



Publisher:

KIST Europe Forschungsgesellschaft mbH Campus E7.1 66123 Saarbrücken Germany

Planning and Coordination :

Global Cooperation Department, KIST Europe Forschungsgesellschaft mbH



2 0 2 1
K I S T
E U R O P E
A N N U A L
R E P O R T

PREFACE



DIRECTOR'S GREETING

A pessimist sees the difficulty in every opportunity; an optimist sees the opportunity in every difficulty. - Winston Churchill

Dear Readers,

KIST Europe was established in Saarbrücken, Germany in 1996. With the support of the Korean government, KIST Europe has enjoyed nearly 26 years of successful operations accomplishing many great achievements and is performing its mission of facilitating joint research among high-tech R&D institutes throughout Korea and the EU. Such an outcome was possible because of our researchers and supporting staff - while they may hail from different cultural and ethnic backgrounds, they are united in their pursuit of excellence and their commitment to further enhancing their capabilities and expertise.

With this in mind, we are very pleased to present you this annual report summarizing our research activities and notable achievements for 2021. In this report, you will find affirmation of our specialized expertise in conducting open and innovative research, as well as detailed descriptions of the diverse forms of collaboration in which we participate.

Despite these past achievements, KIST Europe remains deeply committed to exploring potential new opportunities for cooperation. For research institutes seeking an experienced collaboration partner for joint research projects or industry organizations wishing to expand into the Korean or European markets, KIST Europe, which plays a key role in facilitating S&T cooperation between Korea and the EU, could be the ideal partner to realize that.

I wish to thank everyone who has consistently supported the work we do at KIST Europe. It is only through your efforts that our success has been possible. My particular gratitude goes out to the Saarland Government and Saarland University for always standing by our side. I hope that our partnership will only continue to strengthen over the years to come.

Lastly, I wish to express my heartfelt appreciation to the staff at KIST Europe for their hard work and valuable contributions. Their dedication is truly unparalleled. As KIST Europe turns 26, we look forward to the journey ahead, and to strengthening KIST Europe's solidarity as the only Korean government R&D institute in Europe.

Sincerely

Dr. Soo Hyun Kim Director, KIST Europe



TABLE OF CONTENTS A

02	Preface – Director's Greeting	18	Research with PASSION
03	Table of Contents	20	Environmental Safety
04	Our Profile	34	Biosensor
06	History of KIST Europe	40	Cooperation for the FUTURE
07	Organization & People	42	Cooperation Agreements
80	Vision & Strategies	43	Cooperation Platform
09	Advisory Board	44	Representative Events
10	Overview of KIST Headquarters	49	Location
12	KIST's International Cooperation Activities		

16

Guest House Facilities



OUR PROFILE

HISTORY OF KIST EUROPE

Mar
Official Visit by 14th
President of Korea
KIM, Youngsam to Germany

Feb
Foundation of KIST Europe

Apr
Completion of 1st Building
(4 stories, 5,275 m²)

Apr 10th Anniversary

Apr
Completion of 2nd Building
(3 stories, 2,069 m²)

May 20th Anniversary 2021

Jan Inauguration of 9th Director (Dr. Soo Hyun Kim) **Nov** Opening of Guest House

CONTACTS



Institute Director
Dr. Soo Hyun Kim
+49 (0) 681-9382-100
soohkim@kist-europe.de

Secretary
Ms. Jong-Ok Arnhold
+49 (0) 681-9382-101
arnhold@kist-europe.de



Audit and Inspection Manager Mr. Tae Min Kim +49 (0) 681-9382-113 taemin.kim@kist-europe.de



Head of Administration Dr. Kyu Young Lee +49 (0) 681-9382-207 kylee@kist-europe.de



Head of Global Cooperation Dr. Jeongho Seo +49 (0) 681-9382-364 j.seo@kist-europe.de

ORGANIZATION & PEOPLE 0 Director **Advisory Board** Audit and Inspection Manager **Environmental** Administration **Global Cooperation** Biosensor **瓣 E** 0 Safety Department Department **NUMBER OF EMPLOYEES** (AS OF DEC. 2021) NATIONALITY OF EMPLOYEES (AS OF DEC. 2021) 21 3 16 16 15 30 5% German 20% 37% 53[%] Researchers Students Korean Technicians/RAs 29% Administrators 29[%] 27% Other

VISION & STRATEGIES

"KIST Europe, a specialized on-site institution leading the future of environmental research"

Respond to society's needs through excellence in research

Pursuing initiatives to support collaboration

Emphasizing innovative governance

Strengthening environmental research capacity under Industry 4.0

Expanding research areas through international joint R&D

Establishing an on-site R&D base camp for collaboration with domestic institutions

Expanding areas of service for domestic SMEs

Promoting the efficiency and advancement of administrative support functions

Implementing integrated project management systems and processes

Excellence

Support

Governance

ADVISORY BOARD



Korean Members (as of December 2021)

Dr. Seok-Jin Yoon (Chairman)

President, Korea Institute of Science and Technology



Mr. Seong Gyu Kim

Director General of the International Cooperation Bureau, Ministry of Science and ICT



Dr. Yoo Seung Kim

Former President, Korea Institute of Science and Technology



Dr. Myung Soo Kim

Vice Mayor for Science,
Daejeon Metropolitan City



Mr. Seok Young Jang

Chief Executive Officer, Kumyang Innovation Co., Ltd.





German Members (as of December 2021)

Mr. Henrik Eitel

Head of Saarland State Chancellery, Saarland State Government



Prof. Dr. Manfred Schmitt

President, University of Saarland



Prof. Dr. Andreas Schäffer

Director of Institute for Environmental Research, RWTH Aachen



Prof. Dr. Wolfgang Wahlster

Chief Executive Advisor, German Research Centre for Artificial Intelligence (DFKI)



Prof. Dr. Rolf Müller

Managing Director, Helmholtz Institute for Pharmaceutical Research Saarland (HIPS)



Dr. Gerold Heinrichs

Head of Department, European and International Cooperation, DLR-Projektträger



OVERVIEW OF KIST HEADQUARTERS



History

The Leading Contributor in Science and Technology in Korea

1960 ~1980s

February 1966 KIST is founded

KIST and the Korea Advanced Institute of Science (KAIS) combine to form the Korea Advanced Institute

of Science and Technology (KAIST)

KIST separates from KAIST and is reestablished June 1989

1990s

February 1996 KIST Europe is established

March 1999 KIST becomes affiliated with the Korea Research Council of Fundamental Science & Technology under

the Office of the Prime Minister

2000s ~ Present

KIST Gangneung is established May 2003

January 2008 KIST Jeonbuk is established

July 2017 KIST becomes affiliated with the National Research

Council of Science and Technology under the Ministry

of Science and ICT

Dr. Seok-Jin Yoon is appointed President of KIST July 2020

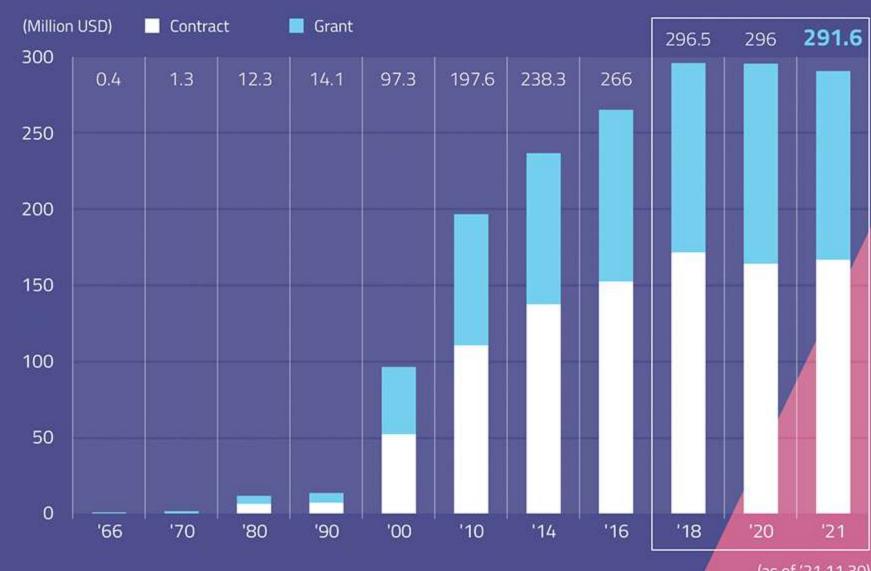
Personnel and Budget



Research Staff

		Principal	Senior	Associate	Total
	Executives	1	-	-	1
	Researchers	304	247	50	601
Regular Positions	Specialists	16	23	70	109
	Administrators	38	36	56	130
	Assistants	-	-	121	121
	Overall	359	306	297	962
Temporary	Docitions	Ph.D.	Master's	Bachelor's or below	Total
Temporary Positions		386	207	155	748
Ctudo	nto	Ph.D.	Master's	Integrated	Total
Stude	321	338	335	994	
Total					2,704

Budget



OVERVIEW OF KIST HEADQUARTERS

Location of Headquarters and Research Areas

Headquarters - KIST Seoul

KIST was established in 1966 with the primary goals of developing creative, original, and cutting edge technologies improving Korea's scientific and technological capacities, and participating in the active transfer of these technologies. Initially, KIST focused on developing technologies suitable for industrialization, and these technologies contributed greatly to the modernization of Korea and fostered remarkable economic growth throughout the nation. Over the course of time, KIST has since gone on to produce many premier S&T talents and spin off numerous specialized research institutes. Such achievements cemented KIST's status as Korea's leading S&T institute. By applying its accumulated R&R expertise, KIST is now expanding its role and taking on large-scale, long-term interdisciplinary R&D projects which are typically considered too challenging for universities or private entities. KIST is continually striving to advance the field of science and technology, both domestically and internationally.





Research Divisions



Brain Science



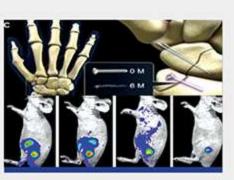
Post-Silicon Semiconductors



Al and Robotics



Climate & Environment



Biomedical

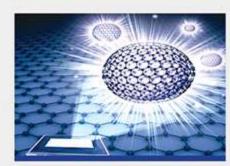
Brain mapping and diagnosis of brain diseases

Quantum computing / artificial neural chips

AR/VR, human communication robots, HRI (Human-Robot Interaction)

Water and clean air / environment, health and welfare

Customized treatment and rehabilitation



Advanced Materials

NT/BT-based materials and

component technologies



Clean Energy

Renewable energy, carbon



The KIST Gangneung Institute of Natural Products

Bringing the world happiness cycle and system convergence through natural products!



The KIST Jeonbuk Institute of Advanced **Composite Materials**

Serving as a key player for composite materials technology in Korea



Research Resources

Doping control, advanced analysis, research animal resources

KIST'S INTERNATIONAL COOPERATION ACTIVITIES

Global Open Research



Overseas Centers

- KIST Europe (Saarbrücken, Germany)
- Indo-Korea Science and Technology Center (Bangalore, India)

Joint Laboratory

- KIST-UBC(Vancouver, Canada)
- KIST-DFCI(Boston, USA)

Global Research Laboratories

- KIST-ENEA(Italy)
- KIST-Johns Hopkins Univ.(USA)



KIST Europe

Founded in Saarbrucken, Germany in 1996, KIST Europe is Korea's only government R&D institute in Europe. Since its inception, KIST Europe has exhibited sustainable growth as it pursues its goal of establishing a bridgehead for Korean R&D institutes and industries seeking opportunities to collaborate and make advances into Europe.









Indo-Korea Science and Technology Center

The Indo-Korea Science & Technology Center was established in Banglaore, India in 2020. Because India has emerged as an important world market, the center has contributed to building Korea's trade relations with India and has performed ICT convergence research (focusing on computational science) that takes advantage of India's rich potential in the science and technology field. The center has become the focal point in promoting scientific and technological exchanges between the two countries.



