

# CeBiTec – Quarterly

## Winter 2022/23



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### Restart of the iGEM activities of Bielefeld University

In the last 12 years students from Bielefeld University have successfully participated in the [iGEM](#) (international Genetically Engineered Machine) competition. Unfortunately, last year this tradition came to an end. Therefore, CeBiTec members started thinking how participation in the iGEM competition could be revived. These considerations were successful and conditions were developed for the formation of further iGEM teams for the years 2023, 2024 and 2025.

The participation of Bielefeld students in the iGEM competition in the years 2010 to 2021 was coordinated by the CeBiTec. Under the direc-

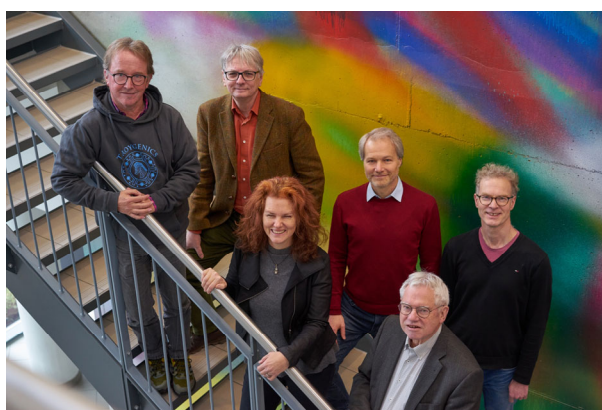
tion of Prof. Dr. J. Kalinowski and his working group, the conditions were provided for students, primarily from the Faculties of Biology and Chemistry as well as the Faculty of Technology, to form joint teams and to work experimentally on self-selected topics. The results achieved were then presented at the final events of the iGEM competition, which brought together iGEM teams from all over the world. The importance of the iGEM competition can be seen from the size of this final competition.

For example, in 2019 in Boston (USA), 353 teams from 42 countries participated in the giant jamboree. It is therefore particularly encoura-

ging that the Bielefeld teams were able to continuously win gold medals in addition to special prizes. Currently, a brochure is being compiled dedicated to the activities of the Bielefeld iGEM teams and their successes. This brochure will contain, among other aspects, an overview of all previous iGEM teams at Bielefeld University, the topics they have chosen and the prizes received. The 12 topics of the previous Bielefeld iGEM teams are shown in this article as a table.

The successes of the iGEM teams so far were reason to reflect on the conditions under which iGEM activities could be continued at Bielefeld University. One of the main problems of the previous iGEM participations was their precarious financing. Up to now, the individual iGEM teams had to make an enormous effort to raise the necessary funding to cover participation fees and travel expenses. Since raising funds became a balancing act for each team, an essential aspect of the new start of iGEM activities was therefore the secure funding, which was made possible by a cooperation between CeBiTec and the Bielefeld rectorate. At the CeBiTec, overhead money from a BMBF project to finance the administration office of the German Network for Bioinformatics Infrastructure (de.NBI) could be used for the new start. This overhead money amounting to 350,000 euros included a substantial rectorate share of 150,000 euros, which, however, had not yet been released. It was now possible to convince the rectorate of the joint financing of future iGEM activities and to obtain its approval. This cleared the biggest hurdle for re-star-

ting the iGEM teams in the next three years. To ensure the success of the future teams, further important steps were taken. An iGEM steering committee consisting of five relevant members was formed to accompany the establishment and activities of future iGEM teams. The iGEM steering committee is mainly composed of people (see figure) from the Faculty of Biology and the Faculty of Technology who have already been involved in the iGEM competition. In detail, J. Kalinowski for DNA analytics, P. Lutter for mathematical modelling, K. Niehaus for proteomics, K. Müller for biotechnology and J. Stoye for bioinformatics were asked to become members of the steering committee.



**Figure 1: iGEM steering committee**

from left to right: J. Kalinowski, K. Niehaus, P. Lutter, K. Müller, A. Pühler (initiator of the restart) and J. Stoye.

In the meantime, the iGEM steering committee has already met several times and will now start the recruiting process for the iGEM team 2023. Information events are planned for this purpose, in particular students from the Master's degree programmes of the Faculties of Biology and Chemistry as well as from the Faculty of Technology are highly welcome.

The CeBiTec is delighted to have been able to initiate the restart of further iGEM activities and to provide laboratory and office space for the iGEM teams in the future.

