

CeBiTec – Quarterly

Autumn 2018

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20th anniversary of the Center for Biotechnology

On September 24, the CeBiTec celebrated its 20th anniversary with a ceremonial event at the Center for Interdisciplinary Research (ZiF) at Bielefeld University. The CeBiTec was founded in September 1998 at Bielefeld University with the aim to bundle activities in the areas of biotechnology and bioinformatics within one central academic institution. The event was opened by the Scientific Director of the CeBiTec, Prof. Dr. Olaf Kruse, followed by welcome addresses given by the *Rektor* of Bielefeld University, Prof. Dr. Gerhard Sagerer and by the speaker of the Scientific Advisory Board of the CeBiTec, Dr. Rolf Apweiler from the EMBL-EBI in Cambridge. Prof. Dr. Alfred Pühler, one of the founding members of the CeBiTec, reviewed the development of the institution within the last 20 years. The event continued with a talk by Prof. Dr. Karl-Erich Jaeger from *Forschungszentrum Jülich* on industrial biotechnology in Germany and a talk about European aspects of biotechnology given by Prof. Dr. Alison Smith from the University of Cambridge. The program was lived up by the presentation of parts of the musical “Das Molekül” by members of the ensemble of the Theater Bielefeld. “Das Molekül” tells the story of the discovery of the structure of DNA in the 1950th and the race competition for the determination of the human genome sequence at the end of the century. William Ward Murat played the piano, Jón Philipp von Linden performed as *Conférencier* and Thomas Klotz acted on stage. “This was a wonderful event, perfectly reflecting the success story of the CeBiTec over the last 20 years, Olaf Kruse summarized at the end.



7th CeBiTec Students Academy

In the last week of the summer holidays (August 20 to 24, 2018), 20 young students from *Ostwestfalen-Lippe* (a region of North Rhine–Westphalia) visited the 7th CeBiTec Students Academy. This academy is a joint project of the CeBiTec, the district government of Detmold and the foundation *Osthushenrich-Stiftung*. This year it was organized by the students laboratory *teutolab*-biotechnologie. The academy aimed at imparting scientific content and research methods in genome research and bioinformatics to particularly talented high school students.

A diverse range of lectures gave the participants the opportunity to network at various levels of university life.

They got in touch with students from the iGEM Bielefeld–CeBiTec team, PhD students, and representatives of different student advisory services as well as university professors of various research fields.

This year's Students Academy opened the third funding period of the *Osthushenrich-Stiftung*. As reported in the previous newsletter, this and the following academies are extended by two additional Saturdays and a Citizen Science experiment. The introduction to Citizen Science was given by Dr. Anett Richter, who presented a general overview of this research field. As being part of the Citizen–Science–Project *BürGER schaffen WISSEN – Wissen schafft Bürger*, which is founded by the Federal Ministry of Education and Research (BMBF) she provided insight into ongoing Citizen Science research in Germany and beyond.

In the practical courses, the students were given the opportunity to conduct laboratory experiments on molecular, genetical, and microbiological analysis of skin bacteria as well as on the transformation of bacteria with plasmids. The students analysed their own skin bacteria, which were first cultivated on solid medium. Subsequently, the bacterial DNA was isolated and subjected to nanopore sequencing. On the following two Saturdays, the students were trained in bioinformatics in regards to the analysis of genome sequences. Among other things, the data obtained through DNA sequencing were evaluated under the guidance of experts from the CeBiTec bioinformatics group.

The 8th CeBiTec Students Academy will take place during the last week of the summer holidays 2019 (August 19 to 23, 2019) and the two following Saturdays (August 31 and September 7, 2019).



PhD students presented their work at the CeBiTec Retreat

About 60 members of the CeBiTec participated at the 5th CeBiTec Retreat on September 10 and 11, 2018. During the two-day meeting 18 PhD students presented their results and progress followed by fruitful discussions. A get-together on Monday night with cold drinks and salty snacks was the pleasant environment for networking. The retreat again took place in Haus Düsse, the seat of the *Landwirtschaftskammer NRW* (Chamber of Agriculture of North Rhine–Westphalia). This year in a guided tour the CeBiTec scientists learned a lot about modern animal husbandry. Next year's retreat will probably take place at the same location.