KIST'S INTERNATIONAL COOPERATION ACTIVITIES

Institutions in Partnership with KIST

Bulgaria

- Bulgarian Academy of Sciences (BAS)

Canada

- University of Waterloo
- University of British Columbia (UBC)

China

- Shanghai Academy of Science and Technology/Shanghai Industrial Technology Institute (SAST/SITI)
- Science and Technology Department of Sichuan Province

Czechia

- Charles University in Prague
- Czech Technical University in Prague

Denmark

- DHI Group

Ethiopia

Adama Science and Technology University (ASTU)

France

- French National Centre for Scientific Research (CNRS)
- University of Grenoble Alpes (UGA)
- Laboratoire d'Electronique et de Technologies de l'Information (CEA-Leti)

Germany

- Technische Universitat Berlin
- Forschungszentrum Karlsruhe GmbH
- Fraunhofer-Gesellschaft (FhG)
- Helmholtz Centre for Infection Research (HZI)
- Saarland University

Indonesia

-Universitas Indonesia (UI)

Italy

- Institute for Advanced Energy Technologies (ITAE)

Japar

- Institute of Physical and Chemical Research (RIKEN)
- Tohoku University
- Tokyo Institute of Technology

Mongolia

- Mongolia Academy of Sciences (MAS)
- Institute of Chemistry and Chemical Technology (ICCT)
- Mongolian National Olympic Committee (MNOC)

Portugal

-University of Minho

Switzerland

- Swiss Federal Laboratories for Materials Science and Technology (EMPA)

Thailand

- Asian Institute of Technology (AIT)

Ukraine

- V.N. Karazin Kahrkiv National University
- National Technical University of Ukraine Kyiv Polytechnic Institute (NTUU KPI)

Uruguay

- National Agency for Research and Innovation (ANII)

USA

- National Institute of Biomedical Imaging & Bioengineering (NIBIB)
- Stony Brook University (SBU)
- Dana-Farber Cancer Institute
- National Cancer Institute (NCI)

Vietnam

 The Ministry of Science and Technology of the Socialist Republic of Vietnam (MOST)

World Bank

 PASET (Partnership for skills in Applied Sciences, Engineering and Technology)





VKIST

VKIST is a new public science and technology agency affiliated with Vietnam's Ministry of Science and Technology (MOST). It was established through a joint ODA project between the Vietnamese and Korean governments following the signing of a Presidential Agreement on September 9th, 2013. VKIST makes use of a specialized financial mechanism to attract professional scientists from both Vietnam and abroad to carry out their research activities at the institute. Going forward, VKIST will serve as a multi-disciplinary scientific research institute with internationally certified researchers. The state-run institute is also equipped with modern infrastructure and research equipment, and will have a self-regulatory mechanism in place as well.



KIST-DFCI On-Site-Lab

To create a synergistic effect through mutual cooperation in the area of cancer biology, KIST and the Dana-Farber Cancer Institute, a major affiliate of Harvard Medical School, signed an MOU to promote joint research in cancer biology in 2013.

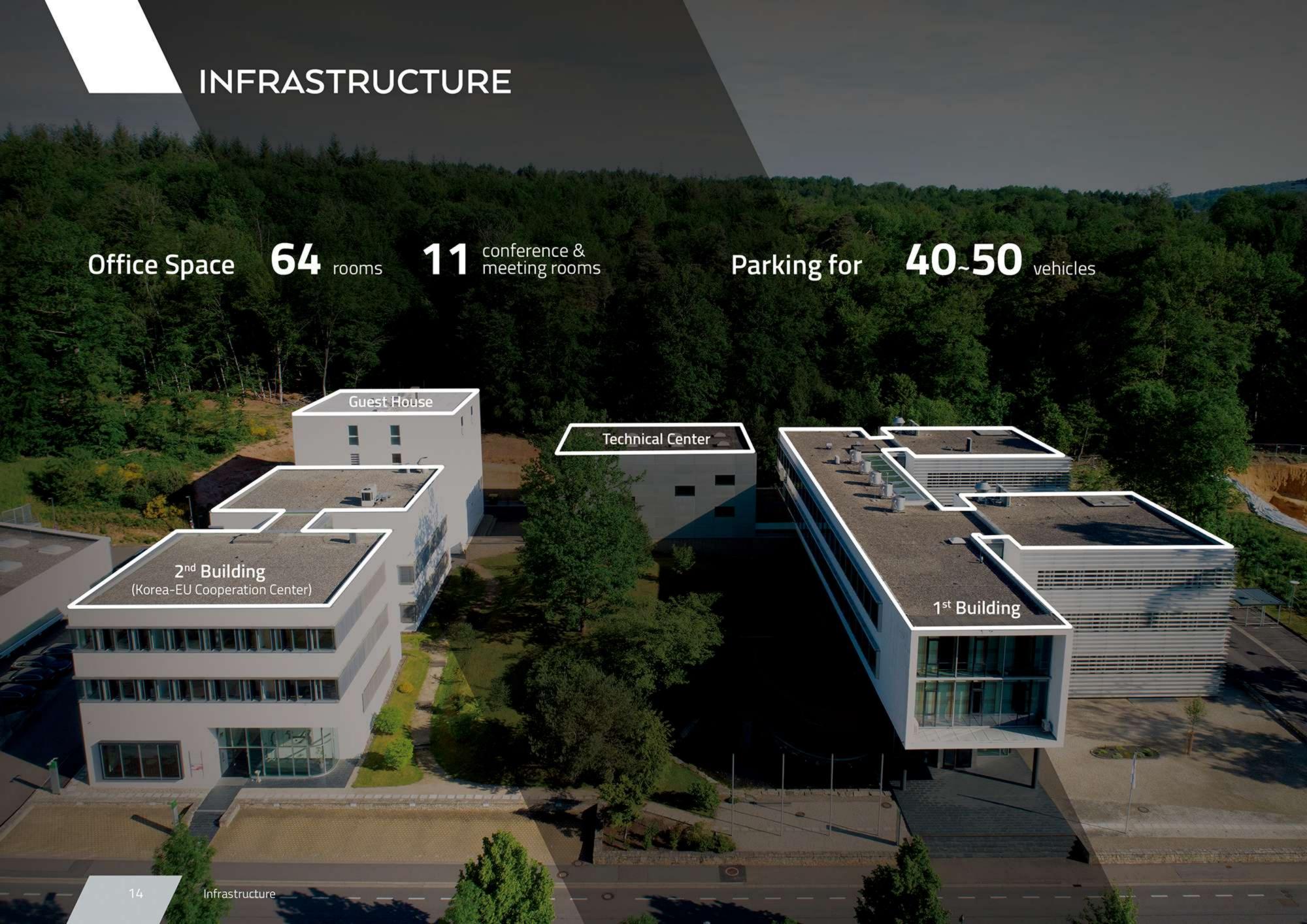
In accordance with this agreement, subsequent measures have included various joint cancer research projects and the establishment of a lab at Dana-Farber Cancer Institute operated by KIST.











RESEARCH FACILITIES

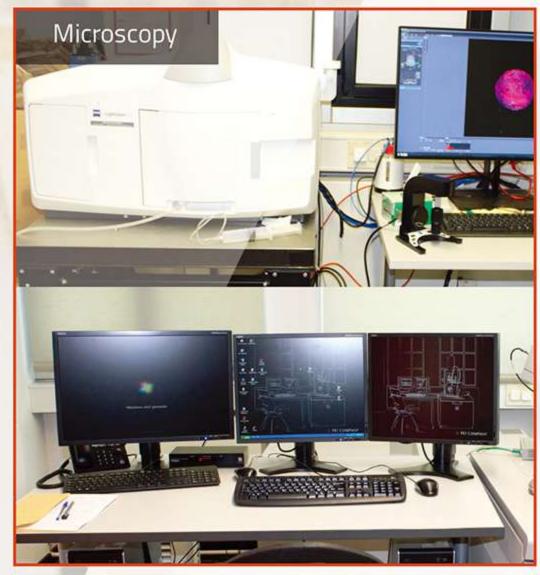
Laboratory Areas

GVO-1, Biosafety Levels 1 & 2

20 work rooms 3 dark rooms

Technical room

Specialties







GUEST HOUSE FACILITIES

Single room

1 bed, drawers, closet with hangers, desk, kitchen with induction range, shower





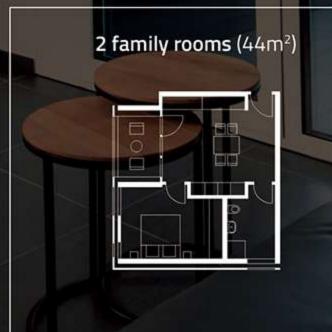


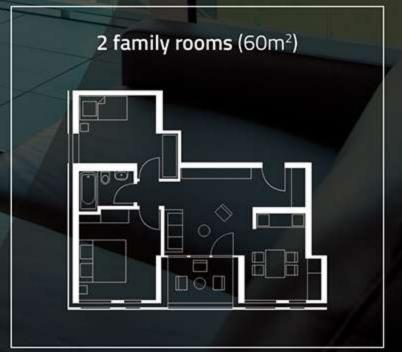


Family room

2 beds, drawers, closet with hangers, desk, kitchen with induction range, shower, dining table, TV, sofa, balcony table, dishwasher, microwave







GUEST HOUSE FACILITIES



€ ½

Common Facilities







Contact

Mr. Holger Krause

guesthouse@kist-europe.de

 +49 (0) 681-2106-8290

÷49 (0) 170-5538-259



RESEARCH WITH PASSION



Dr. Young Jun KIM

Group Leader

youngjunkim@kist-europe.de

Objectives

The Environmental Safety Group contributes to the protection of human health and the environment from hazardous chemicals and mixtures containing these chemicals.

This group also contributes to enhancing the national competitiveness of the chemical industry by ensuring high safety standards for products.

R&D Areas

■ Alternative Toxicity & Ecotoxicity Assessments

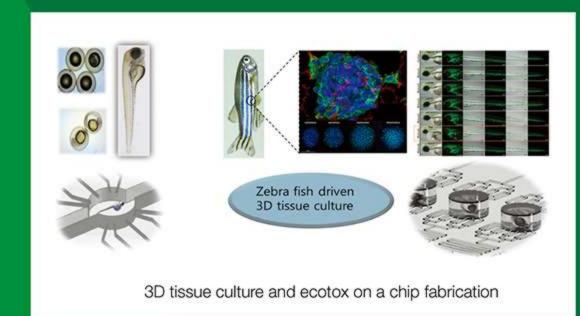
- 3D tissue mimicry for high-throughput toxicity screening
- Development of Alternatives to Animal Testing (AAT) systems for chronic toxicity screening
- Development of environmental risk assessment tools and modelling methodologies

■ Mathematical Biology & Computational Toxicology

- Development of analytical models for mechanism-based toxicity prediction
- Quantitative in silico approach for ecotoxicity screening
- ADMET/QSAR modelling and industrial applications

Development of Metabolomics and their Application to Biomarker Discovery

- Targeted/pseudo-targeted metabolomics of chemicals
- Metabolite identification and reaction phenotypes

