

CeBiTec – Quarterly

Autumn 2022



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***teutolab*-academy ‘systems biology’ 2022**



From October 4th to 7th, 2022 the *teutolab*-academy titled "Systems Biology – Biological Experimentation and Mathematical

Modelling" was held by the [teutolab-biotechnologie](#) at the CeBiTec. The project week addressed particularly interested and motivated high school students from all over North Rhine-Westphalia.

For one week, the 20 participants dealt with systems biology focussing on an intensive examination of the *lac* operon. In the lab, the students performed three different experiments on bacterial growth and enzyme kinetics. In addition, they examined a bioinformatic analysis of the collected data.

Individual aspects of the *lac* operon were modelled and simulated with the program CellDesigner.



Figure 1: High school students performing experiments in a training laboratory of the CeBiTec.

Different research groups of the CeBiTec were committed to the program. The students were introduced to systems biology by Prof. Dr. Karsten Niehaus. By lab tours of the technology

platform 'genomics' and the workgroup 'Multiscale Bioengineering', the participants gained a direct insight into the research field. At the end of the week, the students worked independently on finding and presenting actual research projects in systems biology.

The Academy was financially supported by the [Joachim Herz Foundation](#), Hamburg and [Zukunft durch Innovation \(zdi\)](#). The next *teutolab*-academy will take place during the spring holidays of 2023.



(A. Wenzel, K. Röllke & N. Grotjohann)

CeBiTec member Prof. Karl-Josef Dietz receives Simon-Schwendener-Medal and is re-elected as president of VBIO



The president of the German Society for Plant Sciences (Deutsche Botanische Gesellschaft, [DBG](#)), Prof. Dr. Andreas Weber, awarded the [Simon-Schwendener-Medal](#) to Prof. Dr. Karl-Josef Dietz on the

occasion of the International Botanical Congress in Bonn on the 31st of August.

With this award, the DBG appreciates his merits in supporting plant science and in shaping the society. Dietz served as speaker of the section Plant Physiology and Molecular Biology of the DBG from 2003 until 2009 and as president of the society from 2012 until 2019.

The General Assembly of the German Life Science Association (Verband Biologie, Biowissenschaften und Biomedizin in Deutschland e.V., [VBIO](#)) re-elected Prof. Dr. Karl-Josef Dietz as president of the VBIO on October 7th, 2022 for

the upcoming biennium. With about 25,000 members, VBIO is the association of biological and biomedical scientists and many other members privately or professionally interested in biology. VBIO is engaged in scientific, societal and political opinion making and discussion, and gives independent advice to decision makers in schools, universities, research institutes, economy, politics and administration. Examples for the multiple current activities are the dialogue with politicians and the public about the regulation of gene editing technologies, the Nagoya protocol and digital sequence information or the teaching curricula at schools and in study programs.

For more information see: <https://www.vbio.de>. (K.-J. Dietz)

The 2022 Annual Conference of the de.NBI Industrial Forum on November 24th is dedicated to the topic "Digital Health"

The CeBiTec at Bielefeld University coordinated the BMBF project "German Network for Bioinformatics Infrastructure (de.NBI)" until the end of last year. Subsequently, the [de.NBI](#) network was sustainably continued by integration into the Helmholtz Research Center Jülich. The industry component of the de.NBI network – called [de.NBI Industrial Forum](#) – is guided by the CeBiTec member A. Pühler. This year's annual online conference is planned for November 24, specifically dedicated to the topic "Digital Health". Well-known speakers have been recruited for this topic. Despoina Sousoni will speak on behalf of the European Life Science Infrastructure (ELIXIR) about European activities in the digital health sector. Juliane Fluck will report on the efforts of the National Research Data Infrastructure (NFDI) in the health sector. Roland Eils from the Berlin

Institute of Health (BIH) will present ongoing research projects. Research-related approaches will also be presented by two scientists from Heidelberg: Wolfgang Huber from the European Molecular Biology Laboratory (EMBL) will report on multi-omics and single cell methods in lymphoid malignancies, and Julio Saez-Rodriguez from the University of Heidelberg will focus on machine learning methods for the analysis of multi-omics data in personalized medicine. These contributions will be complemented by three presentations from the industrial sector. Representatives of Merantix Momentum, Nebion AG – an Immunai Company and ITTM (Information Technology for Translational Medicine) will report on their commercial approaches and show that the topic of "Digital Health" has already reached commercial use.

