BioEnergy International offering customized services in all phases of technology development – from concept to market maturity.



BDI has particular, long-lasting expertise in the areas of:

✓ Upcycling

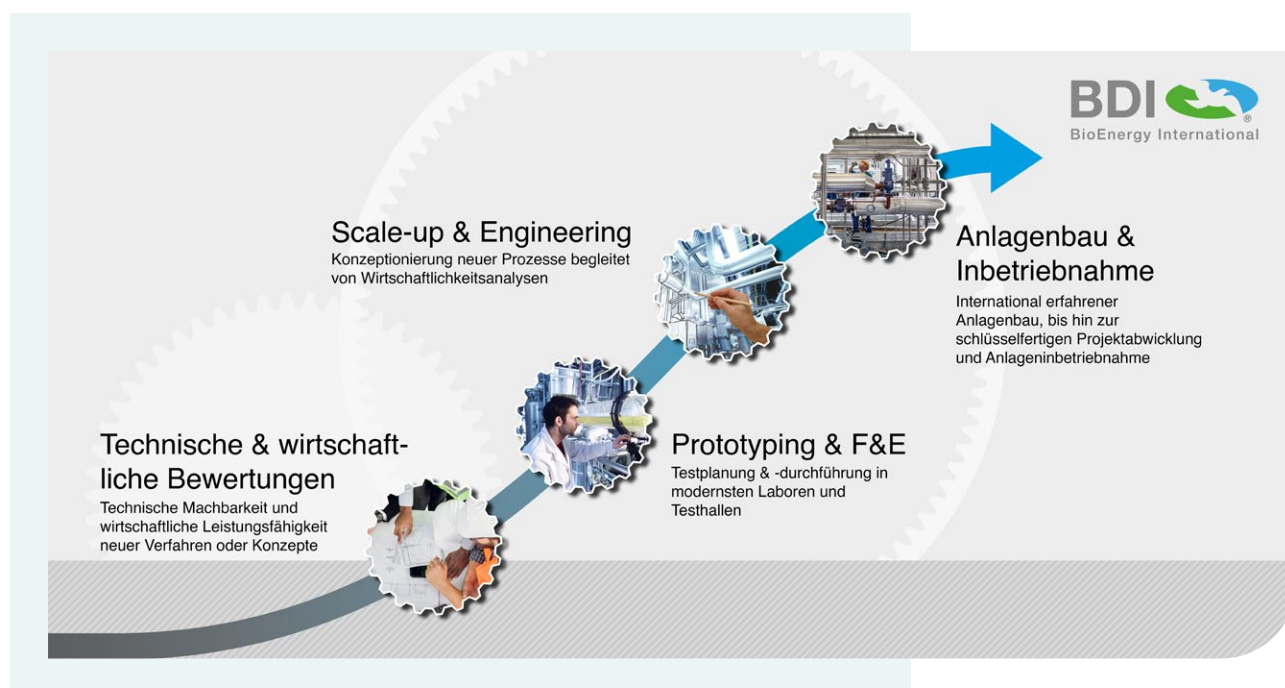
✓ Recycling

✓ Green Technologies

The GTS approach is based on an interdisciplinary team of experts and high-end engineering capabilities, supported by state-of-the-art testing and laboratory facilities.

This unique combination forms the missing industrial link between ideas and a successful

commercial implementation. GTS is very experienced in international collaborations regarding the sustainable use of raw materials, in the reduction or optimization of waste streams and in chemical and biochemical synthesis.



The services offered by GTS at each development stage are as follows:

✓ **Technical and economic evaluations**

Assessment of technical feasibility and profitability of new processes or concepts

✓ **Prototyping and research & development**

Test planning & execution (incl. analytical support) in in-house, state-of-the-art laboratories and experimental halls

✓ **Scale-up and engineering**

Optimized process scale-up, accompanied by economic analyses and preparation of industry-oriented process concepts

✓ **Plant construction and commissioning**

Internationally experienced plant engineering through to turnkey project execution, plant commissioning with production support and subsequent customer service

SynCycle is a joint project by BDI-BioEnergy International and Next Generation Elements (NGE). In this cooperation, the full performance potential of chemical plastic recycling is utilized by developing a plant concept to convert non-recyclable plastic waste into new products. Drawing on renowned experience, the SynCycle technology offers a one-stop shop concept for all process steps.

As a team, GTS and NGE are committed to unwaste plastic!



Pictures © BDI-Bioenergy International GmbH

Contact

BDI-Bioenergy International GmbH – GreenTech Solutions

Fabian WEINHANDL

Fabian.Weinhandl@bdi-bioenergy.com

www.bdi-bioenergy.com

[GTS Audio Snacks - Podcasts](#)



[→ TABLE OF CONTENTS](#)

NORNER AS



Norner 5.000 sqm. Polymer Exploration Centre, established at the bank of the Porsgrunn river, Vestfold Telemark County, Norway. ©NORNER AS

EXPLORING possibilities with polymers.

Our ambition is to be a global independent innovation partner for the polymer value chain. Norner contributes to a variety of clients needing polymer expertise within consumer goods, packaging, healthcare, energy, infrastructure and petrochemical raw materials production industry. Everything in the context of circular economy.

Norner was founded in 2007 as a full transformation of the Norwegian Innovation center of Borealis including employees, competence and laboratory assets. Norner has now grown the business to more than 700 clients, performed projects in 50 countries and is recognized in the market as a leading commercial polymer and plastics solution provider with industrial know-how based on our values Confidence, Impact, Imagine, Passion. We will continue to deliver sustainable solutions and bring ideas for the future into solutions of today.

Norner operates under ISO9001 certification and ISO 17025 accreditation (selected tests) and with GLP routines in place. We offer more than 80 polymer experts and modern well-equipped laboratories and technical facilities, including industrial pilot lines for multi-layer films, injection and rotational moulding, thermoforming and compounding as well as a recycling pilot center to our partners.

NORNER KEY FIGURES



Polymers, Catalysts,
Polymerisation and Process

Additives, chemicals, REACH
and compounding

Plastics processing, product prototypes,
extrusion, moulding, film

Scientific Laboratories for analysing polymer,
chemical, physical, durability and microscopy

Norner expertise, laboratories and test centra ©NORNER AS

The recycling center is equipped to supporting our partners developing solutions with the right kind of materials to reducing the carbon footprint, to reusing materials repeatedly, to recycling materials to new products and to recovering energy from waste.

We work with multinational leading brands, large petrochemical companies, European SME's and in funded consortium projects with clients, universities and research organizations throughout Europe.

We decided to join BNN to 1. seek partnership and collaboration mainly within healthcare, medical and packaging developments and 2. to advance science in developing and bringing new advanced composites fast to market. We already have seen benefits from our membership in BNN, working within two consortium projects with other members from BNN.

Contact

Norner AS

Siri STABEL OLSEN

siri.stabel.olsen@norner.no

Morten LUNDQUIST

morten.lundquist@norner.no

www.norner.no

Recent scientific publications of BioNanoNet association members

In this newsletter issue only new publications of our members are listed.

Certainly, you can always view all members' publications sent to us from 2018 up to now by downloading the document [BioNanoNet member publications](#) or visiting our [website](#).

PERIOD MARCH – MAY 2021

BOKU

Jandric, A., Part, F., Fink, N., Cocco, V., Mouillard, F., Huber-Humer, M., Salhofer, S. and Zafiu, C. (2020) Investigation of the heterogeneity of bromine in plastic components as an indicator for brominated flame retardants in waste electrical and electronic equipment with regard to recyclability. *Journal of Hazardous Materials* 390, 121899. <https://doi.org/10.1016/j.jhazmat.2019.121899>

Part, F., Zaba, C., Bixner, O., Zafiu, C., Lenz, S., Martetschläger, L., Hann, S., Huber-Humer, M. and Ehmoser, E.-K. (2020) Mobility and fate of ligand stabilized semiconductor nanoparticles in landfill leachates. *Journal of Hazardous Materials* 394, 122477. <https://doi.org/10.1016/j.jhazmat.2020.122477>

Pavlicek, A., Part, F., Rose, G., Praetorius, A., Miernicki, M., Gázsó, A. and Huber-Humer, M. (2021) A European nano-registry as a reliable database for quantitative risk assessment of nanomaterials? A comparison of national approaches. *NanoImpact* 21, 100276. <https://doi.org/10.1016/j.impact.2020.100276>

Scherhauer, S., Part, F. and Beigl, P. (2021) Das Sekundärressourcenpotenzial aus Windkraft- und Photovoltaikanlagen. *Österreichische Wasser- und Abfallwirtschaft* 73(1), 36-48. <https://doi.org/10.1007/s00506-020-00723-3>

Zafiu, C., Part, F., Ehmoser, E.K. and Kahkonen, M.A. (2021) Investigations on inhibitory effects of nickel and cobalt salts on the decolorization of textile dyes by the white rot fungus *Phanerochaete velutina*. *Ecotoxicol Environ Saf* 215, 112093. <https://doi.org/10.1016/j.ecoenv.2021.112093>

CIBER-BBN

Joaquin Seras-Franzoso, Zamira V. Díaz-Riascos, José Luis Corchero, Patricia González, Natalia García-Aranda, Mònica Mandaña, Roger Riera, Ana Boullosa, Sandra Mancilla, Alba Grayston,

Marc Moltó-Abad, Elena Garcia-Fruitós, Rosa Mendoza, Guillem Pintos-Morell, Lorenzo Albertazzi, Anna Rosell, Josefina Casas, Antonio Villaverde, Simó Schwartz Jr, Ibane Abasolo. (2021). Extracellular vesicles from recombinant cell factories improve the activity and efficacy of enzymes defective in lysosomal storage disorders. *Journal of Extracellular vesicles*. [DOI]

Vadillo-Rodríguez V, Cavagnola MA, Pérez-Giraldo, Fernández-Calderón MC. (2021) A physico-chemical study of the interaction of ethanolic extracts of propolis with bacterial cells. *Colloids Surf B Biointerfaces* 200, 111571. [DOI]

Marrero D, Pujol-Vila F, Vera D, Gabriel G, Illa X, Elizalde-Torrent A, Alvarez M, Villa R, Gut-on-a-chip: Mimicking and monitoring the human intestine. *Biosensors and Bioelectronics*. Volume 181, 1 June 2021, 113156. [DOI] <https://doi.org/10.1021/acsami.0c21573>

Clua A, Fàbrega C, García-Chica J, Grijalvo S, Eritja R. Parallel G-quadruplex Structures Increase Cellular Uptake and Cytotoxicity of 5-Fluoro-2'-deoxyuridine Oligomers in 5-Fluorouracil Resistant Cells. *Molecules*. 2021; 26(6):1741. [DOI]

Javier García-Pardo, Fernando Novio, Fabiana Nador, Ivana Cavaliere, Salvio Suárez-García, Silvia Lope-Piedrafita, Ana Paula Candiota, Jordi Romero-Gimenez, Beatriz Rodríguez-Galván, Jordi Bové, Miquel Vila, Julia Lorenzo, and Daniel Ruiz-Molina, Bioinspired Theranostic Coordination Polymer Nanoparticles for Intranasal Dopamine Replacement in Parkinson's Disease. *ACS Nano* 2021, 15, 5, 8592–8609, May 2021. [DOI]

Teresa Alejo, Laura Usón, Guillermo Landa, Martin Prieto, Cristina Yus Argón, Sara García-Salinas, Ricardo de Miguel, Ana Rodríguez-Largo, Silvia Irusta, Victor Sebastián, Gracia Mendoza and Manuel Arruebo. Nanogels with High Loading of Anesthetic Nanocrystals for Extended Duration of Sciatic Nerve Block, *ACS Appl. Mater. Interfaces*, 13, 15, 17220–17235. 2021 April 6. [DOI]

Díaz-San Martín, G.; Reyes-González, L.; Sainz-Ruiz, S.; Rodríguez-Cobo, L.; López-Higuera, J.M. Automatic Ankle Angle Detection by Integrated RGB and Depth Camera System. *Sensors* 2021, 21, 1909. <https://doi.org/10.3390/s21051909>

DANUBE UNIVERSITY KREMS

Chiapella, A.M., Kainz, M.J., Strecker, A.L. (2021): Fatty acid stable isotopes add clarity, but also complexity, to tracing energy pathways in aquatic food webs. *Ecosphere*, 12(2):e03360. <https://doi.org/10.1002/ecs2.3360>

Eichhorn, T., Linsberger, I., Lauková, L., Tripisciano, C., Fendl, B., Weiss, R., König, F., Valicek, G., Miestinger, G., Hörmann, C., Weber, V. (2021): Analysis of inflammatory mediator profiles in sepsis patients reveals that extracellular histones are strongly elevated in nonsurvivors. *Mediators of Inflammation*, Mar 17,2021:8395048. <https://doi.org/10.1155/2021/8395048>

Fendl, B., Weiss, R., Eichhorn, T., Linsberger, I., Afonyushkin, T., Puhm, F., Binder, C.J., Fischer, M.B., Weber, V. (2021) Extracellular vesicles are associated with C-reactive protein in sepsis. *Scientific Reports*, Mar 26,11(1):6996. <https://doi.org/10.1038/s41598-021-86489-4>

Huber, S., Knoll, M.A., Berkold, M., Würzner, R., Brindlmayer, A., Weber, V., Posch, A.E., Mrazek, K., Lepuschitz, S., Ante, M., Beisken, S., Orth-Höller, D., Weinberger, J. 2021: Genomic and pheno-typic analysis of linezolid-resistant *Staphylococcus epidermidis* in a tertiary hospital in Innsbruck, Austria. *Microorganisms*, May 10,9(5):1023. <https://doi.org/10.3390/microorganisms9051023>

Karuthedom George, S., Lauková, L., Weiss, R., Semak, V., Fendl, B., Weiss, V.U., Steinberger, S., Allmaier, G., Tripisciano, C., and Weber, V. (2021): Comparative analysis of platelet-derived extra-cellular vesicles using flow cytometry and nanoparticle tracking analysis. *International Journal of Molecular Sciences*, Apr 7,22(8):3839. <https://doi.org/10.3390/ijms22083839>

Pilecky, M., Závorka, L., Arts, M.L., and Kainz, M.J. (2021): Omega-3 PUFA Profoundly affect neural, physiological, and behavioral competences – Implications for systemic changes in trophic interactions. *Biological Reviews Cambridge Philosophical Society*, May 20. <https://doi.org/10.1111/brv.12747>

Rock G, Weber V, Stegmayr B. (2021): Therapeutic plasma exchange (TPE) as a plausible rescue therapy in severe vaccine-induced immune thrombotic thrombocytopenia. *Transfusion and Apheresis Sciences*, May 28:103174. <https://doi.org/10.1016/j.transci.2021.103174>

Pasztorek, M., Mrazova, D., Rossmanith, E., Walzer, S., Rauscher, S., Gröger, M., Weber, V., Rychtarikova-Stysova, R., Stys, D. and Fischer, M.B. (2021): Stress fiber formation, mitochondrial morphology and membrane properties of human mesenchymal stem cells cultured in plastic adherence or in spherical aggregates. *Journal of Regenerative Medicine*, 10(1). doi: 10.37532/jrgm.2021.10(1).171. [https://doi:10.37532/jrgm.2021.10\(1\).176](https://doi:10.37532/jrgm.2021.10(1).176)

HAHN-SCHICKARD

Mitsakakis, K. Novel lab-on-a-disk platforms: a powerful tool for molecular fingerprinting of oral and respiratory tract infections. (2021): Expert Rev. Mol. Diagn., 1-4. DOI: 10.1080/14737159.2021.1920400

Bostanci, N., Mitsakakis, K., Afacan, B., Bao, K., Johannsen, B., Baumgartner, D., Müller, L., Kotoľová, H., Emingil, G., Karpíšek, M. (2021): Validation and verification of predictive salivary biomarkers for oral health. Sci. Rep., 11, 6406. DOI: 10.1038/s41598-021-85120-w

Paqué, P.N., Herz, C., Wiedemeier, D.B., Mitsakakis, K., Attin, T., Bao, K., Belibasakis, G.N., Hays, J.P., Jenzer, J.S., Kaman, W.E., Karpíšek, M., Körner, P., Peham, J.R., Schmidlin, P.R., Thurnheer, T., Wegehaupt, F.J., Bostanci, N. (2021): Salivary Biomarkers for Dental Caries Detection and Personalized Monitoring. J. Pers. Med., 11(3), 235. DOI: 10.3390/jpm11030235

INSTITUTE FOR MEDICAL RESEARCH AND OCCUPATIONAL HEALTH (IMI)

Murugadoss, S., Vinković Vrček, I., Pem, B., Jagiello, K., Judzinska, B., Sosnowska, A., Martens, M., Willighagen, E.L., Puzyn, T., Dusinska, M. et al. (2021) A strategy towards the generation of testable adverse outcome pathways for nanomaterials. ALTEX-Alternatives to Animal Experimentation. <https://doi.org/10.14573/altex.2102191>

Opačak, S., Babić, D., Perić, B., Marinić, Ž., Smrečki, V., Pem, B., Vinković Vrček, I., Kirin, S.I. (2021) A ferrocene-based pseudopeptide chiroptical switch. Dalton transactions, 13, 4504-4511. <https://doi.org/10.1039/D1DT00508A>

Murugadoss S, Vinković Vrček I, Pem B, Jagiello K, Judzinska B, Sosnowska A, Martens M, Willighagen EL, Puzyn T, Dusinska M, Cimpan MR, Fessard V, Hoet PH (2021). A strategy towards the generation of testable adverse outcome pathways for nanomaterials. ALTEX - Alternatives to animal experimentation. doi: 10.14573/altex.2102191.

JOANNEUM RESEARCH

Proksch, A., Smolka, M., Haase A., Nees D., Ruttloff, St., Goetz, J., Wolf, Ch., Hierschlager B., Katzmayer, I., Sonnleitner, M., Stadlober, B., Hesse, J. Lab on a foil devices with integrated retro reflective structures for multiplexed DNA testing Pelin Toren. Accepted: 4 May 2021, MRS Advances. <https://doi.org/10.1557/s43580-021-00064-7>

KNOW-CENTER

Lovrić, M., Malev, O., Klobučar, G., Kern, R., Liu, J. J., & Lučić, B. (2021). Predictive Capability of QSAR Models Based on the CompTox Zebrafish Embryo Assays: An Imbalanced Classification Problem. *Molecules*, 26(6), 1617. <https://doi.org/10.3390/molecules26061617>

Lovrić, M., Pavlović, K., Žuvela, P., Spataru, A., Lučić, B., Kern, R., & Wong, M. W. (2021). Machine learning in prediction of intrinsic aqueous solubility of drug-like compounds: Generalization, complexity, or predictive ability? *Journal of Chemometrics*, e3349. <https://doi.org/10.1002/CEM.3349>

Lovrić, M., Banić, I., Lacić, E., Pavlović, K., Kern, R., & Turkalj, M. (2021). Predicting Treatment Outcomes Using Explainable Machine Learning in Children with Asthma. *Children*, 8(5), 376. <https://doi.org/10.3390/children8050376>

PARACELSUS MEDICAL UNIVERSITY (PMU)

Atta, G., Schroedl, F., Kaser-Eichberger, A., Spitzer, G., Traweger, A., Heindl, L. M., & Tempfer, H. (2021). Scleraxis expressing scleral cells respond to inflammatory stimulation. *Histochem Cell Biol.* <https://doi.org/10.1007/s00418-021-01985-y>

Heindl, L. M., Trester, M., Guo, Y., Zwiener, F., Sadat, N., Pine, N. S., Pine, K. R., Traweger, A., & Rokohl, A. C. (2021). Anxiety and depression in patients wearing prosthetic eyes. *Graefes Arch Clin Exp Ophthalmol*, 259(2), 495-503. <https://doi.org/10.1007/s00417-020-04908-0>

Wang, T., Wagner, A., Gehwolf, R., Yan, W., Passini, F. S., Thien, C., Weissenbacher, N., Lin, Z., Lehner, C., Teng, H., Wittner, C., Zheng, Q., Dai, J., Ni, M., Wang, A., Papadimitriou, J., Leys, T., Tuan, R. S., Senck, S., Snedeker, J. G., Tempfer, H., Jiang, Q., Zheng, M. H., & Traweger, A. (2021). Load-induced regulation of tendon homeostasis by SPARC, a genetic predisposition factor for tendon and ligament injuries. *Sci Transl Med*, 13(582). <https://doi.org/10.1126/scitranslmed.abe5738>

PROFACTOR

Muehlberger, M., Ruttloff, S., Nees, D., Moharana, A., Belegatis, M. R., Taus, P., ... Fechtig, D. (2021). Nanoimprint Replication of Biomimetic, Multilevel Undercut Nanostructures. *Nanomaterials*, 11(4), 1051. doi:10.3390/nano11041051

Taus, P., Prinz, A., Wanzenboeck, H. D., Schuller, P., Tsenov, A., Schinnerl, M., ... Muehlberger, M. (2021). Mastering of NIL Stamps with Undercut T-Shaped Features from Single Layer to Multi-layer Stamps. *Nanomaterials*, 11(4), 956. doi:10.3390/nano11040956

Prinz, I., Haslinger, M. J., Mühlberger, M., Reiter, G., Prinz, A., Schmidt, M. M., Schaller, T., Bauer, M., Musso, M., & Bauer, G. (2021). Industrial view of plasmonic devices made by nanoimprint or injection molding. *Journal of Applied Physics*, 129(13), 130902. <https://doi.org/10.1063/5.0039152>

Prajzler, V., Chlupaty, V., Kulha, P., Neruda, M., Kopp, S., & Mühlberger, M. (2021). Optical Polymer Waveguides Fabricated by Roll-to-Plate Nanoimprinting Technique. *Nanomaterials*, 11(3), 724. doi:10.3390/nano11030724

Brueckl, H., Shoshi, A., Schrittwieser, S., Schmid, B., Schneeweiss, P., Mitteramskogler, T., Haslinger, M. J., Muehlberger, M., & Schotter, J. (2021). Nanoimprinted multifunctional nanoprobe for a homogeneous immunoassay in a top-down fabrication approach. *Scientific Reports*, 11(1), 6039. <https://doi.org/10.1038/s41598-021-85524-8>

Guillén, E., Krause, M., Heras, I., Rincón-Llorente, G., & Escobar-Galindo, R. (2021). Tailoring Crystalline Structure of Titanium Oxide Films for Optical Applications Using Non-Biased Filtered Cathodic Vacuum Arc Deposition at Room Temperature. *Coatings*, 11(2), 233. doi:10.3390/coatings11020233

TECHNISCHE UNIVERSITÄT WIEN

Y. Suchorski, J. Zeininger, S. Buhr, M. Raab, M. Stöger-Pollach, J. Bernardi, H. Grönbeck, View G. Rupprechter (2021). Resolving multifrequential oscillations and nanoscale interfacet communication in single-particle catalysis. *Science* 18 Jun 2021:Vol. 372, Issue 6548, pp. 1314-1318. DOI: [10.1126/science.abf8107](https://doi.org/10.1126/science.abf8107)

J. Göhring et al., Temporal analysis of T-cell receptor-imposed forces via quantitative single molecule FRET measurements, *Nature Communications* 12, 2502 (2021), opens an external URL in a new window. <https://doi.org/10.1038/s41467-021-22775-z>

C. Ellenberger et al., A Microfluidic Multisize Spheroid Array for Multiparametric Screening of Anti-cancer Drugs and Blood-Brain Barrier Transport Properties, *Adv. Sci.* 2021, 2004856., opens an external URL in a new window. <https://doi.org/10.1002/advs.202004856>

UNIVERSITY OF GRAZ

S. Berg-Johansen, M. Neugebauer, A. Aiello, G. Leuchs, P. Banzer, and C. Marquardt, Microsphere kinematics from the polarization of tightly focused nonseparable light, *Opt. Express* 29, 12429-12439 (2021); <https://doi.org/10.1364/OE.419540>

K. M. Fürpaß, L. M. Peschel, J. A. Schachner, S. M. Borisov, H. Krenn, F. Belaj, and N. C. Mösch-Zanetti, Vapochromism and Magnetochemical Switching of a Nickel(II) Paddlewheel Complex by Reversible NH₃ Uptake and Release, *Angew. Chem. Int. Ed.*, 60,13401–13404 (2021); <https://doi.org/10.1002/anie.202102149>

M. Stücker, L. Weissitsch, S. Wurster, H. Krenn, R. Pippan, A. Bachmaier, Sampling the Cu-Fe-Co phase diagram by severe plastic deformation for enhanced soft magnetic properties, *J. Mat. Res. & Technology*, 12, 1235-1242 (2021); <https://doi.org/10.1016/j.jmrt.2021.03.073>

M. Gößler, S. Topolovec, H. Krenn, and R. Würschum, Nanoporous Pd₁–xCox for hydrogen-intercalation magneto-ionics, *APL Mater.*, 9, 041101-8 (2021); <https://doi.org/10.1063/5.0039136>

G. Klinser, H. Krenn, and Roland Würschum, Operando Monitoring of Charging Processes in Battery Cathodes by Magnetometry and Positron Annihilation, *Materials Science Forum*, 1016, 1647-52 (2021); <http://doi.org/10.4028/www.scientific.net/msf.1016.1647>

M. Stücker, C. Teichert, A. Matkovi, H. Krenn, L. Weissitsch, S. Wurster, R. Pippan, A. Bachmaier, On the magnetic nanostructure of a Co-Cu alloy processed by high-pressure torsion, *J. Sci: Adv. Mat. and Devices.*, 6. 33-41 (2021), <http://doi.org/10.1016/j.jsamd.2020.09.013>

Book Chapter: R. Nuster and G. Paltauf, Photoacoustic Imaging, in *Imaging Modalities for Biological and Preclinical Research: A Compendium*, Volume 2, Chapter 3, IOP Publishing (2021); <https://doi.org/10.1088/978-0-7503-3747-2ch3>

Book: M. Chekhova and P. Banzer, *Polarization of Light in Classical, Quantum, and Nonlinear Optics*, De Gruyter, ISBN: 9783110668018 (2021); <https://www.degruyter.com/document/isbn/9783110668025/html>

INISS-NANO – CONCEPT PAPER PUBLISHED

2ND MEETING OF THE WORK GROUP



Together with colleagues from around the globe and under the lead of BNN (in the frame of NanoSyn2 project), the development of the international network initiative on safe and sustainable nanotechnologies – INISS-nano – has moved forward. This global collaboration shall ensure to further support the community, fostering the uptake and integration of the methods and concepts developed within the nanosafety field, and thus to enable to maximize the impact of nanosafety-achievements as well as further develop it towards SSbD, addressing the challenges along different value chains.

