

CeBiTec – Quarterly

Autumn 2023



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CeBiTec member Norbert Sewald receives the Jörg Schwarzbich Inventor Award for innovation in cancer research



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CeBiTec member Professor Dr. Norbert Sewald received the Jörg Schwarzbich Inventor Award for outstanding innovation for his pioneering contributions to basic research on cancer drugs. The prize, worth 40,000 euros, is awarded by the Bielefeld University Society (UGBi) in close cooperation with Bielefeld University.

Norbert Sewald and his team developed a new, highly potent drug that can be delivered specifically to tumour tissue and causes much less damage to healthy cells. It makes them more effective and at the same time more tolerable. In order to treat cancer, many side effects often have to be accepted. In classical chemotherapy, nausea, impairment of skin and mucous membranes, hair loss and damage to blood and immune cells usually occur. These side effects are the result of the strong toxicity of the administered substances. Norbert Sewald's and his team's research aim to mitigate or even avoid these side effects.

For example, cancer therapy with antibody-drug conjugates (ADC) has been available for a short time. Their special feature lies in their targeting accuracy, as the antibody - as an "address label", so to speak - recognises tumour cells, binds to them and thus delivers the active substance to

the tumour tissue. The development of ADC requires active substances that are as highly potent as possible. The Sewald group has designed and produced a new, very effective cancer drug from the cryptophycin family, which has high cytotoxic and cytostatic potential, i.e. inhibits cell division and cell growth. However, this alone would lead to side effects - as in classical chemotherapy. The highlight of the new substance is that it can be chemically linked to a specific binding partner for tumour cells, the "molecular address label". The new cryptophycin can thus be used in ADC therapies. None of the toxins used in these therapies so far is as potent as the new cryptophycin developed by the chemists, which is also effective against drug-resistant tumours. Another problem with the - otherwise very successful - ADC therapy is that it involves very large molecules, which therefore cannot penetrate the tumour tissue well. Therefore, Norbert Sewald and his team are also working on the development of smaller "molecular address labels" that can be used in SMDC (small molecule-drug conjugates).

The chemical synthesis of complex natural products has always been a challenge for chemists. The cryptophycins were particularly interesting molecules for him, but they failed as classical cancer drugs because of their side effects. The application of the aforementioned conjugates has been the subject of basic research in Bielefeld for about 10 years. This is also referred to as the "magic bullet" (see [research tv](#) contribution). He emphasises that even with the new substances, there is still a long way to go until clinical application. This means that only a small step in the long process of drug development has been completed before a drug can be admitted for actual use.

Prof. Dr. Norbert Sewald is thrilled about the award and the visibility it brings: "We don't want to work in an ivory tower and are very pleased that we are now also taking research outside and a step towards application. Bielefeld University has patented the new cryptophycin and its conjugates. This aroused the interest of a pharmaceutical company, which is now cooperating with us."

(Bielefeld University / [Translation of a news blog article](#) with slight modifications)

New funding of Master and PhD student mobility for cooperation between CeBiTec and the International Center for Biotechnology of Osaka University



Petra Peters-Wendisch, Kohsuke Honda, Stephan Hammer and Volker F. Wendisch (from left) met at the 3rd Japan-Switzerland-Germany Workshop on Biocatalysis and Bioprocess Development in Inuyama, Japan. The conference received support from Amano Enzymes who also provided deep cultural insight into the National Treasures Urakuen garden with tea house Jo-An and Inuyama castle. | © Petra-Peters Wendisch, Universität Bielefeld

Within the framework of the Erasmus International Initiative - [Mobility with Partner Countries](#) (KA171) - the long-standing cooperation between CeBiTec and the [ICBiotech](#) of Osaka University will now also be financially supported. In the next 3 years, Master and PhD students from both universities will be able to spend up to 6 months at the other university, respectively, and will receive funding of up to 700 € per month. In total, the project will be funded

with approximately 32,000 €. Both, the Faculty of Biology as well as the Faculty of Chemistry have long manifested agreements on academic and student exchange with Osaka University.