With the start of the medical study programme at Bielefeld University, life science data will become more and more important in the future. It therefore makes sense to keep an eye on the current developments in this field. Participation in the abovementioned online event is therefore recommended. More information and details about this event can be obtained [here](#).



(A. Pühler)

Science and Socialising at the 8th CeBiTec Retreat held at Haus Düsse

The 8th CeBiTec Retreat took place from September 15 to 16, 2022 at *Haus Düsse*, the seat of the *Landwirtschaftskammer NRW* (Chamber of Agriculture of North Rhine-Westphalia), in Bad Sassendorf. Eighty participants attended to the two-day meeting with 23 excellent scien-



Figure 2: Participants of the 8th CeBiTec Retreat in front of the main entrance of *Haus Düsse*.

tific talks covering topics from both research fields of the CeBiTec and ranging from bioinformatic algorithms to challenges associated with bioprocess development (Figure 2). Talks were presented by 13 distinct CeBiTec research groups, providing a broad and exhaustive overview of the research activities currently ongoing in the CeBiTec. Especially for PhD students, the CeBiTec Retreat represents an excellent surrounding to present their thesis results in front of an expert audience, sparking fruitful discussions with CeBiTec PIs and colleagues at the Monday night get-together with cold drinks and salty snacks.

As one of the highlights, the new CeBiTec member Jun.-Prof. Dr. Stephan Hammer gave an intriguing introduction into his main research interests. Next year's retreat is already scheduled and will be held from September 18 to 19, 2023 at *Haus Düsse*.

(L. Wobbe)

CeBiTec Summer Party 2022

After two years of cancellation due to the pandemic, the CeBiTec Summer Party took place on the 8th of September 2022 in front of the CeBiTec main entrance. Cold beverages and barbecue along with music created a pleasant ambience for CeBiTec members and their families (Figure 3). The event was perfectly organized by the research groups of CeBiTec members Prof. N. Sewald (Bioorganic Chemistry) and Prof. O. Kruse (Algae Biotechnology & Bioenergy), with a leading role play-

ed by Gertraut Lehmann and Jan Mussnug (both Algae Biotechnology & Bioenergy Group) as well as Beate Nachtigall (Bioorganic Chemistry Group).



Again, the party was kindly sponsored by the business unit [IIT BioTech GmbH](#), which is part of the *Institut für Innovationstransfer der Universität Bielefeld (IIT GmbH)*.



Figure 3: Pleasant atmosphere at the summer party 2022.

(L. Wobbe)

9th CeBiTec Students Academy in the summer holidays

After a break of 2 years, A. Pühler, N. Grotjohann and J. Kalinowski could host again the CeBiTec Students Academy for particularly gifted upper school students. Since the beginning, 11 years ago, it is financially supported by the Osthusenrich-Stiftung. In the last week of the summer holidays, 16 young people who were particularly interested in science took part in the cooperation between CeBiTec and the teutolab-biotechnologie (Figure 4). This year, for the first time, the focus was placed on biomedicine. The adolescents listened to specialist lectures on various biomedical topics.



Figure 4: Group photo with participants and organizers of the 9th CeBiTec-Schüler*innen-Akademie in front of the CeBiTec building.

The lecture program started with a guest lecture by Dr. Robert Kulis-Horn, head of the genetics diagnostics laboratory at MVZ Labor Krone (Bad Salzufen).

On the following day, the participants listened and discussed the topics of medical genomics (Prof. Dr. Jörn Kalinowski), industrial biotechnology (Prof. Dr. Volker Wendisch), microscopic histopathology (Prof. Dr. Karsten Niehaus), algae biotechnology (Dr. Jan Mussnug), production of pharmaceuticals (Dr. Heino Büntemeyer) and the CRISPR/Cas method (Dr. Manuel Wittchen).

