

CeBiTec – Quarterly

Summer 2018

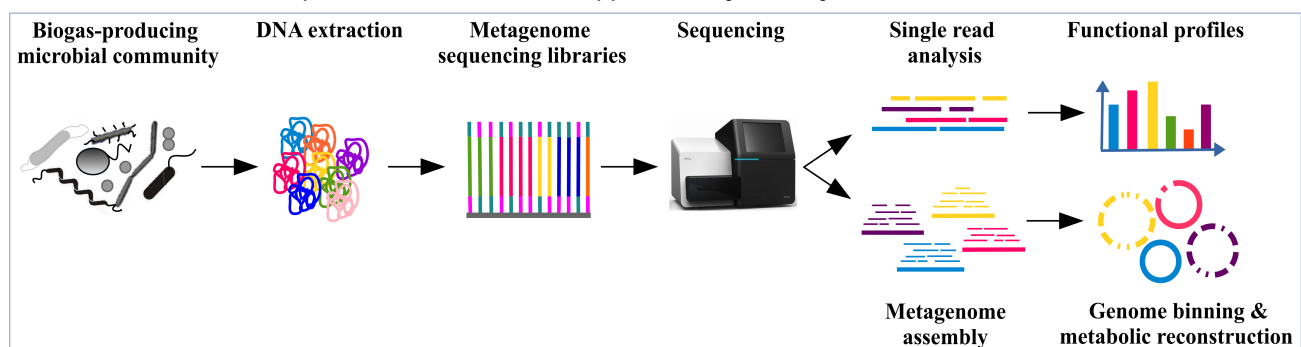
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Advanced bioinformatics techniques for the analysis of *meta-omics* data applied for the characterization of microbiomes

Members of the CeBiTec research group Genome Research of Industrial Microorganisms (Julia Hassa, Dr. Irena Maus, Dr. Andreas Schlüter and Prof. Dr. Alfred Pühler) published an invited review article on the topic "Metagenome, meta-transcriptome, and metaproteome approaches unraveled compositions and functional relationships of microbial communities residing in biogas plants" in the journal *Applied Microbiology and Biotechnology*.

Organic biomass comprising renewable primary products, bio-wastes, agricultural residues and other biodegradable organic compounds are converted to valuable industrial products and utilized for energy recovery implementing value-added chains in so-called bio-refinery concepts. The microbiome involved in biodegradation, conversion of biomass and production of biogas is complex and mostly unknown or at least insufficiently investigated. State-of-the-art *meta-omics* technologies complemented by highly developed bioinformatics methods and software platforms helped to elucidate compositions and functional relationships of microbial communities accomplishing anaerobic digestion of organic residues. Assembly of metagenome sequence data, binning of assembled contigs to genome bins and their functional interpretation enable access to the currently unknown, non-cultivable fraction of the respective microbiome. Achievement potential of the outlined approach very recently has been demonstrated in an article with

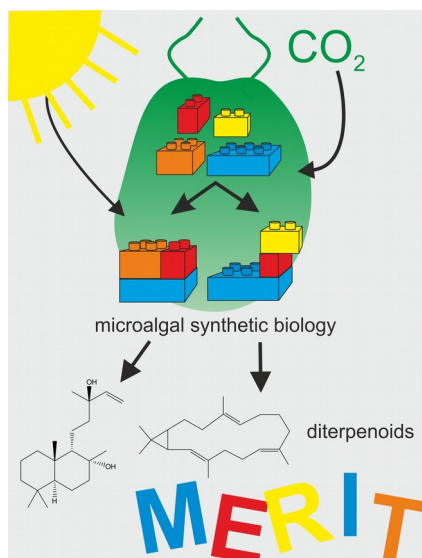


the title “Characterization of *Bathymarchaeota* genomes assembled from metagenomes of biofilms residing in mesophilic and thermophilic biogas reactors” published by the same CeBiTec research group in the journal *Biotechnology for Biofuels*. Current knowledge in the research field including recent studies carried out at the CeBiTec, the cooperating Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB, Potsdam) and the Hamburg University of Applied Sciences (HAW, Hamburg) was summarized in the now available open-access review article. Thereby, the authors intend to encourage exploitation and application of results from microbiome research for innovative biomass conversion processes and approaches addressing monitoring, management and engineering of microbiomes involved.

1. Hassa J, Maus I, Off S, Pühler A, Scherer P, Klocke M, Schlüter A (2018) Metagenome, metatranscriptome, and metaproteome approaches unraveled compositions and functional relationships of microbial communities residing in biogas plants. *Applied Microbiology and Biotechnology* 102 (12): 5045–5063. <https://doi.org/10.1007/s00253-018-8976-7>; PUB-ID: 2920170.
2. Maus I, Rummig M, Bergmann I, Heeg H, Pohl M, Nettmann E, Jaenicke S, Blom J, Pühler A, Schlüter A, Sczyrba A, Klocke M (2018). Characterization of *Bathymarchaeota* genomes assembled from metagenomes of biofilms residing in mesophilic and thermophilic biogas reactors. *Biotechnology for Biofuels* 11: 167. <https://doi.org/10.1186/s13068-018-1162-4>; PUB-ID: 2920750.