#### Topics of the previous Bielefeld iGEM teams

- 2010 MARSS – Modulated Acetosyringone Receptor Sensor System**  
(Measurement of Spiciness in Food)
- 2011 The Bisphenol A Team**  
(Detection of the environmental toxin bisphenol A by a cell-free system)
- 2012 A Case for Laccase**  
(Removing Estrogens from Wastewater)
- 2013 Ecoelectricity – currently available**  
(Development of a Microbial Fuel Cell)
- 2014 The Transformers – From CO<sub>2</sub> to Biofuel**  
(Production of isobutanol from CO<sub>2</sub>)
- 2015 Cell-free Sticks – it works on paper**  
(Cell free biosensor for detecting date rape drugs and heavy metals)
- 2016 Evobodies – Molecular Speed Dating**  
(Production of easy to modify binding proteins in *E. coli*)
- 2017 Expand – Expanding the Genetic Code**  
(Expanding the genetic code for introduction of non-canonical amino acids into proteins)
- 2018 nanoFACTORY**  
(A combined system to scavenge metal ions in the environment)
- 2019 Troygenics**  
(A sophisticated bacteriophage-based system to transform eukaryotic microorganisms)
- 2020 Wavy Sense**  
(The determination of the current human fertility status applying the surface acoustic waves technique)

#### 2021 P.L.A.N.T. – Plant-based Ligand Activated Noxious agent Tracker

(a plant-based detection of specific chemical weapons in the soil)

(A. Pühler)

#### CeBiTec-Participation at the “Active Enzyme Molecule 2022”-conference in Japan & Research stays at Toyama Prefectural University

In Toyama at the north coast of Japan directly located at the Sea of Japan and surrounded by an impressive mountain scenery, the “Active Enzyme Molecule 2022”-conference took place on September 30 and October 1, 2022.

Researchers from the Chair of Industrial Organic Chemistry and Biotechnology (IOCB) contributed to this biocatalysis conference with three posters presented by the doctoral course students Hannah Bork, Alina Guntermann and Tim Guntelmann as well as a “Keynote Lecture” held by CeBiTec-member Professor Dr. Harald Gröger on novel synthetic pathways to industrial chemicals by combining chemo- and biocatalysis. The photo shows the IOCB-team members in front of the newly established university building at Toyama Prefectural University, where the conference took place.

This conference series has been established in 2014 and now took place for the 3rd time. Founder and chairman of this conference series is Professor Dr. Yasuhisa Asano from the Biotechnology research center at Toyama Prefectural University, with whom and his re-

search group IOCB is intensively collaborating since more than a decade. Within this collaboration project, in September and October 2022 Hannah Bork, Alina Guntermann and Tim Guntelmann stayed in the laboratories of Prof. Asano, supported by a DAAD-grant within the DAAD-JSPS-PPP-funding program. A major focus of this collaboration project funded by DAAD and JSPS is to develop biotransformations running in flow reactors.



**Figure 2:** IOCB-Members Alina Guntermann, Tim Guntelmann, Hannah Bork and Prof. Harald Gröger (from left to right) at Toyama Prefectural University

(H. Gröger)

### **“ChemBioChem-Poster Prize” awarded to Tim Guntelmann for CeBiTec-project on plant hormone**

The poster presentation of Tim Guntelmann at the very recent “Active Enzyme Molecule 2022”-conference in Toyama in autumn 2022 has been awarded a “ChemBioChem-Poster Prize” sponsored by the international scientific journal “ChemBioChem”. The photo shown below was taken at the award ceremony when Professor

Dr. Yasuhisa Asano, the Chairman of this conference, handed over the certificate of this prize to Tim Guntelmann.



**Figure 3:** Award ceremony at the “Active Enzyme Molecule 2022”-conference.

The poster of Tim Guntelmann has been entitled “Optimized reaction conditions for the synthesis of 12-opda” and describes his research achievements on an improvement of both, the biocatalyst design including enzyme expression as well as the biocatalytic process.

The awarded research work is part of a joint interdisciplinary project jointly carried out between the research groups of CeBiTec-members Prof. Dr. Karl-Josef Dietz (Biochemistry and Physiology of Plants) and Prof. Dr. Harald Gröger (Industrial Organic Chemistry and Biotechnology).

This collaboration is funded by the German Research Foundation (DFG) and targets a better understanding of the biological role of this plant hormone 12-oxophytodienoic acid (OPDA) as well as a straightforward and practical enzymatic synthesis of OPDA. The synthetic method developed within the long-

standing joint research work of the Dietz and Gröger groups has been already proven to be suitable for an efficient synthesis of lab-scale samples of OPDA.