The scientists were happy about the extraordinarily lively discussions that followed, which showed the great interest in the topics presented. In addition, the adolescents got to know the CeBiTec as a relevant research institution through guided tours. In the lab, they performed microbiological analyses to identify bacteria, prepared nanopore sequencing experiments (Figure 5), learned various techniques for microscopic histopathology and analysed different variants of SARS-CoV-2 phylogenetically. The students emphasized that all components of the newly developed practical part were much fun to them. The evaluation showed that the participants highly enjoyed the complete pro-

gram and that they felt encouraged in their interest in science and in their plans to study in a field of science.



Figure 5: Students preparing a nanopore sequencing experiment.

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

teutolab project weeks in the holidays for gifted students – online and in presence



Besides the CeBiTec students' academy and the *teutolab* academy 'Systems Biology', the *teutolab*-biotechnologie offered four further project weeks in the holidays, all dealing with biomedical topics. In the first week of the summer holidays, 16 senior class students worked in an online project on issues in the field of lactose intolerance and of corona viruses. Facilitated by the video conference tool Zoom, the students became acquainted with enzyme activities and their regulation and learned about the evolution of coronaviruses and virus diagnostics.

The tutors introduced to the theoretical backgrounds and demonstrated experiments that they performed in the student lab. Predominantly, the students themselves performed experiments at home and worked interactive with the tools on the website <https://teutolabbotechnologie-online.de/>. In the second and fourth week of the summer

holidays, a total of 30 students from class 8, 9 and 10 attended the project week 'Medical research trip through the body' in the student lab in the CeBiTec.

The following topics were treated experimentally: Immune system - bacterial and viral diagnostics, digestive system - lactose degradation, cardiovascular system - blood group determination and dissection of a pig heart, genetics - DNA extraction, and microscopy - Investigation of cells. In the last week of the autumn holidays, 22 students from class 8, 9 and 10 dealt with the same topics in an online project week. Like in the other online concept described above, the video conference tool Zoom and the online website of the *teutolab*-biotechnology were used (Figure 6).

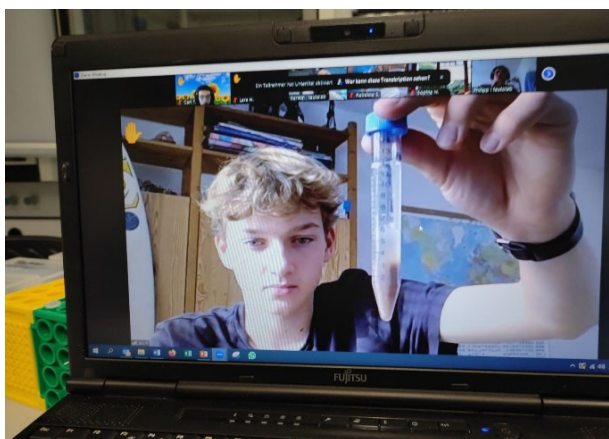
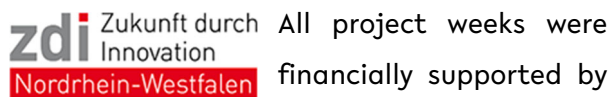


Figure 6: Discussion of experiments via Zoom.

The participants performed experiments at home like enzymatic digestion of lactose, the dissection of a pig heart, DNA extraction with items from the household and microscopy with a [virtual microscopy laboratory](#).



All project weeks were financially supported by zdi (future through innovation), a fellowship campaign from the regional office of the Federal Employment Agency in North Rhine-Westphalia and the Ministry of Culture and

Science of North Rhine-Westphalia.

(K. Röhlke, M. Panhorst, A. Wenzel & N. Grotjohann)

Microalgae as renewable resource for heterotrophic production of fine chemicals

Renewable resources are essential for a modern, decentralized bioeconomy and sustainable generation of valuable bioproducts. The algae biotechnology & bioenergy group of



Federal Ministry of Food and Agriculture

Prof. Dr. Olaf Kruse now initiated a [Federal Ministry of Food & Agriculture \(BMEL\)](#)

funded project, which seeks to establish the green and fast-growing microalga *Chlamydomonas reinhardtii* as a biocatalytic source for efficient bioproduction of fine chemicals. This single-celled, green microalga harbours a very powerful 2-C-methyl-D-erythritol 4-phosphate/1-deoxy-D-xylulose 5-phosphate (MEP/ DOXP) pathway, which natively fuels endogenous terpenoid and sterol biosynthesis. Recently developed, innovative synthetic biology strategies now enable engineered biocatalysis towards desired products.