At this year's [3rd Japan-Switzerland-Germany Workshop on Biocatalysis and Bioprocess Development](#), which took place in Inuyama, Japan, from 10 to 13 September 2023, CeBiTec researchers **Volker F. Wendisch**, **Stephan Hammer** and **Petra Peters-Wendisch**, who also is the representative for internationalization of the Faculty of Biology, met with Kohsuke Honda, Full Professor at ICBiotech, to plan future activities in academic and student exchange. In April this year, Kohsuke Honda visited Bielefeld to give an inspiring lecture at the [CeBiTec Colloquium](#). The intensive cooperation between Bielefeld and Osaka has now also been underpinned by an overarching agreement for the implementation of a [joint doctoral degree program](#), which was initiated by CeBiTec researcher **Harald Gröger** and recently signed by both universities.

(P. Peters-Wendisch)

Information event presenting the current iGEM activities at Bielefeld University

Bielefeld University has regularly participated in the international iGEM (international Genetically Engineered Machine) competition since 2010. This competition, dedicated to the new field of synthetic biology, is aimed at student teams worldwide who are challenged to demonstrate the use of synthetic biology to solve current problems by means of self-selected projects. The participation of the Bielefeld iGEM teams has been very successful in the past years and

resulted in each case winning a gold medal, in addition to special awards.



Part of the iGEM 2023-Team together with their advisors explaining the content of the ASTERISK*-Project. © D. Jording

On Thursday, 19 October 2023, there was an event dedicated to informing on the ongoing iGEM activities at Bielefeld University. First, Andreas Schlüter presented the brochure "[Participation of Bielefeld University Teams in the iGEM Competition of Synthetic Biology](#)", which reports on the successes of all former Bielefeld iGEM teams. CeBiTec played a crucial role for all iGEM teams so far, as CeBiTec not only provides the required laboratory space to carry out project work but also enables the use of technology platforms to answer molecular biology questions. The brochure provides insight into the previous topics of the iGEM teams originating from the life science field. In addition, the brochure includes several interviews with people who have been involved in the successes of the Bielefeld iGEM teams to date. First and foremost, **Jörn Kalinowski**, who, together with his CeBiTec working group, supervised the annually changing iGEM teams for the competition. The iGEM brochure also reveals that members of previous iGEM teams were enormously successful in pursuing their professional careers in both academia and industry. Of particular importance is the selection of the iGEM team members. **Petra Lutter** emphasized that the composition of the iGEM teams works in a self-organized way. Students from life science bachelor's and mas-

ter's programs at the Faculties of Biology, Chemistry, Physics, the Faculty of Technology, and even at the Faculty of Business Administration and Economics – with more to come – announce their willingness to participate in the iGEM competition. Subsequently, the team members elaborate their project to be submitted to the iGEM committee and distribute the tasks necessary to achieve the project goals. After CeBiTec's participation in the iGEM competition was interrupted last year for various reasons, this tradition could be resumed in the current year. A great help for this reactivation was that both the CeBiTec and the rectorate of the University found a way to cover the financial expenses of the current iGEM team. At short notice, an iGEM 2023 team of 10 members was formed, which chose the very challenging topic "ASTERISK* - Advanced Sequencing of Tumor markers Enabling RNA-based Intraoperative Sensing and Killing" to work on. The aim was to develop a method for the classification of brain tumors as well as their experimental treatment. The iGEM 2023 team, led by **Sinan Zimmermann**, presented this project and explained that modern sequencing techniques are used to classify brain tumours and that molecular biology techniques based on synthetic biology methods are used to treat them.