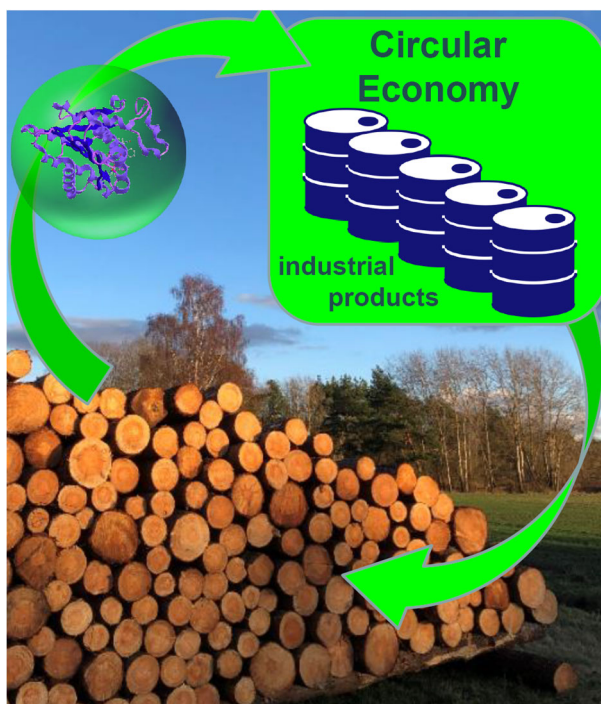
(H. Gröger)

### **Start of collaborative network project funded with 8.7 million EUR on sustainable plastics and circular economy**

On January 1, 2023, a new funding project of a consortium consisting of research groups from Bielefeld University of Applied Sciences (FH Bielefeld) and Bielefeld University has started with CeBiTec-member and organic chemist Prof. Dr. Harald Gröger being involved as one of three participants from Bielefeld University side besides the colleagues Prof. Dr. Andreas Hütten and Prof. Dr. Dario Anselmetti, both from the Faculty of Physics.

The collaborative network project being entitled “Innovation Campus for Sustainable Solutions (InCamS@BI)” is supported with a grant of 8.7 million EUR within the federal-state funding initiative “Innovative Hochschule” (“Innovative University”), which is considered as the excellence initiative for transfer of academic research achievements. A particular goal of the consortium “InCamS@BI” is to strengthen the ties between Bielefeld academia and companies in the region of East Westphalia being active in the field of materials, in particular plastics. This consortium centers on jointly identifying solutions in material science,

e.g., the sustainable production of polymers and circular economy, as a highly timely research topic in both industry and academia.



**Figure 4:** Depiction of the basic idea behind InCamS@BI

At the Chair of Industrial Organic Chemistry and Biotechnology headed by Prof. Gröger, the area of “Green Chemistry” represents a research focus since the beginning of this research group more than a decade ago. A major focus of the group of Prof. Gröger in this project is on identifying solutions for the design of novel polymers based on biorenewable feedstocks and their production with technically feasible and economically attractive processes as well as „chemical recycling“ of plastic waste by catalytic degradation under environmentally benign conditions.

(H. Gröger)

## A children's book by CeBiTec doctoral student Johanna Nelkner teaches preschoolers about microorganisms.

The children's book "[Bakterien und so, die leben wo?!](#)" was published at the beginning of this year by tredition GmbH, Hamburg. The book by Jane Jott provides basic knowledge about microorganisms and is designed to explain the world of microorganisms to preschool children through illustrations that were contributed by Carlotta Klee.



**Figure 5:** Cover of children's book "Bakterien und so, die leben wo?!".



**Figure 6:**  
Author Johanna Nelkner

The CeBiTec is of course very interested that preschool children are taught scientific content, including microorganisms and their concise role in infectious diseases, in the digestive process and in biotechnology. One may ask why the above-mentioned children's book receives such a detailed

appreciation in the CeBiTec Quarterly Newsletter. The answer is simple. Behind the author's pseudonym Jane Jott is Johanna Nelkner, a doctoral student of the CeBiTec working group "Genome Research of Industrial Microorganisms" who is currently finalizing her dissertation which is also dedicated to microorganisms and deals with bacterial communities in European agricultural soils. For this purpose, she has isolated community DNA from bacterial soil consortia, sequenced the DNA and subsequently analysed the sequence data.