Following the decisions made at the EU-Asia dialogue that took place on October 7th, 2020, and based on the first meeting in December 2020, now, during the 2nd (virtual) preparation meeting on April 9th 2021, INISS-nano has matured itself towards a global collaboration initiative, described in a jointly created concept paper: <http://doi.org/10.5281/zenodo.5004929>.

This concept paper is meant to prepare the ecosystem for global collaboration in fields of action, so called pillars, dedicated to **harmonisation, support industrial understanding, sharing/facilitate sharing of resources/infrastructures, and ethical aspects** (other pillars might appear at a later stage), enabling “collaboration without borders” within joint projects, joint funding initiatives, and any fur-

ther way of cooperation. The concept paper is open for comments which shall be sent in before August 17th, 2021.

Comments, contributions and remarks that are meant to support INISS-nano are highly welcome and shall be sent to the corresponding author: andreas.falk@bnn.at

NanoSyn²

FUNDED BY

Federal Ministry
Republic of Austria
Climate Action, Environment,
Energy, Mobility,
Innovation and Technology

Lead and Coordination of INISS-nano NanoSyn2 is funded by the Federal Ministry of Republic of Austria, Climate Action, Environment, Energy, Mobility, Innovation and Technology

BNN and further NanoFabNet-project partners LNE, CEITEC, AcumenIST contributed to specific pillars of the concept paper.



NanoFabNet



NanoFabNet project has received funding from the European Union’s HORIZON 2020 research and innovation programme under grant agreement n° 886171.

Project presentations

EU H2020 FET OPEN PROJECT BREADCELL



Upgrading of cellulose fibers into porous materials

What is BreadCell about? What are its objectives?

The H2020 funded project BreadCell officially started on April 1st, 2021, for a four-years period and with a budget of 3 million EUR.

The major challenge to reduce consequences of climate change, microplastic pollution and raw material shortages is to convert our economic system. We need to replace fossil-based resources by renewable ones, replace persistent materials by biodegradables while developing and employing environmentally friendly processing technologies to create safe products with minimum impact on the environment. A real impact on economy, society and ecology is only generated if the materials, processes and products to be replaced are in large scale.

In BreadCell, we develop a radically new technology to produce porous lightweight low-density materials which are currently used in large scale industries and mainly consist of synthetic non-degradable polymers. BreadCell technology comprises a foaming process to create products relying on existing and new raw materials from pulping (cellulose, xylan), and to convert them to high value, lightweight, energy-absorbing and load-transferring composites, with application in sports and safety components of cars.

The whole process chain will be guided by safe and sustainable-by-design principles to ensure the production of sustainable and inherently safe products.

Today, the innovation capacity of European scientists and industry in the area of renewable materials makes them already the leading global players in the field. We will provide a scalable technology that will further support the European technological leadership in the area by cross-fertilization of different fields (pulp and paper, biotechnology, polymer technology, toxicity) while addressing needs of future materials.

Who are BreadCell`s beneficiaries?

- ✓ CHALMERS UNIVERSITY OF TECHNOLOGY (Project Coordinator, Sweden)
- ✓ BIONANONET FORSCHUNGSGESELLSCHAFT MBH (Austria)
- ✓ FUNDACION TECNALIA RESEARCH & INNOVATION (Spain)
- ✓ GRAZ UNIVERSITY OF TECHNOLOGY (Austria)
- ✓ UNIVERSITY OF VIENNA (Austria)

Role of BNN in BreadCell project:

BNN will screen and conceptualize safety and sustainability assessments of the developed Bread-Cell technology. Safety aspects will be evaluated regarding the manufacturing process and the resulting foam, while sustainability-related considerations will cover the environmental, social and economic dimension. Moreover, BNN will actively support Dissemination and Exploitation activities.

Contact

Chalmers University of Technology

Tiina NYPELÖ

tiina.nypelo@chalmers.se



This project has received funding from the European Union's HORIZON 2020 research and innovation programme under grant agreement n° 964430.

Get connected with BreadCell on:

[SEE WEBSITE](#)

[→ TABLE OF CONTENTS](#)

EU H2020 FET OPEN PROJECT DEDNAED

DeDNAed – Cluster decorated recognition elements on DNA origami for enhanced Raman spectroscopic detection methods



What is DeDNAed about? What are its objectives?

DeDNAed started on March 1st, 2021 with a duration of 36 months. The project „DeDNAed“ intends to develop a novel, innovative biosensing platform whose advantages and benefits are in terms of sensitivity, versatility and being ultrafast by an optical approach. Our platform will be based on the assembly and integration of sensing elements (transducer and bioreceptor) by DNA origami. The DNA origami will serve as a “nano breadboard” in order to precisely control the position of these elements and thus the sensor architecture at the nanometer scale.

Metallic atomic clusters are integrated into a biological marker molecule (DNA or antibody) and thus represent the biological sensor element. This is specifically integrated into a nanoarray made of additional metallic nanoparticles precisely controlled by a DNA ori-

gami template and will lead to a significant increase in signal. DNA origami serves as an individually inter- and intramolecularly programmable “nano breadboard”. A DNA origami consists of a single strand of DNA, folded by a thermal treatment and certain staple strands into any shapes (2D as well as 3D, dimensions of approx. 100 nanometers). So-called „sticky ends“ on the surface of the DNA origami offer the possibility of an individual implementation of the sensing elements and nanoparticles, by means of correspondingly complementary oligonucleotides with a resolution of approx. 2 nm. When the analyte binds to the sensor element, a change in the Raman signal can be detected without major delay using surface-enhanced Raman spectroscopy (SERS). This sensor method is not limited to a specific biomarker molecule for the sensor element, but can be transferred to different marker molecules. This results in a high degree of flexibility in the area of application, reaching from

medical technology to food monitoring. In addition, a transfer of the DNA origami-based sensor platform to flexible, textile substrates will be developed using lipid bi-layers and the Langmuir-Blodgett method for later use as a wipe test or medical wearable.

Who are DeDNAed's beneficiaries?

Seven beneficiaries from four different countries collaborate in the DeDNAed project:

- ✓ TECHNISCHE UNIVERSITÄT CHEMNITZ (Project Coordinator, Germany)
- ✓ ASOCIACION CENTRO DE INVESTIGACION COOPERATIVA EN BIOMATERIALES-CIC biomaGUNE (Spain)
- ✓ KURT-SCHWABE-INSTITUT FÜR MESS- UND SENSORTECHNIK MEINSBERG EV (Germany)
- ✓ UNIVERSITÉ DU MANS (France)
- ✓ UNIVERSITÄT POTSDAM (Germany)
- ✓ FUNDACION TECNALIA RESEARCH & INNOVATION (Spain)
- ✓ BIONANONET FORSCHUNGSGESELLSCHAFT MBH (Austria)

DeDNAed Kick-off meeting

The DeDNAed Kick-off meeting took place virtually due to the ongoing SARS-COV-2 pandemic, on March 18th, 2021. The meeting allowed all partners of the consortium to start good relationships among them. All partners were provided with general information about the project and about the administrative and management procedures that will be followed during project execution. Additionally, the partners had fruitful discussions about the scientific work to be carried out in each work package. DeDNAed's kick-off meeting was the first step for a successful execution of this FET OPEN project.

BNN's role in the DeDNAed project

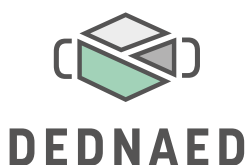
Within DeDNAed, BNN will be engaged in Dissemination and Exploitation tasks, such as constructing and maintaining the project's website as well as preparing and implementing the dissemination strategy. Moreover, BNN will be involved in the Coordination and Management of the project, for instance with the development of the project quality plan. Finally, BNN will develop a Safe-by-Design concept, considering nano- and biosafety aspects.

Contact

Technische Universität Chemnitz- Zentrum für Mikrotechnologien

Danny REUTER

info@dednaed.eu



This project has received funding from the European Union's HORIZON 2020 research and innovation programme under grant agreement n° 964248.

Get connected with DeDNAed on:

[SEE WEBSITE](#)



EU H2020 PROJECT DIAGONAL

Development and scaled Implementation of sAfe by design tools and Guidelines for multicOmponent aNd hArn nanomaterials



Participants of DIAGONAL Kick-Off-Meeting on 4th May

On May 4th, 2021, the brandnew H2020 EU project DIAGONAL was officially kicked-off. High-level experts from 22 international organisations committed to collaborate for a period of 42 months, with a total project budget of more than € 6 million. The newly funded research and innovation action addresses nanosafety issues of the next generation of nanomaterials, such as complex mixtures and multicomponent materials, and how to expand the Safe-by-Design concept towards sustainability to allow not only safe but also sustainable nanotechnology applications.

DIAGONAL aims to bring Safe-by-Design knowledge and tools to a development stage which can be implemented in the multicomponent nanomaterials (MCNMs) and high aspect ratio nanomaterials (HARNs) related industries, relying on experimental (in-vitro) and modelling (in-silico) research, to study specific hazard and exposure properties that MCNMs & HARNs exhibit along their life cycle, with emphasis in the interactions between nanomaterial constituents, with other particles and the environment, as well as their release rate and fate. While hazard and exposure de-

termination will allow gaining understanding on the MCNMs & HARNs behavior and evolution, multi-scale modelling will answer the questions „what are they?“ and „where do they go?“, through novel predictors for properties estimation, resulting from additive and/or synergistic interactions between components, as well as system-dependent properties. Ultimately, the obtained results will serve as basis to provide adapted or novel risk management guidelines, ready to use Safe-by-Design tools and strategies to increase nanomaterials safety, including Sustainable-by-Design considerations, and recommendations for risk governance.

7 industrial cases producing or using MCNMs/ HARNs will participate providing data from scaled up scenarios, validating models, and implementing the novel Safe-by-Design approaches and tools developed in the project. Exploitation activities and connection with Open Innovation Test Beds will allow mainstreaming Safe-by-Design among targeted industries.

DIAGONAL partners are involved in current R&D projects (e.g., NMBP-12-2017, NMBP-13-2018, NMBP-14-2018, NMBP-15-2019), networks (e.g., NanoSafety Cluster and EMMC) and working groups (e.g., OECD - WPMN and BNCT). The project will establish cooperation lines with the US nanosafety research community involving a US partner and integrating renowned US institutions on its advisory board, guaranteeing resource-efficient working plans, aligned with current EU and international efforts in the nanosafety field, and facilitating the use of existing reference platforms and databases.

Who are DIAGONAL's beneficiaries?

- ✓ UNIVERSIDAD DE BURGOS as project coordinator, Spain and 21 project organizations:
- ✓ BIONANONET FORSCHUNGSGESELLSCHAFT MBH (Austria)
- ✓ **BRIMATECH SERVICES GMBH (Austria)**
- ✓ CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS (France)
- ✓ CREATIVE NANO PC (Greece)
- ✓ GRAPHENE-XT SRL (Italy)
- ✓ IDRYMA TECHNOLOGIAS KAI EREVNAS (Greece)
- ✓ INSTITUTO DE SOLDADURA E QUALIDADE (Portugal)
- ✓ INSTITUTO TEC
- ✓ IRIS SRL (Italy)
- ✓ IZES GGMBH (Germany)
- ✓ **LUXEMBOURG INSTITUTE OF SCIENCE AND TECHNOLOGY (Luxembourg)**
- ✓ MONOLITHOS KATALITES KE ANAKIKLOSI ETAIREIA PERIORISMENIS EVTHINIS (Greece)
- ✓ NOLOGICO DEL EMBALAJE, TRANSPORTE Y LOGISTICA (Spain)
- ✓ **NOVAMECHANICS LIMITED (Cyprus)**
- ✓ NEOVILI SA (Switzerland)
- ✓ OCSIAL EUROPE SARL (Luxembourg)
- ✓ PHORNANO HOLDING GMBH (Austria)

- ✓ QSAR LAB SPOLKA Z OGRANICZONA ODPOWIEDZIALNOSCIA (Poland)
- ✓ RINA CONSULTING - CENTRO SVILUPPO MATERIALI SPA (Italy)
- ✓ TEKNOLOGISK INSTITUT (Denmark)
- ✓ VIREO ADVISORS LLC (United States)
- ✓ WAGENINGEN UNIVERSITY (Netherlands)

All partner organizations marked bold are BioNanoNet members!

Role of BNN

As WP2 leader, BNN ensures efficient and successful liaisons with other relevant projects, networks and clusters, as well as, appropriate and timely stakeholder engagement. Next to that, BNN supports to integrate sustainability aspects into the Safety-by-Design concept. Moreover, BNN develops the overall communication & dissemination strategy.

Contact

ICCRAM – UNIVERSIDAD DE BURGOS, Spain

Juan Antonia TAMAYO RAMOS

jatramos@ubu.es

www.ubu.es/iccram



This project has received funding from the European Union's HORIZON 2020 research and innovation programme under grant agreement n° 953152.

Get connected with DIAGONAL on:



EU H2020 MSCA ITN PROJECT DIRNANO



Directing the Immune Response through designed NANOMaterials

“The immune system, and especially the innate one, may be an inflexible enemy of nanomedicine. However, if we know how our enemy thinks, we can direct its action and even use its power to our advantage.”

The H2020 funded project DIRNANO which stands for “Directing the immune response through designed nanomaterials” officially started on October 1st, 2020, for a four-years period and with a budget of more than 4 million EUR.

The full therapeutic potential of nanomedicines is unfulfilled due to opposing interactions with body’s defenses and adverse immune reactions. Overcoming these obstacles requires a comprehensive understanding of nanomaterials-host interplay and an extensive animal model testing.

This project responds to such need by developing strategies to map, study, modulate and exploit nanoparticle (NP)-immune interactions through core state-of-the-art approaches. These include:

- 1) inception of novel, but simple, coating engineering based on new organic polymers and conjugation chemistry, rational polymer pairing and zwitterionic lipids,
- 2) engineering (with a green-chemistry approach) of libraries of host or microbial derived modulators of the innate immunity (particularly of the complement system) and

3) designing and preclinical testing of next generation therapeutic nanovaccines (i. e. NPs with optimized multivalent neo-antigen presentation and immunostimulatory cues) and immunomodulating NPs directly targeting tumor cells or immune suppressive cells.

The DIRNANO’s core-scientific training is focused on gross structure-activity profiling, integrating interfacial and chemical sciences with systems immunology for mapping of dynamic host and interfacial factors that regulate NP performance. This approach will lead to rational engineering of libraries of on-demand NPs with tunable immune modulating functions (exemplified in the pictogram). Moreover, the combinatorial analysis of NP core-coat scaffold will improve our temporal and spatial understanding of biomaterial-innate immune interactions at a deeper molecular level, and potentially fill the void in overcoming adverse injection reactions to nanopharmaceuticals in sensitive individuals.

The participating teams comprise internationally renowned scientists and industrialists at the forefront of nanomedicine, immune safety, pharmaceutical sciences, green chemistry, commerce and business, where many of the participants have a proven record of accomplishment and working with each other. The program provides an integrated and highly interdisciplinary approach for academic and regulatory/business training of next-generation

European Early Stage Researchers (ESRs) having a broader cutting-edge knowledge in translational nanomedicine bioengineering. ESRs will master immune safe-by-design and pharmaceutically viable smart-by-design approaches to lead the development of the future nanopharmaceuticals through a low-risk-high gain perspective.

All-in-all, DIRNANO generates a unique pan-European macro-environment for integrated, advanced and accelerated training and circulation of ESRs through open innovation and outreach activities at the highest international level, thereby contributing to the European socioeconomics and education values, skill retention and brain-gain.

Who we are

DIRNANO Consortium consists of 12 European partners and five participating organizations, coordinated by Prof. Emanuele Papini, Università degli Studi di Padova.

Partner organizations:

- ✓ UNIVERSITÀ DEGLI STUDI DI PADOVA-UNIPD (Italy)
- ✓ UNIVERSITY OF NEWCASTLE UPON TYNE-UNEW (United Kingdom)
- ✓ EIDGENÖSSISCHE MATERIALPRÜFUNGS-UND FORSCHUNGSANSTALT-EMPA (Switzerland)
- ✓ FUNDACION RIOJA SALUD-FRS (Spain)
- ✓ PARIS-LODRON-UNIVERSITÄT SALZ-

BURG-PLUS (Austria)

- ✓ UNIVERSITY OF LINCOLN UOL (United Kingdom)
- ✓ STAB VIDA INVESTIGACAO E SERVICOS EM CIENCIAS BIOLOGICAS LDA-STABV-DA (Portugal)
- ✓ OSLO UNIVERSITETSSYKEHUS HF-OUS (Norway)
- ✓ SUSOS AG (Switzerland)
- ✓ UNIVERSIDAD DE LA RIOJA-UNIRIOJA (Spain)
- ✓ LIPOCOAT BV (Netherlands)
- ✓ UNIVERSITÀ DI VERONA-UNIVR (Italy)

Participating organizations:

- ✓ BIONANONET FORSCHUNGSGESELLSCHAFT (Austria)
- ✓ BIOTALENTUM TUDASFEJLESZTO (Hungary)
- ✓ S. M. DISCOVERY GROUP LIMITED (United Kingdom)
- ✓ UNIVERSIDADE NOVA DE LISBOA (Portugal)
- ✓ MOLECULAR HORIZON SRL (Italy)

BioNanoNet member Prof. Albert Duschl, representing the Allergy Cancer BioNano Research Centre (ACBN) from Paris-Lodron-Universität Salzburg (PLUS) is beneficiary of DIRNANO.

The role of BNN in DIRNANO project is to support as partner organization with training for Safe-by-design aspects, translational safety, regulatory aspects in the nanotech field, networking and governance.

The logo for the DIRNANO project, with the word "DIRNANO" in a bold, red, sans-serif font, followed by a small blue and white circular icon.

Contact

Università degli Studi di Padova
Emanuele PAPINI

emanuele.papini@unipd.it

<https://cordis.europa.eu/project/id/956544>

This project has received funding from the European Union's HORIZON 2020 research and innovation programme under grant agreement n° 956544.

Project updates



ACENANO HOLDS ITS FINAL STAKEHOLDER EVENT



ACEnano coordinator Eva Valsami-Jones presents an overview of the project at the final stakeholder event.

The ACEnano H2020 project held its final stakeholder event on 21st June 2021. This 4 year project (extended to 4.5 years due to the COVID-19 pandemic) has worked to develop analytical techniques for the characterization of nanomaterials for risk assessment. The project has developed analytical knowledge at three levels: (i) innovation in new techniques; (ii) refinement of existing techniques; (iii) benchmarking, performance assessment and standardization of established techniques. The project has developed a range of tools to help users through the process of selecting techniques for their needs. These include a

decision tool for technique selection (based on the NanoDefiner e-tool) and a Knowledge Infrastructure for storage and retrieval of Standard Operating Procedures, performance data from interlaboratory comparisons, and links to video protocols for selected techniques.

The event was intended to provide an overview of the project outcomes for stakeholders, to allow stakeholders to ask questions on the work presented, and to facilitate discussion on how the project outcomes could usefully be used by the nanosafety community and further developed in future projects.

The presentations provided were on:

- ✓ Project overview (Eva Valsami-Jones, Co-ordinator, University of Birmingham);
- ✓ Analytical method development (Frank von der Kammer, Vienna University);
- ✓ Method benchmarking and interlaboratory comparisons (Stephen Lofts, UK Centre for Ecology and Hydrology);
- ✓ The ACEnano Toolbox (Decision Tool and Knowledge Warehouse) (Ruud Peters, Wageningen Food Safety Research) and Barry Hardy, Edelweiss Connect);
- ✓ Standardisation activities in ACEnano (Jörg Radnik, Federal Institute for Materials Research and Testing)

Additionally, two members of the ACEnano consortium presented special ‘Highlights’ of the analytical development work done within the project:

- ✓ Florian Meier (Postnova): Automated and reproducible preparation of nanoparticle suspensions using the SP2000 NOVA-PREP – Nano Particle Sample Preparator;
- ✓ Andy Chetwynd (University of Birmingham): An Untargeted TGA-FTIR-GCMS Approach for Plastic Polymer Identification

The event was attended by stakeholders from academia, regulation and industry. Stakeholders generally considered that the project had achieved its stated objectives and that the developed tools were of potential use for stakeholders with interests in nanomaterial analysis for academic, regulatory and risk assessment purposes. Stakeholders emphasized the

need to disseminate the project outcomes to increase their usefulness in related areas such as the development of robust standards and guidelines for nanomaterial characterization, including grouping and read-across approaches in nanotoxicology. Considering future developments, stakeholders emphasized the need for analytical development to focus on robust characterization of nanomaterials in media such as consumer products and the natural environment.

Contact

UK Centre for Ecology & Hydrology
Stephen LOFTS
stlo@ceh.ac.uk
www.ceh.ac.uk

University of Birmingham
Eugenia Èva VALSAMI-JONES
e.valsamijones@bham.ac.uk
www.birmingham.ac.uk



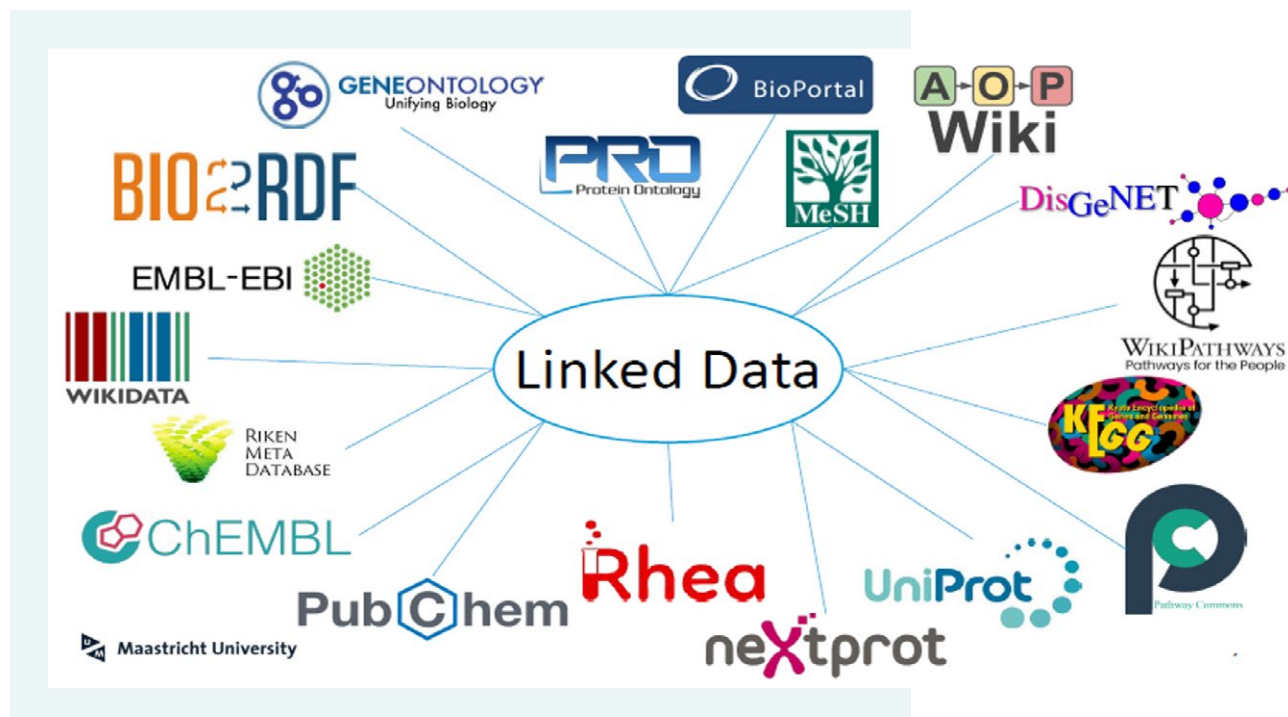
This project has received funding from the European Union’s HORIZON 2020 research and innovation programme under grant agreement n° 720952.