Two films were shown to introduce the project. The first short film dedicated to the announcement of the iGEM project, was made to set the mood for ASTERISK*. The second short film reported on the results achieved in the ASTERISK* project. The deadline for this second short film was 6 p.m. on the day of the event. Therefore, the iGEM team was very much challenged and could finish the short film only a few minutes before the presentation took place. The children's book "Juna's Journey", which was

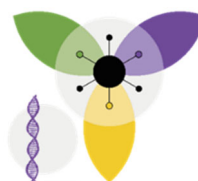
also produced, received special attention. This children's book, which informs about the ASTERISK* project in a child-friendly way, is intended for children of pre-school age and should be read together with the parents. The time for experimental work on the project was particularly short in the current year, but surprising successes were nevertheless achieved. It has to be emphasized that the chosen topic is based on a close cooperation with the recently founded Medical Faculty. During the implementation, contacts have also been established with the university hospital in Bethel. In early November, the iGEM team will travel to Paris for the Grand Jamboree event, where more than 400 international teams will gather for peer review. The successful work on a current medical topic so far gives hope that the iGEM 2023 team will be able to follow up on the successes of previous Bielefeld teams.

(A. Pühler)

Computational Biology successful in DFG-funded research groups

Research unit Chemodiversity (FOR3000)

renewed



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The CeBiTec research group "Computational Biology" received a grant to study the molecular sources of chemodiversity in the genome in the plant *Tanacetum vulgare* as part of the research unit chemodiversity (FOR3000). Chemodiversity describes the phenotypic observations of diversity of specialized metabolism-produced metabolites

within an individual, within individuals of a population, and within a system. *T. vulgare* has particularly high chemodiversity within populations with leaf terpenoids showing major differences even between closely related individuals in one site. The research group studies how 1) chemodiversity varies in time and space, 2) how it is modified by environmental challenges and what the ecological consequences of such variation are, and 3) how chemodiversity is genetically determined and maintained. The working group Computational Biology specifically addresses the first and third objectives in studying, which genes shape intraspecies and intra-population chemodiversity. Genome and quantitative transcriptome sequencing identify candidate genes for the production of terpenes. In collaboration with the CeBiTec group of **Stephan Hammer** and the group of **Caroline Müller**, terpene synthases are functionally characterized. The regulatory genes controlling the expression of these terpene synthases are studied using omics methods, such as DNA affinity purification sequencing. The PhD student on the project will start in January 2024. The resulting knowledge about molecular mechanisms feeds back into models, and into research of ecology and evolution. Given that our world is in a state of flux with regard to biotic and abiotic stressors it seems more important than ever to understand how plants evolve to withstand the pressures.

Computational Biology participates in the newly established CRC MibiNet (CRC1535)

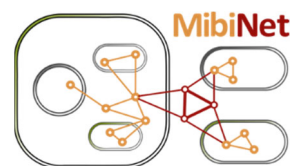
The team Computational Biology was recently strengthened by **Tim Schulze** a PhD student working in the framework of the newly established CRC1535 MibiNet. MibiNet is a collaborative research consortium bringing together



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researchers from the HHU Düsseldorf, Forschungszentrum Jülich, Universität Köln, RWTH Aachen, Max Planck Institute for Plant Breeding Research, and the Universität Bielefeld. It aims to understand microbial networking in its entire complexity to explain how organelles evolve and how

the microbiome functions. Life on Earth depends on photosynthesis. This process enables plants, algae, and cyanobacteria to fix CO₂ and produce



food to eat but also O₂ to breathe. Photosynthesis takes place in special organelles, the chloroplasts. According to the Primary Endosymbiosis theory, a single cyanobacterium was once engulfed by a eukaryotic cell, sustained, and finally transformed into the cell organelle chloroplast. In our joined project, led by **A. Weber** (HHU Düsseldorf), **D. Kohlheyer** (FZ Jülich), and **M. Eisenhut** (Uni Bielefeld, CeBiTec), we will recapitulate this unique process that happened about 1 billion years ago, using synthetic microbiology and microfluidic approaches. It will be Tim's task together with our team to engineer a stepwise conversion of a cyanobacterium into a chloroplast. We expect to retrace the central steps of the event of Primary Endosymbiosis on the molecular level and thus answer fundamental evolutionary questions.