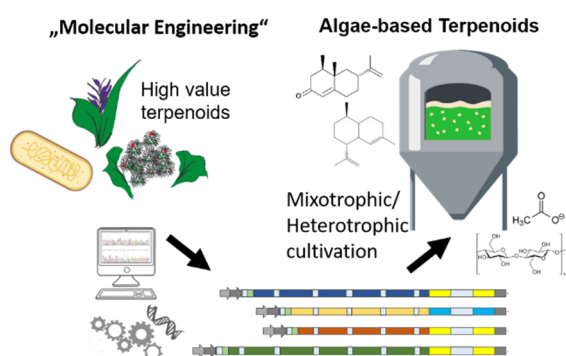


Figure 7: Project design for efficient algae-based terpenoid production.

Efficient heterotrophic production processes and the use of biogenic residues as carbon

sources will establish powerful, environmentally friendly biological production of high value tri- and sesquiterpenoids. It is planned that the entire production process is part of an efficient value chain, which also includes the utilization and conversion of photosynthetically produced organic material (e.g. cellulose). The project is also supported by the industrial partner [UNIPER](#) and the biotech company [BIBITECH](#).

(T. Baier & O. Kruse)

Description of the new species *Anaeropeptidivorans aminofermentans* of a new genus using genome sequence information, physiological and chemotaxonomic features

Culture-independent analyses of microbial taxa have dramatically progressed in the last decade due to advances in high-throughput next generation sequencing (NGS) technologies and launched microbial taxonomy into a new era. Applying metagenome sequencing complemented by a subsequent binning approach resulting in metagenome assembled genomes (MAGs) provides access to microbial genome sequences. Reconstructed genomes of so far unknown taxa promise significant advances in the systematics of prokaryotes. Due to the limitation of this methodology (possible incompleteness and contamination of MAG genome sequences), this approach is not recognized by the International Committee on Systematics of Prokaryotes (ICSP) for valid species description. Consequently, a cultivation-based approach complemented by phenotype-based taxonomy and chemotaxonomic characterization is state-of-the-art for classifying new isolates (description of new taxa) and their nomenclature. However,

description of new species nowadays also should include genome sequence information to obtain a clear picture of the genomic landscape of the novel organism. In this context, CeBiTec researchers from the group “Genome Research of Industrial Microorganisms” led by Prof. Alfred Pühler together with colleagues from the Technical University of Munich, the Ludwig-Maximilians University of Munich, the Leibniz Institute DSMZ-German Collection of Microorganisms and Cell Cultures GmbH (DSMZ), the Justus-Liebig University Giessen, the University of Oldenburg and the Humboldt University of Berlin joined forces and described a new species within a new genus, namely *Anaeropeptidivorans aminofermentans* strain M3/9^T. The corresponding approach involved interpretation of established genome sequence information and physiological characterization of the isolate. An anaerobic bacterial strain, designated M3/9^T, was isolated from a mesophilic laboratory-scale biogas fermenter. It featured straight, non-motile rods which occurred as single cells (Figure 8).

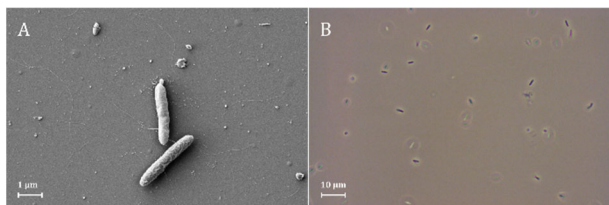


Figure 8: Cell morphology of strain M3/9^T grown in TSB medium for one day. (A) Scanning electron photomicrograph; (B) Phase-contrast photomicrograph (Source: Andreas Klingl).