In parallel to this work, she managed to conceive the present children's book in her remaining free time and to organize the publication of the book. First, it was necessary to build a substantial financial base, which was required to carry out first steps. To do this, she launched a crowdfunding process that was really enormously successful. The Association for General and Applied Microbiology (Vereinigung für Allgemeine und Angewandte Mikrobiologie - VAAM) also participated as a crowdfunder and significantly contributed to the publication of the book. For the printing of the book she uses the 'print-on-demand' process of tredition-Verlag, Hamburg. By the way, this children's book was awarded "Book of the Month" by tredition-Verlag. It was announced as follows: "In 'Bakterien und so, die leben wo?!' the author takes us into a very unique world of microorganisms and shows where they live, why we depend on them, and what cool, exciting, and funny abilities bacteria have." Johanna gave her first public lecture on this children's book at Forschungszentrum Jülich on November 17

last year in the lecture series "Science online" and reported on the genesis of the book. She explained that the initial motivation for the book came from her own children, who wanted to know what she does in her job and which organisms she deals with. The book provides excellent answers to all these questions. It is therefore recommended to use the book to teach one's own children or those in the family environment about the tasks of CeBiTec.

(A. Pühler)

### Newly acquired third-party funded projects of the *teutolab*-biotechnologie

The *teutolab*-biotechnologie has raised third-party funds for numerous projects.

***teutolab* biotechnologie** First, a 4<sup>th</sup> funding phase of the *CeBiTec Students' Academy* (2023 to 2025) has been approved. The main focus will be on biotechnology and medicine. This year, the one-week event for students with a high talent for science will take place from July 31 to August 4, 2023.



The Osthusenrich Foundation has been supporting the *CeBiTec Students' Academy* since 2012. Since that time, more than 150 young people had the chance to be encouraged in their interest in biotechnology.



In addition, the Joachim Herz Foundation has been supporting adolescents with interest in science by funding the *teutolab*-

*Academy 'Systems Biology'* since 2016. Last year, the project week was in especially high demand. This year, the young people from the waiting list will take part in the project in their Easter holidays (April 3 - 6, 2023).



Further projects in school holidays to promote students in the field of STEM (Science, Technology, Engineering, and Mathematics) are funded by zdi ('Future Through Innovation', North Rhine-Westphalia). For students in grades 8 to 10, the project *Medical research trip through the body* will be supported during the Easter, summer and autumn school vacations. For students in grades 11 to 13, the project week *Practical work on biomedical topics* is offered from June 26 - 30, 2023.

More information about the supplies for gifted young people in 2023 can be found [here](#).

Zdi will also sponsor one-day workshops for high school biology courses. This enables the students to experiment in the laboratory and thus supports their scientific literacy. The *teutolab*-biotechnologie asks for budgets at the various centers in the districts of North-rhine-Westphalia. The financial resources are expected to be shortened in 2023. In 2022, the *teutolab*-biotechnologie conducted one-day workshops with 128 biology courses. Therefrom, zdi funded 100 courses and thus the participation of about 2000 students.

The *teutolab*-biotechnologie will receive further third-party funds through the participation in the BMBF project *School laboratories as a site for teacher training in the digital world*.

The *teutolab*-biotechnologie will perform and evaluate courses on the combination of genetics and evolution by working with phylogenetic software.

(K. Röllke, M. Panhorst & N. Grotjohann)

### **Project courses of the *teutolab*-biotechnologie with schools in Bielefeld and Gütersloh**

For the first time, the *teutolab*-biotechnologie performed project courses with middle school students comprising several units in the school year 2022. The project was developed in cooperation with the participating schools and deals intensively with medical technology and biomedicine. The students carried out experiments on biomedical issues with each unit focusing on a specific topic. The units took place in the student's lab and in the schools as well.

The students got to know different methods of bacterial and virus diagnostics, carried out blood group determinations, dissected a pig's heart, extracted DNA from oral mucosa cells and carried out microscopic examinations.

The practical experiments with the relevant biotechnological laboratory equipment were embedded in medical contexts such as leukaemia, AIDS and cervical cancer. In addition, the students slipped into the role of doctors in an interactive rally and worked on a case themselves - from the anamnesis to the therapy. They searched for clues in the main building of

the university, had to find books in the library and to research them, carried out tests in the laboratory and finally made the diagnosis and a therapy recommendation. The students reported that they enjoyed these activities very much.



**Figure 7:** Students determining blood groups with a research kit.

The project was carried out with 3 classes of the Friedrich-von-Bodelschwingh School in Bielefeld and with one class of the Evangelical Grammar School in Werther. For 2023, it is planned to continue the cooperations.

**zdi** Zukunft durch Innovation  
Nordrhein-Westfalen It will be financially supported by zdi (*future through innovation*) in the special funding line *Medical Technology*.

A report about the first implementation can be found here: [Click](#) to see report.