(M. Eisenhut & A. Bräutigam)

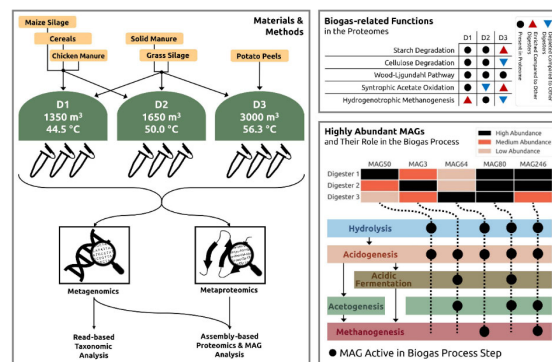
CeBiTec research group ‘Genome Research of Industrial Microorganisms’ and the Graduate School ‘Digital Infrastructure for the Life Sciences (DILS) analyzed microbiome adaptations in a full-scale biogas plant

PhD students Julia Hassa and Tom Tubbesing from the CeBiTec working group ‘Genome Research of Industrial Microorganisms’ and the Graduate School ‘Digital Infrastructure for the Life Sciences (DILS)’, respectively, have published the article ‘Uncovering Microbiome Adaptations in a Full-Scale Biogas Plant: Insights from MAG-Centric Metagenomics and Metaproteomics’ in the journal ‘*Microorganisms*’ (MDPI).

The work presented goes beyond the working group's previous biogas microbiome analyses by conducting genome-centric metaproteomics in addition to a genome-centric metagenome analysis. This approach enabled the identification of genes of microbial genomes that are actually expressed in the reactor environment studied. Great efforts are currently being made to promote energy transition and to increase the share of renewable energies in the energy supply. In this context, microbial anaerobic digestion (AD) of biomass to produce methane plays an important role. Microbiome management strategies are considered to improve biomass fermentation and increase methane yields. To enable such strategies, genome-centric metagenome analyses combined with metaproteome approaches are applied to identify highly competitive as well as resilient fermentative and methanogenic microbial species that also show superior performance under varying and demanding process conditions.

The published work describes the analysis of a

production-scale biogas plant consisting of three differentially operated digesters (see Graphical Abstract below).



Graphical abstract of the published article in the journal ‘*Microorganisms*’. For more information, please visit: <https://doi.org/10.3390/microorganisms11102412>

Metagenome sequence data were used to reconstruct genomes for microbiome members. Metagenomically assembled genomes (MAGs) enable genome-centric analyses to identify species adapted to the different reactor environments. Notably, the reconstruction of MAGs also facilitated the analysis of genomes whose corresponding microorganisms have not yet been cultivated. Microbiomes were also analyzed in terms of their taxonomic composition, functional potential, as well as expressed functions based on metaproteome data. Differential abundances of genes and enzymes important for the biogas process could mostly be attributed to the prevailing process conditions. Individual MAGs exhibiting differential abundances in the digesters were studied in detail and their roles in the hydrolysis, acidogenesis and acetogenesis phases of anaerobic digestion could be assigned by applying metabolic reconstruction workflows. *Methanoculleus thermohydrogenotrophicum* and *Methanothermobacter wolfeii* were the most abundant and active hydrogenotrophic methanogens, the latter being more prevalent at higher process temperatures. Further analysis focused on MAGs, which were abundant in all

digesters, indicating their potential to ensure biogas process stability. The most prevalent MAG represents a member of the class *Limnochordia*. The corresponding species was ubiquitous in all three digesters and featured expressed enzymes assigned to numerous pathways related to different phases of the AD process chain. These results were derived from the obtained metaproteome data by assigning metaproteins to reconstructed MAGs. The techniques applied for the published work involved high-throughput (HT) sequencing of microbial community DNA, deep metaproteome profiling and corresponding bioinformatics methods also taking advantage of high-performance compute environments established by the de.NBI Cloud initiative (<https://www.denbi/cloud>). The CeBiTec hosts the Technology Platform 'Genomics' running state-of-the-art HT-sequencers and devices to conduct other *omics* analyses. Moreover, the 'Bioinformatics' platform supports large-scale computational analyses that were very helpful for carrying out the microbiome project outlined above.

