UNIVERSITÄT BIELEFELD

CeBiTec Center for Biotechnology

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Nattkemper group is part of the international research consortium “Deep Vision”, which uses AI to map the Atlantic Sea

As the deep-sea becomes more accessible for exploitation, there is an urgent need to map its ecosystems to enable the conservation of biodiversity in this, the last wild frontier on Earth. The Deep Vision project will use AI to greatly accelerate mapping of vulnerable marine ecosystems (VME) such as cold-water coral reefs and sponge fields in the deep Atlantic, generating the evidence needed to effectively implement legal protections for these ecosystems and their benefits to society, creating AI tools that will enable upscaling, ultimately to the entire global ocean. We will train AI models to identify VME indicator taxa in seabed imagery from the UK, Norway, Ireland and Portugal, already annotated by expert taxonomists in a near-consistent way. We will apply the AI models to analyse thousands of images to generate the largest ever, high-quality dataset describing the spatial distribution of VME indicator taxa. Combining these data with in-situ environmental data will enable us to understand the conditions each taxon requires and develop models that predict where they occur based on environmental conditions alone. We will use these models to predict VME distribution in the Atlantic, identifying biodiversity hotspots, visualised as maps.

This is exactly the evidence needed by decision-makers responsible for implementing existing legislation to protect VME, including the new High Seas Biodiversity Treaty, and timely national marine planning in Ireland, Norway and Portugal (see ICES letter of support in additional material). We will engage these decision-makers to guide deep-sea biodiversity protections, including new bottom fishing closures and marine protected areas (MPAs). The project legacy will be improved protection of deep-sea biodiversity in the North Atlantic and scalable AI tools to accelerate conservation across the entire Atlantic Basin and beyond. AI is undoubtedly the way to overcome human annotation limitations and enable a step-change in mapping and protection of life in the deep ocean.

Title: Deep Vision: Harnessing AI to Map Atlantic Seafloor Biodiversity

Total funding amount: $1,995,000

Partners: Plymouth University, Plymouth Marine Laboratory, Institute of Marine Research (NO), University of Bergen (NO), University of Galway (IR), University of Aveiro (Por), University of Gibraltar (UK)

(T. Nattkemper)

From the wastewater treatment plant to the circular economy - New algae project BiAlDüB of the Kruse research group at CeBiTec

With the launch of the BiAlDüB research project ("Algae biofilm system for nutrient recycling from wastewater with utilisation as agricultural fertiliser and green biogas"), Bielefeld University, together with Forschungszentrum Jülich, aims to open up new ways of sustainable wastewater treatment. The project is being funded with around 800,000 euros as part of the "Sustainable Bioeconomy" funding initiative of the Federal Ministry of Agriculture, Food and Home Affairs (BMLEH).

Federal Ministry of Agriculture, Food and Regional Identity

The focus is on an innovative process that utilises nutrients such as phosphorus, nitrogen and potassium from municipal wastewater for the sustainable production of algae biomass using a biofilm technology developed at Jülich. This biomass can be used directly as an ecological fertiliser, but also as a substrate for the production of biogas and biomethane - a closed cycle that combines agriculture, energy and environmental protection (Figure 1).

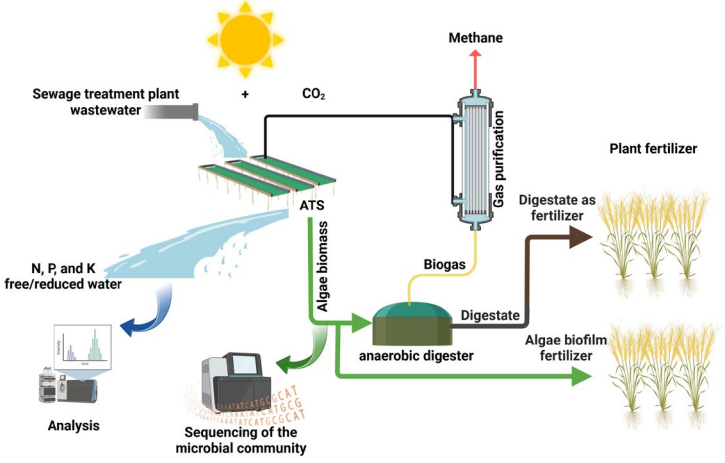


Figure 1 | Concept behind BiAlDüB; ©Viktor Klassen

The scientific basis for BiAlDüB was laid by the work of Dr Olga Blifernez-Klassen at Bielefeld University in a predecessor project funded by the NRW State Environment Agency for Nature Conservation, in which decisive insights were gained into the microbial composition and stability of algae biofilms.