New international ERA Co-BioTech Research Project MERIT at the CeBiTec

Within the framework of the European Research Area-Net Cofund on Biotechnologies (ERA Co-BioTech) the CeBiTec research group Algae Biotechnology of Prof. Dr. Olaf Kruse now received funding approval for their work in the international research consortium MERIT with industry and academia partners from Argentina, the United Kingdom and the



Netherlands. The work will be funded with a total of 0.5 million € over a period of three years. MERIT aims for using microalgae as ‘green cell factories’ to produce alternative, sustainable sources of valuable compounds. Within this project, a novel synthetic biology platform for the two microalgae *Chlamydomonas reinhardtii* and *Phaeodactylum tricornutum* will be established. This platform will be used to sustainably synthesize various diterpenoids from carbon dioxide and sunlight with an improved partitioning of fixed carbon into desired products. Currently, many of these production processes typically depend on fossil fuel resources such as petroleum. Strains will be eventually subjected to large-scale cultivation experiments with subsequent down-stream processing and product purification at the facilities of MERIT partners. “This is a great success for biotechnology research at Bielefeld University, and it underscores CeBiTec’s prominent international standing in the field of industrial biotechnology with microorganisms,” says Professor Kruse, who also serves as director of CeBiTec.

CeBiTec coordinates CLIB Competence Center Biotechnology, a collaborative research project with Dortmund and Düsseldorf universities and Jülich Research Center

The CLIB Competence Center Biotechnology (CKB) is a multi-site collaborative project aiming at a sustainable, resource-efficient economy in North Rhine-Westphalia. The focus is on accelerating the development of biotechnological processes. The European Union and the Ministry for Economic Affairs, Innovation, Digitalization and Energy of North Rhine-Westphalia are funding CKB for a total of more than 8 million € for three years. In addition to the CeBiTec, Heinrich Heine University Düsseldorf, the Technical University Dortmund and Forschungszentrum Jülich are also involved in the project. Prof. Dr. Volker F. Wendisch from CeBiTec coordinates the project.

On May 7, 2018, Marianne Thomann-Stahl, President of the District Detmold, handed over the grants in the presence of the rector representative Prof. Dr. Martin Egelhaaf and the Scientific Director of the CeBiTec Prof. Dr. Olaf Kruse to the cooperation partners: Prof. Dr. Karl-Erich Jaeger (FZ Jülich), Prof. Dr. Jörg Pietruszka (TU Düsseldorf), Prof. Dr. Volker F. Wendisch (CeBiTec) and Prof. Dr. Stephan Lütz (HHU Dortmund).

The development of a bio-based and sustainable economy using renewable raw materials addresses the current global challenges and is part of North Rhine-Westphalia's (NRW) research strategy. Biotechnological research plays an important role. "There are more than 60 technology incubators in NRW. Most biotechnological patent applications in Europe come from NRW. Almost half of the total German turnover of the biotechnology industry is generated here. In short: NRW is a federal state of biotechnology," said government president Marianne Thomann-Stahl. "By investing 8.34 million € in a research network with four high-performance partners, we ensure this excellent status. We take development processes to a higher level, drive value creation and, not least, give young researchers a home."

Biotechnology as a key technology is central to an economy that is to be independent of fossil resources for the long term. The problem: In biotechnology, the time from idea to market entry is greater than in the IT sector. One of the reasons is that biotechnology is divided into different process areas. "Against this backdrop, the Competence Center aims to establish a multi-site, integrated research infrastructure that supports and accelerates the biotech value chain – from gene and enzyme to process and product," says Prof. Wendisch.

At the four research centers, experts will develop strategies with which currently separated sub-processes can be brought together in the future. This should shorten the time span from the development of the idea to market entry. Concepts for biotechnological solutions – for example to increase resource efficiency – are in the focus of the research and have to be applied as examples for the important life science and health markets. "The research in the CLIB Competence Center fits in perfectly with CeBiTec's research agenda in the field of omics-based biotechnology," said Professor Kruse, Director of CeBiTec.

In particular, the CKB will work with CLIB2021 e.V., an international network of over 100 industry and research members, business and society. The universities in Bielefeld, Düsseldorf and Dortmund as well as the Forschungszentrum Jülich can draw on already established cooperations, previous successful collaborative research projects and results of joint applied research and basic research.