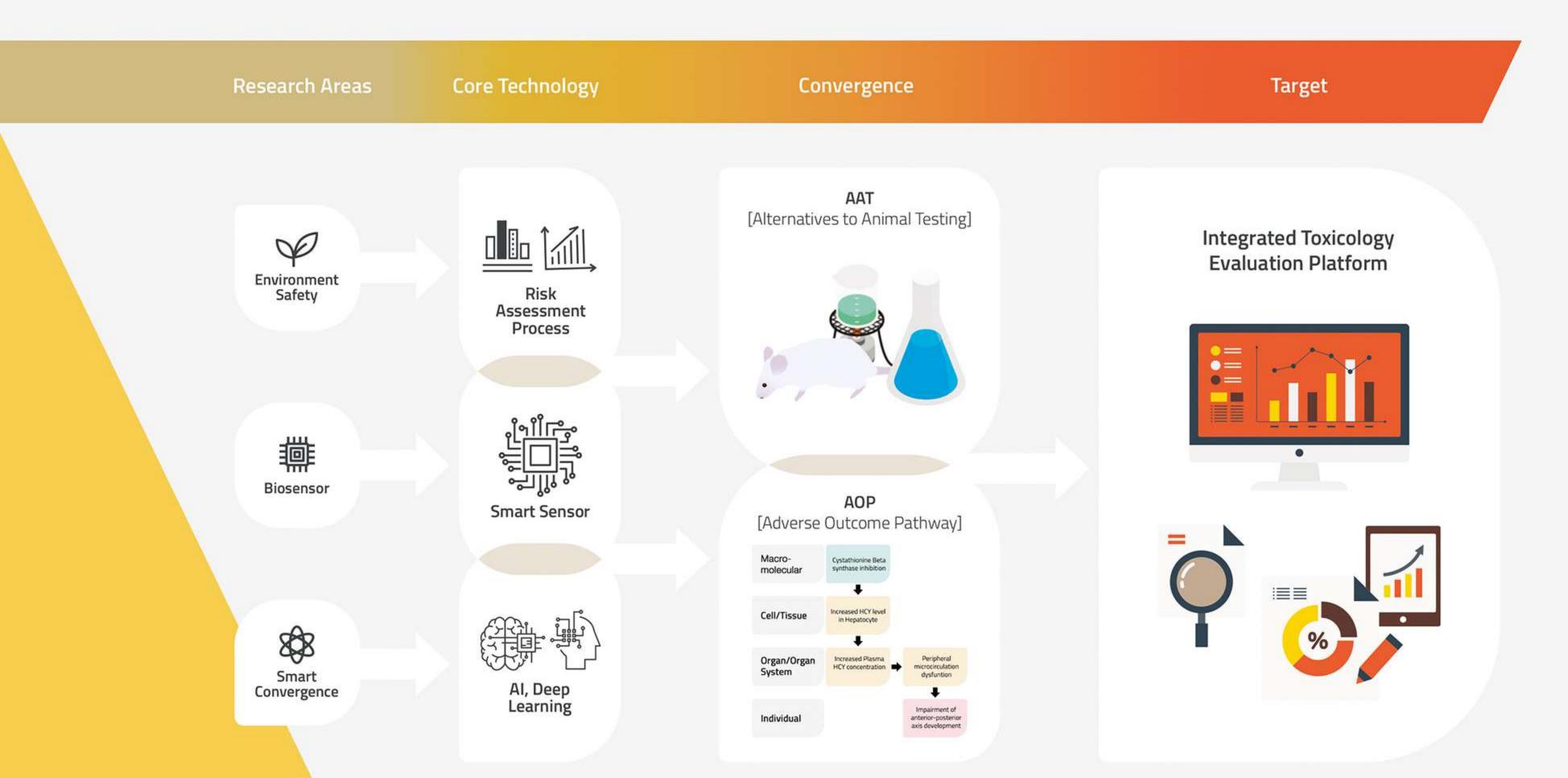




Food chain metabolomics monitoring and analysis

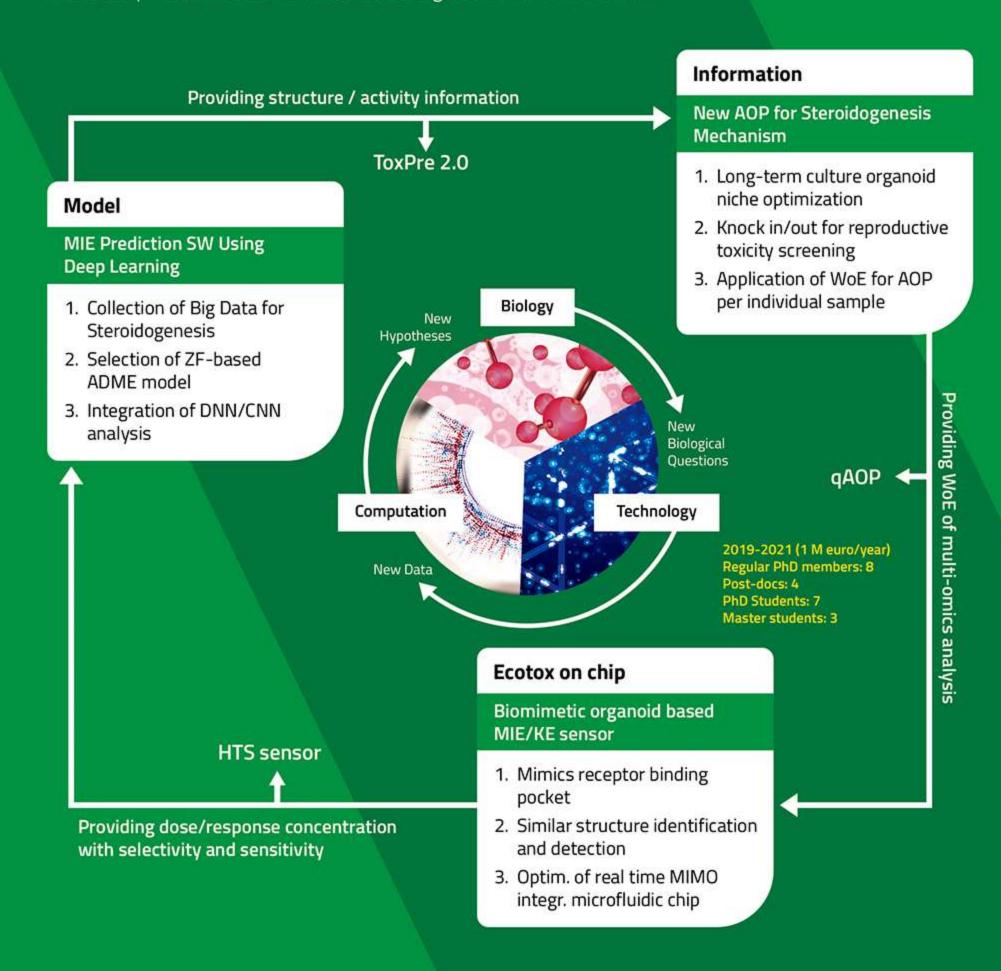
MAIN RESEARCH I

Integration of all possible capacities among KIST Europe researchers



Theme

■ Development of Environmental Steroidogenesis AOP Framework



What is Adverse Outcome Pathway (AOP)?

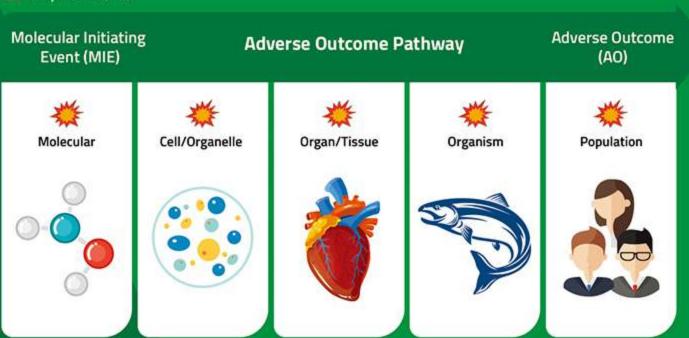
- AOP is associated with toxicity pathways and regulatory applications
- AOP network is the functional unit of endpoint prediction
- A Molecular initiating event or early key event is essential for alternatives to animal testing
- AOP facilitates the multidisciplinary studies through the need for network building

Status of AOP Development

- OECD AOP network developed to date
- 270 AOPs (user defined)
- 750 Key Events
- 1000 Key Event Relationships

Definition of AOP

- Relationship of adverse outcomes from molecular to population level
- Key Event (KE)



MAIN RESEARCH I

Development of 14 AOP Titles

■ Expansion of own research capacities including COVID-19 research themes

■ 2021 (4): Own capacities ■ 2020 (4): Own capacities ■ 2019 (5): Own capacities

■ 2018 (1): Joint development with Korea Institute of Toxicology

AOP No.	OECD PJT ID	AOP Title	Status	Ref.	Reg.Year	
271	1.59	TPO inhibition leading to impaired fertility in fish> Inhibition of thyroid peroxidase leading to impaired fertility in fish	Coaching	with KIT	2018	
289	1.81	Inhibition of 5α-reductase leading to impaired fertility in female fish	Coaching	KIST Europe		
292	1.78	Inhibition of tyrosinase leads to decreased population in fish	Coaching	KIST Europe	2019	
297	1.77	Inhibition of retinaldehyde dehydrogenase leads to population decline	Coaching	KIST Europe		
301	-	Inhibition of Cystathionine Beta synthase leading to impaired the early development of anterior-posterior axis	Under Development	KIST Europe		
309	Ξ.	Luteinizing hormone receptor antagonism leading to reproductive dysfunction	Under Development	KIST Europe		
319	1.96	ACE2 antagonism leading to lung fibrosis	Coaching	CIAO [COVID-19]	2020	
320	1.96	Binding of viral S-glycoprotein to ACE2 receptor leading to acute respiratory distress associated mortality	Coaching	CIAO [COVID-19]		
348	1.93	Inhibition of 11β-HSD leading to impaired spermatogenesis in fish	Under Development	KIST Europe		
349	1.93	Inhibition of 11β-hydroxylase leading to infertility in male fish	Under Development	KIST Europe		
379	1.96	Increased susceptibility to viral entry and coronavirus production leading to thrombosis and disseminated intravascular coagulation	Coaching	NISH [COVID-19]		
381	111	Binding of viral S-glycoprotein to ACE2 receptor leading to dysgeusia	Under Development	KE [COVID-19]	2021	
382	200	Angiotensin II type 1 receptor (AT1R) agonism leading to lung fibrosis	Coaching	KE [COVID-19]		
383	<u> </u>	Inhibition of Angiotensin-converting enzyme 2 leading to liver fibrosis	Under Development	KE [COVID-19]	2021	
384	-	Hyper activation of ACE/Ang-II/AT1 Raxis leading to chronic kidney disease	Under Development	KE [COVID-19]		

Journals

Sung, Baeckkyoung,; Kim, Min-Ho,; Abelmann, Leon.; Magnetic Microgels and Nanogels: Physical Mechanisms and Biomedical Applications. Bioengineering & Translational Medicine 2021, 6, e10190.

Web of Science Core Collection: SCIE 2021 JIF: 10.711

Kim, Dahye,; Cho, Hyunki,; Eggers, Ruth,; Kim, Sang Kyum,; Ryu, Chang Seon,; Kim Young Jun.: Development of a Liquid Chromatography/Mass Spectrometry-Based Inhibition Assay for the Screening of Steroid 5-α Reductase in Human and Fish Cell Lines. Molecules 2021, 26 (4), 893.

Web of Science Core Collection: SCIE 2021 JIF: 4.411

Choi, Young Jae,; Ryu, Chang Seon,; Lee, Sang Yoon,; Kim, Ha Gyeong,; Kim, Nan Young,; Lee, Ji-Yoon,; Oh, Soo Jin,; Park, Han-Jin,; Cho, Seung-Woo,; Kim, Jong-Hoon,; Kim, Sang Kyum.: Effects of rifampicin on hepatic antioxidant enzymes in PXR and CAR double humanized mice. Molecular & Cellular Toxicology 2021, 17, pp277–286

Web of Science Core Collection: SCIE 2021 JIF: 1.08

Jun, Indong,; Han, Hyung-Seop,; Lee, Jae Won,; Lee, Kyungwoo,; Kim, Yu-Chan,; Ok, Myoung-Ryul,; Seok, Hyun-Kwang,; Kim, Young Jun,; Song, In-Seok,; Shin, Heungsoo,; Edwards, James R,; Lee, Keun Yong,; Jeon Hojeong.: On/off switchable physical stimuli regulate the future direction of adherent cellular fate. Journal of Materials Chemistry B 2021, 9, pp5560-5571

Web of Science Core Collection: SCIE 2021 JIF: 6.331

Lee, Woohyun,; Yudhistira, Tesla,; Youn, Wongu,; Han, Sol,; Halle, Mahesh B,; Choi, Jae Hyuck,; Kim, Youngsam,; Choi, Insung S, Churchill, David G.: Inexpensive water soluble methyl methacrylatefunctionalized hydroxyphthalimide: variations of the mycophenolic acid core for selective live cell imaging of free cysteine. Analyst 2021, 146, pp2212-2220. Web of Science Core Collection: SCIE 2021 JIF: 4.616

Smith, Kilian E.C. & Jeong, Yoonah.: Passive Sampling and Dosing of Aquatic Organic Contaminant Mixtures for Ecotoxicological Analyses. Environmental Science & Technology 2021, 55, 14, pp9538–9547.

Web of Science Core Collection: SCIE 2021 JIF: 9.028

Kim, Youngsam,; Samadi, Afshin,; Gwag, Eun Heui,; Park, Jayoung,; Kwak, Minjeong,; Park, Jihoon,; Lee, Tae Geol,; Kim, Young Jun.: Physiological and Behavioral Effects of SiO2 Nanoparticle Ingestion on Daphnia magna. Micromachines 2021, 12, pp1105-1116.