Contemporary Arts meets Contemporary Science: Nanopore Sequencing at Marta

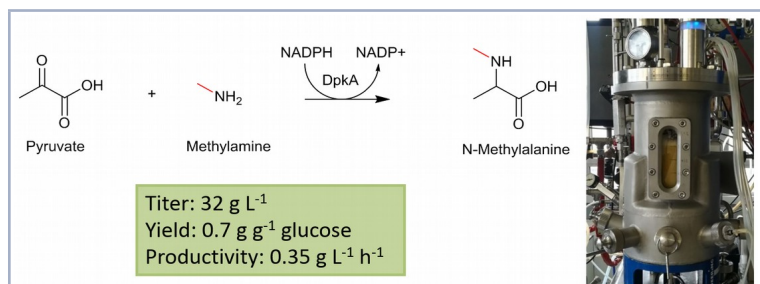
For many years now, the Marta Herford has provided visitors with an alternative view on various fields through the thoughtful assembled exhibitions. On September 16, the exhibition "Creatures made to measure – Animals and Contemporary Design" was opened. In addition to the innovative works of numerous artists – from animal-inspired robots to coiffed guinea pigs – visitors could also take a scientific view on animals. Members of the CeBiTec conducted engaging workshops for the public. Representatives of the CeBiTec were the *teutolab*-biotechnologie, the iGEM team Bielefeld-CeBiTec 2018, the high school iGEM team Rheda_Bielefeld 2018 and the sequencing team Markus Haak and Dr. Christian Rückert. The experiments included the extraction of DNA from fruits, the determination of the composition of meat by DNA markers and – as a highlight – live sequencing of DNA of minced meat using the MinION nanopore sequencer. The aim of the experiments was to provide visitors with a different perspective on the use of animals in today's world, in keeping with the exhibition. The opportunity to see through a demonstration what is contained in the meat we consume and how science works has inspired many visitors and even museum employees. The extraction of DNA from fruits using simple home remedies was supposed to show those interested how easy it is to apply science. The numerous questions visitors had about the experiments and genetic engineering were answered with pleasure and could hopefully spark the interest in science even further.

<https://marta-herford.de/>

<https://marta-blog.de/der-dna-auf-der-spur-cebitech-der-uni-bielefeld-im-marta/>

Development of a fermentative process for *N*-methyl-L-alanine, a building block in peptide drugs