In summary, the combined analysis of metagenomes and metaproteomes of microbiomes residing in biogas digesters provided deeper insights into the microbial composition and expressed enzymes of the anaerobic digestion process which should allow the development of microbiome-based management strategies for improved biomass fermentation aimed at optimized biogas yields. The results of the newly published article impressively confirm that MAG-centric metagenomics complemented by metaproteome analyses provide detailed insights into the performance and adaptations of biogas-producing microbiomes.

It should also be mentioned that the work presented was based on the collaboration of scientists from different German Institutes and

Universities, including the Leibniz Institute for Analytical Sciences (ISAS, Dortmund), Anhalt University of Applied Sciences (Köthen), Otto von Guericke University (Magdeburg), Bavarian State Research Center for Agriculture (Freising) and the CeBiTec of Bielefeld University. The successful implementation of this project once again demonstrates the effectiveness of CeBiTec's national collaborations in the field of biogas microbiome research.

Reference:

Hassa J, Tubbesing TJ, Maus I, Heyer R, Benndorf D, Effenberger M, Henke C, Osterholz B, Beckstette M, Pühler A, Sczyrba A, and Schlüter A (2023). Uncovering Microbiome Adaptations in a Full-Scale Biogas Plant: Insights from MAG-Centric Metagenomics and Metaproteomics. *Microorganisms* 11(10): 2412. <https://doi.org/10.3390/microorganisms11102412>

(A. Schlüter)

Kickoff meeting of the EU project

iCULTURE

From Sept 18th-20th, about forty participants representing 17 members from 10 countries of the EU project iCULTURE (<https://iculture-project.eu/>) met in Porto, Portugal, to kick off the project.



The iCULTURE consortium | © iCULTURE

The 6 million € project was one of two funded in the HORIZON-CL6-2022-CIRCBIO-02-05 call.

CeBiTec researchers **Volker F. Wendisch** and **Sara-Sophie Poethe** were representing Bielefeld University in the project led by **Prof. Nadav Bar** from NTNU, Trondheim Norway.

Academic and industrial partners join forces to develop a digital bio-platform and co-culture bioprocess to prospect and utilize macroalgae responsibly and sustainably. One focus is on brown algae with academic specialists from Ghent University, Portuguese marine research centers CCMAR and CIIMAR as well as algal companies such as Algaia, Polar Algae, Iberagar, and Alginor. The Wendisch Lab with PhD students Sara-Sophie Poethe and **Irene Tomy Parappuram** will contribute to develop an algae biomass-based bioprocess using *Corynebacterium glutamicum* together with Ulm University and NTNU. Thirdly, artificial intelligence and machine learning specialists from Intellomics and Fondazione Bruno Kessler, bioprocess companies onCyt and Applikon and life cycle assessment experts from TU Crete and BASF will help to



achieve the overall goals of iCULTURE: 1) to boost the prospecting efficiency of new algal species, 2) to understand the potential

and vulnerability of resources, so that a responsible management strategy can guide the operations of stakeholders, and 3) to create a novel value-chain, valorizing European seaweed side-streams into valuable compounds for feed, food, and pharma, while reducing the CO₂ footprint. Cooperation between the partners is organized by work packages and in the clusters “Biotechnology”, “Bioprocessing”, “AI & data”, “Biodiversity”, and “Analytics” including a social science perspective (NTNU and FVA New Media). Meeting in person in Porto was not only rewarding but decisive in comprehending the many dimensions of this complex project.

(V. F. Wendisch & S.-S. Poethe)

Celebration highlighting the 10-year anniversary of CeBiTec Students

Academy



Former participants from each of the 1st and 10th Students Academy, Svenja Vinke, Matthias Otto, Nana Klaus and Annika Pütz (from left to right), report on the value of participation for their university study and professional career. | © N. Grotjohann, Universität Bielefeld