Web of Science Core Collection: SCIE 2021 JIF: 2.74

Von Wolff, Marya Anne,; Stephan, Pflugmacher,; Stephan, Dietmar.: Testing of Eluates from Waterproof Building Materials for Potential Environmental Effects Due to the Behavior of Enchytraeus albidus. Materials 2021, 14(2), 294. Web of Science Core Collection: SCIE 2021 JIF: 3.623

Jun, Indong,; Li, Na,; Shin, Jaehee,; Park, Jaeho,; Kim, Young Jun,; Jeon, Hojeong,; Choi, Hyuk,; Cho, Jae-Gu,; Choi, Byoung Chan,; Han, Hyung-Seop,; Song, Jae-Jun.: Synergistic stimulation of surface topography and biphasic electric current promotes muscle regeneration. Bioactive Materials 2021, 11, pp118-129.

Web of Science Core Collection: SCIE 2021 JIF: 14.593

Cho, Kichul,; Lee, Sang-Moo,; Heo, Jina,; Kwon, Yong Min,; Chung, Dawoon,; Yu, Woon-Jong,; Bae, Seung Seob,; Choi, Grace,; Lee, Dae-Sung,; Kim Youngjun.: Retinaldehyde Dehydrogenase Inhibition-Related Adverse Outcome Pathway: Potential Risk of Retinoic Acid Synthesis Inhibition during Embryogenesis. Toxins 2021, 13(11): 739.

Web of Science Core Collection: SCIE 2021 JIF: 3.273

Omidi, Azam,; Pflugmacher, Stephan,; Kaplan, Aaron,; Kim, Young Jun,; Esterhuizen, Maranda.: Reviewing Interspecies Interactions as a Driving Force Affecting the Community Structure in Lakes via Cyanotoxins. Microorganisms 2021, 9(8), 1583.

Web of Science Core Collection: SCIE 2021 JIF: 4.128

Pflugmacher, Stephan,; Tallinen, Saila,; Mitrovic, Simon M,; Penttinen, Olli-Pekka,; Kim, Young-Jun,; Kim, Sanghun,; Esterhuizen, Maranda.: Case Study Comparing Effects of Microplastic Derived from Bottle Caps Collected in Two Cities on Triticum aestivum (Wheat). Environments 2021, 8(7), 64. Web of Science Core Collection: ETC 2021 JIF: 2.52

Pflugmacher, Stephan,; Tallinen, Saila,; Kim, Young-Jun,; Kim, Sanghun,; Esterhuizen, Maranda.: Ageing affects microplastic toxicity over time: Effects of aged polycarbonate on germination, growth, and oxidative stress of Lepidium sativum. Science of the Total Environment 2021, 790:148166.

Web of Science Core Collection: SCIE 2021 JIF: 7.963

Kuoppamäki, Kirsi,; Pflugmacher Lima, Stephan,; Scopetani, Costanza,; Setälä, Heikki.: The ability of selected filter materials in removing nutrients, metals, and microplastics from stormwater in biofilter structures. Journal of Environmental Quality 2021, 50(2), pp465-475

Web of Science Core Collection: SCIE 2021 JIF: 2.751

Park, Chang Gyun,; Jung, Ki Chun,; Kim, Da-Hye,; Kim, Young Jun.: Monohaloacetonitriles induce cytotoxicity and exhibit different mode of action in endocrine disruption. Science of the Total Environment 2021, 761,143316.

Web of Science Core Collection: SCIE 2021 JF: 7.963

ACHIEVEMENTS 2021



Esterhuizen, Maranda. & Kim, Young Jun.: Effects of polypropylene, polyvinyl chloride, polyethylene terephthalate, polyurethane, high-density polyethylene, and polystyrene microplastic on Nelumbo nucifera (Lotus) in water and sediment. Environmental Science and Pollution Research 2021, 0944-1344.

Web of Science Core Collection: SCIE 2021 JIF: 4.223

Kim, Young Jun,; Park, Chang Gyun,; Lim, Sang Rak,; Jun, Indong,; Lee, Yong Oh.: Advanced Adverse Outcome Pathways Potentially Bridging the Pathogenesis of COVID-19. Preprint 2021, 2021010065.

Web of Science Core Collection: ETC 2021 JIF: 2.52

Suh, Sungho,; Lukowicz, Paul,; Lee Yong Oh.: Discriminative feature generation for classification of imbalanced data. Pattern Recognition 2021, Pattern Recognition 2022, 122, 108302.

Web of Science Core Collection: SCIE 2021 JIF: 7.74

Suh, Sungho,; Cheon, Sojeong,; Chang, Dong-Jin,; Lee, Deukhee,; Lee, Yong Oh.: Sequential Lung Nodule Synthesis Using Attribute-Guided Generative Adversarial Networks. LNCS 2021, 12906, pp1–10.

Web of Science Core Collection: ETC

Suh, Sungho,; Lukowicz, Paul,; Lee Yong Oh.: Generalized multiscale feature extraction for remaining useful life prediction of bearings with generative adversarial networks. Knowledge-Based Systems 2021, 237, 107866.

Web of Science Core Collection: SCIE 2021 JIF: 8.038

Books

Lee, Yong Oh. & Sung, Baeckkyoung.: Chemometrics and Cheminformatics in Aquatic Toxicology- Chapter 23 - In Silico Platforms for Predictive Ecotoxicology: From Machine Learning to Deep Learning, Wiley 2021

Oral Presentations

Gwag, Eunheui. "Effect of magnetic field gradient on the cellular uptake of magnetic nanoparticles". British Society for Nanomedicine ECRM 2021, March 3-4 2021, Liverpool, UK.

Sung, Baeckkyoung. "Analytical model for predicting the temperature-responsive behaviours of implantable and biodegradable microgels". Mathematical Modelling and Control for Healthcare and Biomedical Systems (MCHBS) 2021 Virtual Workshop, Sep 28-30 2021, Rome, Italy.

Sung, Baeckkyoung." From polymer microgels to biomicrofluidics: some examples in soft matter technology for the future development of biomedical microdevices". 2021 Korean Society for Biomaterials (KSBM) Fall Meeting & Tutorial Symposium, Sep 29-Oct 01 2021, Jeju, Korea.

Ryu, Changseon. "In vitro metabolic characterization of GRL0617 and HY-17542, SARS-CoV-2 PLpro Inhibitors". Europe-Korea Conference 2021, Oct 10 2021, Essen, Germany.

Cho, Hyunki. "LC-MS-based assay of granisetron 7-hydroxylation activity for the evaluation of CYP1A1 induction from diesel particulate matter-exposed hepatic and respiratory cell lines". Europe-Korea Conference 2021, Oct 10 2021, Essen, Germany.

Poster Presentations

O'Connor, J.S.; Kim, Heesoo,; Gwag, Eunheui,; Abelmann, Leon,; Sung, Baeckkyoung,; Andreas Manz.: "3D Printing for Microgel-Based Liver Cell Encapsulation", 2021 IEEE MEMS, 25-29 Jan 2021, Online, Munich, Germany.

Apushkinskaya, N,; O'Connor, J.S,; Gwag, E,; Sung, B,; Abelmann, L,; Manz, A.: "In vitro assay for assessing the ethanol cytotoxicity to the human liver cells encapsulated in gelatin microgels", The HIPS Symposium 2021, 20 May 2021, Saarbrücken, Germany.

O'Connor, J.S.; Kim, Heesoo,; Gwag, Eunheui,; Abelmann, Leon,; Sung, Baeckkyoung,; Andreas Manz.: "3D printer models for the microgel encapsulation of liver cells", The HIPS Symposium 2021, 20 May 2021, Online, Saarbrücken, Germany.

O'Connor, J.S.; Gwag, Eunheui,; Abelmann, Leon,; Sung, Baeckkyoung,; Andreas Manz.: "Concentration gradients of magnetic and non-magnetic nanoparticles in channel slides", The HIPS Symposium 2021, 20 May 2021, Online, Saarbrücken, Germany.

Sung, Baeckkyoung.: "Endocrine dynamics modelling on the hypothalamic-pituitary-gonadal axis of the aquatic lower vertebrates", Society for Mathematical Biology Virtual Annual Meeting 2021, June 13-17 2021, Riverside, CA, USA.

Sung, Baeckkyoung. & Lee, Ryung Kyung.: "Statistical data analysis on the human and ecological toxicity of polycyclic aromatic hydrocarbons". The 3rd Belgrade Bioinformatics Conference June 21-25 2021, Belgrade, Serbia.

Kim, Youngsam,; Park, Ja Young,; Kim, Young Jun.: "Silica Nanoparticle Effects on Heart Rate and Swimming Performance of Daphnia". NANO KOREA 2021, July 7-9 2021, Ilsan, Korea.

O'Connor, J.S.; Regnault, Estelle,; Delafosse, Margaux,; Gebaurer-Barrett, Jasmin,; Apushkinskaya, Nina,; Jeong, Seongho,; Kim, Heesoo,; Gwag, Eunheui,; Abelmann, Leon,; Ryu, Changseon,; Kim, Young Jun,; Lee, Jaehoo,; Sung, Baeckkyoung,; Manz, Andreas.: "Human liver cell-encapsulated microgels for organ-on-a-chip toxicity sensing applications", 31st Anniversary World Congress on Biosensors, 26-29 July 2021, Online, Busan, Korea.

Gwag, Eunheui,; Abelmann, Leon,; Manz, Andreas,; Sung, Baeckkyoung.: "Tissue-mimicking gelatin microgels implement 3D in vitro nanotoxicity screening". The 31st Conference of the European Society for Biomaterials (ESB 2021), Sep 05-09 2021, Lisbon, Portugal.

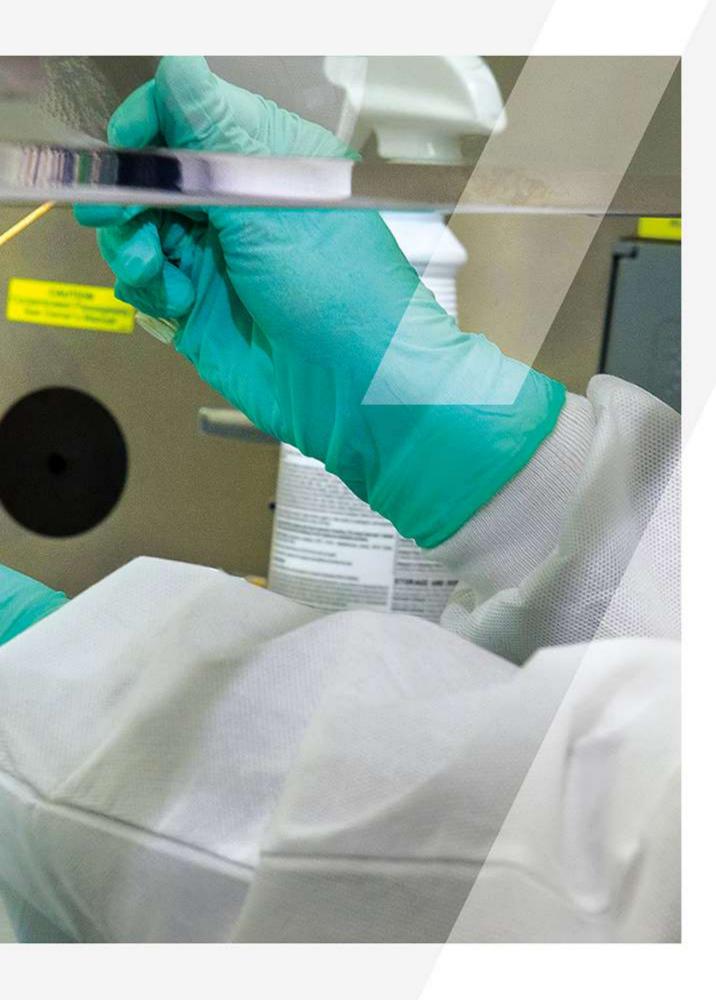
Sung, Baeckkyoung. & Lee, Ryung Kyung.: "Machine learning-driven statistical prediction of the skin sensitisation induced by polycyclic aromatic hydrocarbons". The 32nd Conference of the Austro-Swiss Region (ROeS) of the International Biometric Society, Sep 06-10, 2021, Salzburg, Austria.

Apushkinskaya, Nina,; O'Connor, Jonathan,; Kuhn, Thomas,; Fuhrmann, Gregor,; Gwag, Eunheui; Sung, Baeckkyoung,; Abelmann, Leon,; Manz, Andreas.: "Microfluidic generation of soft microgels as a tool for studying the influence of 3D microenvironments on the cellular responses upon external stimuli". Cell Physics 2021, Sep 29-Oct 01 2021, Saarbrücken, Germany.