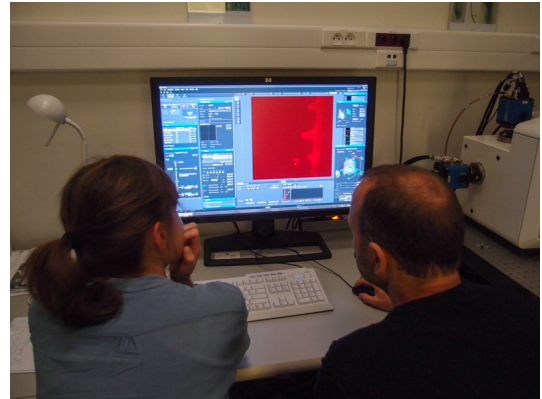


(from left to right) Prof. Dr. K.-E. Jaeger, Prof. Dr. J. Pietruszka, Prof. Dr. V. Wendisch, M. Thomann-Stahl, Prof. Dr. M. Egelhaaf, Prof. Dr. O. Kruse, Prof. Dr. S. Lütz.

Alexander von Humboldt Foundation support for partnership between the Palacký University (Czech Republic) and the CeBiTec

The Alexander von Humboldt Foundation will support the exchange of scientists from both organisation in 2018 and 2019 with 55.000 € to intensify joint projects in the field of plant biotechnology. The primary aim of the research project is to establish a sustainable basis for long-term collaboration between the Department of Cell Biology, Centre of the Region Haná for Biotechnological and Agricultural Research, Palacký University and the CeBiTec. This basis will be built on joint complementary investigations of the *Arabidopsis thaliana* metabolome reprogramming modulated by mitogen activated protein kinases (MAPKs) when the plant is under pathogen attack. We aim to promote vital interactions between research teams through (1) reciprocal research visits of junior researchers, (2) workshop organized by German participant (3) final joint meeting with presentations of results with the presence of external expert parti-

cipants. All these interactions between the two research groups will contribute to the long-term collaboration focused on the investigation of MAPK signalling (especially spatial and temporal distribution, subcellular localization and activation) and metabolomics during the interaction between *Arabidopsis* and the bacterial phytopathogen *Xanthomonas*, by using modern experimental tools. In this respect, detailed expression and localization studies of MAPKs as well as selected single and double MAPK mutants will be used (provided by Olomouc laboratory) while these will be corroborated by metabolomic and MALDI-imaging analyses (provided by Bielefeld laboratory). Dr. Hanna Bednarz and Prof. Dr. Karsten Niehaus visited the department of Prof. Dr. Jozef Samaj who established the Zeiss reference centre for life cell imaging at the Centre of the Region Haná for Biotechnological and Agricultural Research, Palacký University in Olomouc, to discuss results of an earlier research stay using the Zeiss Lightsheet Microscope Z.1 and different confocal systems.



CeBiTec Students' Academy in summer holidays and *teutolab*-Academy Systems Biology in autumn holidays

***teutolab* biotechnologie** The *teutolab*-biotechnology organizes two projects for gifted and talented students in the coming holidays.

The 7th CeBiTec Students' Academy "The Role of Genome Sequencing and Bioinformatics in Biotechnology/Synthetic Biology" will be held at the CeBiTec from August 20 to 24, 2018 and September 1 as well as September 8, 2018. The Students' Academy is a joint project of the CeBiTec, the District Council Detmold as well as the Osthusenrich-Stiftung, which provides the essential financial support. The experimental work will focus on the characterization of skin bacteria. In addition, aspects of Citizen Science will be included in this year's event. The students cultivate their own skin bacteria, from which the DNA sequence will be determined. On the two following Saturdays the students will deal with the bioinformatic evaluation of their own skin bacterial DNA sequences. Particularly scientifically interested and talented young people could apply to participate in this academy, which had 20 places available. Currently, a selection of students is being made.

The *teutolab*-Academy Systems Biology will be held at the CeBiTec from October 15 to 19, 2018. The one-week course is combining lab experiments with mathematical modelling. The sugar processing in the bacterium *E. coli* will be investigated using a systems biology approach: The students generate data on growth processes and gene regulation in the laboratory and analyse them using the program Cell Designer. Accompanying lectures by scientists as well as excursions complete the program. The application period will end at July 15, 2018.

<http://www.uni-bielefeld.de/teutolab/fachorientiert/biotechnologie/Aktionen/2018%20teutolab-Akademie-Systembiologie.html>

Upcoming Events

- August 20 – 24, 2018 | CeBiTec, Bielefeld University
[7th CeBiTec Students Academy Synthetic Biology/Biotechnology](#)
- September 10–11, 2018 | Landwirtschaftszentrum Haus Düsse, Bad Sassendorf
4th CeBiTec Retreat
- September 24, 2018 | Center for Interdisciplinary Research (ZiF), Bielefeld University
20 Years Anniversary of CeBiTec
- October 15–19, 2018 | CeBiTec, Bielefeld University
3rd *teutolab*-Academy Systems Biology
- November 26, 2018, 17 c.t. | Center for Interdisciplinary Research (ZiF), Bielefeld University
[CeBiTec Distinguished Lecture – Dr. Tobias Erb](#) (Max Planck Institut für terrestrische Mikrobiologie, Marburg)
- September 23 – 25, 2019 | Center for Interdisciplinary Research (ZiF), Bielefeld University
- 9th International CeBiTec Research Conference Bielefeld
- further events are announced on the [CeBiTec web page](#)