Get connected with ACEnano on:

[SEE WEBSITE](#)



ONLINE SPARQL ACCESS TO WIKIPATHWAY AND AOP-WIKI WEBINAR



On Tuesday, 23rd March 2021, the H2020 projects [NanoCommons](#) and [NanoSolveIT](#), in a joint initiative with the [NanoSafety Cluster](#) (NSC), organised an online webinar on “Online SPARQL Access to linked data”, explaining the use of linked data resources such as WikiPathways and AOP-Wiki. The webinar was run by [Ammar Ammar](#) and [Marvin Martens](#), from the [BiGCaT](#) (Department of Bioinformatics, University of Maastricht), The Netherlands.

Under the title “Online SPARQL Access to WikiPathway and AOP-Wiki Webinar”, 40 participants from a mixed audience (academia, industry, regulation, etc.) learned how to use

the SPARQL interface by walking through the various functionalities, and a variety of example queries against the WikiPathways and AOP-Wiki data. Furthermore, federated queries across resources were executed to illustrate the strength of linked data.

At the start a short introduction was given by [Martin Himly](#), Chair of the [WG-A “Education, Training and Communication”](#) of the NSC, on the brand new [NanoCommons User Guidance Handbook](#), where to find the different training materials offered by NanoCommons, and the forthcoming events being organised by NanoCommons.

Following Martin's intro, Ammar and Marvin took the lead of the webinar, guiding the audience through the following topics:

- ✓ Linked Data → Semantic Web Technologies → Life Sciences
- ✓ Introduction to WikiPathways and AOP-Wiki
- ✓ SNORQL User Interface (UI) for SPARQL exploration
- ✓ Brief description of SPARQL
- ✓ Demo of SNORQL UIs of WikiPathways and AOP-Wiki

In regard to linked data the graphic on the previous page represents nicely the potential capacity that arises for research in the field of life sciences from the ability of semantically querying various databases.

In the slide set, which is available at [Zenodo](#), direct access to the RDF or SPARQL endpoints of the displayed databases is provided by simply clicking on their logos. Thereafter, two specific datasets, WikiPathways and AOP-Wiki, were elaborated on in greater detail. Both are open source community resources to contribute and maintain biological information, particularly of interest for systems biology approaches to elucidate mechanisms of toxicological effects.

It was a well attended webinar with active and very interested participants who communicated their appreciation at the end of the webinar for the high interactivity and the gained skills. The webinar presentation slides and the recording (recorded for educational purposes) are available in the [NanoCommons Infrastructure](#)

[ture](#), in [Zenodo](#), [YouTube](#) and in the [NanoCommons' Elixir TeSS channel](#).

Role of BNN: BNN takes care of leading the Work Package on "Integration & Sustainability".

BioNanoNet member [PLUS](#) (Martin Himly, martin.himly@sbg.ac.at) takes care of all Training activities within NanoCommons and is chair of the EU NanoSafety Cluster - Work Group A on Education, Training, and Communication.



This project has received funding from the European Union's Horizon 2020 programme under grant agreement n° 731032.

Get connected with NanoCommons on:



[SEE WEBSITE](#)



This project has received funding from the European Union's Horizon 2020 programme under grant agreement n° 814572.

Get connected with NanoSolveIT on:



[SEE WEBSITE](#)

SBD4NANO FIRST YEAR'S PROGRESS & ACHIEVEMENTS



SbD4Nano partners show great progress during their 1st annual meeting held virtually in May 2021



On 19th - 20th May the SbD4Nano project successfully held their Annual Consortium Meeting virtually. The project partners presented an overview of the results obtained during the last 12 months.

Key objective of the project is the development of an e-infrastructure to foster dialogue and collaboration between actors along the nanotechnology supply chain for a know-

ledge-driven definition of Safe-by-Design approaches based on hazard, exposure, product performance and cost criteria. During the meeting the draft design of the platform was presented followed by a discussion of the provisioned modules of the platform including materials, life cycle assessment, release & exposure estimation, safety and hazard profiling and SbD strategy modules.

Interactive discussions with industrial partners allowed the consortium to confirm and discuss key results from the recently completed SAbYNA & SbD4Nano Nanotechnology value chain needs survey.

SbD4Nano Project Coordinator, Carlos Fito says: “The project developments over the last year have exceeded my expectations. In future SbD4Nano is expected to make a significant impact for the safe manufacturing and use of ENMs via its e-infrastructure. We look forward to sharing it with stakeholders.”

The SbD4Nano Videos

The SbD4Nano project contributed with a video pitch to the EuroNanoForum 2021. The video is available to watch on the NSC [YouTube](#) channel.

We also remind you about the SbD4Nano project overview video! Want to learn what SbD4Nano is about in 3 minutes? Watch our [video](#)!

Get connected with SbD4Nano on:



[SEE WEBSITE](#)

[→ TABLE OF CONTENTS](#)



Contact

Yordas Group
Stella STOYCHEVA (SbD4Nano Project Communication)
s.stoycheva@yordasgroup.com



This project has received funding from the European Union's HORIZON 2020 research and innovation programme under grant agreement n° 862195.

CUTTING-EDGE SCIENCE WITHIN THE PHARMACEUTICAL OPEN-INNOVATION TEST BED PHOENIX



In nowadays medical arena, nano-pharmaceuticals and nano-sized tools are used for the diagnosis, prevention and the treatment of diseases. Nano-pharmaceuticals have the potential to drive the scientific and technological uplift offering great clinical and socio-economic benefits to the society in general, as well as industry and other key stakeholders of the health sector. Affordable and advanced testing, manufacturing facilities and services for novel nano-pharmaceuticals to reach the clinics are main prerequisites for successful implementation of these advances to further enhance the growth and innovation capacity.

Framed within this challenge, the recently kicked-off H2020 EU-Project PHOENIX aims to contribute and tackle exactly those prerequisites by enabling seamless, timely and cost-friendly transfer of nano-pharmaceuticals from lab bench to clinical trials and providing the necessary advanced, affordable and easily accessible knowledge, services and facilities for it. PHOENIX-OITB will offer a single entry-point for a consolidated network of facilities, technologies, services and expertise for all the technology transfer aspects from characterization, testing, verification up to scale-up, GMP compliant manufacturing and regulato-

ry guidance. As an innovation action, PHOENIX is focused and devoted to serve industry, providing the latest State-of-the-Art scientific knowledge around scale-up and manufacturing of nano-pharmaceuticals. To do so, PHOENIX counts with high-level experts from different countries including research organizations that ensure cutting-edge research implementation into the offered services. Taking a closer look at the research organizations participating in PHOENIX-OITB and their specific roles, PHOENIX builds on:

1. An organization expert in the fields of materials, environment and informatics, the [Luxembourg Institute of Science and Technology \(LIST\)](#). More specifically, its Environmental Research and Innovation (ERIN) Department provides a broad interdisciplinary knowledge and expertise to confront major environmental challenges. The Environmental Health unit within the ERIN Department and the team led by Prof. Dr. Arno C. Gutleb contributes by developing complex in vitro models for human safety, among others 3D in vitro models for the lung (alveolar region) and the small intestine, development of alternative testing strategies for nanomaterials, human and environmental risk assessment and eco-toxicology. Within PHOENIX, LIST provides services and expertise for in vitro safety on nanodrugs.

2. The [Institute for Medical Research and Occupational Health \(IMROH\)](#) which is the second largest public research institution in Croatia. It integrates services and products within the analytical, monitoring, toxicological, human safety and consulting sectors. The team of Prof. Ivana Vinković Vrček leads within the project the establishment of the Regu-

latory Support (RS) Department of PHOENIX. The RS team is in charge of developing an effective regulatory strategy to support PHOENIX-OITB activities and services, maintaining at the same time high level of regulatory compliance. Moreover, it will assist end-users to solve questions and requirements related to regulatory requirements of R&D and production of nano-pharmaceuticals, contributing in this way to the shortening of R&D projects timelines and guiding clients to focus on specific hotspots that will help to get their products to the market faster, and balancing efforts and costs. Finally, the RS team is in charge to create a training program for both PHOENIX-OITB services and end-users to ensure the understanding of regulatory compliance and how it impacts on nano-pharmaceuticals development.

3. Next to that, PHOENIX-OITB builds on the expertise and experience of two different groups belonging to two different institutes of the largest public institution dedicated to research in Spain, the [Spanish National Research Council \(CSIC\)](#). Under the leadership of Prof. Jesus Martinez de la Fuente (Instituto de Nanociencia y Materiales de Aragón (INMA)) and in close collaboration with Prof. Nora Ventosa (Instituto de Ciencia de Materiales de Barcelona (ICMAB)), CSIC is in charge of the transfer, assessment and validation of structural and functional characterization methods for nano-pharmaceuticals. This is a must to ensure their quality, efficacy, safety and their clinical launch.

4. To develop a multiscale simulation framework for nanoparticle production processes and use it as a digital simulation tool for pro-

cess design scale-up or optimization, PHOENIX-OITB counts with the [Research Center Pharmaceutical Engineering \(RCPE\)](#). RCPE is a global leader in pharmaceutical engineering sciences that supports to create and manufacture advanced medicines for patients around the world, through optimizing products and processes. RCPE's services encompass the entire value chain of pharmaceutical product development: continuous API synthesis, advanced formulations, next-generation manufacturing, and also device design and optimization. RCPE links outstanding science, application and industry in a business-oriented approach and is a K1 Competence Centre within the COMET program, operated by the Austrian Research Promotion Agency.



Contact

LIST – Luxembourg Institute of Science and Technology

Tommaso SERCHI (Project coordinator)

Tommaso.serchi@list.lu

MyB – MyBiotech GmbH

Nazende GÜNDAY-TÜRELI

(Scientific coordinator)

N.guenday-tuereli@mybiotech.de



This project has received funding from the European Union's HORIZON 2020 research and innovation programme under grant agreement n° 953110.

Get connected with PHOENIX-OITB on:



[SEE WEBSITE](#)

[→ TABLE OF CONTENTS](#)

FIRST DEVELOPMENTS OF SBYDOMA'S TECHNOLOGY – NEW AUDIO-VISUAL MATERIALS ONLINE



A number of short videos were developed by SBYDOMA partners with the aim of showing current technological developments within the project:

✓ [SBYDOMA's pitch video](#) → Short video giving an overview of the EU H2020 project SBY-DOMA. Presenter: Andrew Nelson, Project Coordinator.

✓ [Development of the SBYDOMA “bio-membrane” sensor and “mini-release accelerator”](#) → William Stokes, a researcher from [UNIVLEEDS](#), explains how a nano-material production line is coupled to a bio-membrane screening platform to demonstrate ‘in-line’ screening. The video describes how the bio-membrane sensor is being developed, how it is intended to perform and how it is integrated into the screening platform. It also shows how the coupling to continuous-flow production systems will be delivered.

✓ [Key findings on the Legal Aspects of SbD](#) → Anthony Bochon, from [G&S](#), talks about the key findings of the [1st legal workshop on SbD](#) organised by SBYDOMA on 28th January 2021, where together with international lawyers and scientists, SBYDOMA explored potential definitions of SbD approaches from the legal perspective.

✓ [Development of a Regulatory Sandbox for Nanomaterials](#) → Ignasi Gispert Pi, from [APPNPS](#), talks about SBYDOMA's aim of

developing a Regulatory Sandbox for Nanomaterials under-pinned by Safe- & Sustainability-by-Design (SSbD) methodologies and strategies taking advantage of Computational Models based on Artificial Intelligence (AI). This will offer opportunities to explore and test a regulatory framework capable of delivering effective and efficient oversight of nanomaterials while promoting nano-innovations.

✓ [SBYDOMA's 'In-line' Toxicity Screening of Nanomaterials](#) → Thorsten Knoll, from [Fraunhofer IBMT](#), explains how the SBYDOMA project is developing ‘In-line’ Toxicity Screening of Nano-materials, where in vitro toxicity testing procedures are aligned with on-line production process of nanomaterials to enable safer manufacturing of nanomaterials.



This project has received funding from the European Union's HORIZON 2020 research and innovation programme under grant agreement n° 862296.

Get connected with SBYDOMA on:



[SEE WEBSITE](#)

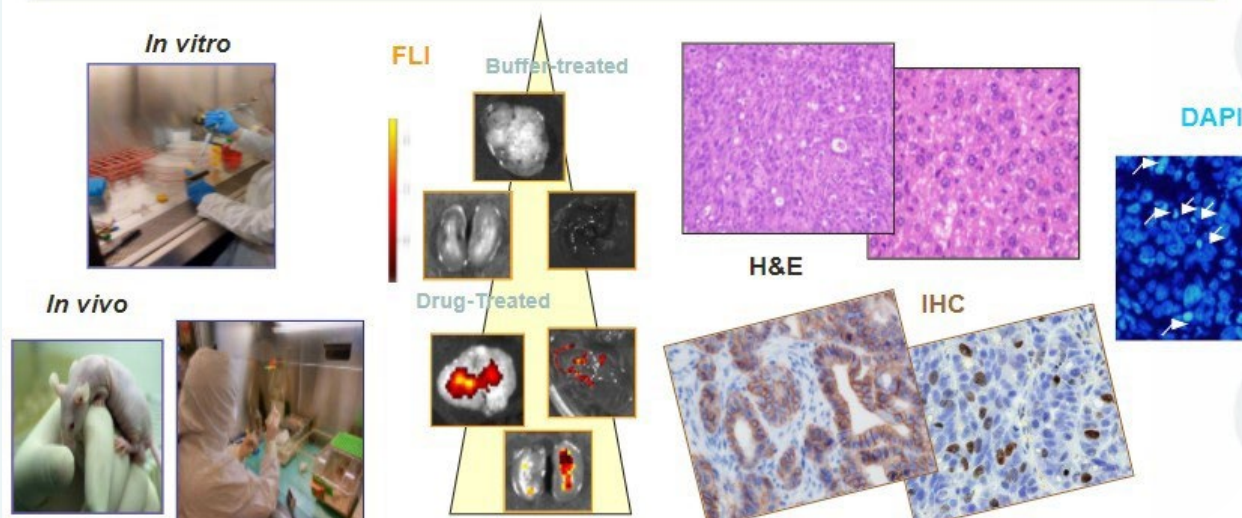
BioNanoNet Member Contributions

CONTRIBUTION FROM CIBER-BBN

ciber-bbn isciiii

The Need to Determine the Therapeutic Window of Novel Targeted Anticancer Nanomedicines

➤ Evaluation of toxicity of new drugs, nanoparticles or nanotechnology-based biomaterials in *in vitro* and *in vivo* systems



The Nanotoxicology Unit of CIBER-BBN and ICTS NANBIOSIS, led by Ramón Mangués at the Research Institute of the Hospital de Sant Pau is devoted to evaluating effectiveness and toxicity of novel nanoparticles. This Unit advises clients on the need to study simultaneously anticancer activity and associated toxicity. Thus, preclinical evaluation of novel Nanomedicines is usually carried out performing studies that assess their therapeutic effect, separated from additional ex-

periments devoted to evaluating the toxicity associated with treatment. The dosage used to assess the therapeutic effect, often, significantly differs from the one used to study toxicity, since one is aiming to know the bio-distribution of the nanoparticle and whether it can control cancer growth, whereas the other tries to identify the maximal tolerated dosage that can be achieved without conferring severe toxicity or lethality. However, to maximize the effectiveness of novel nanoparticles in the

pre-clinical assessment and their subsequent clinical translation it is important to consider a crucial point of divergence between nanomedicines and classical low molecular weight drugs.

On the one hand, lipophilic small drug biodistribute by passive diffusion, reaching similar concentration in tumor and non-tumor tissues. Besides, they display a steep dose/effect curve, so that higher doses reach higher anticancer effect (e.g. genotoxic drugs, such as 5-fluorouracil or cisplatin). Nevertheless, this increased effect, obtained intensifying the drug dosage, is achieved at the expense of higher toxicity, that is also dose dependent. In contrast, this situation differs in the case of nanomedicines that use targeted drug delivery, which are capable of selectively concentrating the payload drug delivered by the nanocarrier in target cancer cells, leading to an enhanced uptake in tumor tissue. This effect makes it unnecessary and inefficient to increase the nanomedicine dosage over the one that effectively kill target cells, while maintaining low the associated toxicity. This is because nanomedicines that exploit targeted drug delivery do not have a dose dependent increase in antitumor activity; whereas if administered at high dosage they lose selectivity in their delivery, triggering off-target toxicity, that is likely to be dose-dependent. Thus, increasing the dosage of targeted nanoparticles may increase off-target effects without increasing anticancer effectiveness. In this regard, administering a dosage higher than the

one that reaches optimal therapeutic effect can only lead to unspecific internalization in non-target cells and subsequent toxicity.

Therefore, the evaluation of the tumor and non-tumor tissues biodistribution and the assessment of the therapeutic effect is more informative if at the same time and in the same model the associated toxicity is tested. The testing of various dosage levels will determine which of the evaluated dosage achieves the highest therapeutic window, that is, the one that achieves effective cancer cell killing and optimal antitumor activity without associated toxicity, and the one for which an additional increase in dosage will not improve further the antitumor effect, while increasing instead its toxicity.

For more information [click here](#).

Contact:

Biomedical Research Networking Center Bioengineering, Biomaterials & Nanomedicine Research Area (CIBER-BBN)

Nerea ARGARATE

nargarate@ciber-bbn.es

www.ciber-bbn.es & www.nanbiosis.es

CONTRIBUTION FROM CIBER-BBN



CIBER-BBN researcher Prof. Luis Liz Marzán receives the 2021 Lilly Foundation for Preclinical Biomedical Research Award



From left to right: José Antonio Sacristán del Castillo (Lilly Foundation President), Prof. Luis Liz Marzán y Carlos Simón Val-lés.

Prof. Luis Liz Marzán, group leader at CIBER-BBN, scientific director of the Center for Cooperative Research in Biomaterials - CIC biomAGUNE and professor Ikerbasque, received on 15th June 2021, the Lilly Foundation Award for Biomedical Research 2021 in the category of preclinical research. These awards, which recognize the scientific trajectory of outstanding research that contribute to the development of biomedicine, were presented in a ceremony chaired by the Minister of Science and Innovation, Pedro Duque. Prof. Liz Marzán and his group (BioNanoPlasmonics Lab) have developed a system for detecting the formation of amyloid fibers, responsible for many neurodegenerative diseases such as Parkinson's, based on the phenomenon of plasmonic chirality - in which light interacts in a special way

and have incorporated photoluminescent nanothermometers to photothermal therapy to control laser heating. At present, they are focused on the study of cancer and his line of research is aimed at incorporating nanosensors in 3D tumor constructions in order to identify biomarkers that allow understanding the behavior of the tumor under different conditions.

Contact:

Biomedical Research Networking Center Bioengineering, Biomaterials & Nanomedicine Research Area (CIBER-BBN)

Luis Manuel LIZ MARZÁN

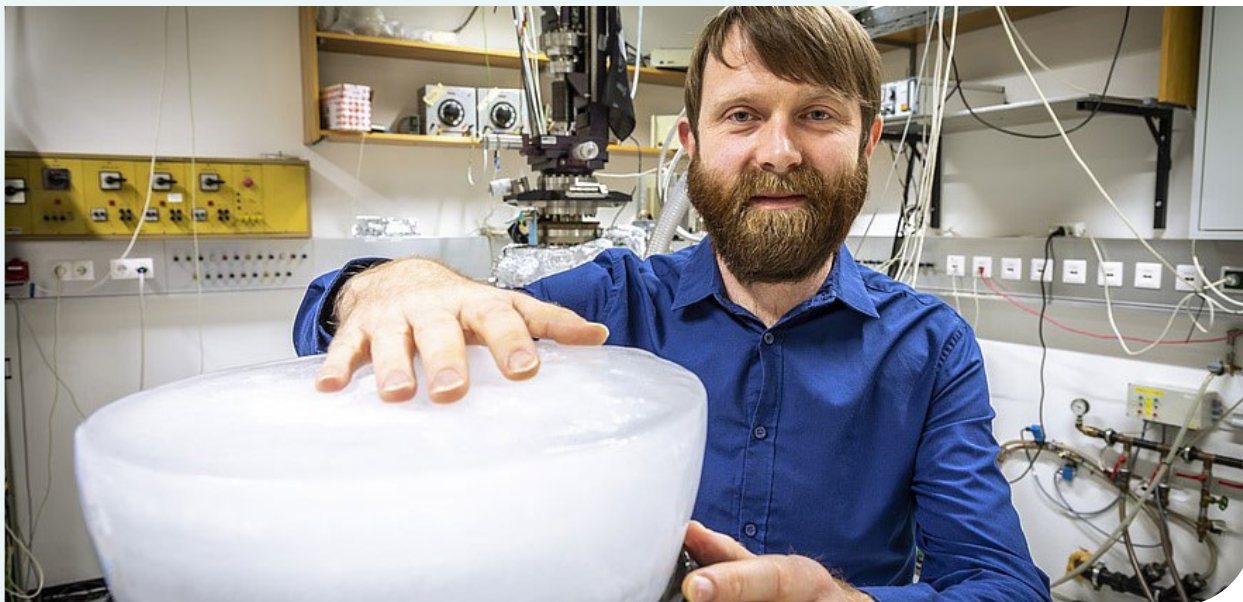
llizmarzan@cicbiomagune.es

www.ciber-bbn.es

CONTRIBUTION FROM GRAZ UNIVERSITY OF TECHNOLOGY



It takes some heat to form ice



The study results of Anton Tamtögl et al lead to a completely new understanding of ice formation: Water molecules require additional energy before they freeze into ice. © Lunghammer - TU Graz

Water freezes and turns to ice when brought in contact with a cold surface – a well-known fact. However, the exact process and its microscopic details remained elusive up to now. Anton Tamtögl from the Institute of Experimental Physics at TU Graz explains: “The first step in ice formation is called ‘nucleation’ and happens in an incredibly short length of time, a fraction of a billionth of a second, when highly mobile individual water molecules ‘find each other’ and coalesce.” Conventional microscopes are far too slow to follow the motion of water molecules and so it is impossible

to use them to ‘watch’ how molecules combine on top of solid surfaces.

Findings turn previous understanding of ice formation upside down

With the help of a new experimental technique and computational simulations, Tamtögl and a group of researchers from the Universities of Cambridge and Surrey were able to track down the first step in ice formation on a graphene surface. In a [paper published in Nature Communications](#), they made the remarkable observation that the water molecules repel

each other and need to gain sufficient energy to overcome that repulsion before ice can start to form: It has to become hot, so to speak, before ice forms. Talking in the general sense, the lead author Anton Tamtögl says “repulsion between water molecules has simply not been considered during ice nucleation - this work will change all that”.

Following the ‘dance’ of water molecules

The effect was discovered with a method called Helium Spin-Echo (HeSE) – a technique developed at the Cavendish Laboratory in Cambridge and specially designed to follow the motion of atoms and molecules. The machine scatters helium from moving molecules on a surface, similar to the way radio waves scatter from vehicles in a radar speed-trap. By registering the number of scattered helium and their energy / velocity after scattering, it allows to follow the movement of atoms and molecules.