This year, the CeBiTec Students Academy took place for the 10th time. The Students Academy is an offer for high-achieving students from prebaccalaureate classes in OWL. Each year, up to 20 students are selected to participate and to gain insights into new developments in the life sciences at the CeBiTec. In recent decades, breath-taking developments in molecular biology took place. Omics technologies enabled the identification of cell components such as genomes, transcripts, proteins and metabolites. This has laid the foundation for systems biology and synthetic biology. The new findings are increasingly important for biotechnology and have triggered broad application in the agricultural, medical and industrial sectors. The Students Academy has set itself the task of imparting the new findings in theory and practice to prospective high school graduates. Theoretical instruction is provided by professors working at the CeBiTec. The teutolab-biotechnology laboratory located at CeBiTec is used for practical work. Funding provided by the Osthusenrich



Foundation was crucial for the start of the Students Academy, and these funds are used for accommodation and meals for the high school students. Since the Students Academy could not take place in the two Corona years, the 10th event had to be postponed. This year, the 10th Academy took place and this was taken as an opportunity to hold an anniversary event, which took place on Friday, 20 October 2023 in the CeBiTec lecture hall. **Alfred Pühler**, who started this series of Academies at the beginning of his senior professorship at CeBiTec, gave a review of the 10 successful Students Academies. A keynote lecture on the importance of Students Academies was presented by **Tilo Grosser**, a pharmacologist at the new Medical Faculty of Bielefeld University. He reported on his experiences with students events, which go back to his stay in the USA. Afterwards, Walter Arnold, former head of the isotope laboratory at Bielefeld University, held a panel discussion with participants of the Student Academies. The participating students confirmed that the academy provided new insights into the life sciences and thus had a great impact on their studies and careers. **Norbert Grotjohann**, head of biology didactics, presented the use of teutolab-biotechnology by the Students Academy. The well-equipped teutolab is an ideal place for practical training, where future-oriented experiments such as genetic engineering can be carried out. With this program, the speakers succeeded in presenting the meaning and purpose of the Students Academy in a vivid way. At the end of the anniversary event, **Jörn Kalinowski**, head of the technology platform Genomics at CeBiTec, informed about CeBiTec research priorities and

the iGEM student competition. The offered guided tour through the CeBiTec building was well received by the participants of the anniversary event.

(A. Pühler)

BIOSCALE: CeBiTec researcher Dr. Nadja A. Henke awarded with fellowship from Carl-Zeiss-Stiftung



© Jannik Jilg

Nadja A. Henke from the Wendisch lab received 1.5 million Euro in the Nexus program of the Carl-Zeiss-Stiftung, which allows her to establish a junior research group at Karlsruher Institut für Technologie (KIT). The research subject of her 5-year grant BIOSCALE focusses on transcriptomics changes in microbial populations in bioreactors. Her aim is to understand the influence of technical parameters on the cells' physiology, a research theme at the intersection of bioprocess engineering, molecular biotechnology and data science. This systematic insight will provide a foundation for running bioprocesses in a more precise and targeted manner. Based on her strain development expertise, Henke is now pioneering a change into bioprocess engineering and up-scaling.

Henke studied Bachelor and Master courses in Biology and Genome-Based Systems Biology in Bielefeld and during her PhD developed metabolic engineering strategies for carotenoid production in *Corynebacterium glutamicum*. After her PhD thesis (awarded with the university



prize), she won two larger grants (Bicomer and KaroTec) to transfer these strategies to a sustainable astaxanthin process and, together with **Petra Peters-Wendisch** and **Volker F. Wendisch** she received the Jörg Schwarzbich Inventor Award in 2019. “Bielefeld University, the CeBiTec and my own lab can be proud of Nadja Henke and we wish her all the best for her future at KIT, but besides one smiling eye, there is a crying eye that sees a successful early-career women scientist leave Bielefeld to new frontiers.” concludes Wendisch. Fortunately, both labs will continue collaborative research.

(V. F. Wendisch)

10th CeBiTec students academy in the summer holidays

From July 31st to August 4th the CeBiTec Students Academy took place for the tenth time. 17 senior class students dealt intensively with biotechnology and biomedicine by listening to lectures and performing experiments. The participants came from all over East-Westphalia and stayed throughout the week in the Youth Hostel in Bielefeld. They enjoyed the time together very much because of their interests and the joint programme.