As an expert in microbial interactions and biogas processes, Dr Viktor Klassen from Prof. Dr Olaf Kruse's working group at CeBiTec is now investigating how algae biomass can be completely converted into green biogas and how the fermentation residues can then be used as a high-quality fertiliser. "We want to show that wastewater utilisation, energy generation and fertiliser production can work in a cycle," says Dr Klassen.

Figure 2 | Liquid cultures of *Chlamydomonas reinhardtii* ©CeBiTec

Automated pilot plant in Bielefeld

To this end, an automated pilot plant is being built in Bielefeld that runs wastewater through algae biofilms under light and temperature control. The aim is to optimise the system both technically and economically. "Thanks to the innovative approaches through the use of microbial communities, this project can make an important contribution both to the circular economy and to the MDDW focus area at Bielefeld University at the research level," says project coordinator Prof Dr Olaf Kruse confidently.

The MDDW focus area offers a platform for multidisciplinary life science projects that are framed by ethical and social aspects. In times of synthetic biology and machine learning, it builds on strengths in biotechnology and bioinformatics to research and improve microbiomes.

English translation of the Bielefeld University press release.

(O. Kruse)

The Crop Genomics group publishes a research article on epigenetics in sugar beet

Figure 3 | Sugar beet (*Beta vulgaris*) ©BMFTR

Epigenetic modifications, like cytosine methylation (5mC), play a major role in plant development, orchestrate phenotypic plasticity and affect a multitude of plant traits. Despite its extensive influence, control of DNA methylation patterning remains poorly understood in non-model plants. Consequently, the potential of epigenetic breeding approaches targeting cytosine methylation in crop plants cannot be unlocked yet.

To unravel the epigenetic patterns and lay the foundation for future studies, an Oxford Nanopore Technologies (ONT)-based reference 5mC methylome of *Beta vulgaris* ssp. *vulgaris* (*Bvu*) nuclear genome was created (Figure 4). It descrybes the cytosine methylation pattern from young leaf tissue of sugar beet using data from ONT long-read sequencing, which was performed by Prisca Viehöver at the CeBiTec. The newly developed tool 5mCartograph provides deeper insights into cytosine methylation probabilities

and was published alongside the reference methylome of the genotype KWS2320 in Current Plant Biology. The *Bvu* methylome work was funded by the BMFTR (PLANT2030; FKZ031B1221B). The de.NBI Cloud and 'PUB - Publications at Bielefeld University' repository enabled the processing and provision of the very complex data sets. The project was realised in the context of a collaboration of the Crop Genomics group around Daniela Holtgräwe (CeBiTec, Uni Bielefeld) with Tony Heitkam (RWTH Aachen) and Britta Schulz (KWS SAAT SE).

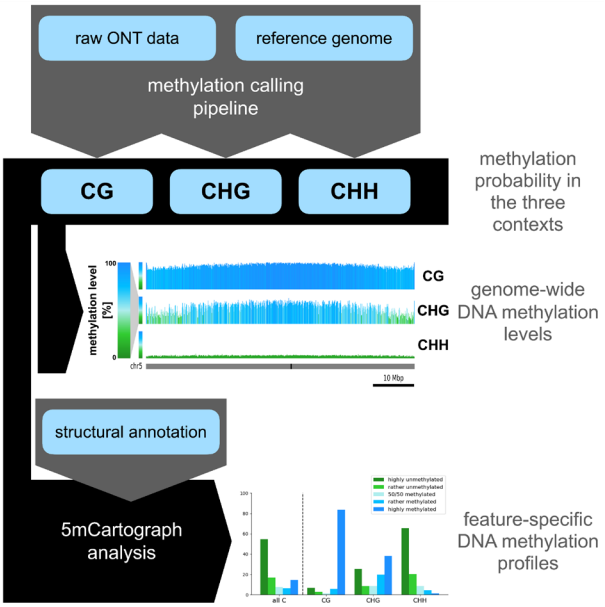


Figure 4 | Workflow applied to unravel the epigenetic patterns in *Beta vulgaris*; ©M. Wulfhorst