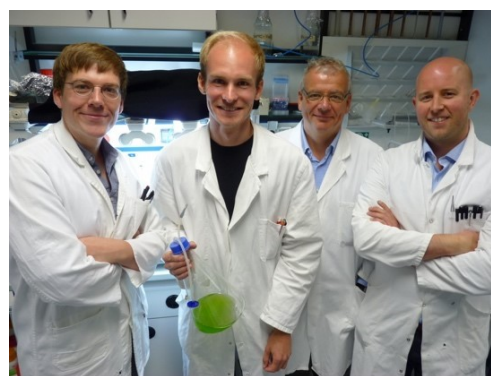
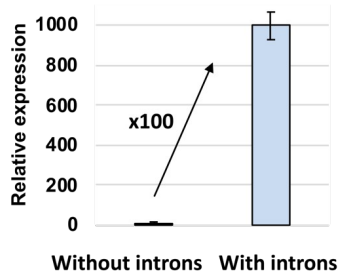
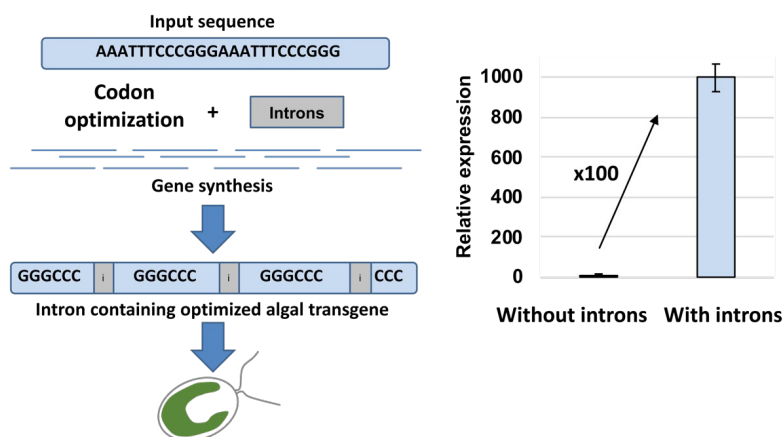
The group of Prof. Dr. Volker Wendisch (CeBiTec and Faculty of Biology) has developed a fermentative approach to access *N*-methylated amino acids. *N*-methylated amino acids can serve as building blocks for peptide-based drugs since they show higher biological activity *in vivo* compared to the native peptide. *Corynebacterium glutamicum* was chosen as model organism for several reasons: it is a natural amino acid producer and already used for decades for the industrial production of the food and feed additives L-glutamate and L-lysine. Additionally, the group of Prof. Dr. Bernhard Eikmanns, University of Ulm, provided a pyruvate overproducing strain. Heterologous expression of *dpkA* from *Pseudomonas putida* in that strain enabled fermentative production of the *N*-methylated amino acid *N*-methylalanine. A fed-batch bioreactor cultivation led to high production titers of 32 g L⁻¹ *N*-methylalanine. The strategy could be transferred to sustainable production of *N*-methylalanine from second generation feedstocks such as xylose and arabinose. The research group of Prof. Dr. Norbert Sewald and CeBiTec's technology platform fermentation with Dr. Joe Risse contributed to this collaboration. Melanie Mindt, the first author of the study, was awarded a poster prize at the International Biotechnology Forum 2018 in Munich.



Mindt, M., Risse, J.M., Größ, H., Sewald, N., Eikmanns, B.J., Wendisch, V.F., 2018. Sci. Rep. 8. <https://doi.org/10.1038/s41598-018-31309-5>.

Overcoming limitations in nuclear engineering of a green alga to develop Green-Cell Bio-Factories

In June, the synthetic biology team of the Algae Biotechnology and Bioenergy Group of Prof. Dr. Olaf Kruse (CeBiTec Scientific Director) published a breakthrough article on the engineering of the model green microalga *Chlamydomonas reinhardtii* in the journal *Nucleic Acids Research* [1]. Engineering the nuclear genomes of eukaryotic green microalgae is inherently difficult, as these organisms often have special genetic features including high GC contents and intron densities. The breakthrough of the Algae Biotechnology Group was to design nuclear transgene expression constructs containing repetitive copies of a native *C. reinhardtii* intron which mimicked host genomic architecture. The team, lead author Dr. Thomas Baier, Julian Wichmann and Dr. Kyle Lauersen, showed that a systematic use of these introns could enable expression of almost any desired transgene from the nuclear genome of this alga. This innovation has led to the demonstration of unprecedented levels of engineering in the eukaryotic alga for a range of different applications. The team has used this technology to demonstrate the first examples of metabolic engineering for heterologous terpenoid production with this host, having generated strains which produce perfume products [2], modified fatty acid profiles [3] (in collaboration with Imperial College, London) and potential biofuel replacements [4] as part of the EU Horizon2020 project Photofuel. The team also recently published a collaborative project with the University of Copenhagen where medicinal plant diterpenoids were produced from *C. reinhardtii* using this gene design strategy [5]. The newly developed technology has opened a new era of engineering capabilities with this model green microalga and is enabling the development of algal green-cell bio-factories for light driven production of customized products from carbon dioxide. The gene design strategy played a key role in the acquisition of several funding initiatives for the research group and will be used as part of the ERA CoBioTech (Horizon 2020) funded project led by Prof. Kruse "MERIT" which began in July, the BMBF (Federal Ministry of Education and research) funded collaborative project "IBÖM-04" in collaboration with Ludwig Maximilian University of Munich, which began in August, and the "EFRE-CLIB-Kompetenzzentrum Biotechnologie" from the state of North Rhine-Westphalia which also began this year.