Sung, Baeckkyoung. & Lee, Ryung Kyung.: "Bayesian hierarchical modelling for statistical benchmark dose estimation of mammalian thyroid toxicity of perchlorates under multiple developmental conditions". Europe-Korea Conference on Science & Technology (EKC) 2021, Oct 10 2021, Essen, Germany.



ACHIEVEMENTS 2021



Baik, Seungyun,; Chun, Jihyun,; Cho, Hyunki,; Ryu, Changseon.: "Assessment for toxicity effects of BPA, BPS and their mixtures on seed germination and accumulation on different compartments". Europe-Korea Conference on Science & Technology (EKC) 2021, Oct 10 2021, Essen, Germany.

Gebauer-Barrett, Jasmin,; Jeong, Seongho,; Manz, Andreas,; Sung, Baeckkyoung.: "Cell-embedded biopolymeric microgels: from tissue regeneration to alternative animal testing". Europe-Korea Conference on Science & Technology (EKC) 2021, Oct 10 2021, Essen, Germany.

O'Connor, Jonathan,; Apushkinskaya, Nina,; Abelmann, Leon,; Sung, Baeckkyoung,; Manz, Andreas.: "Bioinspired three-dimensional multiplexed cross-flow droplet generator". µTAS 2021: The 25th International Conference on Miniaturized Systems for Chemistry and Life Sciences, Oct 10-14 2021, Palm Springs, CA, USA.

O'Connor, Jonathan,; Kim, Heesoo,; Apushkinskaya, Nina,; Gwag, Eunheui,; Abelmann, Leon,; Sung, Baeckkyoung,; Andreas Manz.: "3D-printed microfluidic chip for producing human liver cell-laden gelatin microgels". NanoBioTech-Montreux, November 15-17 2021, Montreux, Switzerland.

Ryu, Changseon,; Cho, Hyunki,; Seol, Yohan,; Chae, Jung-woo,; Kim, Woo-Keun,; Baek, Seung-Hoon,; Jung, Young-Suk,; Kim, Sang Kyum,; Kim, Young Jun.: "Evaluation of mono(2-ethylhexyl) phthalate metabolites, lipid accumulation and reproductive signaling in daphnia magna". The 37th Annual meeting of KSOT/KEMS, Nov 1-2, 2021, Gangneung, Korea.

Moon, Hyeon-ki,; Cho, Hyunki,; Ryu, Chang Seon,; Chae, Jung-woo.: "Development of physiologically based pharmacokinetcs model of bisphenol S in zebrafish". 2021 Fall International Convention of PSK, Dec 20-22, 2021, Jeonju, Korea.

Suh, Sungho. & Lukowicz, Paul.: "Fusion of Global-Local Features for Image Quality Inspection of Shipping Label", 25th International Conference on Pattern Recognition (ICPR), 10-15 Jan 2021, Milano, Italy.

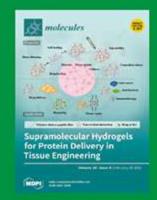
Lim, Sangrak.: "Predicting Chemical Properties using Self-Attention Multi-task Learning based on SMILES Representation", 25th International Conference on Pattern Recognition (ICPR), 10-15 Jan 2021, Milano, Italy.

Proceedings

Sung, Baeckkyoung.: "Photobiological Dynamics of P53 Pathway Represented by the Time-Dependent Damping of a Harmonic Oscillator". The 12th International Conference on Dynamical Systems Applied to Biology and Natural Sciences, The 12th International Conference on Dynamical Systems Applied to Biology and Natural Sciences 2021, 1, 206.

Sung, Baeckkyoung. & Lee, Ryung Kyung.: "Statistical Data Analysis on the Human and Ecological Toxicity of Polycyclic Aromatic Hydrocarbons". The 3rd Belgrade Bioinformatics Conference 2021, 43, 96/

O'Connor, J.S.; Kim, Heesoo,; Gwag, Eunheui,; Abelmann, Leon,; Sung, Baeckkyoung,; Andreas Manz.: "3D Printing for Microgel-Based Liver Cell Encapsulation", The 34th IEEE International Conference on Micro Electro Mechanical Systems (MEMS) 2021, 1, 1023-1026.



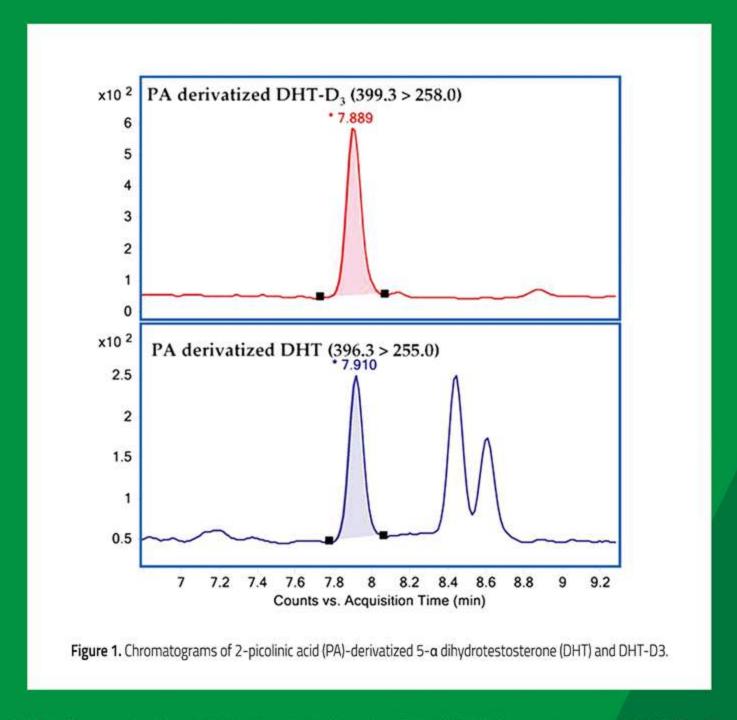
Development of a Liquid Chromatography/Mass Spectrometry-Based Inhibition Assay for the Screening of Steroid 5- α Reductase in Human and Fish Cell Lines

Dahye Kim 1,t, Hyunki Cho 1,t, Ruth Eggers 1, Sang Kyum Kim 2, Chang Seon Ryu 1,t and Young Jun Kim 1.

- ¹ Environmental Safety Group, Korea Institute of Science and Technology (KIST) Europe Forschungsgesellschaft mbH, 66123 Saarbruecken, Germany
- ² College of Pharmacy, Chungnam National University, Daejeon 34134, Korea
- ³ Division of Energy & Environment Technology, University of Science and Technology, Daejeon 34113, Korea
- * Author to whom correspondence should be addressed.
- [†]These authors equally contributed to this work. Academic Editor: Jorge A. R. Salvador

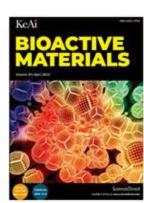
Abstract

Steroid 5- α reductase (5AR) is responsible for the reduction of steroids to 5- α reduced metabolites, such as the reduction of testosterone to $5-\alpha$ dihydrotestosterone (DHT). A new adverse outcome pathway (AOP) for 5AR inhibition to reduce female reproduction in fish (AOP 289) is under development to clarify the antiestrogenic effects of 5AR inhibitors in female fish. A sensitive method for the DHT analysis using chemical derivatization and liquid chromatography-tandem mass spectrometry was developed. A cell-based 5AR inhibition assay that utilizes human cell lines, a transient overexpression system, and fish cell lines was developed. The measured IC50 values of two well-known 5AR inhibitors, finasteride and dutasteride, were comparable in the different systems. However, the IC50 of dutasteride in the fish cell lines was lower than that in the human cell lines. Finasteride showed a higher IC50 against the RTG-2 cell line. These results demonstrated that 5Ars inhibition could differ in terms of structural characteristics among species. The assay has high sensitivity and reproducibility and is suitable for the application in 5AR inhibition screening for various endocrine disruption chemicals (EDCs). Future studies will continue to evaluate the quantitative inhibition of 5AR by EDCs to compare the endocrine-disrupting pathway in different species.



Reprinted from Dahye Kim, Hyunki Cho, Ruth Eggers, Sang Kyun Kim, Chang Seon Ryu, and Young Jun Kim, "Development of a Liquid Chromatography/Mass Spectrometry-Based Inhibition Assay for the Screening of Steroid 5-α Reductase in Human and Fish Cell Lines", Molecules 2021, 26(4), 893. Copyright 2021 Creative Commons BY 4.0.

MAJOR ACHIEVEMENTS



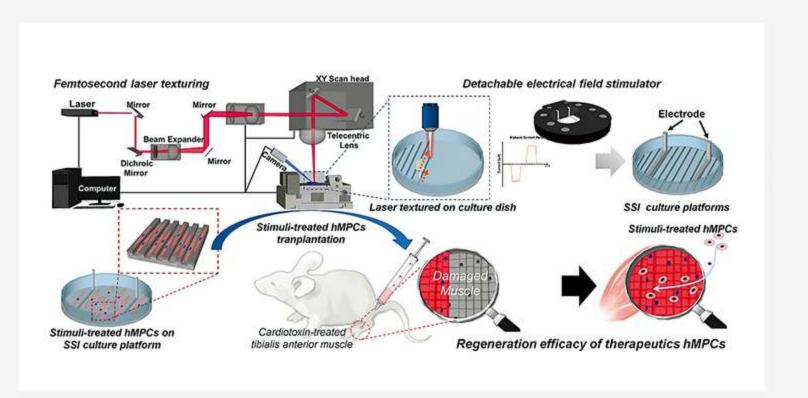
Synergistic stimulation of surface topography and biphasic electric current promotes muscle regeneration

Indong Juna, Na Lib, Jaehee Shinc, Jaeho Parka, Young Jun Kima, Hojeong Jeona, Hyuk Choic, Jae-Gu Chob, Byoung Chan Choie, Hyung-Seop Hana, Jae-Jun Songb

- ^a Environmental Safety Group, Korea Institute of Science & Technology Europe (KIST-EUROPE), Saarbrücken, 66123, Germany
- b Department of Otorhinolaryngology-Head and Neck Surgery, Korea University College of Medicine, Seoul, 02841, Republic of Korea
- ^c Department of Medical Sciences, Graduate School of Medicine, Korea University, Seoul, 02841, Republic of Korea
- d Center for Biomaterials, Biomedical Research Institute, Korea Institute of Science & Technology (KIST), Seoul, 02792, Republic of Korea
- ^e Laser Surface Texturing Group, AYECLUS, Gyeonggi-do, 14255, Republic of Korea

Abstract

Developing a universal culture platform that manipulates cell fate is one of the most important tasks in the investigation of the role of the cellular microenvironment. This study focuses on the application of topographical and electrical field stimuli to human myogenic precursor cell (hMPC) cultures to assess the influences of the adherent direction, proliferation, and differentiation, and induce preconditioning-induced therapeutic benefits. First, a topographical surface of commercially available culture dishes was achieved by femtosecond laser texturing. The detachable biphasic electrical current system was then applied to the hMPCs cultured on laser-textured culture dishes. Laser-textured topographies were remarkably effective in inducing the assembly of hMPC myotubes by enhancing the orientation of adherent hMPCs compared with flat surfaces.



Furthermore, electrical field stimulation through laser-textured topographies was found to promote the expression of myogenic regulatory factors compared with nonstimulated cells. As such, we successfully demonstrated that the combined stimulation of topographical and electrical cues could effectively enhance the myogenic maturation of hMPCs in a surface spatial and electrical field-dependent manner, thus providing the basis for therapeutic strategies.

Reprinted from Indong Jun, Na Li, Jaehee Shin, Jaeho Park, Young Jun Kim, Hojeong Jeon, Hyuk Choi, Jae-Gu Cho, Byoung Chan Choi, Hyung-Seop Han, and Jae-Jun Song, "Synergistic stimulation of surface topography and biphasic electric current promotes muscle regeneration", Bioactive materials, 11., 118-129. Copyright 2021 Creative Commons BY-NC-ND 4.0.