The HeSE experiments show that water molecules on a graphene surface, i. e. a single atomic layer of carbon, repel each other. The repulsion arises due to the same alignment of the molecules, perpendicular to the surface. The scenario is analogous to bringing two magnets with like-poles together: They will push themselves apart. In order for the nucleation of ice to begin, one of the two molecules must reorient itself, only then can they approach each other. Such a reorientation requires additional energy and thus represents a barrier that must be overcome for the growth of ice crystals.

Computational simulations in which the precise energy of water molecules in different configurations was mapped and the interactions between molecules near to each other were calculated, confirm the experimental findings. Moreover, simulations allow to ‘switch’ the repulsion on and off, providing thus further proof of the effect. The combination of experimental and theoretical methods allowed the international scientific team to unravel the behavior of the water molecules. It captures for the first time, exactly how the first step of ice formation at a surface evolves and allowed them to propose a previously unknown physical mechanism.

Relevance for other fields and applications

The group further suggests the newly observed effect may occur more widely, on other surfaces. “Our findings pave the way for new strategies to control ice formation or prevent icing,” says Tamtögl, thinking, for example, of surface treatments specifically for wind power, aviation or tele-communications.

Understanding the microscopic processes at work during ice formation, is also essential to predicting the formation and melting of ice, from individual crystals to glaciers and ice sheets. The latter is crucial to our ability to quantify environmental transformation in connection with climate change and global warming.

Contact:

TU Graz | Institute of Experimental Physics

Anton TAMTÖGL

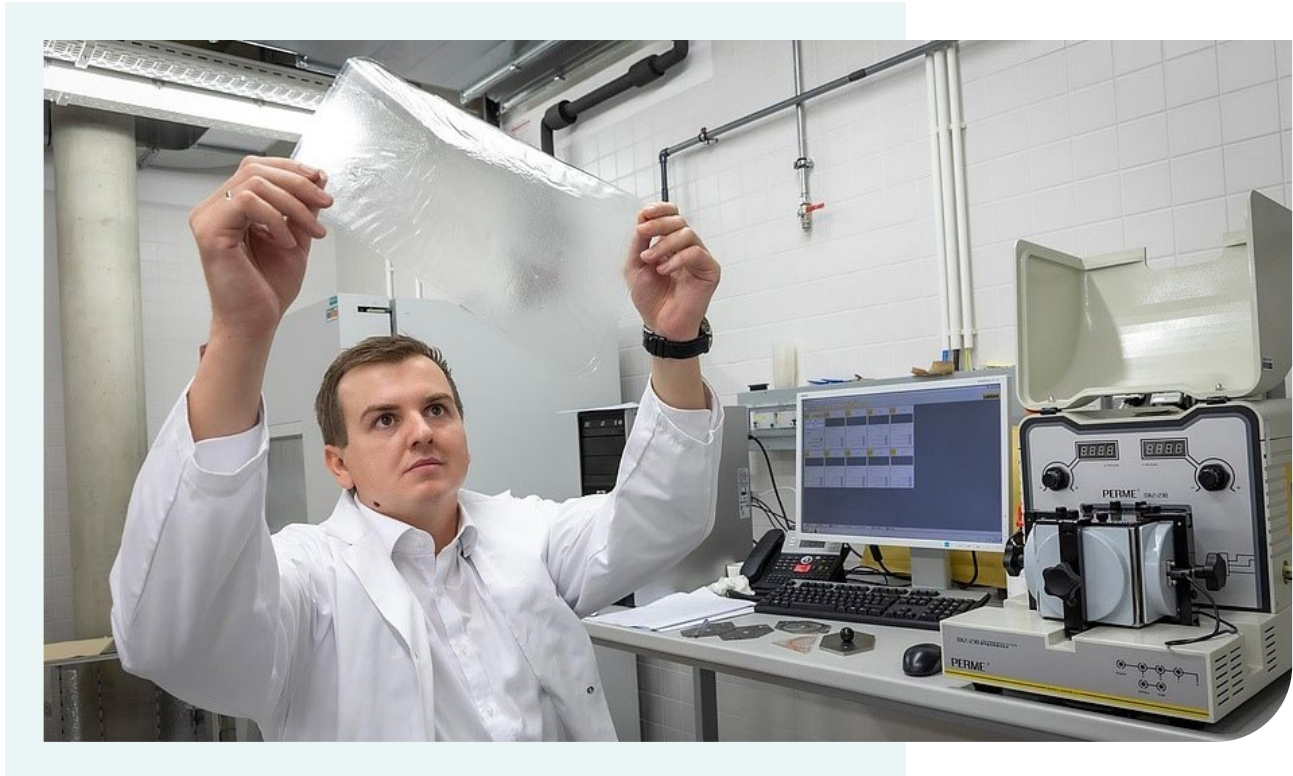
tamtogl@tugraz.at

www.tugraz.at

CONTRIBUTION FROM GRAZ UNIVERSITY OF TECHNOLOGY



Materials research says yes to wood



Samir Kopacic is working on his own paper-based alternatives to plastic packaging. © Lunghammer – TU Graz

Researchers at TU Graz develop green alternatives to fossil raw materials. Bio-based materials are expected to reduce pollution and drive the shift to a more sustainable economy.

As a renewable resource, wood offers great potential in the fight against the climate crisis. First, it sequesters large amounts of carbon (1 ton per cubic meter!). Moreover, it is an environmentally friendly alternative to fossil

based resources, which cause the majority of greenhouse gas emissions. At the Institute of Bioproducts and Paper Technology at Graz University of Technology (TU Graz), researchers produce biodegradable materials from the wood components cellulose, hemicellulose and lignin.

Samir Kopacic, for example, would like to use such materials to help ensure that in the future less plastic and more biodegradable mate-

rials are used. For this purpose, the Institute's so-called „barrier lab“ has been established in cooperation with academic and industrial partners. There, Kopacic carries out research on biobased packaging materials with barrier properties as good as those for synthetic plastics. They have to protect the package contents (food, cosmetics, medicines, etc.) from oxygen, humidity and other external influences, as well as to preserve the aroma and freshness of the products. Currently, paper and cardboard are only suitable for this to a limited extent, as Kopacic points out: „Paper and cardboard are porous and fibrous. To achieve the necessary impermeability, they are often coated with synthetic polymers that are non-biodegradable and difficult to recycle, or laminated with metal foils.“

Learn more about Samir Kopacic and his work, as well as his career and motivations for going into materials research, in the [Young Talent Portrait on Planet Research](#).

Kopacic would like to remedy this situation in cooperation with the Association of the Austrian Paper Industry [Austropapier](#) and with the support of its industrial partners. In the FFG research project PapSpray, which is funded to the tune of 810,000 euros, the project team is pursuing the approach of spraying paper or cardboard with biopolymers. „When applying bio-based barrier materials to paper, conventional coating methods have had limited success due to the complex flow characteristics of these materials. We are now testing the suitability of spray coating processes and investigating how biopolymers need to be sprayed onto paper to obtain the desired barrier properties,“ says project leader Kopa-

cic. For the young researcher (born in 1989), the conditions are right for a decisive breakthrough: „From a technological point of view, spray coating is a flexible process that can be integrated into paper production and can also be used in combination with or as a supplement to conventional coating technologies.“ The three-year research project aims to develop a fundamental understanding of the interactions between paper, biopolymer and spray process, thus creating the basis for being able to produce and use plastic-free and recyclable paper packaging for an even broader range of applications than before.

Ultralight materials between materials engineering and biotechnology

The use of bio-based materials on a large scale is also the aim of the EU project BreadCell from the FET Open funding line, another research project at the Institute of Bioproducts and Paper Technology. Under the consortium leadership of [Chalmers University of Technology](#) (Göteborg, Schweden), an interdisciplinary team of researchers from TU Graz, the [University of Vienna](#), [BioNanoNet](#) and the European research center [Tecnalia](#) aim at developing a radically new technology for the production of environmentally friendly lightweight materials based on wood and cellulose. Currently, for example, large-scale industry uses mainly lightweight materials made of synthetic, non-degradable polymers for safety components in cars or for lightweight, robust and resistant sports equipment. „We want to offer alternatives and are working on sustainable cellulose foams to replace existing composites,“ explains Stefan Spirk.



Stefan Spirk wants to replace environmentally harmful components with bio-based materials, primarily substances from the paper and pulp industry. © Lunghammer – TU Graz

Spirk has already caused a stir with the development of a lignin-based redox flow battery („vanillin battery“) and, together with Institute head Wolfgang Bauer, is contributing know-how from pulp and paper research to the project. More about „Stefan Spirk’s ecological power storage using vanillin“ can be found in TU Graz News.

Hermann Steffan and Florian Feist from the [Institute of Vehicle Safety](#) are supporting the project with their experience in the field of crash-proof materials in order to make the innovative materials usable with respect to safety-relevant applications. The European Union

is funding the project BreadCell to the amount of three million euros. Around 900,000 euros of this amount goes to TU Graz.

Contact:

TU Graz | Institute of Bioproducts and Paper Technology
Samir KOPACIC
samir.kopacic@tugraz.at

Stefan SPIRK
stefan.spirk@tugraz.at
www.cell-rocks.com/contact
www.tugraz.at

→ [TABLE OF CONTENTS](#)

CONTRIBUTION FROM INSTITUTE FOR MEDICAL RESEARCH & OCCUPATIONAL HEALTH



Institute
for Medical
Research and
Occupational
Health

Institute for Medical Research & Occupational Health participating in the RiskGONE Horizon 2020 project

Researchers from the NanoBioFaces group at the Institute for Medical Research and Occupational Health, Zagreb, Croatia are proud to report their participation in the RiskGONE Horizon 2020 project, that yielded a published paper on the use of adverse outcome pathways (AOPs) for creating strategies nanomaterial toxicity prediction. The publication [1] was the result of international collaborative work, including researchers and institutions from Belgium, Croatia, Poland, The Netherlands, Norway, and France. Our work within the RiskGONE project aims to develop tools and data-bases for identification and recognition of human and environmental impacts of nanomaterials, in order to contribute to the creation of regulations and guidelines for safe development and application of various nano-enabled products. The essence of the project is evidence-based risk governance of nanomaterials, considering their increasingly wide use in science, technology and commercial sectors.

Adverse outcome pathways (AOPs) are models (structured representations) of a sequence of biological events that lead to toxic effects (adverse outcomes) in the organism exposed to a substance. The sequence starts with a molecular initiating event, which is the result of the interaction of nanomaterial with molecular or cellular structure. That initiating event starts

a chain reaction of key negative events in the cellular and supracellular systems, e.g. altered signaling pathways, oxidative stress, altered gene expression etc. The result is identified as cytotoxicity, tissue damage, loss of function or similar negative consequence. Each of the key events, as well as the end result, may be identified experimentally through different in vitro and in vivo assays, however rarely will they all be performed in the same publication, and identifying them for each nanomaterial type is an enormous task. Putting together, all of the events in a chain sequence enables the prediction of consequences of each initiating event that is discovered for new nanomaterials, and contributes greatly to the streamlining of nanomaterial toxicity testing.

The paper involved an extensive literature search to identify and recover data on initiating and key events reported for nanomaterials. Then, those events were connected to the AOPs by searching through the AOP-Wiki database. Using two case studies, the applicability of the AOP framework for the design and planning of nanomaterial toxicity studies is demonstrated. This approach is, however, still limited by the general unfamiliarity of wider scientific community with AOPs and the lack of reliable data acquired on molecular key events. The facilitation of AOP development will have to include the evaluation of existing

information, identification of data gaps, generation of new knowledge and iterative decision making. Once established and widely accepted, the AOP framework will significantly contribute to the design, development, testing and regulations of nano-enabled products.

The NanoBioFaces team is grateful to be a part of the RiskGONE project and extends a Thank You to all collaborators for the joint work and fruitful collaboration.

REFERENCE

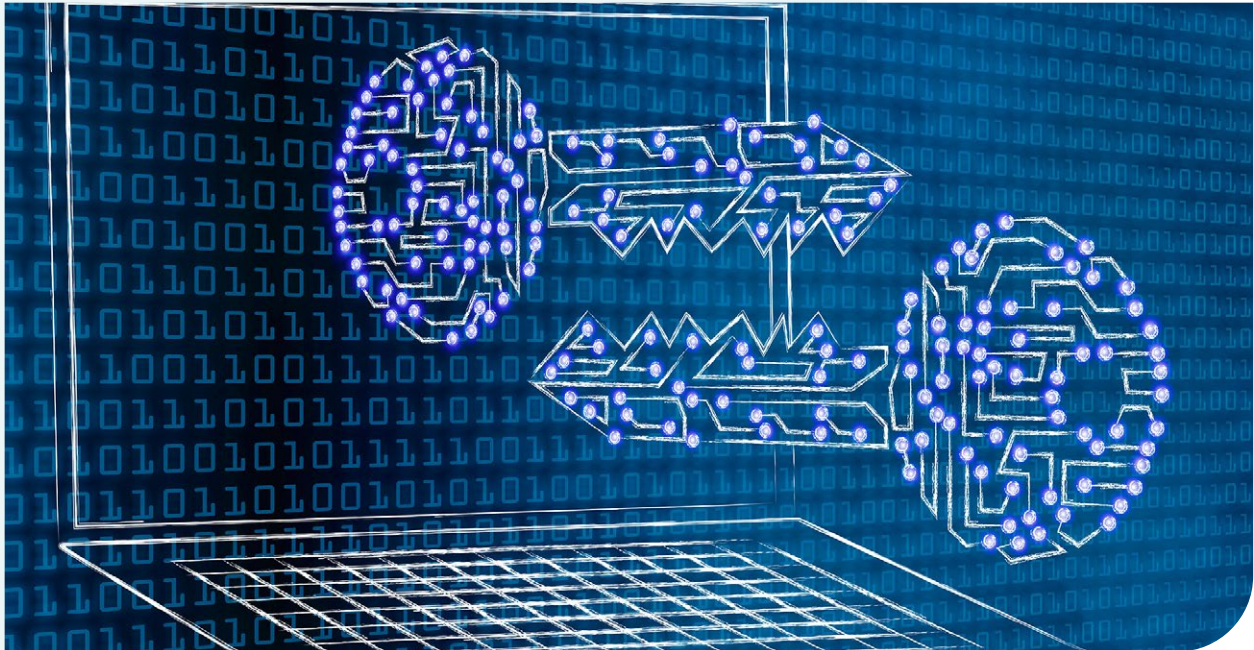
[1] Murugadoss S, Vinković Vrček I, Pem B, Jagiello K, Judzinska B, Sosnowska A, Martens M, Willighagen EL, Puzyn T, Dusinska M, Cimpan MR, Fessard V, Hoet PH (2021) A strategy towards the generation of testable adverse outcome pathways for nanomaterials. ALTEX - Alternatives to animal experimentation. doi: 10.14573/altex.2102191.

Contact

IMI – Institute for Medical Research and
Occupational Health
NanoBioFaces group
Ivana VINKOVIC VRCEK
ivinkovic@imi.hr
www.nanobiofaces.imi.hr

CONTRIBUTION FROM KNOW-CENTER GMBH

Collection and analysis of sensitive health data and data protection are reconcilable



© Shutterstock

Knowing the exact location where more people become infected is an important factor in managing the COVID19 pandemic. At the same time the collection of sensitive health data faces heavy criticism since it is feared that data protection and data security cannot be guaranteed. In fact, ready-to-use technologies to solve this dilemma have long been developed in research. Applied cryptography methods, such as homomorphic encryption, enable secure and verifiable evaluation of confidential and sensitive data while protecting privacy. As part of the Safe-DEED research project, in co-

operation with the Institute for Applied Information Processing and Communication Technology (IAIK) at Graz University of Technology and international partners, Know-Center has successfully demonstrated the application of these methods using simulated data.

Corona Tracking with Data Protection

The so-called CoronaHeatMap shows where people infected with the Corona virus were located when they got infected, providing a valuable addition to contact tracing. This could help health authorities to better understand

the regional spread of the virus and to take specific measures effectively. In order to achieve this, a person's health data are interlaced with the mobile phone movement data via homomorphic encryption.

Anonymized movement profiles

Two sets of data are required in order to create the Corona Heatmap. First, the Corona patient's cell phone numbers at the health authorities' disposal. Second, the location data held by the mobile phone providers. The problem at hand: the mobile phone provider can identify who has tested positive for Corona based

on requests made by the health authorities. Conversely, the health authorities are able to identify individuals' movement data. Therefore, data protection cannot be guaranteed, since the patient data can be leaked and individual monitoring is possible. To solve this problem cell phone numbers of patients are encrypted before they are sent to the mobile phone provider. The provider calculates the movement profiles without decrypting the patient data. Since movement profiles are aggregated, individual monitoring or conclusions are impossible.

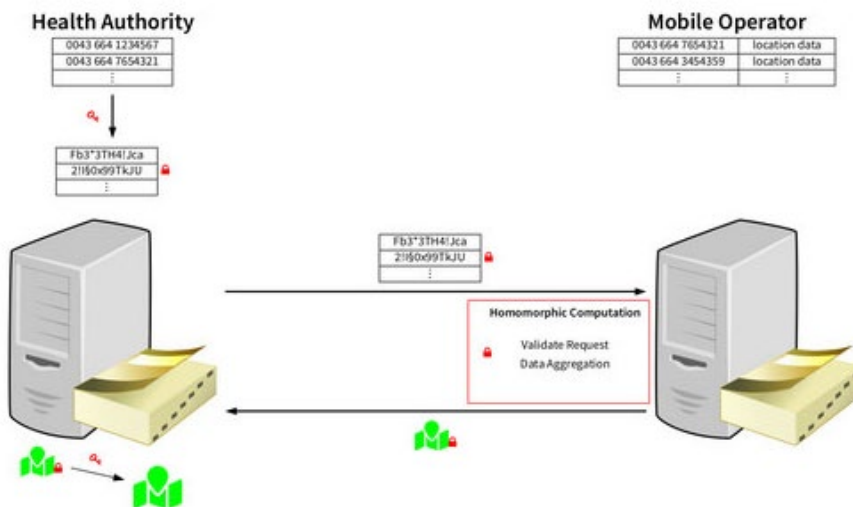


Figure 1: Homomorphic encryption makes it possible for the mobile phone provider to calculate the Heatmap, without decryption of patient data.

For more details visit:

<https://covid-heatmap.iaik.tugraz.at>
<https://safe-deed.eu>
<https://www.know-center.tugraz.at/research/comet-modul>

Contact

Know-Center GmbH
 Melanie MAYR
mmayr@know-center.at
www.know-center.at

TU Graz, Institute of Applied Information Processing and Communications
 Christian RECHBERGER
Christian.Rechberger@iaik.tugraz.at
www.iaik.tugraz.at

CONTRIBUTION FROM KNOW-CENTER GMBH

Using human telemetry to understand cognitive and emotional states for daily activity improvement



© Know-Center

Know-Center is developing human-centered intelligent systems that detect cognitive, emotional and health related states by action, perception and by means of cognitive and health metrics. Models of human behavior and intention allow to be derived during different activities.

The innovative set-up is reflected by linking the human telemetry (HT) system with activity monitors and by synchronizing the data. The system is composed of several wearable sensors, such as EEG, eye-tracker, ECG, EMG, and a data-logger.

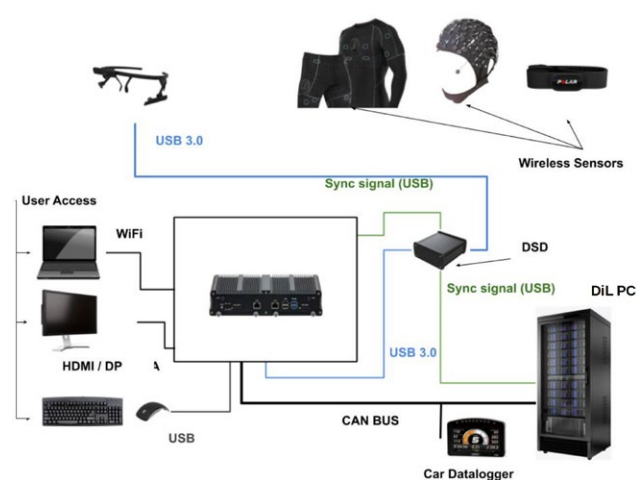


Figure 1: Human Telemetry System

Emotion elicitation experiments

For monitored experiments the HT system and machine learning (ML) algorithms are used to induce and measure emotional and cognitive related states of test subjects. To elicit emotions such as fear, amusement, sadness, etc.

different video sequences from movies are shown to participants while their physiological response is being measured. The models are trained with collected data. Once algorithms are trained they can be used to predict the person's emotional state based on physiological data captured by wearables.

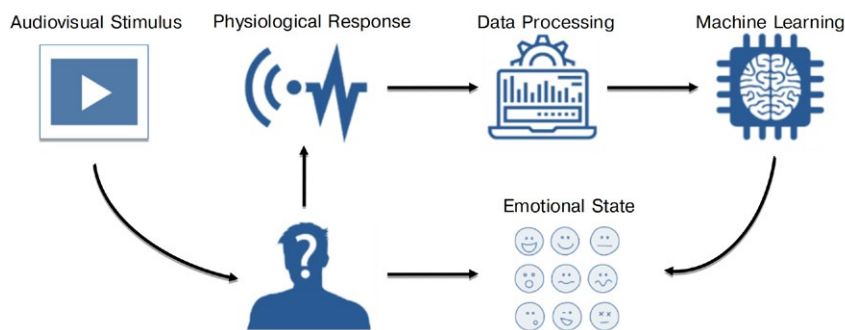


Figure 2: Learning representations of physiological responses

Improving driving behavior

The researchers are currently applying the HT system to collect data on car and driver performance in connection with motorsport, street and road condition. The system provides a synchronization mechanism to associate human data with a professional driving simulator. That allows to gain data from driver and vehicle. In order to study steering behavior in racing e.g., the muscle activity of the upper muscle body group is correlated with steering motions and other sensors like an eye tracker is used to study focus and gaze position. In street and road driving, the trained models process the data and detect the emotional state of the driver. The system allows to find relations (e. g. drowsiness) between the states of the driver and specific events detected inside the car during driving (e. g. lane change). The overall objective is to make driving safer by providing information about the driver directly to the car. The car can use this information to interact with the driver in order

to change the driver's mental state, like for example change music or light to "rouse" the driver.

Predicting Alzheimer disease

In future studies the HT system will be applied in life sciences to identify predictive digital biomarkers in order to diagnose conditions such as Alzheimer's disease. The integration of these digital biomarkers together with current Alzheimer diagnostic methods could provide an earlier, more sensitive and specific detection of Alzheimer's disease prior to the clinical manifestation. This will be a key factor in the development of prevention and treatment strategies.