Through the genome-wide detection and analysis of cytosine methylation with regard to the three sequence contexts (CG, CHG, and CHH), it was shown that the DNA methylation pattern in sugar beet is highly context-specific and typical for plants. The methylation level is highest in CG (89.8%), followed by CHG (62.8%) and CHH (10.1%) context. Overall, 14.5% of all re-detected cytosines were classified as 'highly methylated'. The study revealed that genes and genomic repeats display feature-specific DNA methylation patterns. 2,088 gene body methylated genes were identified, which are mainly involved in core metabolic and regulatory processes. This detailed methylome provides a robust foundation for future studies and supports potential applications in crop breeding.

Federal Ministry of Research, Technology and Space

Wulfhorst M, Sielemann K, Schmidt N, ... and Holtgräwe D. Towards epigenetics in sugar beet – the ONT based reference 5mC methylome of *Beta vulgaris* ssp. *vulgaris*. 2026. Current Plant Biology. DOI: 10.1016/j.cpb.2026.100583

(M. Wulfhorst & D. Holtgräwe)

CeBiTec Student Academies: Funding Renewed and Leadership Team Extended

The CeBiTec Student Academies are delighted to announce that their funding by the Osthushenrich-Stiftung has been renewed for another three years (2026–2028). This continued support ensures that the long-standing commitment to fostering STEM excellence among highly gifted students in the Ostwestfalen-Lippe region can move forward with new momentum.

For many years, the Academies have inspired young learners through hands-on scientific experiences. During five-day summer project weeks, participants gain practical research insights and academic orientation through a rich program that includes expert lectures, laboratory experiments, guided lab tours, and tailored career and study guidance. The goal is to spark enthusiasm for the natural sciences, and contribute to securing the next generation of scientific and technical talent for the region. A survey of former

participants showed that more than 80% of them chose a career in the life sciences.

In the upcoming fifth funding phase, the strong foundation in biotechnology will be complemented by an expanded focus on medicine and translational research. This development is supported by the newly composed leadership team, which brings together expertise from across key scientific disciplines. With Prof. Dr Volker F. Wendisch, Chair of Genetics of Prokaryotes at Bielefeld University and Scientific Director of the CeBiTec, and Prof. Dr med. Tilo Grosser, Professor at the Medical Faculty OWL and Head of the Translational Pharmacology Research Group, the team unites essential strengths from both biotechnology and medical research. Together with long-standing member Prof. Dr Norbert Grotjohann (Biology Education, teutolab-biotechnology), this interdisciplinary leadership team will guide the Academies into the next era of integrated scientific education.

(K. Röllke)

The new CeBiTec group "Mathematical Modeling in Systems Biology" is currently working on the following research projects:

Mini6Ei - Minimally invasive sex detection in six-day-old hatching eggs using time-resolved fluorescence microscopy (supported by Federal Ministry of Agriculture, Food and Regional Identity; cooperation partners: AAT, TH OWL, University of Potsdam):

Federal Ministry of Agriculture, Food and Regional Identity

Figure 5 | Glimpse inside an egg; ©Petra Lutter

It is the aim of the project to detect sex-specific markers on the basis of protein profiles. The responses to the excitation of autofluorescence by a UV laser beam are recorded at various measuring points on the egg or egg membrane. This measurement has no or only minimal impact on the vitality of the embryo. Sex-specific differences of the fluorescent structures are then worked out using novel authentication algorithms. As for the biological background, the proteome analysis of the chicken egg is carried out at CeBiTec: PhD student Sophie Nöhring is analyzing the protein composition at different incubation stages (day 0, day 3 and day 5) from isolated egg fractions using nanoLC-Orbitrap mass spectrometry.

©Sophie Nöhring

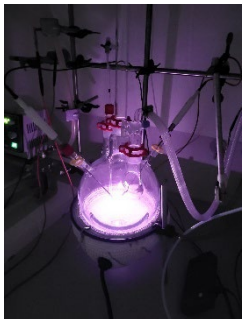
Just before Christmas the BLE (Federal Office for Agriculture and Food) presented the project with a Christmas gift, a half-year extension including additional financial support. As Sophie Nöhring has detected crucial proteins in the eggshell, the group will no longer need to drill a hole and can carry out their laser experiments with intact eggshells. In addition, the data analysis algorithm of TH OWL is supported by the analysis pipeline for Raman signals developed by the CeBiTec group.