Phylogenetic analysis allocated strain M3/9^T within the family *Lachnospiraceae* (phylum *Bacillota*) with *Clostridium colinum* DSM 6011^T and *Anaerotignum lactatifermentans* DSM 14214^T being the most closely related species as deduced from their 16S rRNA gene sequence similarities complemented with comparative genome analyses e.g. average amino acid

identity (AAI) calculations. Based on physiological, chemotaxonomic and genetic data, we propose the description of a novel species and genus of which *Anaeropeptidivorans aminofermentans* gen. nov., sp. nov. M3/9^T represents the type strain. This study showcases the value of genome sequencing at the CeBiTec and once again highlights its power for describing novel microbial taxa.

The species description entitled “*Anaeropeptidivorans aminofermentans* gen. nov., sp. nov., a mesophilic proteolytic salt-tolerant bacterium isolated from a laboratory-scale biogas fermenter, and emended description of *Clostridium colinum*” was recently published in *International Journal of Systematic and Evolutionary Microbiology*. The complementary manuscript on *Anaeropeptidivorans aminofermentans* M3/9^T genome analysis entitled “The novel oligopeptide utilizing species *Anaeropeptidivorans aminofermentans* M3/9^T and its role in anaerobic digestion as deduced from large-scale fragment recruitment analyses” was published almost in the same time in the [Frontiers of Microbiology](#) Journal.

Reference

Maus, I., Wibberg, D., Belmann, P., Hahnke, S., Huang, L. et al (2022) The novel proteolytic species *Anaeropeptidivorans aminofermentans* M3/9^T and its role in anaerobic digestion as deduced from large-scale fragment recruitment analyses. *Front. Microbiol.* doi: 10.3389/fmicb.2022.1032515

(I. Maus, A. Schlüter & A. Pühler)

Intensification of collaboration with Japan during “Specially Appointed Professorship” of Prof. Dr. Harald Gröger at Osaka University

The scientific exchange and intensification of existing collaboration projects with research

groups from Osaka University were a major focus of the first stay of CeBiTec-member Prof. Dr. Harald Gröger (Chair of Industrial Organic Chemistry and Biotechnology at Bielefeld University) within his “Specially Appointed Professorship” at Osaka University. Osaka University is one of the largest national universities in Japan with an outstanding international scientific visibility and track record, being ranked 3rd among all universities in Japan and 68th worldwide in the “QS World University Rankings 2023” on top global universities. Furthermore, Osaka University is one of the official international partner universities of Bielefeld University, and since many years there are close ties between the Chair of Industrial Organic Chemistry and Biotechnology at Bielefeld University and research groups from different departments at Osaka University. Thus, besides current projects also future strategies for collaboration initiatives in the field of organic chemistry and biotechnology have been discussed within this stay of Prof. Gröger at Osaka University. In addition, he gave scientific lectures such as a Special Lecture at the “Mini-Symposium on Organic Chemistry” of the Graduate School of Pharmaceutical Sciences at Osaka University as well as further lectures at the Graduate School of Engineering (Figure 9). An ongoing collaboration project with the research group of [Prof. Dr. Shuji Akai](#) from Osaka University centers on the extension of the jointly demonstrated recent proof-of-concept for a chemoenzymatic dynamic kinetic resolution of a tertiary alcohol towards a



Figure 9: Prof. Akai (right) and Prof. Gröger (left) after his Special Lecture at the “Mini-Symposium on Organic Chemistry” of the Graduate School of Pharmaceutical Sciences at Osaka University

broadly applicable process technology platform for this class of compounds. Chiral tertiary alcohols and derivatives thereof are of high industrial interest in the field of pharmaceuticals. A representative example being also a target molecule in this collaboration project is the anti-HIV drug Efavirenz. The next stay of Prof. Gröger in Osaka within this “Specially Appointed Professorship” at Osaka University is scheduled to take place in March 2023.

(H. Gröger)

Impressum

Centrum für Biotechnologie
Universität Bielefeld
Dr. Lutz Wobbe
Universitätsstr. 27
33615 Bielefeld
Germany
info@cebitec.uni-bielefeld.de



Concept & Idea:
Dr. Stefan Weidner

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