Contact

Know-Center GmbH - Knowledge Visualization Group

Lucas IACONO

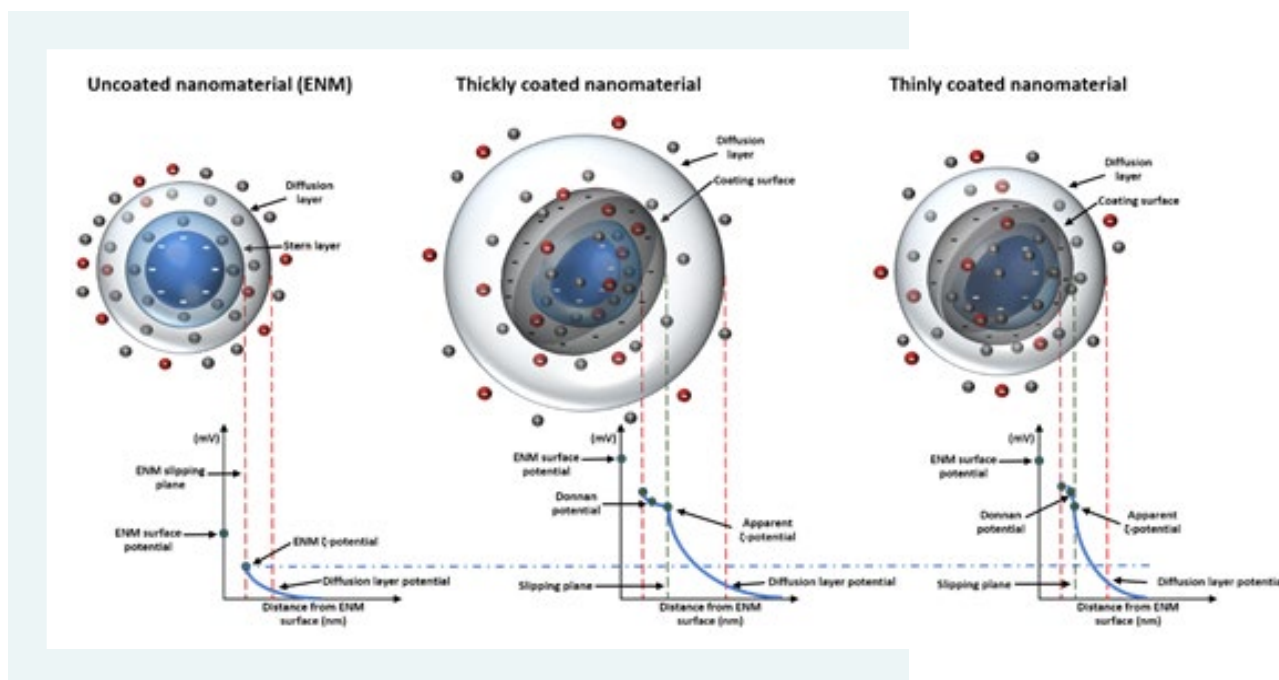
liacono@know-center.at

www.know-center.at

CONTRIBUTION FROM NOVAMECHANICS LTD



NanoSolveIT H2020 project makes freely available a library of critical characteristics for 69 engineered nanomaterials



Schematic representation of a negatively charged uncoated (left), a negatively charged thickly polymer-coated (middle) and negatively charged thinly polymer-coated (right) ENM © <https://www.sciencedirect.com/science/article/pii/S2452074821000173>

The development of nanomaterials (NMs) is an evolving process that has offered benefits to a wide span of industries and at the same time it has revolutionized our everyday lives. Although numerous benefits of NMs have been identified over the years, the innovation potential of NMs is inhibited by concerns regarding their potential adverse effects. These can include toxic effects, following accumulation in different organs, as well as indirect effects from transport of co-pollutants. Concerns are also arising as risk assessment is lagging be-

hind product development, mainly because current approaches to assessing exposure, hazard and risk are expensive and time-consuming, and frequently involve testing in animal models.

To address these challenges, the European Union H2020-funded project NanoSolveIT aspires to introduce a ground-breaking computer-based (in silico) Integrated Approach to Testing and Assessment (IATA) for the environmental health and safety of NMs, implemented

through a decision support system packaged as both a stand-alone open software and via a Cloud platform.

Antreas Afantitis, NanoSolveIT Project Coordinator says that “in the last 2 years the project has already presented some very impressive results with more than 30 publications, making the project one of the most active in the NMs space.”

One of the project’s latest achievements is a freely available cloud application that aims to enrich our knowledge of NMs properties and the link from property to effect, by providing a library that contains the full physicochemical characterization of 69 NMs supplemented with calculated molecular descriptors to increase the value of the available information. The enriched dataset contains >70 descriptors per NM, and was used to develop an in silico workflow to predict NM ζ -potential (effective surface charge) based on a number of descriptors that can be used as part of a safe by design (SbD) approach for design and production of safer and more functional NMs.

As Prof. Iseult Lynch, NanoSolveIT Project deputy Coordinator and NanoCommons project Coordinator, says “One of the limitations to

the widespread application of in silico approaches is the lack of large quantities of high-quality data, or of data with adequate metadata that will allow dataset interoperability and their combination to create larger datasets.”

Making the library of calculated and experimental descriptors available to the community, along with the detailed description of how they were calculated (the metadata, presented in the emerging community standard format of a MODA template) is a key first step towards filling the datagap.

The read across predictive model has been made publicly and freely available as a web-service through the Horizon 2020 (H2020) NanoCommons project (<http://enaloscloud.novamechanics.com/nanocommons/mszeta>) and via the H2020 NanoSolveIT Cloud Platform (<https://mszeta.cloud.nanosolveit.eu>) to ensure accessibility to the community and interested stakeholders. In addition, the full data set, ready for further computational modeling, is available through NanoPharos database, as the project consortium supports the FAIR data principles (i.e., is committing to making its data Findable, Accessible, Interoperable and Re-usable).

Contact:

NovaMechanics Ltd
Antreas AFANTITIS
afantitis@novamechanics.com
www.novamechanics.com

→ [TABLE OF CONTENTS](#)

CONTRIBUTION FROM NOVAMECHANICS LTD



Open toxicogenomic data project improves our knowledge for nanomaterials toxicity

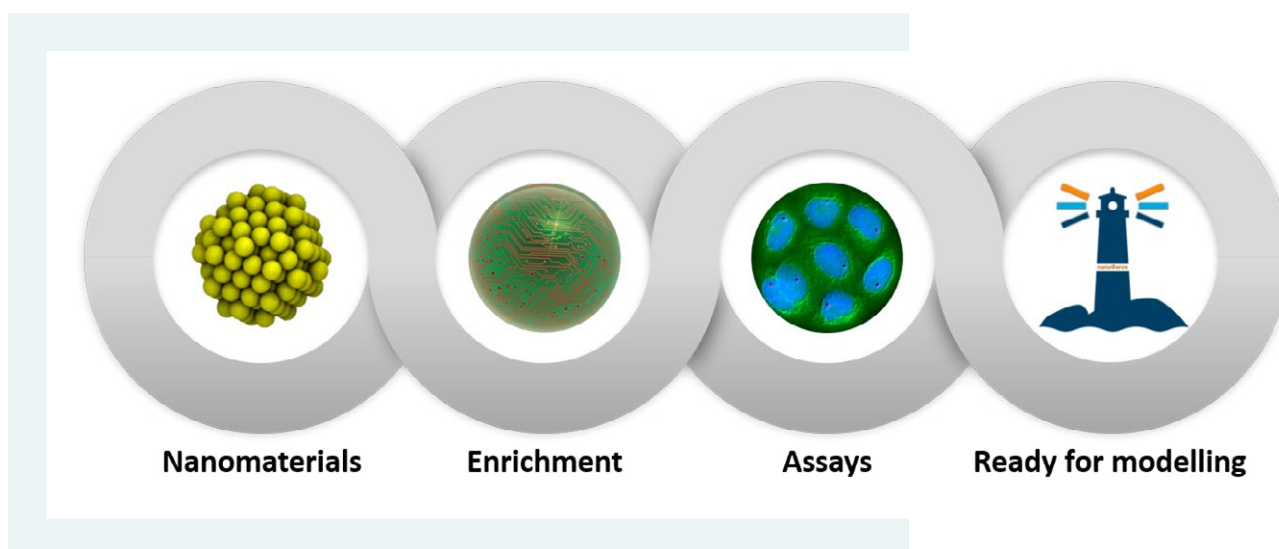


Figure 1: The nanaΦaros database concept provides the users with structured, harmonised and ready for modelling datasets.

Nanomaterials are part of our everyday life but we are still at the very first steps of understanding the ways they interact with live organisms, including animals and humans. Toxicogenomics is a relatively new method that helps us to gain insight into the possible toxicity mechanisms of engineered nanomaterials (ENMs).

A team of scientists involved in NanoSolveIT, an EU nanoinformatics project funded under Horizon 2020, completed a study that was published in [Nature journal Scientific Data](#), in order to unleash the full potential of already existing transcriptomics data on ENM exposures. “While large amounts of transcriptomics

data from ENM exposures have already been accumulated, a unified, easily accessible and reusable collection of transcriptomics data for ENMs was lacking” says Antreas Afantitis, NanoSolveIT Project Coordinator “The team manually curated, and preprocessed and unified a collection of 101 data sets, covering a range of ENMs, organisms, and exposure setups.”

As Professor Dario Greco, Director of the Finnish Hub for Development and Validation of Integrated Approaches, at Tampere University says “In an attempt to improve the FAIRness of already existing transcriptomics data for ENMs, we curated a collection of homogenized transcriptomics data from human, mouse and

rat ENM exposures in vitro and in vivo including extracting the physicochemical characteristics of the ENMs used in each study from the associated publications.”

The traditional methods of toxicology, used for decades now to scrutinize the safety levels of engineered materials, provide us with a useful tool. However, the successful marriage of computer technology and bioinformatics has given birth to a new generation of Toxicogenomics (TGx) tools. Their main function is to collect and store data sets which are further explored and used as the basis for development of predictive models.

The application of TGx data to nanosafety can provide novel possibilities for grouping and classifying ENMs based on the similarity of molecular alterations in biological systems they induce, and help to derive biomarkers to identify nano-specific signatures.

Transcriptomics technologies, used to study an organism as the sum of its RNA transcripts (known as the transcriptome), are the frontli-

ne of TGx. While large amounts of transcriptomics data for multiple ENMs have already been generated, offering a valuable resource for future studies and applications, the data are scattered across public repositories, and their FAIRness is currently hampered by their heterogeneous nature and a lack of standardization in the preprocessing and analysis.

The [nanoPharos](#) database, where all the datasets generated within the H2020 [NanoSolveIT](#) and [NanoCommons](#) projects are available, assists accessibility, interoperability and reusability of curated datasets.

Antreas Afantitis, from NovaMechanics Ltd and NanoSolveIT H2020 project coordinator, commented: nanoPharos database has been designed under the FAIR data principles to include computationally derived data based on simulations of ENMs at different levels of complexity. The database was further extended to include ENM characterization data and biological effects to support complete in silico nanosafety evaluation.

Contact:

NovaMechanics Ltd
Antreas AFANTITIS
afantitis@novamechanics.com
www.novamechanics.com

[→ TABLE OF CONTENTS](#)

CONTRIBUTION FROM PAYER INTERNATIONAL TECHNOLOGIES GMBH

PAYER Group invests in the Styrian Technology & Innovation Center



In order to ensure a sustainable success, PAYER pursues a diversified and effective location strategy. Currently, the company invests five million euro in the Technology & Innovation Center, which is also the headquarters of PAYER Group, located west of Graz. The production facility specializing on medical technology is being expanded, the laboratory and testing infrastructure is being modernized, the Cutter Competence Center is being expanded and modernized, and office space is being renewed. Due to that, the technological lead, the innovative strength and the cutting expertise can be continuously advanced and sustainably ensured.

„In addition to its good location, Styria offers proximity to many innovative and successful companies, and it is home to some of Austria's leading universities,“ says Group CEO Michael Viet.

Furthermore, the global setup of PAYER Group will be expanded by a further location in Southeast Asia at the beginning of next year. After intensive analysis, the decision has been made in favor of Malaysia.

„The reason for the expansion to Malaysia is to diversify our supply chain in Asia and thus to further strengthen our resilience and agility. Therefore, we can optimally serve our cus-

tomers with whom we want to continue our growth path,“ reports Michael Viet, CEO PAYER Group.

Merger

In order to bundle the strengths of the Styrian location and to use existing synergies even more effectively and efficiently, the two companies PAYER Medical GmbH and PAYER International Technologies GmbH were merged as PAYER International Technologies GmbH as of May 1, 2021. With the great strategic importance of the business area „Healthcare & Medical“ as a growth area of PAYER Group, the quality brand „PAYER Medical“ will continue to exist.

PAYER MEDICAL

75 years of PAYER

PAYER is celebrating its 75th anniversary this year. Since then, the company has combined tradition with innovation and the courage to try something new. During its many years of existence, PAYER has developed from a pure

manufacturer of men's shavers under its own brand to a leading development and industrialization partner for global market leaders in the areas of personal care, home as well as healthcare & medical.

„Through a resilient organization with a clear strategic direction and a strong focus on the

most important resource in a company – the people – we ensure PAYER's sustainable business success. I am proud to be part of such a great, passionate and ambitious team and look forward to many more exciting and successful projects,“ highlights Viet.

Contact

PAYER International Technologies GmbH

Michelle HEMMER

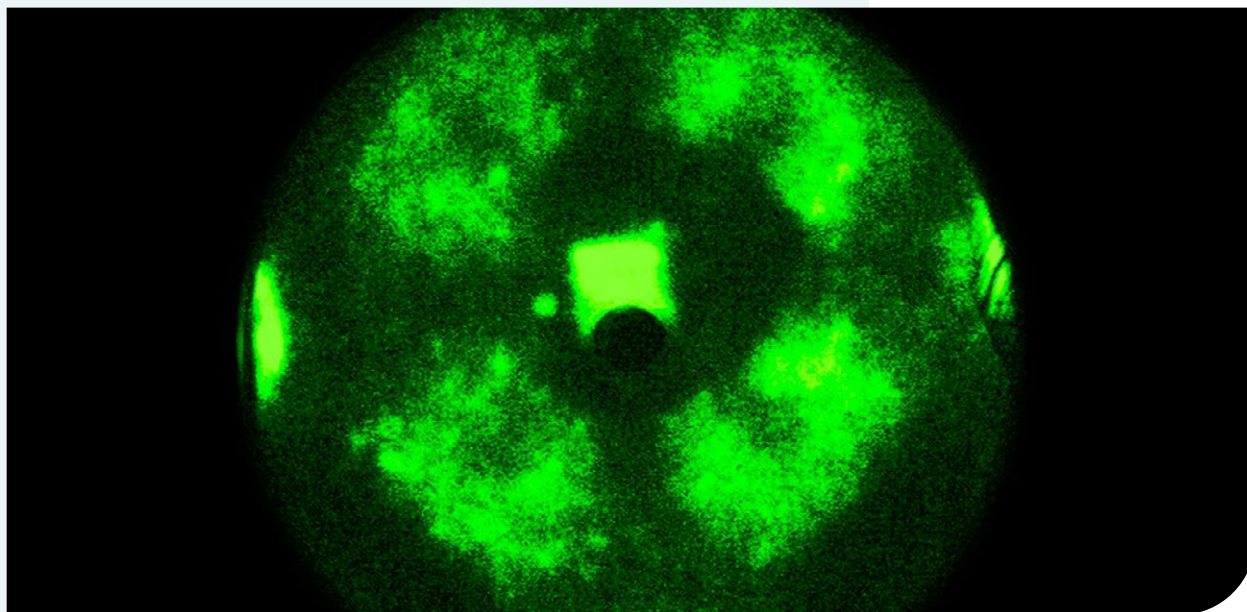
michelle.hemmer@payergroup.com

www.payergroup.com

CONTRIBUTION FROM TECHNISCHE
UNIVERSITÄT WIEN



Nanoparticles: The Complex Rhythm of Chemistry



The chemical reaction moves across the nanoparticle like a wave

Nanoparticles are often used as catalysts. The chemical reactions on their surface are more complex than previously thought, experiments at TU Wien (Vienna) show.

Most of commercial chemicals are produced using catalysts. Usually, these catalysts consist of tiny metal nanoparticles that are placed on an oxidic support. Similar to a cut diamond, whose surface consists of different facets oriented in different directions, a catalytic nanoparticle also possesses crystallographically different facets - and these facets

can have different chemical properties. Until now, these differences have often remained unconsidered in catalysis research because it is very difficult to simultaneously obtain information about the chemical reaction itself and about the surface structure of the catalyst. At TU Wien (Vienna), this has now been achieved by combining different microscopic methods: with the help of field electron microscopy and field ion microscopy, it became possible to visualize the oxidation of hydrogen on a single rhodium nanoparticle in real time at nanome-

ter resolution. This revealed surprising effects that will have to be taken into account in the search for better catalysts in the future. The results have now been presented in the scientific journal „Science“.

The rhythm of chemical reactions

„In certain chemical reactions, a catalyst can periodically switch back and forth between an active and an inactive state,“ says Prof. Günther Rupprechter from the Institute of Materials Chemistry at TU Wien. „Self-sustaining chemical oscillations can occur between the two states – the chemist Gerhard Ertl received the Nobel Prize in Chemistry for this discovery in 2007.“ This is also the case with rhodium nanoparticles, which are used as a catalyst for hydrogen oxidation – the basis of every fuel cell. Under certain conditions, the nanoparticles can oscillate between a state in which oxygen molecules dissociate on the surface of the particle and a state in which hydrogen is bound.

Incorporated oxygen changes the surface behaviour

„When a rhodium particle is exposed to an atmosphere of oxygen and hydrogen, the oxygen molecules are split into individual atoms at the rhodium surface. These oxygen atoms can then migrate below the uppermost rhodium layer and accumulate as the subsurface oxygen there,“ explains Prof. Yuri Suchorski, the first author of the study. Through interaction with hydrogen, these stored oxygen atoms can then be brought out again and react with hydrogen atoms. Then, there is again room for more oxygen atoms inside the rhodium particle and the cycle starts again. „This

feedback mechanism controls the frequency of the oscillations“, says Yuri Suchorski. Until now, it was thought that these chemical oscillations always took place synchronously in the same rhythm over the entire nanoparticle. After all, the chemical processes on the different facets of the nanoparticle surface are spatially coupled, as the hydrogen atoms can easily migrate from one facet to the adjacent facets. However, the results of the research group of Prof. Günther Rupprechter and Prof. Yuri Suchorski show that things are actually much more complex: Under certain conditions, the spatial coupling is lifted and adjacent facets suddenly oscillate with significantly different frequencies – and in some regions of the nanoparticle, these oscillating „chemical waves“ do not propagate at all. „This can be explained on an atomic scale,“ says Yuri Suchorski. „Under the influence of oxygen, protruding rows of rhodium atoms can emerge from a smooth surface.“ These rows of atoms can then act as a kind of „wave breaker“ and hamper the migration of hydrogen atoms from one facet to another – the facets become decoupled. If this is the case, the individual facets can form oscillations of different frequencies. „On different facets, the rhodium atoms are arranged differently on the surface,“ says Günther Rupprechter. „That’s why the incorporation of oxygen under the differing facets of the rhodium particle also proceeds at different rates, and so oscillations with different frequencies result on crystallographically different facets.“

A hemisphere tip as a nanoparticle model

The key to unravelling this complex chemical behavior lays in using a fine rhodium tip as a model for a catalytic nanoparticle. An electric

field is applied, and due to the quantum mechanical tunnelling effect, electrons can leave the tip. These electrons are accelerated in the electric field and hit a screen, where a projection image of the tip is then created with a resolution of around 2 nanometers. In contrast to scanning microscopies, where the surface sites are scanned one after the other, such parallel imaging visualizes all surface atoms simultaneously - otherwise it would not be possible to monitor the synchronization and desynchronization of the oscillations.

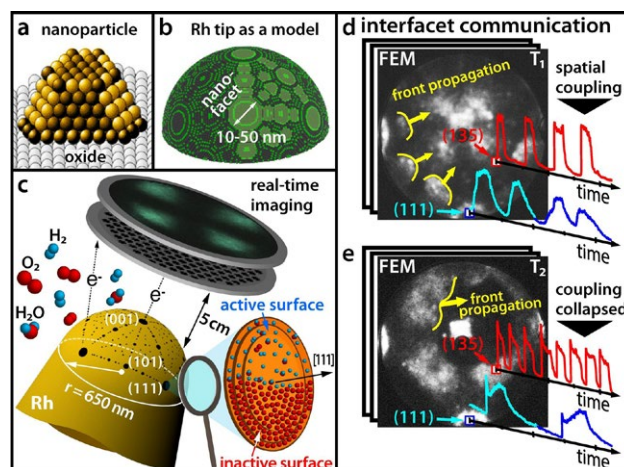
The new insights into the interaction of individual facets of a nanoparticle can now lead to more effective catalysts and provide deep atomic insights into mechanisms of non-linear reaction kinetics, pattern formation and spatial coupling.

Research funded by the Austrian Science Fund (FWF) within Project „Spatial-temporal phenomena on surface structure libraries“.

Oscillating Chemical Reactions

[Watch the video!](#)

Modern catalysts consist of nanoparticles; (b) a rhodium tip as model of a nanoparticle; (c) real-time monitoring of a reaction using a field electron microscope; (d) at low temperatures oscillations on different nanofacets are synchronized; (e)... Modern catalysts consist of nanoparticles; (b) a rhodium tip as model of a nanoparticle; (c) real-time monitoring of a reaction using a field electron microscope; (d) at low temperatures oscillations on different



The chemical reaction moves across the nanoparticle like a wave

nanofacets are synchronized; (e) at higher temperatures the spatial coupling collapses: desynchronization.

Original publication: [Y. Suchorski et al., Science, 2021, DOI: 10.1126/science.abf8107](#)

Contact

Institute of Materials Chemistry, TU Wien
Prof. Günther RUPPRECHTER
guenther.rupprechter@tuwien.ac.at

Institute of Materials Chemistry, TU Wien
Prof. Yuri SUCHORSKI
yuri.suchorski@tuwien.ac.at
www.tuwien.at/en/tu-wien

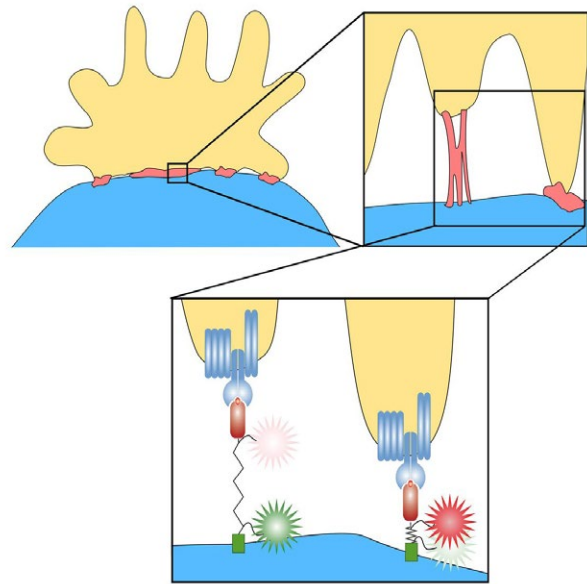
CONTRIBUTION FROM TECHNISCHE UNIVERSITÄT WIEN



Tracking down the tiniest of forces: how T cells detect invaders

T cells use their antigen receptors like sticky fingers - a team from TU Wien and MedUni Vienna was able to observe them doing so.

The T cell (yellow) touches the antigen-presenting cell. Tiny forces are applied on the surface, eventually the connection breaks. The T cell (yellow) touches the antigen-presenting cell. Tiny forces are applied on the surface, eventually the connection breaks. T-cells play a central role in our immune system: by means of their so-called T-cell receptors (TCR) they make out dangerous invaders or cancer cells in the body and then trigger an immune reaction. On a molecular level, this recognition process is still not sufficiently understood. Intriguing observations have now been made by an interdisciplinary Viennese team of immunologists, biochemists and biophysicists. In a joint project funded by the Vienna Science and Technology Fund and the FWF, they investigated which mechanical processes take place when an antigen is recognized: As T cells move their TCRs pull on the antigen with a tiny force - about five pico-newtons (5×10^{-12} or 0.0000000005 newtons). This is not only sufficient to break the bonds between the TCRs and the antigen, it also helps T cells to find out whether they are interacting indeed with the antigen they are looking for. These results have now been published in the scientific journal „Nature Communications“.



T cell and antigen-presenting cell

Tailor-made for a specific antigen

„Each T cell recognizes one specific antigen particularly well,“ explains Johannes Huppa, biochemist and immunology professor at MedUni Vienna. „To do so, it features around 100,000 TCRs of the same kind on its surface.“ When viruses attack our body, infected cells present various fragments of viral proteins on their surface. T cells examine such cells for the presence of such antigens. „This works according to the lock-and-key principle,“ explains Johannes Huppa. „For each antigen, the body must produce T cells with matching TCRs. Put

simply, each T-cell recognizes only one specific antigen to then subsequently trigger an immune response.“ That particular antigen, or more precisely, any antigenic protein fragment presented that exactly matches the T cell’s TCR, can form a somewhat stable bond. The question that needs to be answered by the T cell is: how stable is the binding between antigen and receptor?

Like a finger on the sticky surface

„Let’s say we wish to find out whether a surface is sticky - we then test how stable the bond is between the surface and our finger,“ says Gerhard Schütz, Professor of Biophysics at TU Wien. „We touch the surface and pull the finger away until it comes off. That’s a good strategy because this pull-away behavior quickly and easily provides us information about the attractive force between the finger and the surface.“ In principle, T-cells do exactly the same. T cells are not static, they deform continuously and their cell membrane is in constant motion. When a TCR binds to an antigen, the cell exerts a steadily increasing pulling force until the binding eventually breaks. This can provide information about whether it is the antigen that the cell is looking for.