Major Achievements



Effects of polypropylene, polyvinyl chloride, polyethylene terephthalate, polyurethane, high-density polyethylene, and polystyrene microplastic on Nelumbo nucifera (Lotus) in water and sediment

Maranda Esterhuizen (University of Helsinki: Helsingin Yliopisto), Youngjun Kim (Korea Institute of Science and Technology Europe Forschungsgesellschaft mbH)

Abstract

Plastic waste is recognised as hazardous, with the risk increasing as the polymers break down in nature to secondary microplastics or even nanoplastics. The number of studies reporting on the prevalence of microplastic in every perceivable niche and bioavailable to biota is dramatically increasing. Knowledge of the ecotoxicology of microplastic is advancing as well; however, information regarding plants, specifically aquatic macrophytes, is still lacking. The present study aimed to gain more information on the ecotoxicological effects of six different polymer types as 4 mm microplastic on the morphology (germination and growth) and the physiology (catalase and glutathione S-transferase activity) of the rooted aquatic macrophyte, Nelumbo nucifera. The role of sediment was also considered by conducting all exposure both in a sediment-containing and sediment-free exposure system. Polyvinyl chloride and polyurethane exposures caused the highest inhibition of germination and growth compared to the control. However, the presence of sediment significantly decreased the adverse effects. Catalase activity was increased with exposure to polyvinyl chloride, polyurethane, and polystyrene, both in the presence and absence of sediment but more so in the sediment-free system. Glutathione S-transferase activity was significantly increased with exposure to polypropylene, polyvinyl chloride, and polyethylene terephthalate in the sediment-free system and exposure to polyethylene terephthalate and polyurethane in the absence of sediment. There was no clear correlation between the morphological and physiological effects observed. Further studies are required to understand the underlying toxicity mechanism of microplastics.

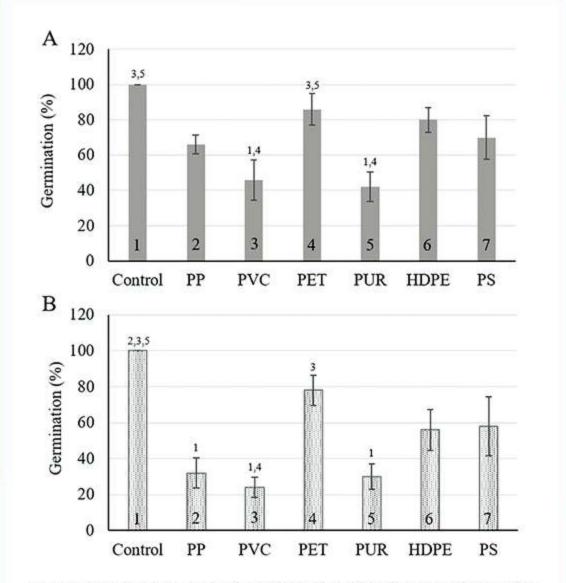


Figure 1. Germination percentage of Nelumbo nucifera seeds after 7 days of exposure to six types of microplastic particles in A sediment and B a sediment-free system. Bars present average germination percentage \pm standard deviation (n = 5). Numbers above the bars indicate statistical significance (p \leq 0.05) compared to 1: control, 2: polypropylene, 3: polyvinyl chloride, 4: Polyethylene terephthalate, 5: polyurethane, 6: high-density polyethylene, 7: polystyrene

Reprinted from Maranda Esterhuizen, and Young Jun Kim, "Effects of polypropylene, polyvinyl chloride, polyethylene terephthalate, polyurethane, high-density polyethylene, and polystyrene microplastic on Nelumbo nucifera (Lotus) in water and sediment", Environ Sci Pollut Res, 2021. Copyright 2021 Creative Commons BY 4.0.

MAJOR ACHIEVEMENTS



Discriminative feature generation for classification of imbalanced data

Sungho Suh 1.a.b , Paul Lukowicz b.c , Yong Oh Lee a

- ^a Smart Convergence Group, Korea Institute of Science and Technology Europe Forschungsgesellschaft mbH, Saarbrücken 66123, Germany
- ^b Department of Computer Science, TU Kaiserslautern, Kaiserslautern 67663, Germany
- ^c German Research Center for Artificial Intelligence (DFKI), Kaiserslautern 67663, Germany

Abstract

The data imbalance problem is a frequent bottleneck in the classification performance of neural networks. In this paper, we propose a novel supervised discriminative feature generation (DFG) method for a minority class dataset. DFG is based on the modified structure of a generative adversarial network consisting of four independent networks: generator, discriminator, feature extractor, and classifier. To augment the selected discriminative features of the minority class data by adopting an attention mechanism, the generator for the class–imbalanced target task is trained, and the feature extractor and classifier are regularized using the pre–trained features from a large source data. The experimental results show that the DFG generator enhances the augmentation of the label–preserved and diverse features, and the classification results are significantly improved on the target task. The feature generation model can contribute greatly to the development of data augmentation methods through discriminative feature generation and supervised attention methods.

Reprinted from Pattern Recognition, 122, Sungho Suh, Paul Lukowicz and Yong Oh Lee, "Discriminative feature generation for classification of imbalanced data" 108302. Copyright (2022), with permission from Elsevier.



Generalized multiscale feature extraction for remaining useful life prediction of bearings with generative adversarial networks

Sungho Suh a, 1, Paul Lukowicz a, Yong Oh Lee b,

- ^a German Research Center for Artificial Intelligence (DFKI), 67663 Kaiserslautern, Germany
- ^bSmart Convergence Group, Korea Institute of Science and
- Technology Europe Forschungsgesellschaft mbH, 66123 Saarbrücken, Germany

Abstract

Bearing is a key component in industrial machinery and its failure may lead to unwanted downtime and economic loss. Hence, it is necessary to predict the remaining useful life (RUL) of bearings. Conventional data-driven approaches of RUL prediction require expert domain knowledge for manual feature extraction and may suffer from data distribution discrepancy between training and test data. In this study, we propose a novel generalized multiscale feature extraction method with generative adversarial networks. The adversarial training learns the distribution of training data from different bearings and is introduced for health stage division and RUL prediction. To capture the sequence feature from a one-dimensional vibration signal, we adapt a U-Net architecture that reconstructs features to process them with multiscale layers in the generator of the adversarial network. To validate the proposed method, comprehensive experiments on two rotating machinery datasets have been conducted to predict the RUL. The experimental results show that the proposed feature extraction method can effectively predict the RUL and outperforms the conventional RUL prediction approaches based on deep neural networks.

Reprinted from Knowledge-Based Systems, Vol 237, Sungho Suh, Paul Lukowicz, and Yong Oh Lee, "Generalized multiscale feature extraction for remaining useful life prediction of bearings with generative adversarial networks", 107866, Copyright (2022), with permission from Elsevier.



Effects of rifampicin on hepatic antioxidant enzymes in PXR and CAR double humanized mice

Young Jae Choi, Chang Seon Ryu, Sang Yoon Lee, Ha Gyeong Kim, Nan Young Kim, Ji-Yoon Lee, Soo Jin Oh, Han-Jin Park, Seung-Woo Cho, Jong-Hoon Kim & Sang Kyum Kim

Molecular & Cellular Toxicology volume 17, pages277-286 (2021)

Abstract

Background

Nuclear receptor are major regulators of hepatic drug metabolizing enzymes and antioxidants enzymes. Nuclear receptor humanized mice were used for overcome species differences between experimental animals and human.

Objective

The present study was performed to investigate the hepatic regulation of antioxidant enzymes in pregnane X receptor (PXR) and constitutive androstane receptor (CAR) double humanized mice treated with the human PXR ligand, rifampicin (RIF; 10 mg/kg for 4 days).

Results

RIF decreased the hepatic protein levels of superoxide dismutase-1, thioredoxin-1, and γ -glutamylcysteine ligase catalytic subunit in wild-type (WT) mice, but not in the double humanized mice. Catalase protein levels were decreased by RIF in both WT and double humanized mice. The hepatic protein level and activity of glutathione reductase (GR) were increased in the humanized mice treated with RIF, but decreased in WT mice. Glutathione S-transferase (GST) alpha-class (GSTA) and mu-class (GSTM) but not pi-class were induced by RIF in the humanized mice, but not in WT mice. The activities of total GST, GSTA and GSTM were also increased only in humanized mice treated with RIF.

Conclusion

These results suggest that PXR and CAR may play roles in xenobiotic-induced hepatic regulation of GSTA, GSTM, and GR. The PXR/CAR double humanized mouse can be used as a suitable predictive model of the regulation of human antioxidant enzymes by xenobiotics.

Reprinted by permission from Springer Nature: Molecular & Cellular Toxicology, 17(3), Young Jae Choi et al, "Effects of rifampicin on hepatic antioxidant enzymes in PXR and CAR double humanized mice", 277-286, COPYRIGHT (2021)

MAJOR ACHIEVEMENTS

Getting partership as Joint research organization for COVID-19 AOP

Project Name : CIAO



Modelling the Pathogenesis of COVID-19 Using the Adverse Outcome Pathway Framework

Brief introduction

The CIAO project will help to make sense of the disparate information sources on COVID-19 pathogenesis by exploiting a well-established knowledge sharing framework. Knowledge from different disciplines and specialists will be consolidated in a way that is understandable and actionable by relevant stakeholders (e.g. medical professionals, public health officials and policy makers, managers in the healthcare sector, etc.). Moreover, this mechanistic knowledge will be used to develop an understanding of the biological modulating factors that determine different clinical outcomes and will be exploited to develop mathematical models that simulate the pathogenesis and health impact of COVID-19.

In regulatory toxicology, an Adverse Outcome Pathway (AOP) is a conceptual construct that portrays existing knowledge concerning the linkage between a direct molecular initiating event and an adverse outcome at a biological level of organisation relevant to risk assessment.

The AOP Framework originates from regulatory toxicology, but molecular initiating events can be triggered by much more than chemicals.

In the CIAO project, we consider the SARS-CoV-2 virus as the stressor.

The AOP Framework is managed by the Organisation for Economic Co-operation and Development (OECD), but the CIAO project is an independent undertaking, making use of the OECD standards.

Partnership organizations

Parties involved

















































































BIOSENSOR



Dr. Jaeho LEE

Group Leader



Objectives

The Biosensor Group conducts multi-disciplinary research for the protection of our health and a sustainable environment. Our primary focus is on projects involving airborne particulate pollutants which threaten our safety and health. In order to safeguard society's well-being and mitigate the risks posed by these pollutants, it is necessary to implement a warning system which issues a prompt alert as soon as they are detected.

We have also developed fundamental technologies capable of real-time notification of analysis results from collected samples, and aim to ultimately build a comprehensive system which integrates these technologies. At the same time, we are working on developing methods for quickly determining the potential effects of pollutants on our health. In addition to our real-time monitoring system development, we are also conducting energy-related research to help promote environmental sustainability.

R&D Areas

■ Biosensors and Microfluidics

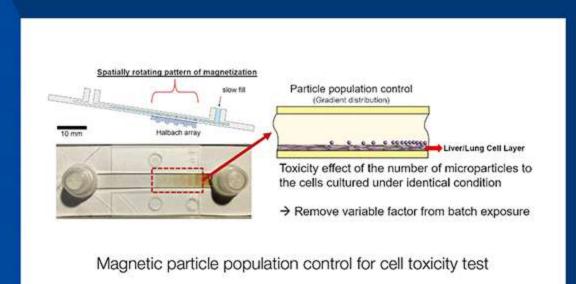
- Development of probe materials using chemical and biological methods
- Development of optical, electrical and electrochemical sensing methods
- Utilization of soft matter in microfluidic platforms for biological/biophysical applications

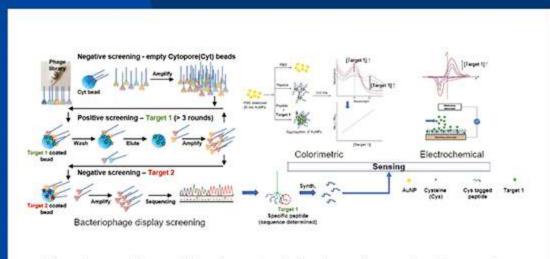
Magnetic Materials

- Controlling and collecting magnetic particles in various fluidic environments

Energy Storage

- Using microfluidics biomimicking for energy storage applications
- Fluid simulations for optimization of electrical energy and hydrogen storage





Target specific peptides from bacteriophage for molecular sensing

MAIN RESEARCH II

Advanced real-time risk assessment of airborne anthropogenic particles (from 2022)

Working Group I Real-time separation of particles Collection Collection & Preparation Rapid preparation of samples Preparation **Working Group II** Analysis of chemical components Analysis Analysis & Sensing Toxic substance-selective sensors Sensing **Working Group III** On-chip screening of cellular responses in vitro & biomarker development Effects & **Predictions** in silico Computational analysis and predictions



BIOSENSOR

Journals

Sung, Baeckkyoung & Abelmann, Leon. : Agglomeration structure of superparamagnetic nanoparticles in a nematic liquid crystal medium: image analysis datasets based on cryo-electron microscopy and polarised optical microscopy techniques. Data in brief 2021, 34, 106716.