(from left to right) Dr. Thomas Baier, Julian Wichmann, Prof. Dr. Olaf Kruse, Dr. Kyle Lauersen.

1. Baier, T., Wichmann, J., Kruse, O. & Lauersen, K. J. Intron-containing algal transgenes mediate efficient recombinant gene expression in the green microalga *Chlamydomonas reinhardtii*. *Nucleic Acids Res.* 46, 6909–6919 (2018).
2. Lauersen, K. J. *et al.* Efficient phototrophic production of a high-value sesquiterpenoid from the eukaryotic microalga *Chlamydomonas reinhardtii*. *Metab. Eng.* 38, 331–343 (2016).
3. Yunus, I. S. *et al.* Synthetic metabolic pathways for photobiological conversion of CO₂ into hydrocarbon fuel. *Metab. Eng.* 49, 201–211 (2018).
4. Wichmann, J., Baier, T., Wentnagel, E., Lauersen, K. J. & Kruse, O. Tailored carbon partitioning for phototrophic production of (E)- α -bisabolene from the green microalga *Chlamydomonas reinhardtii*. *Metab. Eng.* 45, 211–222 (2018).
5. Lauersen, K. J. *et al.* Phototrophic production of heterologous diterpenoids and a hydroxy-functionalized derivative from *Chlamydomonas reinhardtii*. *Metab. Eng.* 49, 116–127 (2018).

Genome Informatics Group welcomes Guest Researchers from Brazil

Confirming the international recognition of bioinformatics research and education at Bielefeld University, and attracted by excellent cooperation opportunities in particular at the CeBiTec, in total four scientists from Brazil will be participating in research projects of the Genome Informatics group during the forthcoming academic year 2018/19. In a reception event on July 27, 2018, the head of the host group, Prof. Dr. Jens Stoye, welcomed the guests Prof. Dr. Michael Sammeth from the Federal University of Rio de Janeiro, who is visiting Bielefeld as a Humboldt Fellow during the years 2018 and 2019; Dr. Marília Braga, also from Rio de Janeiro, who will join the Genome Informatics group as a postdoctoral staff scientist starting in October 2018; and finally Prof. Dr. Diego Rubert and Prof. Dr. Fábio Martinez, both DAAD-funded scholars from the Federal University of Mato Grosso do Sul in Campo Grande, spending their sabbatical year in Bielefeld. The visiting researchers are elaborating projects with differing aims that all require the development of advanced algorithms for establishing computational methods that allow to gain better insights in comparative genomics and on complex transcriptomics.



(from left to right) Prof. Dr. Jens Stoye, Prof. Dr. Michael Sammeth, Dr. Marília Braga, Prof. Dr. Diego Rubert and Prof. Dr. Fábio Martinez.

Bicomer and Nadja Henke awarded funding from ERDF and prize in regional business competition

Bicomer aims at producing astaxanthin by fermentation with *Corynebacterium glutamicum*. Natural astaxanthin is a red pigment, antioxidant and high-performance ingredient with an attractive market growth. The business idea of Bicomer won the second prize in the business plan competition for life science entrepreneurship that is organized by the Bio-security competence center, Bönen. Now, Nadja Henke received 240,000 € funding from *Start-Up Hochschulausgründungen NRW*. With the support from this ERDF program Bicomer will optimize fermentative astaxanthin production in order to build up a flexible, eco-friendly and sustainable production process. Bicomer is hosted by the group of Prof. Dr. Volker F. Wendisch.

<https://www.facebook.com/BioGruender/photos/a.202576326497142/1901615216593236/?type=3&theater>

<https://www.facebook.com/BielefeldUniversity/photos/a.312912318775666/1893752577358291/?type=3&theater>



CeBiTec Summer Party 2018

The Wendisch Lab organized this year's CeBiTec Summer Party on August 30, 2018. Self-made cakes, salads, barbecue food, deserts and plenty of cold drinks added much to the great event. DJ Daniel entertained the guest into the night and even for this "super summer" unusually "low" temperatures did not spoil the good mood.



Upcoming Events

- 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](#)