A nano-spring for force measurement

„This process can actually be measured, even at the level of individual molecules,“ says Dr. Janett Göhring, who was active as coordinator and first author of the study at both MedUni Vienna and TU Vienna. „A special protein was used for this, which behaves almost like a perfect nano-spring, explain the two other

first authors Florian Kellner and Dr. Lukas Schrangl from MedUni Vienna and TU Vienna respectively: „The more traction is exerted on the protein, the longer it becomes. With special fluorescent marker molecules, you can measure how much the length of the protein has changed, and that provides information about the forces that occur“. In this way, the group was able to show that T cells typically exert a force of up to 5 pico-newtons - a tiny force that can nevertheless separate the receptor from the antigen. By comparison, one would have to pull on more than 100 million such springs simultaneously to feel stickiness with a finger. „Understanding the behavior of T cells at the molecular level would be a huge leap forward for medicine. We are still leagues away from that goal,“ says Johannes Huppa. „But“, adds Gerhard Schütz, „we were able to show that not only chemical but also mechanical effects play a role. They have to be considered together.“

Original publication: [J. Göhring et al., Temporal analysis of T-cell receptor-imposed forces via quantitative single molecule FRET measurements, Nature Communications 12, 2502 \(2021\)](#)

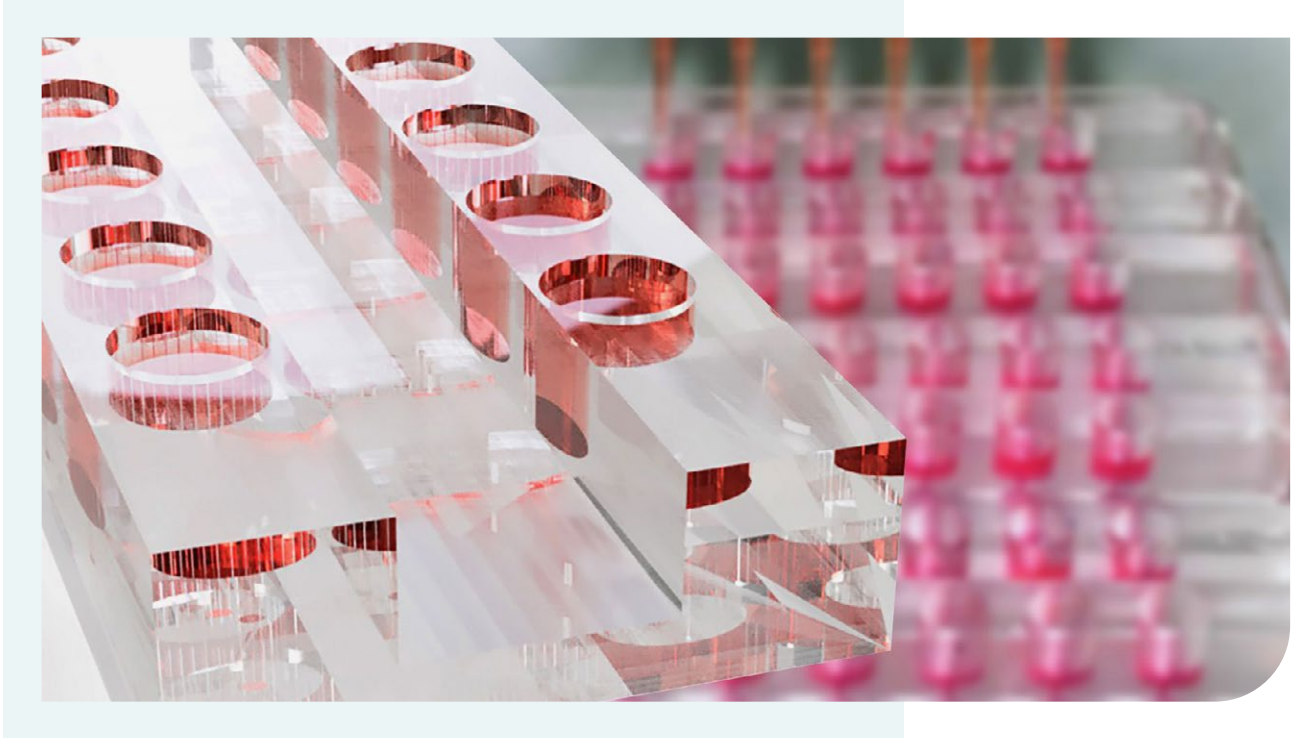
Contact

Institut für Angewandte Physik, Technische Universität Wien
Prof. Gerhard SCHÜTZ
gerhard.schuetz@tuwien.ac.at
www.tuwien.at

CONTRIBUTION FROM TECHNISCHE UNIVERSITÄT WIEN



New Biochip Technology for Pharma Research



Biochip technology, developed at TU Wien

In pharmaceutical research, small tissue spheres are used as mini-organ models for reproducible tests. TU Wien has found a way to develop a reliable standard for these tissue samples.

Before drugs are tested in clinical trials, they must be tested either by animal experiments or, more recently, artificially produced tissue samples. For this purpose, cells are cultivated, and tiny spheres with a diameter of less than one millimeter are made. However, the prob-

lem is that there have been no uniform standards for these tissue samples and no reliable method for producing them with uniform size and shape. Therefore, results from different laboratories are hardly comparable with each other, as the tissue size directly influences the behavior of cells and drugs. An invention by TU Wien can now solve this problem: A biochip has been developed that can be used to produce tissue beads in precisely the desired sizes and supply them with nutrients or even

drugs through a thin channel. A patent application has already been filed for the new biochip technology.

Better preclinical studies

„In preclinical studies, drugs are tested on small tissue samples to understand them as well as possible before they can be administered to test subjects,“ says Christoph Eilenberger, a doctoral student in Prof. Peter Ertl’s biochip research group at the Institute for Applied Synthesis Chemistry at TU Wien. Carrying out these studies with higher precision means taking the next step faster and more reliably. Maximum scientific accuracy in these studies can save not only a lot of money but also a lot of time on the long road to producing a marketable drug. Well-defined tissue samples are also indispensable in other research areas – for example, when studying the development of tumor cells or when ensuring the safety of food or cosmetic products.

Standardizing size and shape

„The size of the samples is a crucial factor in all these studies,“ says Mario Rothbauer, a postdoc at the Institute of Applied Synthesis Chemistry. „If the tissue consists of only a few cells, the environmental conditions are practically the same for all cells. For tissue spheres with a slightly larger diameter, differences begin to play a greater role, for example, when the concentration of certain chemicals is not the same everywhere.“ Therefore, experiments are only comparable if you precisely standardize the size and shape of the tissue samples. The biochip team at TU Wien investigated in numerous experiments how this can best be

done: „We created cavities in our biochips with very different sizes and geometric shapes – cylinders, ellipses, spherical segments. They influence tissue growth in very different ways.“ As it turned out, the radius of curvature is crucial; sharp edges are a disadvantage. Success was finally achieved with hemispherical cell containers, with diameters between 0.1 mm and 1 mm. „Producing such shapes is not easy. We used microlenses, which are usually used for optical experiments,“ says group leader Prof. Peter Ertl. A whole series of these hemispheres is applied to the biochip and populated with cells. With a sophisticated system of fine tubes, it is possible, for example, to ensure that different cavities are supplied with varying concentrations of drug. This creates a precisely defined, standardized experimental environment on an area of just a few square centimeters.

Suitable for industry

The new system was tested with different types of cells: „In one experiment we created an artificial blood-brain barrier. In another, we tested the effectiveness of a cancer drug,“ says Christoph Eilenberger. „This allowed us to show that our chip performs well in typical preclinical tests.“ The biochip is currently being used at the renowned Harvard Medical School, where Eilenberger is spending time abroad to research developed resistance of tumor cells to breast cancer drugs. The chip helps to standardize and replicate the patient’s specific tumor milieu with greater efficiency to make targeted therapy responses and predictions about the risk of relapse. The design of the new method was designed from

the outset for industrial suitability: Experiments can be automated, chips can be combined and stacked to produce and test large numbers of spherical cell samples in a short time. „The system is ideally suited for use in pharmaceutical research,“ Mario Rothbauer is convinced, „which is why we have already applied for a patent for our idea, and we are already in talks with various companies from the pharmaceutical industry who are very interested in our new technology.“

Original publication: [C. Ellenberger et al., A Microfluidic Multisize Spheroid Array for Multiparametric Screening of Anticancer Drugs and Blood–Brain Barrier Transport Properties, Adv. Sci. 2021, 2004856.](#)

Contact

Institut für Angewandte Synthesechemie,
TU Wien

Prof. Peter ERTL

peter.ertl@tuwien.ac.at

Dr. Mario ROTHBAUER

mario.rothbauer@tuwien.ac.at

www.tuwien.at

CONTRIBUTION FROM UNIVERSITY OF NATURAL RESOURCES AND LIFE SCIENCES

SolarCircle project



Flexible Perovskite solar cells (scale from left to right: 1/10/2cm), source: Kaltenbrunner et al. (2015), Nat Mater 14(10), 1032-1039

Assessment of advanced materials for technologies in photovoltaics with emphasis on the aspect of circular economy: SOLARcircle

Photovoltaic (PV) technologies are considered one of the main factors to reduce carbon-based emissions to meet the Paris climate targets 2050, namely producing electricity from 100 percent renewable energy sources. Current technologies on the market are silicon-based solar panels and, more recently, thin film solar cells. Lately, a new generation of

photovoltaics, such as organic photovoltaics (OPVs), Perovskite solar cells, dye-sensitized solar cells (DSSC), or quantum dot solar cells promise to open up new application fields for PV, as these emerging technologies allow light-weighted, flexible or transparent solar cell applications.

Yet, to what extent emerging photovoltaics may contribute to a more sustainable energy transition, e. g. in terms of reduced environmental impacts, remains unclear as issues

such as low stability, potential toxicity of materials and recycling still counter the environmental friendliness of PV.

The project SOLARcircle ultimately aims at strengthening recyclability and environmental friendliness of emerging photovoltaics by conceptualizing their design in terms of safe-by-design and design-for-recycling. To do so, the project provides a detailed overview on emerging photovoltaics and the most common materials used for these technologies. A literature review on current research highlighted market potential and emerging applications across a variety of sectors, such as the building sector (e. g. building-integrated PV in glass facades), agricultural sector (e. g. PV foils for green houses), transport sector (e. g. PV in vehicles or sound barriers), as well as the internet of things (e. g. PV in consumer products such as outdoor equipment and wearables). However, the characterization of environmental impacts of emerging photovoltaics remains a challenge. A literature review on life cycle assessment studies of the four solar cell types listed above showed a general lack of such studies, where studies exist, a great range of analyzed parameters challenge a consistent comparison between technologies at this point. Rather, the review may be considered a first step for more adequate environmental impact assessment as it identifies respective common knowledge gaps. Furthermore, it allows to deduce recommendations for a more sustainable design of emerging photovoltaics. To complement and validate the findings from literature on emerging PV, stakeholder

and expert interviews were conducted. Here, aspects such as durability of PV technologies, real-life assessments, toxicity studies on the used substances and compounds, and adequate recycling concepts and approaches were considered to contribute to more sustainable emerging PVs. The findings of the project were discussed in an online workshop on June 30th, 2021, to ensure their relevance and suitability for stakeholders and experts in the field as a basis for deducing design suggestions and recommendations for policy and research funding.

For more information see the [BOKU website](#) or find research updates on [Research Gate](#).

Project partners and funding

The SOLARcircle project (Oct. 2020 - Sept. 2021) is funded by the Austrian nano EHS program (<https://projekte.ffg.at/projekt/3828182>). The project consortium consists of partners from the University of Natural Resources and Life Sciences in Vienna, Johannes-Kepler University Linz, and the Energy Institute Linz.

Contact

Institute for Synthetic Bioarchitectures,
University of Natural Resources and Life
Sciences, Vienna
Eva-Kathrin EHMOSER
eva.ehmoser@boku.ac.at
<https://forschung.boku.ac.at>

CONTRIBUTION FROM WOOD K PLUS



Production of bio-based resols from structure-defined lignin oligomers (LignoWert)

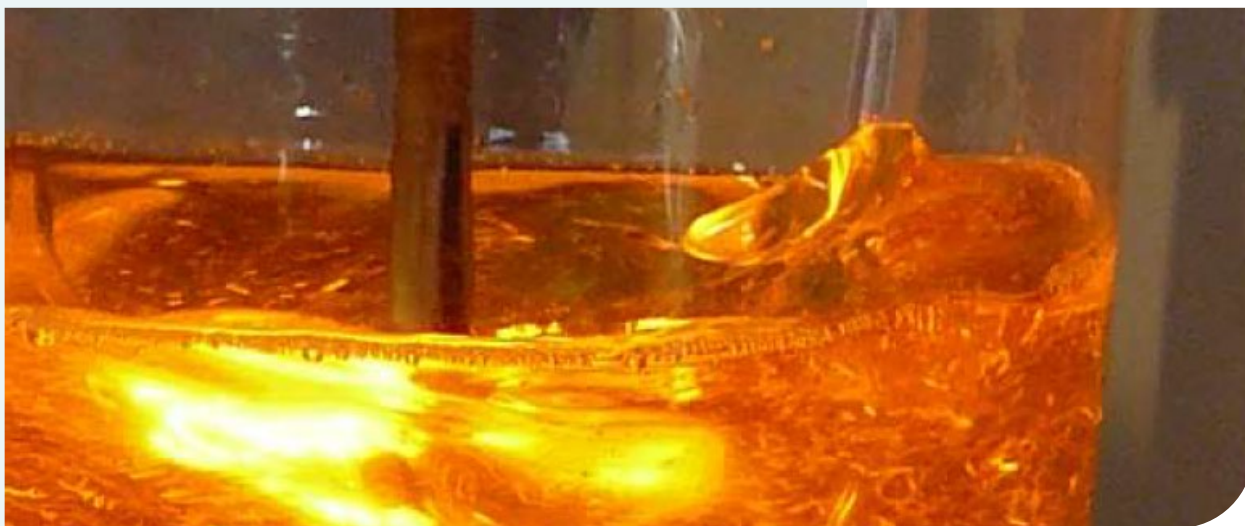


Figure1: Phenolic resins as versatile binders (Photo: E. Fliedner, Prefere Resins)

LignoWert project (April 2020 - March 2023) from Wood K plus is researching together with the Vienna University of Technology and the industrial partners Prefere Resins Germany GmbH and Lenzing AG on the development of bio-based phenol building blocks from the biorefinery products lignin and lignosulfonates.

Phenol from petroleum fractionation is a basic chemical used in the manufacture of phenolic resins. Phenol is reacted with aldehydes under alkaline or acidic conditions. The three-dimensional network of the hardened polymer is responsible for the high chemical and thermal resistance and the good mechanical properties (Fig. 1). For this reason, the thermosetting

polymers are used as binders in numerous applications in construction, insulation and industry. Phenols can be found in abrasives, friction and other technical applications such as foaming or high temperature applications, along with some wood composites or insulation products.

There is great interest in the resin industry in replacing this petrochemically produced phenol with renewable raw materials. Lignin structures, which are basically available as side streams in today's pulp production plants, can be used here. So far, however, only a proportion of 30% lignin can be added to the phenol (so-called drop-in process management). However, in order to replace all of the

petrochemical phenol, completely new ways of providing defined structures from the inhomogeneous raw material lignin are necessary.

In the LignoWert project, the supply of the lignin (pilot plant TU Wien), the oligomerization of the lignin by means of radical scavengers (Wood K plus) and the final resin production (Wood K plus and Prefere Resins) by combining the individual process steps are developed along the value chain. The key here is the use of the Organosolv medium both for the provision of lignin and for the production of oligomers. By using this completely new

method, oligomeric lignin structures with a high atom economy can be produced under moderate temperatures and short reaction times while avoiding by-products that occur in current processes, such as coke and degradation products. The oligomers function as phenol building blocks and as oligomeric backbone for resin production in order to use fewer crosslinkers (aldehydes) at the same time. Finally, the experimental experience in the value chain is expanded through additional testing of the lignosulfonate from Lenzing AG (Figure 2).

The process in industry is upscaled and the bio-based product batches produced are checked in industrial analyzes. This contributes to the development of the high quality requirements for bio-based products within the framework of the bioeconomy.

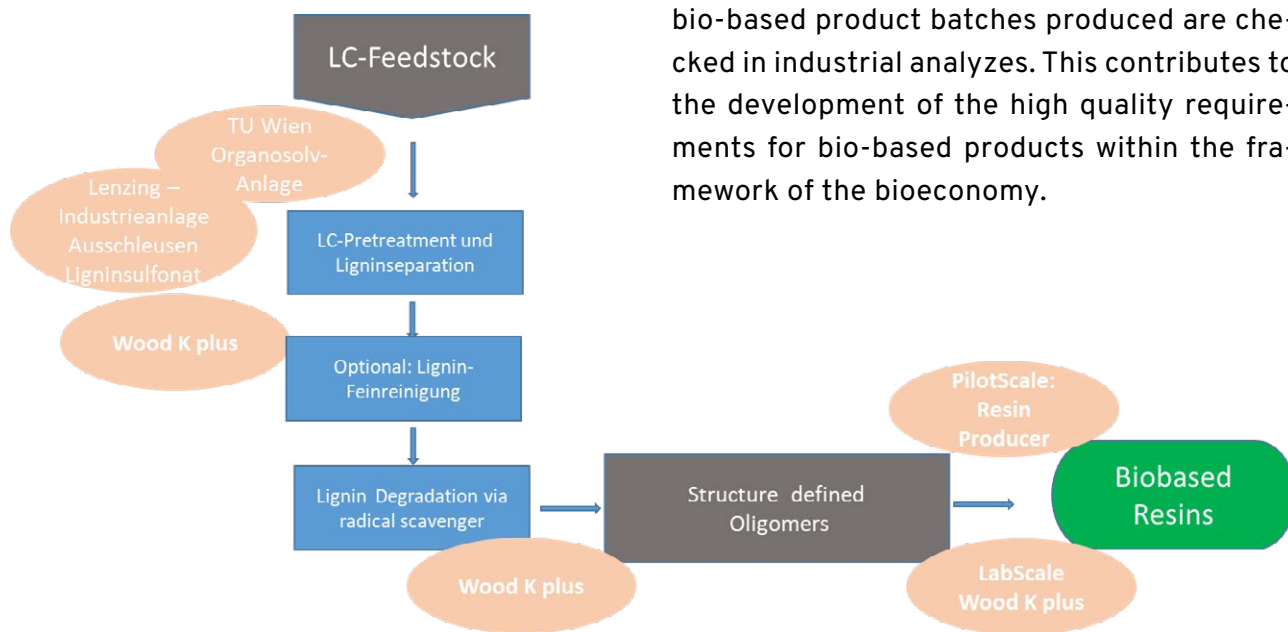


Figure 2: Value chain for the production of bio-based resins

Contact

Kompetenzzentrum Holz GmbH - Area Wood Chemistry and Biotechnology
 Birgit KAMM (project leader)
b.kamm@kplus-wood.at
www.wood-kplus.at

Funding agency: Austrian Research Promotion Agency, Production of the Future

WOOD
K PLUS

Lenzing
Innovative by nature

prefere
phenolics

FFG
Forschung wirkt.

TU WIEN
TECHNISCHE UNIVERSITÄT WIEN

BNN retrospect



1ST STAKEHOLDERS' WORKSHOP ON SAFE AND SUSTAINABLE-BY-DESIGN CRITERIA

19th March 2021, online event

On March 19th, 2021, the European Commission, DG Research & Innovation, hosted the workshop “1st Stakeholders’ workshop on Safe and Sustainable-by-Design criteria”.

Coming from the key enabling technologies, advanced materials and specifically nano-sized materials earned attention to make their use and application safe and sustainable. Funded projects in recent years prepared a very strong fundament for **applying this safety and sustainability expertise in the nowadays European Green Deal actions**.

The SSbD-approach now finds its way into the chemicals strategy for sustainability, contributing to (i) climate neutrality, (ii) zero pollution, and (iii) circular economy. At that point, this workshop has been an important activity towards development of criteria on safe and sustainable-by-design.

BNN participated in the workshop to bring in our competences and experiences based on our in-house development of the implementation of SbD/SSbD in our completed EU-projects (e.g. INSPIRED, Hi-Response, R2R Biofluidics, Smart4Fabry), as well as our real-life implementation expertise that now feeds also into ongoing projects (e.g. Hi-Accuracy, NextGenMicrofluidics, PHOENIX), but also is available as a support service for industry. Besides applying the SSbD-concept, we still

further elaborate our approach and monitor developments on global level to also improve this, and contribute to structuring activities. BNN is involved in this work within EU-projects SbD4Nano, SABYDOMA, HARMLESS, DIAGONAL as well as initiatives and partnerships like INISS-nano, PARC and within the EU NanoSafetyCluster.

Within the workshop, first steps towards the criteria definition, concept and planning – so setting the scene and putting in place the process of the criteria definition - have been done, and current definitions and applications of SSbD have been presented. More than 540 participants listened and contributed to this workshop.

The [full recording of the workshop](#) has been published by the EC Directorate General for Research & Innovation (DG RTD).

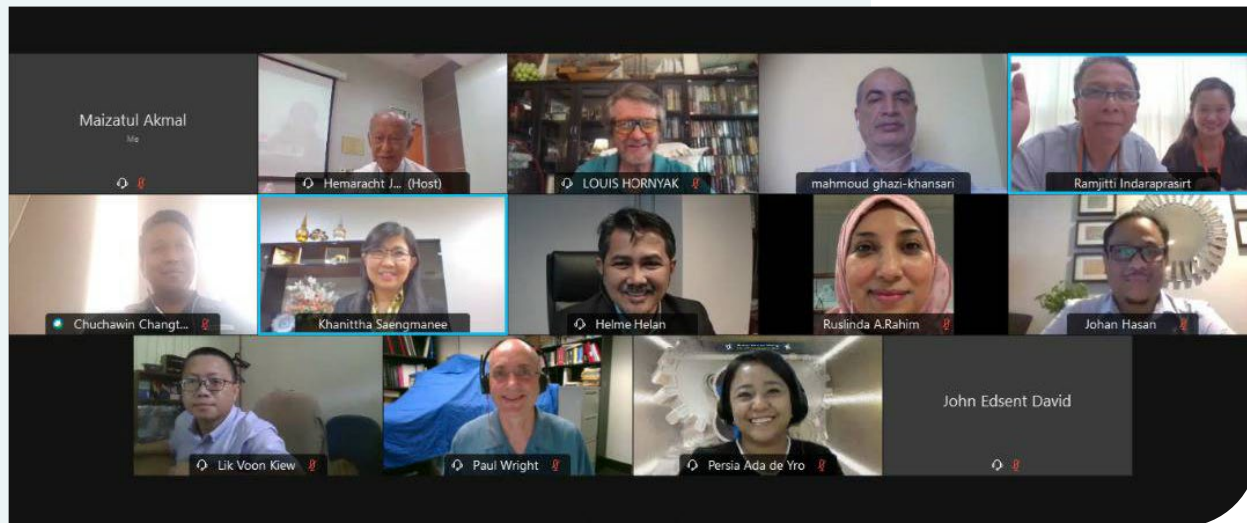


These projects have received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement n° 814401, n° 953183, n° 862296 and n° 862195.

FORUM ON NANOSAFETY: 'FROM LAB TO SOCIETY'

NanoSyn²

24th March 2021, online event



Participants of the Forum on Nanosafety event 'From Lab to Society'

It is without a doubt that nanomaterials present an enormous potential in various fields such as health care, information technologies, energy, production, security and aerospace. The market is growing very quickly and presence of nanotechnology becomes a reality in our daily life. ASEAN countries are embracing the benefits from nanotechnology applications as can be seen in the increase nano products in the market.

With the growing use of nanomaterials there is of course the question of health security and uncertainties. For this reason, reassuring the public on nanosafety becomes a priority. The

public should be able to know exactly which product uses nanotechnology and what are the risks related to health in both terms of hazards and exposures. The knowledge on nanosafety has increased substantially in Thailand since the first national Nanosafety and Ethics Strategic Plan was issued in 2012. Currently we are utilizing the plan for the period 2017-2021 which has received approval for extension to 2024 from the Office of National Higher Education Science Research and Innovation Policy Council (NXPO). The Nanosafety Network for Industry an initiative under NANOTEC announced the collaborative partnership ag-

reement with nine agencies to drive the Nanosafety and Ethics Strategic Plan to enhance industrial understanding and awareness of how new nano-enabled products can pose concerns regarding to human health and environmental risks. The partnership marks a significant strategic approach to promoting synergies and cooperation between state agencies. In addition, the launch of the Easy to Read industrial standards application of nanosafety earlier this year also helps to add to public and industrial awareness to the importance of industrial standards.