Web of Science Core Collection: SCIE 2021 JIF: 1.900

Butyrskaya, Elena V.; Korkmaz, Nuriye.; Zolotukhina, Ekaterina Z.; Krasiukova, V.; Silina, Yuliya E.: Mechanistic aspects of functional layer formation in hybrid one-step designed GOx/Nafion/Pd-NPs nanobiosensors. Analyst 2021, 146, pp2172-2185.

Web of Science Core Collection: SCIE 2021 JIF: 4.616

Korkmaz, Nuriye,; Hwang, C.H.; Kessler, K.K.; Silina, Yuliya E.; Müller, Lisann.; Park, J.Y.: A novel copper (II) binding peptide for a colorimetric biosensor system design. Talanta 2021, 232, 122439.

Web of Science Core Collection: SCIE 2021 JIF: 6.057

Wang, Kangning,; He, Limin.; Manz, Andreas,; Wu, Wenming.: User-Friendly Microfabrication Method for Complex Topological Structure and Three-Dimensional Microchannel with the Application Prospect in Polymerase Chain Reaction. Analytical Chemistry 2021, 93, pp1523-1528.

Web of Science Core Collection: SCIE 2021 JIF: 6.986

Manz, Andreas,; Lee, Abraham. P.; R Wheeler, Aaron,: Lab on a Chip-past, present, and future. Lab on a Chip 2021, 21, pp1197-1198

Web of Science Core Collection: SCIE 2021 JIF: 6.799

Klein, Yannick,; Abelmann, Leon,; Gardeniers, Han.: Influence of the distribution of the properties of permanent magnets on the field homogeneity of magnet assemblies for mobile NMR. IEEE Transactions on Magnetics 2021, 57(7), 6000407. Web of Science Core Collection: SCIE 2021 JIF: 1.700

Stevens, Michiel,; Liu, Peng,; Niessink, Tom,; Mentink, Anouk,; Abelmann, Leon ,; Terstappen, Leon.: Optimal Halbach Configuration for Flow-through Immunomagnetic CTC Enrichment. Diagnostics 2021, 11(6),1020.

Web of Science Core Collection: SCIE 2021 JIF: 3.706

Groenhuis, V. Rolff,; G. Bosman, K.; Abelmann, L.; Stramigioli, S.: Multi-Axis Electric Stepper Motor. IEEE Robotics and automation letters 2021, 6(4), pp7201-7208.

Web of Science Core Collection: SCIE 2021 JIF: 3.741

Song, S.H,; Yoon, Jinsik,; Jeong, Yongkyo,; Jung, Y.G,; Abelmann, Leon,; Park, Wook.: Quantifying and dispensing of magnetic particles in a self-assembled magnetic particle array. Journal of Magnetism and Magnetic Materials 2021, 539, 168341.

Web of Science Core Collection: SCIE 2021 JIF: 2.993

Kabay, G,; Manz, A,; Dincer, C.: Microfluidic roadmap for translational nanotheranostics. Small Methods 2021, 2101217.

Web of Science Core Collection: SCIE 2021 JIF: 14.188

Metelkina, Olga,; Huck, Benedikt,; O'Connor, Jonathan S.; Koch, Marcus,; Manz, Andreas,; Lehr, Claus-Michael,; Alexander Titz.: Targeting extracellular lectins of Pseudomonas aeruginosa with glycomimetic liposomes. Journal of Materials Chemistry B 2022, 10, pp537-548.

Web of Science Core Collection: SCIE 2021 JIF: 6.331



ACHIEVEMENTS 2021



Books

Kim, Sangwon, Jeon, Dong Hyup; Yoon, Sang Jun, Kim, Dong Kyu. Electrochemical cell calculations with OpenFOAM. Modeling vanadium redox flow batteries using OpenFOAM, Springer Nature 2021

Poster Presentations

Abelmann, Leon. "Concentration gradients of magnetic nanoparticles in non-magnetic fluids and non-magnetic particles in magnetic fluids for rapid toxicity screening". IEEE Intermag 2021, 26–30 April. 2021, Lyon, France.

Abelmann, Leon. "Analysis of magneto-tactic bacteria using an optical density meter". IEEE Intermag 2021, 26-30 April. 2021, Lyon, France.

Lee, Jaeho. "Zwitterion-embedded molecular imprinted mesoporous organosilica: Extraordinary sensitivity and selectivity to small molecules". 31st Anniversary World Congress on Biosensors, 26-29 July 2021, Online.

Kim, Sangwon. "Hydrogen Energy Storage and Conversion". The 3rd Webinar on Korea-UK/EU Collaboration for Tacking Climate Change, 02 September 2021, Online.

Poster Presentations

O'Connor, J.S.; Kim, Heesoo,; Gwag, Eunheui,; Abelmann, Leon,; Sung, Baeckkyoung,; Andreas Manz.: "3D Printing for Microgel-Based Liver Cell Encapsulation", 2021 IEEE MEMS, 25-29 Jan 2021, Online.

Abelmann, Leon.: "Capture of magnetic particulate matter directly from air on silicon substrates". IEEE Intermag 2021, 26-30 April 2021, Lyon, France. Apushkinskaya, N.; O'Connor, J.S.; Gwag, E.; Sung, B.; Abelmann, L.; Manz, A.: "In vitro assay for assessing the ethanol cytotoxicity to the human liver cells encapsulated in gelatin microgels", The HIPS Symposium 2021, 20 May 2021, Saarbrücken, Germany.

O'Connor, J.S.; Kim, Heesoo,; Gwag, Eunheui,; Abelmann, Leon,; Sung, Baeckkyoung,; Andreas Manz.: "3D printer models for the microgel encapsulation of liver cells", The HIPS Symposium 2021, 20 May 2021, Online.

O'Connor, J.S.; Gwag, Eunheui,; Abelmann, Leon,; Sung, Baeckkyoung,; Andreas Manz.: "Concentration gradients of magnetic and non-magnetic nanoparticles in channel slides", The HIPS Symposium 2021, 20 May 2021, Online.

O'Connor, J.S,; Regnault, Estelle,; Delafosse, Margaux,; Gebaurer-Barrett, Jasmin,; Apushkinskaya, Nina,; Jeong, Seongho,; Kim, Heesoo,; Gwag, Eunheui,; Abelmann, Leon,; Ryu, Changseon,; Kim, Young Jun,; Lee, Jaehoo,; Sung, Baeckkyoung,; Manz, Andreas.: "Human liver cell-encapsulated microgels for organ-on-a-chip toxicity sensing applications", 31st Anniversary World Congress on Biosensors, 26-29 July 2021, Online, Busan, Korea

BIOSENSOR



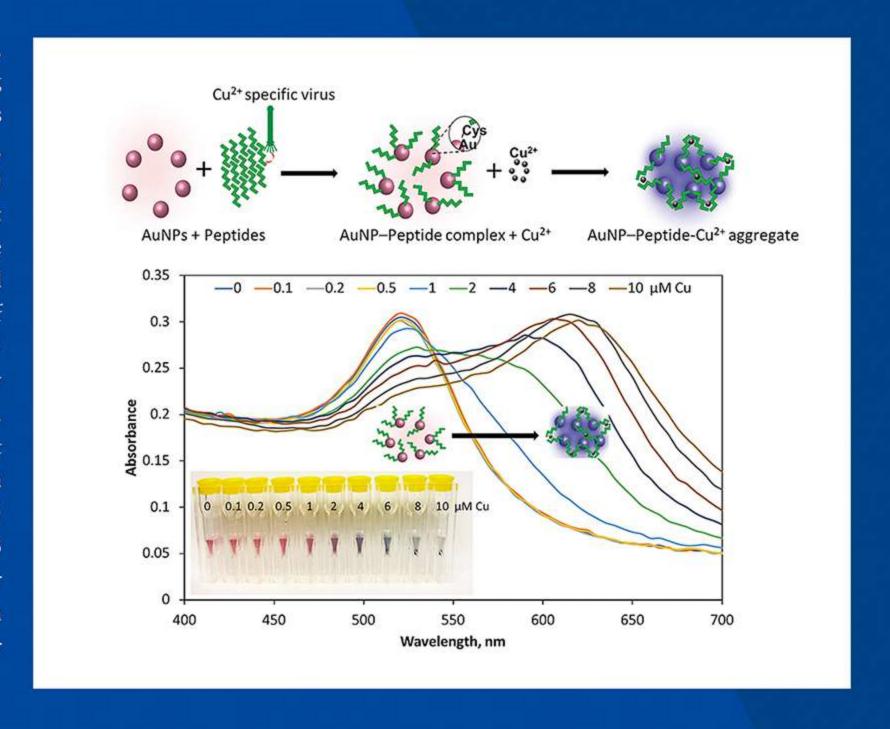
A novel copper (II) binding peptide for a colorimetric biosensor system design

Nuriye Korkmaz a, Changhyun Hwang a,b, Kim Kristin Kessler a, Yuliya E.Silina c, Lisann Müller a, Jayoung Park d

- ^a Biosensor Group, Korea Institute of Science and Technology Europe Forschungsgesellschaft MbH, Campus E 7.1, D-66123, Saarbrücken, Germany
- ^bDepartment of Chemical and Biological Engineering, Korea University, Seoul, 02841, South Korea
- Institute for Biochemistry, Zentrum für Human und Molekularbiologie (ZHMB), Campus B 2.2, University of Saarland, D-66123, Saarbrücken, Germany
- ^dEnvironmental Safety Group, Korea Institute of Science and Technology Europe Forschungsgesellschaft MbH, Campus E 7.1, D-66123, Saarbrücken, Germany