(K. Röllke, M. Panhorst & N. Grotjohann)



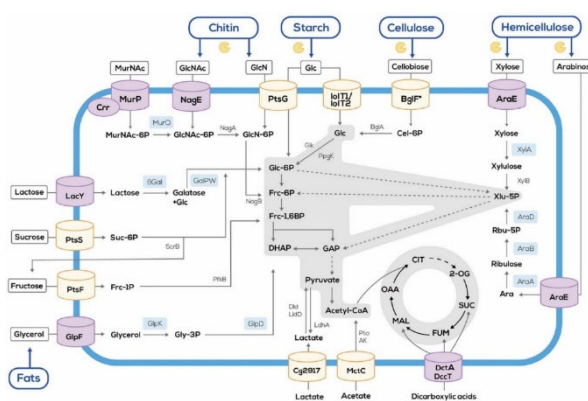
## Wendisch lab to collaborate within the EU consortium iCULTURE

At the end of 2022, an invitation to grant preparation has been received for the project “iCulture: A digital bio-platform and co-culture bioprocess to prospect and utilize macroalgae responsibly and sustainably”. The consortium is coordinated by NTNU, Trondheim, Norway, and brings together expertise from 10 countries by involving 9 industrial and 8 academic partners, one of which is the Wendisch lab of CeBiTec. Seaweed is considered Europe's largest biomass, but less than 0.25% of over 100 Megatons is utilized. iCulture is a cross-disciplinary consortium where European expertise on information and communication technologies, bioinformatics, biodiversity, biotechnology, synthetic biology and bioprocessing is combined to develop a set of digital toolboxes that can prospect for new species of seaweed in microbial fermentation, and understand how to use it responsibly and sustainably.

Seaweed takes centre stage for most part of the consortium as novel, invasive and blooming seaweed species will be prospected using deep learning approaches. A thorough understanding of seaweed biology and biodiversity is sought and responsible harvest guidelines will be developed. To enable a new zero-waste value chain seaweed residuals shall be converted, *i.a.*, to antimicrobials. In accordance with the Research Area 2 of CeBiTec, the Wendisch lab will contribute to develop a microbial co-culture system to valorize European seaweed sidestreams into valuable compounds for use in the

feed, food and pharma industries, while reducing the CO<sub>2</sub> footprint.

The contribution of the Wendisch lab to two units of the iCULTURE tech stack is based on two lines of research. On the one hand, microbial strains have been developed for the efficient valorization of sidestreams from agriculture and aquaculture (reviewed in [Wendisch et al., 2022, Front Microbiol. 13, 835131](#)). To this end, a flexible feedstock utilization concept has been realized with *C. glutamicum* (Figure 8).



**Figure 8: Schematic overview of the flexible feedstock concept established in *Corynebacterium glutamicum* by systems metabolic engineering.** Scheme designed by You-Lim Lee, taken from Wendisch, Nampoothiri, Lee, 2022, *Front Microbiol.* 13, 835131 (CC BY 4.0).

On the other hand, synthetic microbial consortia were developed for small molecule production (reviewed in [Sgobba and Wendisch, 2020, Curr Opin Biotechnol. 62, 72-79](#)), e.g., a mutually dependent *E. coli/C. glutamicum* consortium for amino acid production from chitin that occurs in crustaceans.

In iCULTURE, synthetic microbial consortia will be developed to convert monomeric seaweed sugar components to antimicrobials using QR coding of strains (Ulm University) in A.I. supervised co-culture process (NTNU, Trondheim).

(V. F. Wendisch)

## Biotechnologists' brewing competition in the CeBiTec

After a long and thirsty break due to "Corona" our biotechnologists' brewing competition finally got started again. On the 18<sup>th</sup> of January 2023 traditionally the CeBitec foyer was the place, where four groups competed with their self-brewed beers.



Figure 9: Beer tasting in the foyer of the CeBiTec building

After the students learned the theoretical background of brewing in the seminar, they developed four recipes with our brewingmaster Paul: Skalden Ale (Red Ale), Annalena Beerbock (Bockbier), Brewdolf Renbier (Weizen) and GALA (Ginger Amber Lemon Ale). The brewers started brewing about 6 months ago for the Bockbier and 3-4 months ago for the rest of the beers, as an appropriate storage time makes the beer really tasty.

For our event, the Herforder brewery sponsored four dispensing systems including equipment and a barrel of beer. Thank you very much! Being an excellent German pilsner, the beer served as a benchmark.

All the beers were very well received and also rated almost identically by both the audience and our jury composed of members of the faculty of technology and faculty of biology. The first prize went to the Weizen with fine fruit flavors, followed by the Skalden Ale. The audience and the jury only disagreed about the ranking positions three and four.



Figure 10: Award ceremony

At 20:30, 230 litres of draught beer were well spent. Many thanks to the great audience and the jury composed of members of the faculty of biology and the technical faculty. We are looking forward to the next time!

(D. Cholewa)

### Impressum

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