Asia Nano Forum (ANF) has been encouraging joint collaborations initiatives between its Member States and within its Working Groups. The Nanosafety Working Group has initiated this forum as a joint collaboration between the National Nanotechnology Centre Malaysia (NNC) and National Nanotechnology Center Thailand (NANOTEC) with support from ANF.

The forum was divided into 3 sessions: Technical/Research, Awareness, and Panel Discussion and aims to encourage the discussion of nanosafety in various capacities from research to public awareness activities to standardization. It also provides a venue for sharing of experiences and networking. Participants discussed specific research collaboration opportunities as well as challenges.

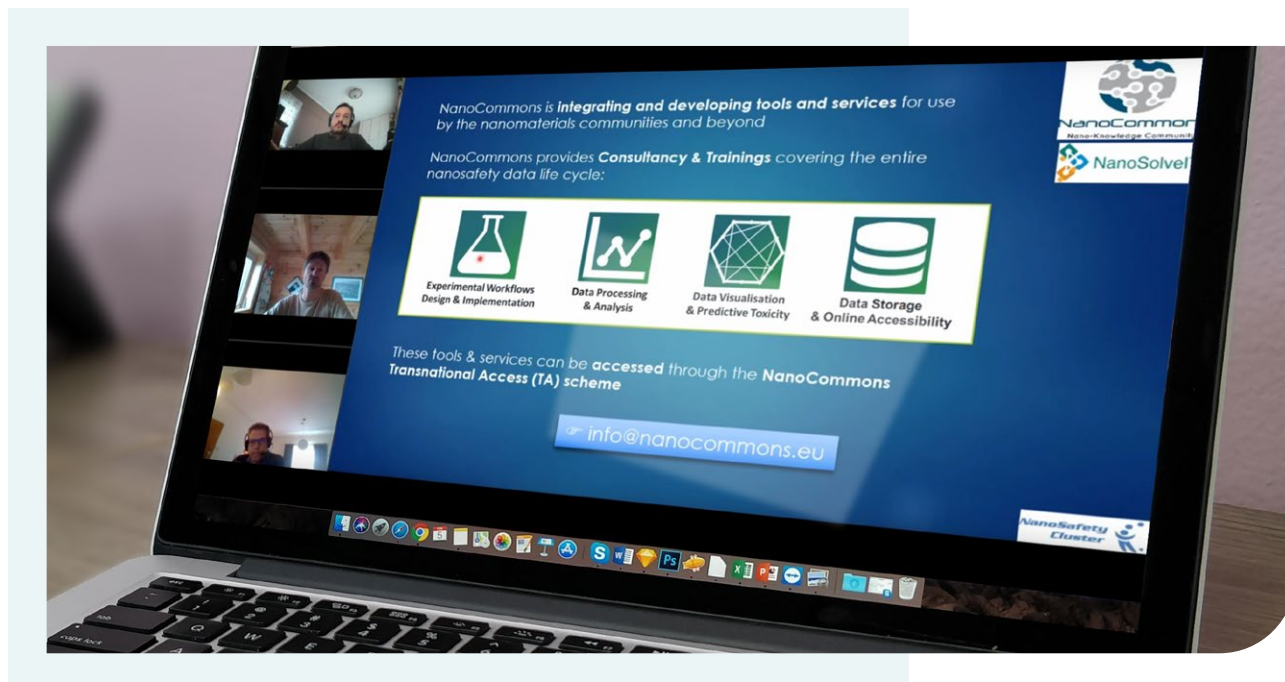
Twelve speakers from Australia, France, Japan, Malaysia, Philippines, Iran, Thailand, and USA, participated in the forum and over 200 participants registered to attend the forum.

This event was organized by [NANOTEC \(Thailand\)](#) and [NNC \(Malaysia\)](#) and supported by [Asian Nano Forum \(ANF\)](#)



ONLINE QSAR MODELLING HACKATHON BY EASY ACCESS TO JAQPOT: DEPLOY YOUR MODEL AS A WEB SERVICE IN A FEW MINUTES

13th April 2021, online event



On 13th April 2021, the H2020 project [NanoCommons](#), in a joint initiative with the [NanoSafety Cluster](#) (NSC) and supported by the developments in the H2020 project [NanoSolveIT](#), organized an online webinar on “Online QSAR Modelling Hackathon by Easy Access to Jaqpot”. The National Technical University of Athens team (NTUA), Haralambos Sarimveis and Philip Doganis, offered an entry-level workshop on in silico nanotoxicology, providing users with easy (no installations required) access to Jaqpot, a powerful and versatile nanotoxicological in silico prediction platform, enabled through powerful Google Colab notebooks.

Under the title “Deploy your model as a web service in a few minutes”, more than 30 participants from a mixed audience (academia, research organizations, industry, regulators, etc.) learned how to develop a Quantitative Structure-Activity Relationship (QSAR) model and to publish it as a web application through the Jaqpot platform with minimal programming skills requirements. The participants also learned that models built on Jaqpot can be used over the graphical user interface or across platforms over the API and that they can be shared to groups with controlled access and rights.

The webinar started with a short introduction to NanoCommons, given by [Martin Himly](#), Chair of the [WG-A “Education, Training and Communication” of the NSC](#), on the brand new [NanoCommons User Guidance Handbook](#), explaining also where to find the different training materials offered by NanoCommons, and the forthcoming events being organized by NanoCommons. There was also a special mention to the upcoming [Targeted TA Call supporting the integration of NanoSafety Tools into the NanoCommons Knowledge Infrastructure](#).

Following Martin’s intro, Haralambos Sarimveis, from NTUA, gave an introduction to QSAR Predictive Modelling on Jaqpot.

After that, his colleague Philip Doganis, from NTUA, guided the audience through the training on Jaqpot easy-accessed by Google Colab Notebooks. In order to support the workshop’s participants through the hands-on training, two break-out rooms were set up and supervised by the NTUA team (Periklis Tsiros, Pantelis Karatzas and Jason Sotiropoulos).

It was a well-attended webinar, with active and very interested participants who communicated their appreciation at the end of the webinar for the high interactivity and the gained skills. The webinar presentation slides and the recording (recorded for educational purposes) are available in the [NanoCommons Infrastructure](#), in [Zenodo](#), [YouTube](#) and in the [NanoCommons’ Elixir TeSS channel](#).

Contact

BioNanoNet Forschungsgesellschaft mbH
Beatriz ALFARO SERRANO (“Integration & Sustainability” lead)
beatriz.alfaro@bnn.at

PLUS

Martin HIMLY (“Training” lead, chair of the EU NanoSafety Cluster - Working Group A on Education, Training, and Communication)
martin.himly@sbg.ac.at

Get connected with NanoCommons on:



[SEE WEBSITE](#)



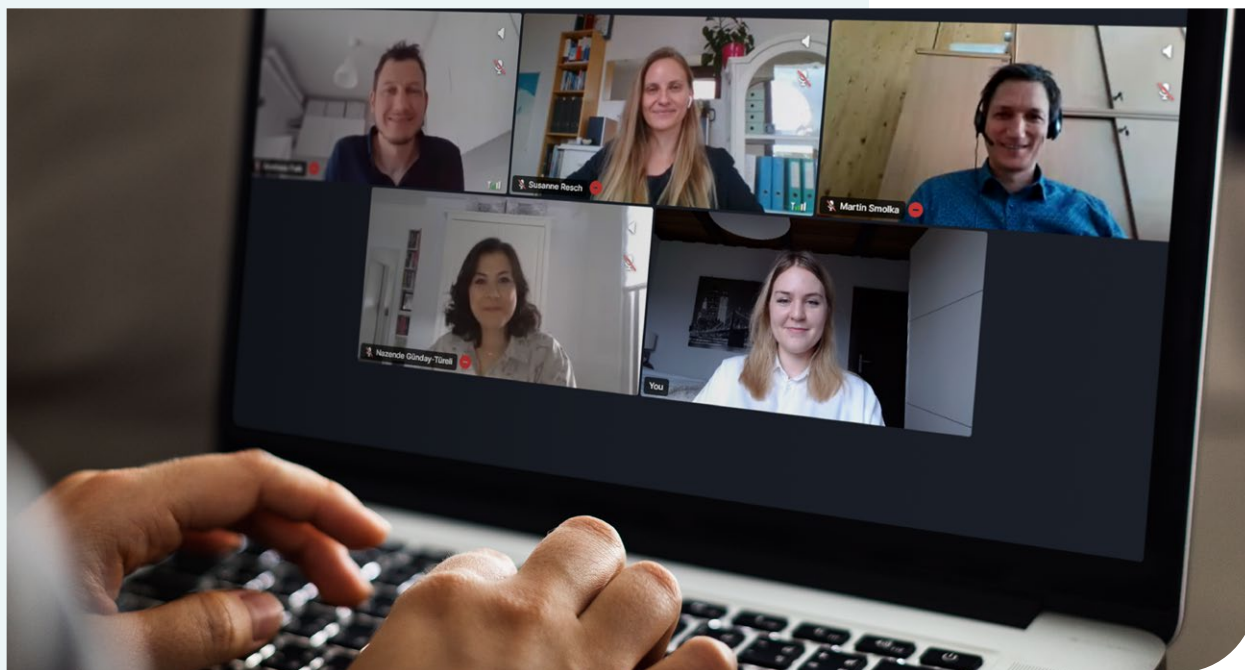
NanoCommons project has received funding from the European Union’s HORIZON 2020 research and innovation programme under grant agreement n° 731032.

[→ TABLE OF CONTENTS](#)

INTERNANOPOLAND2021 CONFERENCE

14th – 15th April 2021, online event

Inter
Nano
Poland
2021



InterNanoPoland is a Business-to-Science Science-to-Business international forum for scientists, entrepreneurs, business support organizations and students working in the nanotechnology and advanced materials sector. The conference is organized by the NANONET Foundation & Silesian Nano Cluster in cooperation with the University of Silesia in Katowice that is a sister initiative to BNN based in Poland.

The conference took place 14th - 15th April for the first time online this year for obvious reasons and gathered not only more than 100 specialists in the sector but also initiated im-

portant discussions including those initiated by worldwide known experts like Denis Koltsov, Zina Cinker or Andreas Falk.

The latter moderated the thematic panel: FROM IDEA TO REALITY - IMPORTANT CORNERSTONES ON THE WAY TO THE (NANO) MARKET. Two important concepts were introduced: Safety-and-Sustainability-by-design as a cornerstone for sustainable innovation by Susanne Resch, BNN, and Open innovation test beds - their role on the way to the market by two existing infrastructures: PHOENIX - Pharmaceutical Open Innovation Test Bed for Enabling Nano-pharmaceutical Innovative

Products by Nazende Günday-Türelı, MyBio-tech GmbH, and NextGenMicrofluidics - Next generation test bed for upscaling of microfluidic devices based on nano-enabled surfaces and membranes by Martin Smolka, JOANNEUM RESEARCH ForschungsGmbH. It was followed by the panel discussion in which the main challenges and opportunities for both

project coordinators and beneficiaries were pointed out. The session organized by BNN was initiated within NanoFabNet, the so-called hub for sustainable nanofabrication, and showcased the strength of inter-project collaboration as it is supported by this EU-funded project.



These projects have received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement n° 953152, n° 953183, n° 862410, n° 886171, n° 862583, n° 862092, n° 862296 and n° 862195.

1ST NANOSYN2-JOINT MEETING & 18TH NANONET-AUSTRIA MEETING

30th April 2021, online event

The 1st NanoSyn2 Joint Meeting supporting the 18th nanoNET-Austria Meeting took place on 30th of April 2021 as an online meeting and attracted more than 35 participants.


NanoNET-Austria arranged a program with top-class speakers from different sectors of industry and research in the fields of micro- and nanotechnology with a focus on industrial fabrication relevant aspects.

This 18th nanoNET-Austria Meeting started with the application of silicon nitrides for integrated photonic devices and continued with the industrial application of plasmonic structures for medical biosensing applications. Frontier research on textile enabled energy generators and the presentation of the research portfolio of a nanoNET-Austria member concluded the scientific part of this meeting.

Mr. Rudolf Heer from Silicon Austria Labs opened and chaired the nanoNET-Austria meeting which gave the audience the chance to follow the invited presentations on:

- ✓ **Cost-efficient Light Generation: The Integrated Silicon Nitride Organic Hybrid (SiNOH) Laser** by Dr. Florian Vogelbacher, Chinese Academy of Sciences Institute of Chemistry, CAS Key Laboratory of Green Printing
- ✓ **Plasmonic Structures for Signal Enhancement – translating basic science for DVD technology into smart polymer chips for**



 Bundesministerium
Klimaschutz, Umwelt,
Energie, Mobilität,
Innovation und Technologie

medical devices by Magdalena Schimke, PhD, STRATEC Consumables GmbH

- ✓ **Textile as nanoenergy generator and self-powered sensor** by Dr. Gaffar Hossain, V-Trion GmbH Textile Research GmbH
- ✓ **R&D activities in sensors at AC2T research GmbH** by Dr. Nicole Dörr, AC2T research GmbH

Furthermore, Alexander Pogany from the Federal Ministry for Climate Protection, Environment, Energy, Mobility, Innovation and Technology (BMK) gave an overview on current topics and activities in the field of production technologies in Austria, on the European- and international level. Special attention was paid to China and the upcoming call „Production of the future“ in the field of nanomaterials.

The meeting was closed by Rudolf Heer from the Silicon Austria Labs with a report from the nano-NET-Austria activities and an outlook on planned events, especially the planned presentations at international trade fairs and delegation trips.

NanoSyn²

FUNDED BY

 Federal Ministry
Republic of Austria
Climate Action, Environment,
Energy, Mobility,
Innovation and Technology

NanoSyn2 is funded by the Federal Ministry of Republic of Austria, Climate Action, Environment, Energy, Mobility, Innovation and Technology

EURONANOFORUM 2021 AND NSC SATELLITE EVENT – NANOSAFETY PROJECTS SHOW THEIR COLLABORATION

4th – 6th May 2021, online event



Joint NMBP-13 Booth on the ENF2021 for Gov4Nano, NANORIGO & RiskGONE projects

Under the Portuguese Presidency of the Council of the European Union in the first half of 2021, this year's online edition of the EuroNanoForum conference addressed nanotechnology and advanced materials as key elements to guarantee the functioning, long term durability, safety and environmental compatibility of many devices, machinery, and services, highlighting the fundamental role of advanced materials for the transition to greener technologies and a more sustainable future, making a significant contribution to the ambitious goals set by the European Green Deal. Moreover, the role of nano-enabled industries in the drive towards a green and resilient Europe was also enhanced.

The EuroNanoForum 2021 gathered a total of 3640 participants from over 140 countries, providing thousands of opportunities for networking and collaboration through almost 200 scientific posters, 17 booths at the exhibition hall, five satellite events and several hours of sessions about topics that the European nanotechnology community is now even more empowered to intervene upon.

The three NMBP-13 projects [Gov4Nano](#), [NANORIGO](#) and [RiskGONE](#) actively participated in the conference and contributed a joint virtual booth to present latest updates from the development of the Nano Risk Governance Council and Framework. All posters that were

presented at the NMBP-13 booth are [online available](#).

The NMBP-15 projects [ASINA](#), [SABYDOMA](#), [SAByNA](#) and [SbD4Nano](#) jointly organized a virtual booth to raise awareness and create interest for Safety-by-Design by explaining the concept, its impacts in the society and bringing it closer to the community.

All four NMBP-15 projects showed their synergies and points in common through several posters that were presented at the booth. Additionally, short pitch videos of each project were shown: [SABYDOMA](#), [SbD4Nano](#), [ASINA](#) and [SAByNA](#)



Joint NMBP-15 Booth on the ENF2021 for SABYDOMA, SbD4Nano, ASINA & SAByNA projects

As a satellite event of the EuroNanoForum 2021, the [EU NanoSafety Cluster](#) organised the [NSC event](#) on May 4th, addressing the topic “The delivery/usability of S(S)bD for science, regulators and the industry”. The online event attracted ~100 participants, listening to great presentations in the three sessions:

1. Delivery from science: 10 presentations featuring SUNSHINE, NanoRIGO, SABYDOMA, SAByNA, NanoFabNet, Safe-n-Medtech, DIAGONAL, ASINA and SbD4Nano, as well as the Working group A activities, showcased the

strengths of research that is delivered in EU-funded projects.

2. Expectations from regulators: Bart Walhout (RIVM) and Xenia Trier (EEA) highlighted their points of view about definitions and approaches of SSbD, and added a policy perspective on SbD in nanotechnology.

3. Perspective from nanofabrication side: organized by BNN in the frame of NanoFabNet project, Patricia M.A. Farias (UFPE/Phronano Holding GmbH) and Fernando de la Vega (PV

NanoCell) showed in their interventions the huge impact they see for their SMEs brought by addressing sustainability and safety aspects from along the nanofabrication path.

The final part of the NSC-event was dedicated to online-networking, which worked well with the selected tool. It enabled an open forum for

the participants, getting to know each other in an informal way, and within an online-tool that we will use also for forthcoming NSC-events.

Furthermore, all presentations of the event are available on the [YouTube channel of the NSC](#), which is one of the benefits of online meetings.



These projects have received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement n° 953152, n° 886171, n° 814401, n° 862296 and n° 862195.



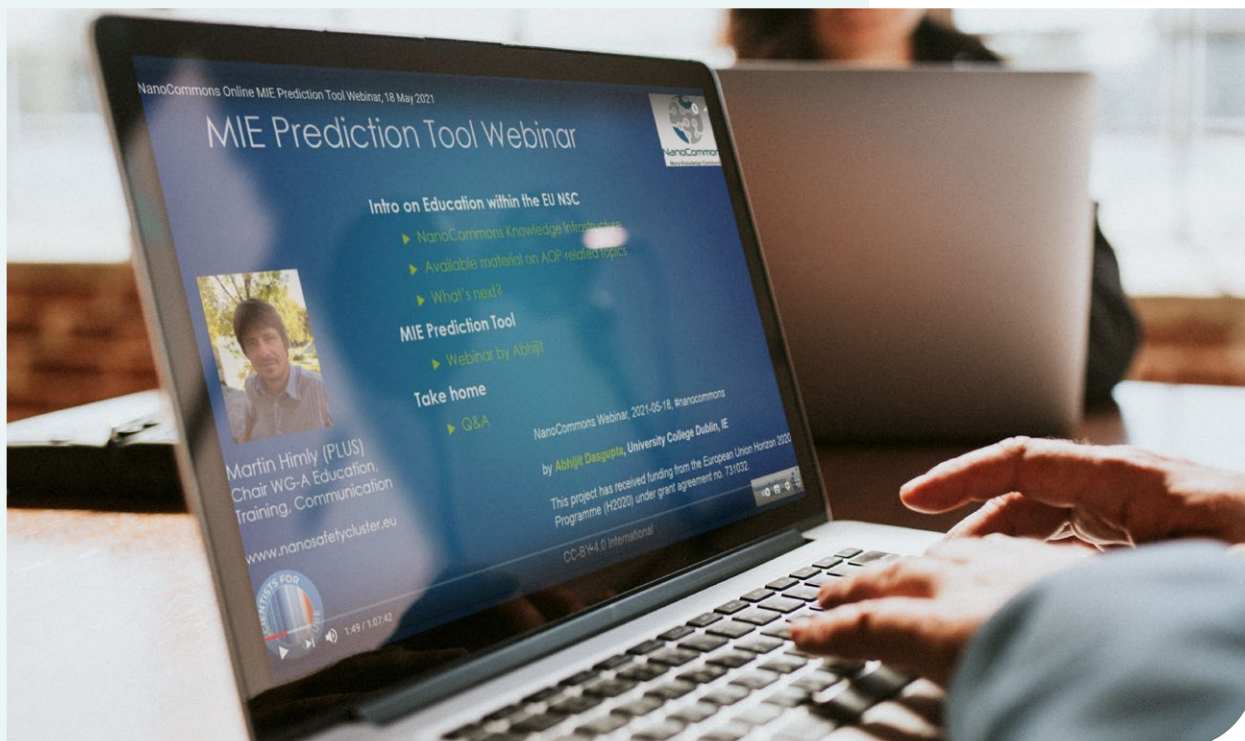
FUNDED BY

 Federal Ministry
Republic of Austria
Climate Action, Environment,
Energy, Mobility,
Innovation and Technology

NanoSyn2 is funded by the Federal Ministry of Republic of Austria, Climate Action, Environment, Energy, Mobility, Innovation and Technology

MIE PREDICTION TOOL WEBINAR

18th May 2021, online event

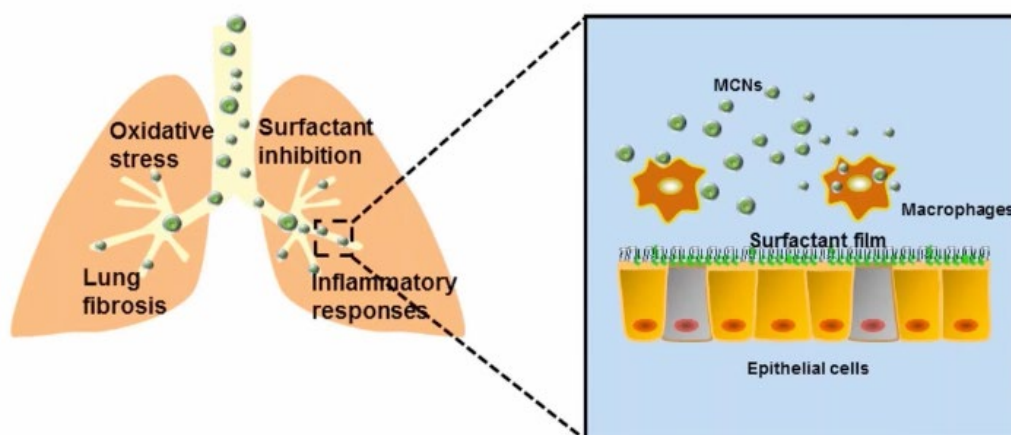


On Tuesday, 18th May 2021, the H2020 project [NanoCommons](#), in a joint initiative with the [NanoSafety Cluster](#), offered an online webinar on the use of their Molecular Initiating Event (MIE) Prediction Tool accessible via the NanoCommons Knowledge Base (NC KB).

Introduction and Host: [Martin Himly](#), PLUS and Chair of NanoSafety Cluster WG-A on Education, Training, and Communication. Webinar Speaker: [Abhijit Dasgupta](#), UCD. Panel for Q+A session: [Vadim Zhernovkov](#) and [Vladimir Lobaskin](#), UCD.

Toxicity testing and regulation of advanced materials at the nanoscale i.e., nanosafety, is challenged by the growing number of nano-materials. The existing animal-reliant toxicity testing tools are onerous in terms of time and resources. There is a need for faster, cheaper, sensitive and effective animal alternatives that are supported by mechanistic evidence. Moreover, there is an urgency for developing alternative testing strategies. The Adverse Outcome Pathway (AOP)-based approaches provide pragmatic insights to promote the development of alternative testing strategies.

MIE1: Disruption of lung surfactant functionality



The comprehensive toxicological profile of mesoporous carbon nanomaterials (MCNs) under the scenario of moderate environmental exposure.

Chen, Yunan, et al. "Mesoporous carbon nanomaterials induced pulmonary surfactant inhibition, cytotoxicity, inflammation and lung fibrosis." *Journal of Environmental Sciences* 62 (2017): 100-114.

Tuesday, May 18, 2021



11

MIE is the first step in an AOP and can be considered as a chemical interaction between a chemical toxicant and a biological molecule. Key chemical characteristics can be identified and used to model the chemistry of these MIEs. Predicting actual MIEs without time-resolved data establishing the MIE is challenging. Risk assessment requires information on the exposure conditions (e.g., route, dose, duration and frequency) needed to cause an AO. The NanoCommons MIE gene set database (NanoCommons GS-MIE DB) captures:

- ✓ Gene signatures (GS) of MIEs by integrating knowledge from KEGG, REACTOME, GO, WikiPathways public databases;
- ✓ Custom gene sets from published data;

✓ To date, manual collection of 132 gene sets representing three different types of MIE actions:

- MIE1. Disruption of lung surfactant functionality
- MIE2. Lysosomal destabilization
- MIE3. Oxidation of cell membrane

The webinar started with a short introduction to NanoCommons, as a nanosafety data and knowledge infrastructure, given by [Martin Himly](#), Chair of the [WG-A "Education, Training and Communication" of the NSC](#), followed by an introduction to the webinar topic highlighting the already existing AOP-related webinar materials that have been offered in the past.