Abstract

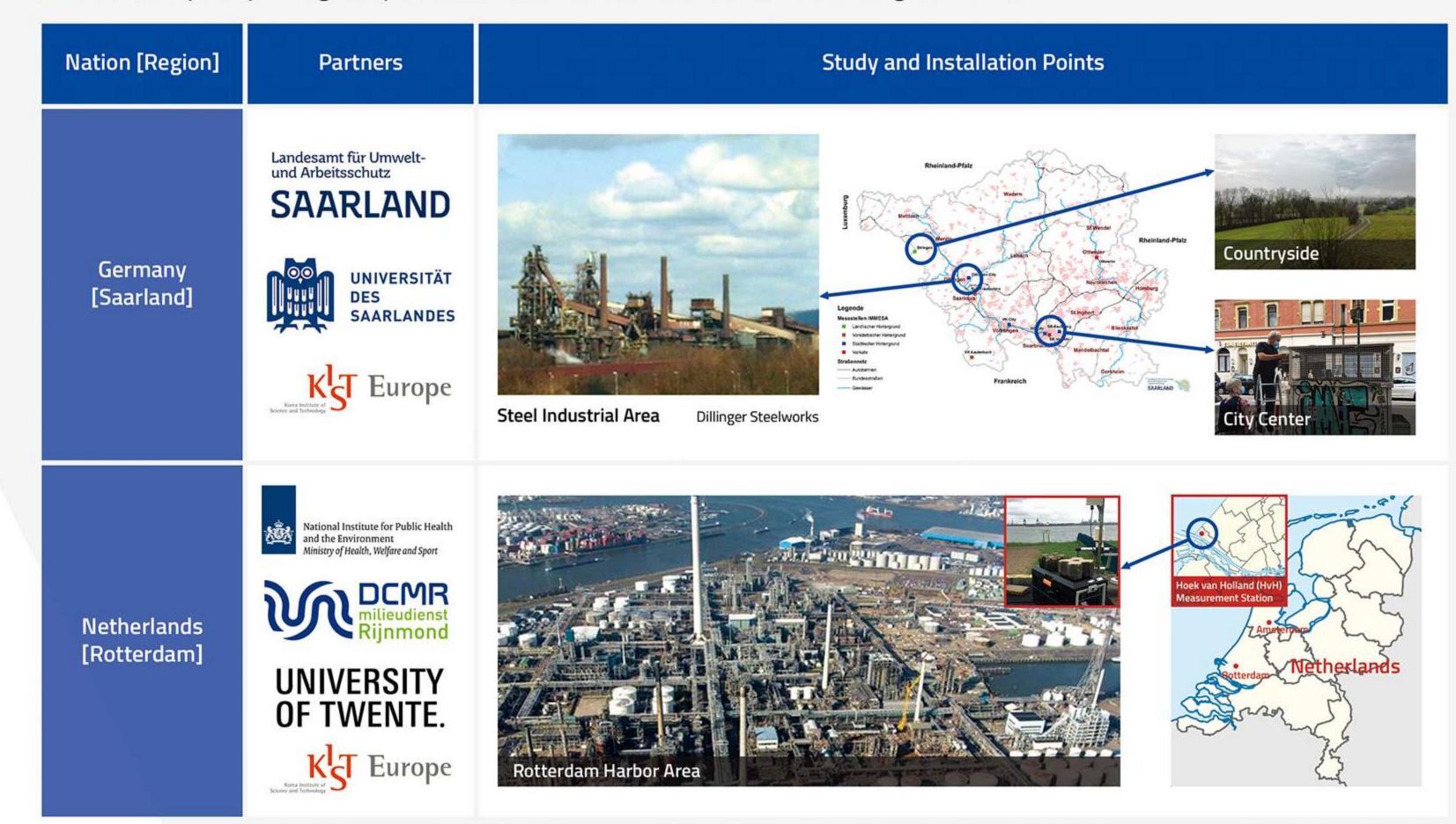
Filamentous bacteriophages are viruses infecting only bacteria. In this study, phage display technique was applied to identify highly selective Cu(II) binding peptides. After five rounds of positive screening against Cu(II) and various rounds of negative screenings against competitive metal ions (Al(III), Co(II), Fe(III), Ni(II) and Zn(II)), bacteriophages were enriched. Selective Cu(II) binding of final phages was confirmed by Enzyme Linked Immunosorbent Assay (ELISA), Scanning Electron Microscopy (SEM) and Energy Dispersive X-ray spectroscopy (EDX) analyses. 15 phage plaques were randomly selected and sequenced. Cu-5 peptide (HGFANVA) with the highest frequency of occurrence and the strongest Cu(II) affinity was chosen for further Cu(II) detection and removal tests. Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) confirmed the strong Cu(II) binding potential of engineered viruses. Cu-5 peptides were synthetically synthesized with three Cysteine units at C-terminal and a AuNP-peptide biosensor system was developed based on aggregation behavior of AuNPs upon Cu(II) ion treatment. AuNP-based Cu(II) sensor was selective for Cu(II) and the LOD was 91.15 nM (ca. $5.8 \times 10-3$ mg/L; $3\sigma/k$, n = 5, R2 = 0.992) for the case study which is considerably lower than the WHO's accepted guideline of 1.3 mg/L. This study provides an interdisciplinary approach to apply short peptides as recognition units for biosensor studies which are user friendly, not bulky and cost-effective.



Reprinted from Talanta, Vol 232, Nuriye Korkmaz, Changhyun Hwang, Kim Kristin Kessler, Yuliya E. Silina, Lisann Müller, and Jayoung Park, "A novel copper (II) binding peptide for a colorimetric biosensor system design.", 122439, Copyright (2022), with permission from Elsevier.

MAJOR ACHIEVEMENTS

Feasibility study of magnetic particulate matter collector with German and Dutch governments





COOPERATION FOR THE FUTURE

COOPERATION AGREEMENTS

29th Sep

BIO-AI Convergence



Research & education activities in BIO-AI, AI-based toxicity prediction research areas



18th Nov

AOP





Future cooperation on research into "Adverse Outcome Pathways"

19th Aug

Academic Cooperation On Pharmacy



College of Phonomery, Changeon National Schommite, Science

In accognition of their execution accesses in air everyoge bloomed advances and string commonal that compresses between contents of their string accesses and their compresses and their compresses and their contents interesting programming processes and their contents of their contents interesting processes and their contents of their contents and the

Collaborative research projects, academic information and materials exchanges, etc.

11th Nov

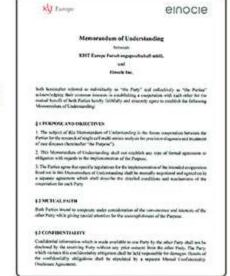
Environmental Research



Joint science & technology symposiums, collaborative activities in environmental research areas

23rd Nov

Bioinformatics



emocie

Future cooperation on single cell multi-omics analysis research for precision diagnoses and treatment of rare diseases

COOPERATION PLATFORM

Open R&I Platform, KIST Europe Korea-Europe Horizon Initiative



Contact Point

Global Cooperation Department
Dr. Jeongho Seo

on Jeongho Se

+49 (0) 681-9382-364





- Discussion on Supporting EINOCLE's Activities in the EU
- Date/Place 25th June 2021 / Saarbrücken, Germany
- **Topic** Consultation on establishing an "On-Site Centre" and networking with German organizations in Saarland
- Participants



emocie





- Cooperation Talks with Government Delegations from Hessen and Saarland
- Date/Place 25th Aug 2021 / Saarbrücken, Germany
- **Topic** Introduction of KIST Headquarters and KIST Europe, discussion on digitalization politics and ecosystems in Korea and Germany's public sectors
- Visitors Patrick Burghardt (Minister for Digital Strategy and Innovation in Hessen)
 Janna Melzer (State Chancellery of Hessen)
 Ammar Alkassar (State Commissioner for the Saarland Government)



REPRESENTATIVE EVENTS

- Cooperation Talks with Korea Shipbuilding & Offshore Engineering
- Date/Place 16th Sep 2021 / Saarbrücken, Germany
- **Topic** Introduction of KIST Europe and hydrogen research trends in Germany
- Participants 9



- 2021 VeKNi Annual Committee
- Date/Place 08-09th Oct 2021 / Essen, Germany
- Activities Introduction of KIST Europe and KOR-EU research initiatives
 - 2021 conference networking
 - Awarding scholarships to students
 - Participation in poster/oral sessions



REPRESENTATIVE EVENTS

Visit by the Delegation from the Korean Embassy in Bonn

Date/Place 5th Nov 2021 / Saarbrücken, Germany

Topic Introduction of KIST Europe's status and discussions on mutual cooperation

Visitors Seung-jae Huh (Consul General)
Kangwoo Lee (Science Attaché)



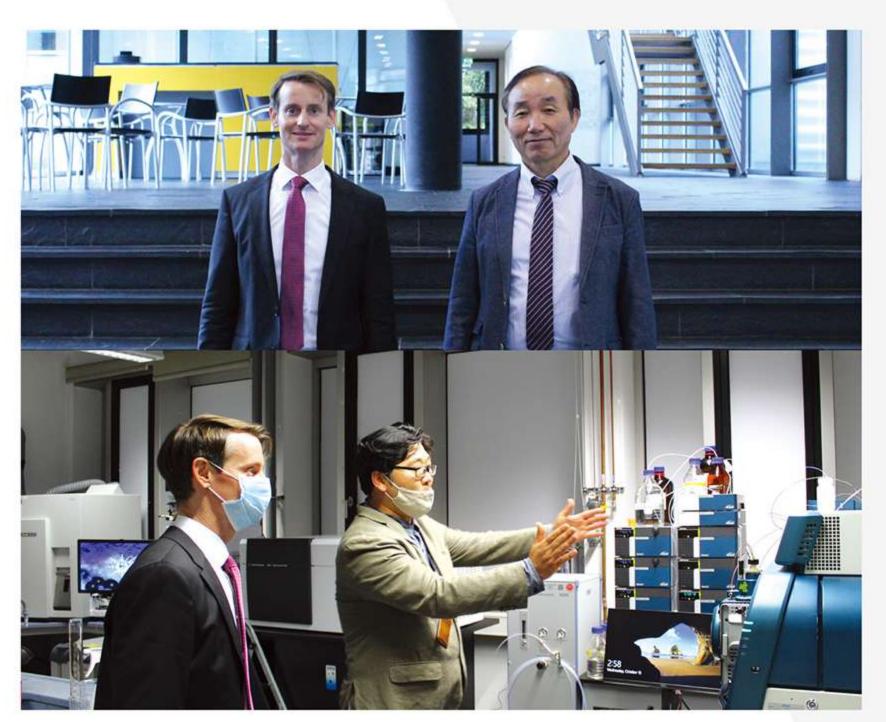
Visit by the Head of Technology of the Saarland State Government

Date/Place 13th Oct 2021 / KIST Europe

Topic 1. Cooperation talks with the Saarland Government on achieving closer research networking

2. Sharing research and lifestyle information as Saarland's only Korean institute

Visitors Dr. Jens Rosenbaum
(Head of the Technolgy for the Saarland State Government)



KIST Europe Forschungsgesellschaft mbH



- KIST Europe Guest House Opening Ceremony
- Date/Place 15th Nov 2021 / Saarbrücken, Germany
- **Topic** Congratulatory addresses, ribbon cutting ceremony, photo sessions with members from German and Korean parties
- Participants 30



REPRESENTATIVE EVENTS

Visit by the Delegation from the Korean National Assembly

Date/Place 15th Dec 2021 / Essen, Germany

Topic Report on status of KIST Europe, research achievements since establishment

Visitors Wonwook Lee (Chairperson of the Science, ICT, Broadcasting and Communications Committee)

Sungjoong Park (Administrative Secretary of the Science, ICT, Broadcasting and Communications Committee)

Jungsuk Yang (Member of the Science, ICT, Broadcasting and Communications Committee)

Jeong Yong Park (Deputy Commissioner C3, National Assembly Secretariat) Kangwoo Lee (Science Attaché of the Korean Embassy in Bonn)



REPRESENTATIVE EVENTS

Global Internship Program on MOUs



- Overview
- Experience a long internship by taking part in laboratory activities
 - Signature Research Fields

- Basic Research Fields



Eligibility

- * Must have a bachelor's or master's degree, or be expected to receive one
- * Must pass a document review
- * Must major in related research areas



Period

- * Runs officially two times a year
- * Generally begins in February & August







LOCATION Hamburg (TU Hamburg) Hannover (Uni. of Hannover) Berlin (TU, FU, HU Berlin) Twente (Uni. of Twente) Cambridge (Uni. of Cambridge) Germany Delft (Delft Uni.) **How to find KIST Europe** Oxford (Uni. of Oxford) Leipzig (Uni. of Leipzig) Aachen (RWTH Aachen, FZJ) London From Frankfurt Airport (Imperial College London, Uni. of London) Brussels (IMEC) Dresden (FEP) Take the fast train (ICE/IC) or local train Frankfurt (DECHEMA) (RE/RB) from Frankfurt Airport to Saarbrücken Main Station. For more Prague (CTU) Heidelberg (DKFZ) KIT Europe information, see: Nürnberg Luxembourg (Uni. of Luxembourg) www.bahn.de (English version available) Rouen (Uni. of Rouen): Karlsruhe (KIT) Information for Navigation Systems München (TU München,Fraunhofer Strasbourg (IBMP) Paris (CNRS, ENS) Stuhlsatzenhausweg 97 66123 Saarbrücken, Germany eadquarters, MPI Headquarters) Stuttgart (Uni. of Stuttgart) **GPS Coordinates:** Vienna (TU Wien) N 49° 15' 32,0" E 07° 02' 25,4" Lorients (IFREMER) Zurich (ETH Zurich) Geneva (CERN) Milano (Politecnico di Milano) Torino (IIT) Grenoble (CNRS, MINATEC, CEA) Location

Imprint





Campus E7.1 66123 Saarbrücken Germany

(1) +49 (0) 681 9382-0

+49 (0) 681 9382-109

info@kist-europe.de

https://www.kist-europe.de



Institute Director

Dr. Soo Hyun KIM



Press and Public Relations

Dr. Jeongho SEO Head of Global Cooperation Department

(1) +49(0)681-9382-364

j.seo@kist-europe.de

Editorial Task Force

Jaesang LEE / Global Cooperation Department Myeongju LEE / Global Cooperation Department

Composition, Layout & Printing

K-GOON Graphix, Seoul, Republic of Korea

kgoon140401@gmail.com





The First Mover in Environmental Sustainability