Like the last year, **Prof. Dr. Alfred Pühler**, **Prof. Dr. Jörn Kalinowski** and **Prof. Dr. Norbert Grotjohann** had organized five lectures from CeBiTec members (**Prof. Dr. Volker Wendisch** – introduction to industrial biotechnology, **Dr. Jan Mussnug** - research and development of biotechnology with microalgae, **Dr. Heino Büntemeyer** - production of pharmaceuticals, **Prof. Dr. Karsten Niehaus** – microscopic histopathology, Prof. Dr. Jörn Kalinowski - introduction to medical genomics). Furthermore, guest lecturer **Dr.**

Robert Kulis-Horn gave insights into laboratory medicine in the MVZ Labor Krone GbR, Bad Salzuflen. In the practical parts of the programme, the participants performed microbiological experiments for the characterization of bacteria, practiced nanopore sequencing and the bioinformatic analyses of the data.



Participants of the 10th Students Academy | © Universität Bielefeld

For a first acquaintance to histopathology, the students produced frozen sections of kidneys of mice and examined the tissue by light microscopy, fluorescence microscopy and by digital microscopy with the Software QuPath. Another software introduced to the youth was Molecular Evolutionary Genetics Analysis (MEGA). Using this tool, they analysed the evolution of the novel Coronavirus SARS-CoV-2.

The schedule was completed by a discussion about the CRISPR/Cas method, guided tours in the CeBiTec and the anatomical department of the Medical Faculty, and presentations of degree programmes in the field of biology at Bielefeld University. For the participants, it is very important to learn about specific differences as they nearly all plan to study biology, biotechnology or medicine.

On the last day, the participants themselves gave lectures as they had prepared talks about the experiments and the results they had gained. They all were very proud and happy when they received their certificate of participation at the

end of the week. Like in the last years, the commitment of several working groups in the CeBiTec and the financial support of the **Osthuis-henrich-Stiftung** facilitated the successful event. The current funding period comprises the following two years as well. You find further insights on [Instagram](#).

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

Project week ‘Medical research trip through the body’ in school holidays



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During the last holidays, the *teutolab*-biotechnologie offered project weeks on topics from biomedicine for students interested in the natural sciences. From July 3rd to 7th, ten students from districts around Bielefeld took the opportunity to spend a week with experiments in the students’ lab in the CeBiTec. From October 9th to 12th a project week with the same contents took place with 14 students from all over Northrhine-Westphalia in an e-course.

In both weeks the participating students from grade 7 to 10 could tie up to contents from biology class at school and they got to know about applications in medical questions. At the first day, they learned about nutrition and digestion and performed experiments with the enzyme lactase. Furthermore, they talked about bacteria and viruses and got to know an ELISA-Test to detect antibodies in simulated infections with the Coronavirus. The second day dealt with the understanding for the cardiovascular system and blood typing. In the following two days, the participants pursued the questions: How is the

body organized from the cell to cell groups and organs to organ systems and which role holds genetic information? The student who took part in the online version of this project in the autumn holidays did experiments at home (lactase digesting different milk products, dissection of a pig heart, DNA extraction with articles from the household), performed the experiments virtually on the internet (digital microscopy, DNA extraction with a kit and proving by gel electrophoresis) and experienced the experiments as a live demonstration from the laboratory. The students were accompanied via the video conferencing tool Zoom. The students who attended in presence at CeBiTec in the summer holidays slipped into the role of doctors on their last day. In an interactive rally, they worked on a case themselves - from anamnesis to therapy. They looked for clues in the university, found books in the library and researched in them, carried out investigations in the laboratory and finally made the diagnoses. All four groups with different patients presented their results in a small symposium. For both versions of the project week, we received very positive feedback. We thank the zdi centers of the regions Bielefeld and Cologne for the financial support and are looking forward to the year 2024 with the same funding commitments. For more insights see the account of the *teutolab*-biotechnologie at [Instagram](#).

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

Impressum	
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