All available training materials provide further background and insight. Concretely, the previous AOP-related webinars, such as the [SmartNanoTox final meeting](#), session 1 at the [NSC Education Day](#), and the [Online AOP-Wiki Webinar](#) were mentioned.

Following Martin's introduction, [Abhijit Dasgupta](#), from UCD, reviewed the AOP concept and elaborated on the challenges of modeling MIEs for the case of nanomaterials. He explained the above-mentioned MIEs relevant for different nanoparticle types (below a screenshot for MIE1).

Later during the webinar, Abhijit went through the background of the underlying data sets and the mathematical models behind the prediction tool. Towards the end of the webinar, he showcased the prediction tool running a few query applications, giving insight in the tool performance.

It was a well-attended webinar, with active and very interested participants, who communicated their appreciation at the end of the webi-

nar during an extensive Q&A session, where [Vadim Zhernovkov](#), who was involved in the development of the tool, provided lots of further details and insights. The webinar presentation slides and the recording (recorded for educational purposes) are available in the [NanoCommons Infrastructure](#), in [Zenodo](#), [YouTube](#) and in the [NanoCommons' Elixir TeSS channel](#).

Contact

BioNanoNet Forschungsgesellschaft mbH
Beatriz ALFARO SERRANO ("Integration & Sustainability" lead)
beatriz.alfaro@bnn.at

PLUS

Martin HIMLY ("Training" lead, chair of the EU NanoSafety Cluster - Working Group A on Education, Training, and Communication)
martin.himly@sbg.ac.at

Get connected with NanoCommons on:



[SEE WEBSITE](#)



NanoCommons project has received funding from the European Union's HORIZON 2020 research and innovation programme under grant agreement n° 731032.

[→ TABLE OF CONTENTS](#)

GLOBAL INNOVATION SUMMIT

18th – 20th May 2021 , online event

GLOBAL INNOVATION SUMMIT

From 18th - 20th of May 2021, the Global Innovation Summit took place in Graz as a hybrid meeting under the heading “Exploring new perspectives”.

BNN was invited to contribute to the session “future of mobility” by BioNanoNet-member ACStyria, which organised this session in the frame of the “green transition”-focus of the event. Thus, the presentation “Safety and Sustainability by design – a must-have towards sustainable innovation” was perfectly placed as recent developments have shown the importance of addressing safety and sustainability aspects right from the very beginning in any innovative product/process development. BNN presented its SSbD (safety and sustain-

nability by design) concept, which helps and guides in efficiently meeting future market requirements in terms of sustainable innovation. As a matter of fact, nanomaterials are part(s) in lots of mobility-relevant products e. g. lightweight materials; thus, the exploration of new perspectives could be delivered right from the beginning.

Several of the projects in which BNN is involved as partner are working on further maturing, upgrading, and/or implementing the SSbD-concept. Thus, the event enabled to show to (business)minds and technical developers the potential and the economic and environmental value that can be associated to the SSbD concept and its use.



These projects have received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement n° 953152, n° 953183, n° 862410, n° 862583, n° 862092, n° 862296 and n° 862195.



FUNDED BY

 Federal Ministry
Republic of Austria
Climate Action, Environment,
Energy, Mobility,
Innovation and Technology

NanoSyn2 is funded by the Federal Ministry of Republic of Austria, Climate Action, Environment, Energy, Mobility, Innovation and Technology

1ST BIONANONET GOLD MEMBER WEBINAR

27th May 2021, online event



Our 1st BioNanoNet Gold Member Webinar took place on 27th May 2021 as virtual event. Our GOLD members Medical University of Graz, Technische Universität Wien, JOANNEUM RESEARCH Forschungsgesellschaft mbh and Graz University of Technology presented their institutions there. All presenters gave an insight into their interesting expertise!

The presentations can be downloaded and the recordings can be watched now:

Caroline SCHÖBER, Vicerector of Research and International Affairs, presenting **Medical University of Graz**

→ [Download presentation](#) → [Watch video](#)

Frank SINNER, Director of the Institute for

Biomedicine and Health Sciences (HEALTH), presenting **JOANNEUM RESEARCH Forschungsgesellschaft mbh**

→ [Download presentation](#) → [Watch video](#)

Elisabeth SCHLUDERMANN, Head of Funding Support & Industry Relations, presenting **Technische Universität Wien**

→ [Download presentation](#) → [Watch video](#)

Torsten MAYR, Deputy Head of the Institute of Analytical Chemistry and Food Chemistry, presenting **Graz University of Technology**

→ [Download presentation](#) → [Watch video](#)

Take a look on our [BNN YouTube channel](#) where all BNN videos have been published so far!

IMAGINE21 – BE THE CHANGE

16th – 17th June 2021, online event



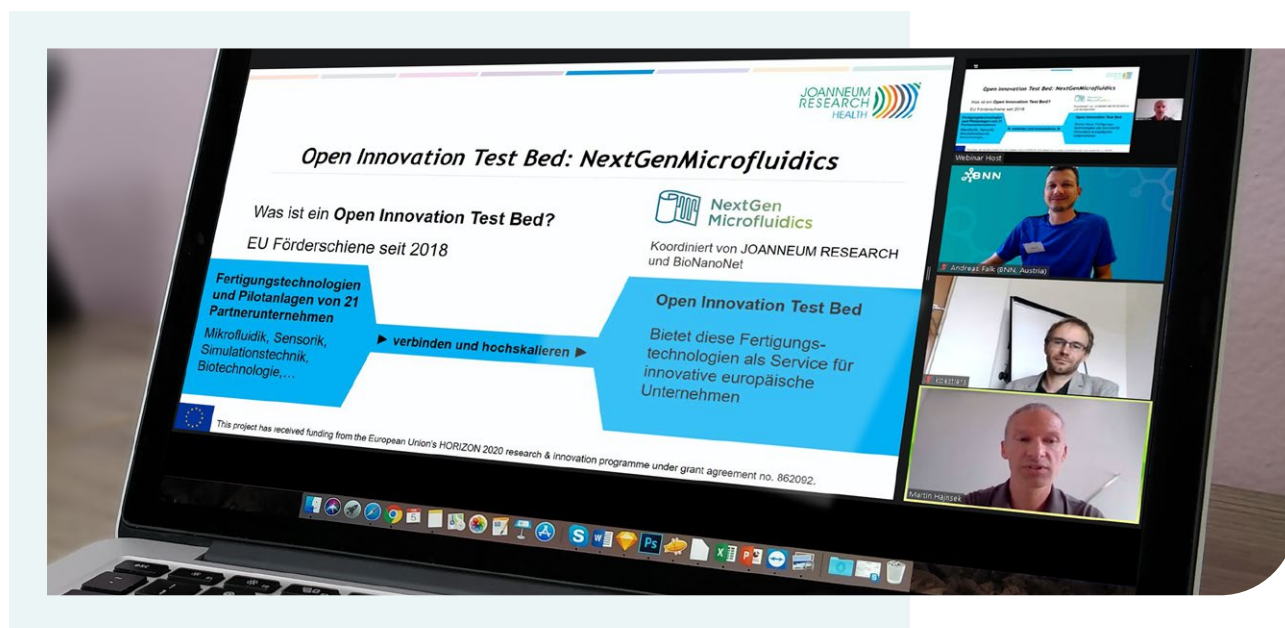
On the left: keynote-speaker Harald Welzer from the Offene Gesellschaft und digitale Ökologie Harald Welzer and on the right moderator Ursula Eysin

On June 17th, 2021, the IMAGINE21-conference took place online. BNN had the pleasure to organize in the frame of NanoSyn2 project a session dedicated to “sustainable (nano)technologies for medical sensors”. Within that session, **Martin Hajnsek, JOANNEUM RESEARCH – HEALTH**, presented the EU-funded project NextGenMicrofluidics in a key-note plenum presentation. He highlighted in his talk a Smart Phone Enabled Home Diagnostics for Potassium in Blood, the technical background and the scientific and commercial potential of this development.

After the key-note speech, the panel discussion that was moderated by **Andreas Falk, BNN**, provided a glimpse on the Safe-and-Sustainable-by-design approach that is run by BNN. Furthermore, panelist **Stefan Köstler, ERBA Technologies Austria GmbH**, also partner in the NextGenMicrofluidics project, introduced their contribution to the development of test strip based sensors for potassium home monitoring. Its main activities are related to microfluidic test strip design, printed electrochemical sensor production, as well as system integration and industrialization.

A key topic during the panel discussion has been sustainability and how this is addressed in all three dimensions within the project. The entire conference proved it valuable that NextGenMicrofluidics and its Microfluidics Innovation Hub (MIH) strongly focus along all their research, development and production

areas on proactive assessment and integration of economic, environmental and societal sustainability aspects. Within the concluding remarks of the panel, the panelists highlighted that the presented home diagnostic solution will meet several criteria and thus will contribute to the UN sustainability goals.



Screenshot from the session „Sustainable (nano)technology for medical sensor technology – on the right Andreas Falk from BNN (moderator), below Stefan Köstler from Erba Technologies Austria GmbH and Martin Hajnsek from JOANNEUM RESEARCH Forschungsgesellschaft mbH (key note).

NanoSyn²

FUNDED BY

 Federal Ministry
Republic of Austria
Climate Action, Environment,
Energy, Mobility,
Innovation and Technology



NextGen
Microfluidics



NanoSyn2 is funded by the Federal Ministry of Republic of Austria, Climate Action, Environment, Energy, Mobility, Innovation and Technology

This project has received funding from the European Union's HORIZON 2020 research & innovation programme under grant agreement n° 862092.

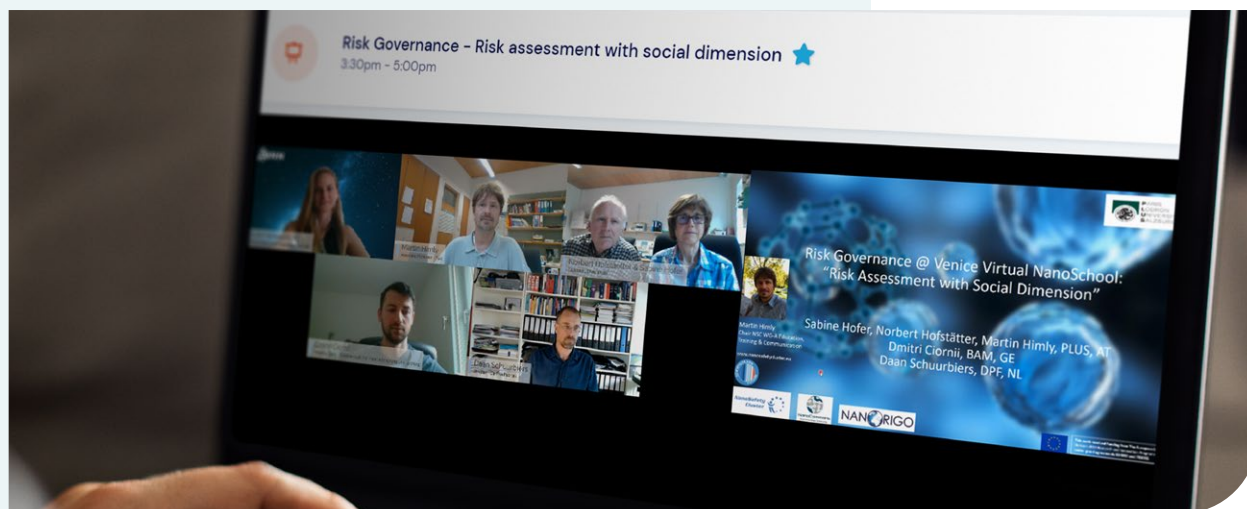


[SEE WEBSITE](#)

[→ TABLE OF CONTENTS](#)

NANOSAFETY TRAINING SCHOOL: FROM BASIC SCIENCE TO RISK GOVERNANCE

21st – 25th June 2021, online event



Jointly organized between seven EU funded H2020 research projects and following more than a decade of tradition, this year's Nanosafety Training School took place from 21st to 25th June in an online setting. Unfortunately, because of the pandemic situation and the restriction of physical events, the nanosafety community couldn't meet as usual in beautiful Venice. Nevertheless, the 10th edition of this Nanosafety Training School was held successfully with more than 170 registrants. The programme included different sessions on each afternoon, with contributions from many experts with different scientific backgrounds presenting the latest results of EU's nanosafety research arena. The training started with two key note lectures on the Monday afternoon: Georgios Katalagarianakis (former

EU Commission) talked about „Let's celebrate: Eleven years of the Venice Training School, sixteen years of European Nanosafety research. History, lessons learned and perspectives“, while Steffi Friedrichs (AcumenIST) introduced „Concepts of sustainable Nanofabrication“. After this inspiring start, several sessions were held during the week, combining lectures with interactive sessions.

From Nanosafety to Nanomedicine: a 10-year Perspective

This session provided a perspective on nanosafety research conducted in the past decade and a view to the application of nanomaterials in medicine. Bengt Fadeel (Karolinska Institutet) has been involved in several EU-funded and national projects focused on nanosafety

including MARINA and BIORIMA as well as the EU-funded Graphene Flagship. Special focus was put on lessons learned from these projects with emphasis on the synthetic and biological “identities” of nanomaterials and interactions of nanomaterials with biological systems.

Hazard to Human Health & Environment

In this training, Hedwig Braakhuis (RIVM), Sabina Halappanavar (Health Canada), Fiona Murphy (Heriot-Watt University) and Samantha Llewellyn (Swansea University) presented the latest progress in nanomaterial hazard testing. This included the use of the Adverse Outcome Pathway (AOP) concept to unravel the mechanisms behind nanomaterial toxicity. In addition, the use of alternative methods was discussed.

Fate & Exposure Assessment

This session focused on recent developments in the assessment of fate of exposure of nanomaterials. Teresa Fernandes (Heriot-Watt University), Socorro Vazquez (LEITAT), Sam Harrison (UK Centre for Ecology & Hydrology) and Joris Quik (RIVM) discussed how to use the basic information on nanomaterial exposure scenarios description to determine the likelihood & route of exposure, and how this information can be used in the assessment and management of exposure to nanomaterials. Next to that, information was provided on how to use models to perform nanomaterial environmental exposure assessment, explaining what these models are, what they include, why they are useful and the different levels of complexity, to make them more realistic and reflecting environmental reality. Participants were able to try some of the models, input some real data, and also analyze the results.

RRI Roleplay Workshop: Safe-by-Design Sustainability Forum

Sean Hardy and Raquel Bertoldo (Symlog) held the First Annual Safe-by-Design Sustainability Forum. Since it’s now common knowledge that nano-enabled products are important to realizing UN Sustainable Development Goals, the implementation of Safe-by-Design processes have been proposed as a method to achieve these goals. But what does Safe-by-Design mean in the field of nanotechnology? Is it already in practice or are we far away from it? What are its challenges? What does it imply for each stakeholder group? These questions and more served as basis of the session’s interactive role-play workshop, which allowed participants to discuss and debate with their peers the various meanings of “Safe/r/ty-by-Design” from their own as well as stakeholders’ perspectives.

Similarity, grouping and read-across approaches

In this session, Vicki Stone (Heriot-Watt University), Agnes Oomen (RIVM), Nina Jeliaskova (IdeaConsult) and Richard Cross (UK Centre for Ecology and Hydrology) focused on:

- ✓ Grouping hypotheses, IATAs and the GRACIOUS Framework
- ✓ A quick introduction to Read Across in a regulatory setting
- ✓ How similar do nanoforms need to be to allow grouping and read-across
- ✓ Environmental case studies for similarity, grouping and read-across

Risk Assessment & Management

Alex Zabeo (Greendecision) provided training in using the BIORIMA Decision Support System. This system employs advanced models to support the occupational, consumer and environmental risk assessment of nanomaterials and biomaterials along the lifecycle of nano-enabled consumer products and medical applications. In situations where the risks are not controlled, the system proposes suitable Risk Management Measures and provides information about the efficacy of these measures.

Risk Governance

Martin Himly, Sabine Hofer and Nobert Hofstaetter (University of Salzburg), as well as Dmitri Ciornii (BAM) and Daan Schuurbiers (DPF) built this session on the question “Risk assessment with social dimension: how does risk governance differ from risk assessment or management?” Starting with introducing the process of risk governance, it was discussed how data support decision-making, what data are needed, and what researchers can do in order to provide such data. This also covered FAIR databases and quality assurance, defined by the Knowledge Readiness Level (KaRL). Next to that, different stakeholder views and how socioeconomic aspects can be included into the risk governance process to warrant inclusiveness for different values into the risk/benefit estimation were discussed.

Modelling

On the last training day, Giulia Mancardi (Politecnico di Torino), Vio Buchete (UCD) and Agur Sevink (Leiden University) talked about upscale from classical Molecular Dynamics to Brownian Dynamic for nanoparticle clus-

tering and aggregation, nanoparticle-protein docking as well as nano-particle-membrane interactions.

Although we had to adapt to a fully online event, the Training School was a great success, huge thanks to all speakers and organizers that made it happen. The School’s Organizing Team is already looking forward to the next edition of the Nanosafety Training School, hopefully as real physical event in Venice, Italy, in 2022.

Contact

BioNanoNet Forschungsgesellschaft mbH

Susanne RESCH

susanne.resch@bnn.at

Yordas Group

Stella STOYCHEVA

s.stoycheva@yordasgroup.com

GreenDecision S.r.l.

Danail HRISTOZOV

danail.hristozov@greendecision.eu



These projects have received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement n° 760928, n° 760840, n° 814426, n° 814401, n° 814425, n° 814530 and n° 760813.

3RD THINK TANK – LIFE SCIENCES IN DIGITAL CHANGE – “NEW BUSINESS MODELS IN LIFE SCIENCES”

23rd June 2021, Graz, Austria



Impressions from the 3rd Think Tank event

After more than a year of pandemic restrictions, we had the pleasure of hosting one of our first offline events in 2021 at the rooftop of the newly opened Unicorn Graz in cooperation with the Know-Center, BioNanoNet Forschungsgesellschaft, Techhouse and Ideen-triebwerk. Squeaking roll-ups and one or the other operating difficulty in the technology revealed how quickly even common practice can be unlearned, but ensured a relaxed start during the 3rd Think Tank in Life Sciences.

A unique sense of calm spreads as Urška Jez from Techhouse welcomes the guests and introduces Michal Lagan's presentation. The Head of IOT at Magenta Telekom starts his lecture with a quote: „The Internet of Things market is like the ocean. It's not the question if there is enough water available for everyone, it's the HOW we can skim the water off it.“ But how?

Faster, Higher, Further

A glance back to the 1960s shows that entrepreneurship as well as the startup mentality has changed significantly. While slower company growth was standard a few decades ago, faster, higher, further has become the basic credo of startup development. The speed of development has accelerated dramatically. Business models have to be revised more often, and agility is part of the game. In any case, the key to a company's success in the IOT sector nowadays is making the right decision with regard to technology, as only the combination of the appropriate technology along with the optimal usecase will lead to success.

And the best ideas are driven by pain!

How can you monitor the health status of a herd of cows? The Graz-based company smaXtec addressed this idea and developed a sensor that is swallowed by the cows, which remains in the stomach and provides various data on the health status of „Moo“. An idea that is a significant time-saver on one hand, and of course a cost saver on the other, because „at the end of the day, it's always a financial decision,“ according to the presenter.

A company based in Tyrol, for example, combined various needs in its business model: a hand sanitizer, advertising placement on the machine and a sensor that monitors the whereabouts of people at the machine. This allows them not only tracking the frequency of usage of the vending machine, but also the effectiveness or ineffectiveness of the advertising message placed on it.

What can one learn from it?

- ✓ Data is the new oil
- ✓ Technology is key
- ✓ Think different

In particular, Michael Lagan also pointed out that the business models Business Model Canvas and Business Model Navigator cannot be ignored.

What about data service cards?

After a short company presentation by the Know-Center, Angelika Riedl and Gert Breiffuss started with the interactive „Data Service Cards“ workshop. In small teams, sets consisting of 50 physical cards were used for brainstorming on the subject of „data in companies“. The card set is designed to understand and identify available data in the enterprise and how it is best used and analyzed. Collaborative group brainstorming based on the topic of data can also be used in corporate team-building sessions. In addition to linking the different expertise of the participants, simple documentation is also possible with the help of the „Data Service Cards“. It was exciting that the individual teams chose different approaches. The cards offer a variety of possibilities and explain the most important technical terms, so that even a layperson can quickly relate to the topic. Another advantage of the cards is that they allow existing and new concepts to be quickly developed and refined. At the end of the workshop, participants were invited to share their feedback with the speakers and enjoy a cool drink accompanied by appetizers in the outdoor area of the Unicorn Rooftop to round up the evening.

Events

BNN EVENTS & BNN CO-ORGANIZED EVENTS

BioNanoNet Annual Forum & BNN Networking Session

When? 16th September 2021, 12:30 – 18:00 CEST

Where? Graz & online

[More information](#)



OPERATED BY



MEMBER EVENTS

Nanomed Europe 21

When? 7th – 9th September 2021

Where? St. Gallen, Switzerland



NanoMed Europe

September 7 - 9, 2021 - St. Gallen, Switzerland

The 16th annual event of ETPN & the 4th ENM conference merged into a unique event: #NME21. NME21 is a unique conference in Europe bringing together scientists, technology providers, entrepreneurs, industry and clinicians, all of them developing great medical applications of Nanotechnologies and emerging MedTech.

For more details [click here](#)!

ESAO-IFAO Webinar: LVAD therapy: clinical perspectives and LVAD for FONTAN: animal research

When? 16th September 2021, 12:00 p.m. (CEST)

Where? Online meeting



ESAO-IFAO (European Society for Artificial Organs – International Faculty of Artificial Organs) Webinars “Artificial Organs & Regenerative Medicine: Clinical Challenges Emerging Technologies for Improved Medical Care”: LVAD therapy: clinical perspectives & LVAD for FONTAN: animal research.

For more details [click here](#)!

Moving On 25 years & beyond

When? 13th – 14th October 2021

Where? Stadthalle Graz, Austria



Moving on! Being Europe's first and oldest mobility cluster is the result of constant change and renewal. Since our founding 25 years ago, more than 300 member companies are working at the forefront of innovation in the mobility industry. Their success in a competitive international environment is based on setting the right goals at the right time. This autumn we invite you and our members to our first international mobility congress, where we will discuss what mobility is going to mean in 25 years – and beyond!

For more details [click here!](#)

ESAO-IFAO Webinar. Membrane innovations for improved blood purification therapies

When? 21st October 2021, 12:00 p.m. (CEST)

Where? Online meeting



ESAO-IFAO (European Society for Artificial Organs – International Faculty of Artificial Organs) Webinars “Artificial Organs & Regenerative Medicine: Clinical Challenges Emerging Technologies for Improved Medical Care”: LVAD therapy: clinical perspectives & LVAD for FONTAN: animal research.

For more details [click here!](#)

Study: Professional MBA Biotech, Pharma & Medtech Management

When? anytime

Where? London, UK



The Department for Biomedical Research offers the Professional MBA Biotech, Pharma & Med-Tech Management program, designed for managers in pharmaceutical and medical organizations to be prepared to take over demanding managerial positions in biopharmaceutical companies in a competitive international environment.

For more details [click here!](#)

Finally



We hope you enjoyed our BNN NEWSLETTER! Please do not hesitate to contact us if you would like to give us any suggestions or feedback! Our next BNN NEWSLETTER will be published in September 2021. BioNanoNet members are welcome to send their contributions until 8th of September 2021!

Contact:

BioNanoNet Forschungsgesellschaft mbH

Simone Jagersbacher-Uhl

simone.jagersbacher@bnn.at

Phone: +43 699 155 266 02

www.bnn.at

Impressum:

Owner and publisher:

BioNanoNet Forschungsgesellschaft mbH

Steyrergasse 17, 8010 Graz, Austria

UID: ATU 63046279, FN 285326 y

[→ TABLE OF CONTENTS](#)

The background is a solid teal color. Overlaid on the right side is a large, faint, light-blue graphic of a molecular structure. It consists of several interconnected circles and hexagons, resembling a chemical or biological network. The text is centered horizontally and vertically in the left half of the image.

**INNOVATION IS THE KEY.
SUSTAINABILITY LEADS THE WAY.**

WWW.BNN.AT