The group is also very happy about the launch of two further projects:

The Sparks of Life (supported by "Konrad Adenauer Stiftung"; cooperation partners: Faculty of Physics and Faculty of Technology, Bielefeld University)

©Niklas Korff

At CeBiTec, PhD student Niklas Korff is conducting experiments with a version of the Miller-Urey experiment called Bielefeld Apparatus for Primordial Soup (BAPS). Using BAPS in combination with theoretical modeling by means of hyper graphs, it is the aim to find out whether the spontaneous synthesis of the most important building blocks of life (e.g ribose) can be influenced and maximized in terms of their abundance and diversity. Moreover, the group wants to unravel whether the synthesis of the primordial organic elements was a continuous process or whether different epochs with different environmental parameters had to take place.



BAPS; ©Petra Lutter

InflamSPEC - Spectroscopy as the key to modern diagnostics of inflammation (supported by "Anschubfonds Medizinische Forschung", Bielefeld University; cooperation partners: Medical School OWL, University Medical Center OWL, Faculty of Physics and Faculty of Technology at Bielefeld University, HDZ NRW, TH OWL).

Within this interdisciplinary, translational research cooperation, complementary spectroscopic and spectrometric methods in conjunction with mathematical, statistical and algorithm-based evaluation methods shall be combined to detect inflammatory markers in blood and serum. These novel diagnostic tools shall later be brought into clinical application.

At CeBiTec, the group's pipeline for processing and analyzing Raman spectra is to be further developed in coordination with the machine learning algorithms established at the University Medical Center OWL for classifying the samples. This development shall open up innovative therapeutic approaches and will contribute to future precision medicine.

(P. Lutter)

CeBiTec hosts brewing competition of the Molecular Biotechnology department

©Dominik Cholewa

On 19 November 2025, it was that time again. The winter semester brewing competition kicked off in the cosy foyer of the CEBITEC. We were supported by the Herforder Brewery, which provided us with taps, glasses, and a reference beer – thank you very much! Once again, the student brewing teams conjured up some excellent beers, supported by the experienced hand of our master brewer Moritz Last. This time, we had only three student groups – the fourth beer came from the heart of MBT – as the Biotechnology Department has been strengthened by new working groups and staff, and a beer is being brewed as a ‘natural arrival’ at our premises. The result of a collaboration between

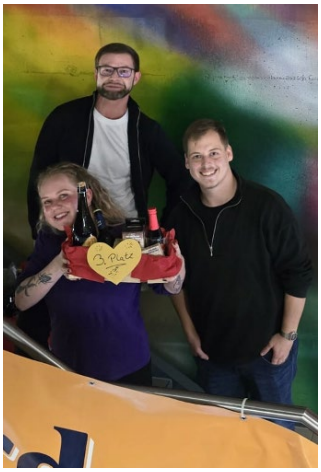
E0 and D5 was a tangy ‘Galaxy Weizen’ with a good dose of the very aromatic Galaxy hops. And the student winners? Around 100 votes were cast:

1st place: Future Brew; ©Dominik Cholewa

1st place: Future Brew – an amber ale with 14° Plato, IBU: 40 and 6.5% Alc.

2nd place: Das Leben des Hopfens; ©Dominik Cholewa

2nd place: Das Leben des Hopfens (The Life of Hops) – an IPA with 14° Plato, IBU: 32.



3rd place: Nicht das Hellste; ©Dominik Cholewa

3rd place: Nicht das Hellste (Not the Brightest) – a dark IPA with 13.7° Plato, IBU: 50 and 5.3% Alc.

It was a fantastic, exuberant evening, with the beer disappearing faster than usual, so that the empty barrels heralded the end of the evening early on.

Many thanks to all our supporters and a huge thank you to CEBITEC: without you, this wonderful event would not be possible – and it has now become something of an institution. On that note, cheers and see you next time!

“Gut Sud”

(D. Cholewa)

Impressum

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