



BioSC | Newsletter | 01/2018

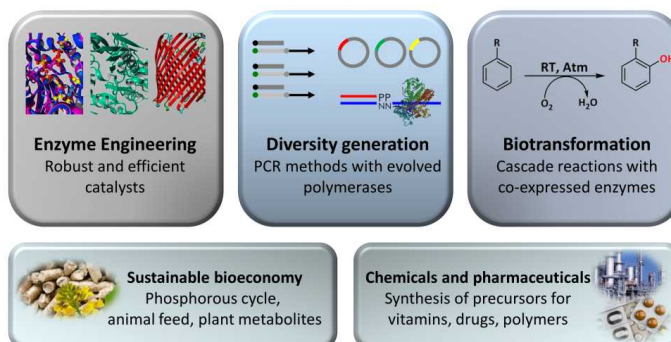


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Dr. Anna Joëlle Ruff | RWTH Aachen | ABBt - Biotechnology

Tailored biocatalysts for a sustainable bioeconomy are the area of research of Anna Joëlle Ruff. Rational and evolutive protein design help to develop enzymes that perform under the conditions in chemical industry. One focus are enzymes that recover valuable substances from agricultural residues.



Anna Joëlle Ruff studied biology at RWTH Aachen University, focusing on microbiology and biotechnology. In her diploma thesis at the Institute of Microbiology in 2009 she analyzed the glutathione metabolism of fission yeast. Subsequently she was offered the possibility to do her PhD with Prof. Schwaneberg at the Chair of Biotechnology at RWTH Aachen University. During this time she worked on enzyme engineering of monooxygenases in the frame of the EU project Oxygreen.

Monooxygenases incorporate oxygen into their substrates. They occur in all organisms, playing an important role in degradation of various substances and thereby in detoxification. Furthermore, in plants they have a key role in production of bioactive substances what makes them highly interesting for biotechnology. In the project Oxygreen, monooxygenases were optimized for the production of vitamin precursors. The results were protected in a patent together with the company DSM.

After finishing her PhD (Dr. rer. nat.) in 2012, Anna Joëlle Ruff built up a research group dealing with monooxygenase evolution and development of diversity generation methods. A highlight was the flow cytometry-based high-throughput platform for screening of bacterial monooxygenases which enables screening of millions of enzyme variants in one hour.

Since 2014 Anna Joëlle Ruff leads the division Molecular Bioeconomy at the Chair of Biotechnology at RWTH Aachen University. PhD students, PostDocs and technical assistants form a team of 12 people. In the division, key technologies for directed evolution (promoter toolbox, cepPCR, OmniChange) are developed and used to produce tailored enzymes for a sustainable bioeconomy. A highlight in monooxygenase evolution is the development of whole cell catalysts with an improved diffusion barrier for efficient oxygenation of aromates and terpenes. This was realized in the BioSC project TPOT by coexpression of monooxygenases with a membrane protein which served as a channel. The development of biocatalysts is being continued in the EU projects ROBOX und OXYTRAIN which aim at an extended industrial use of robust oxidative biocatalysts for transformation and production of alcohols.

Another focus of her research is the development of a technology for enzymatic phosphate recovery which would open up the way to new circular value chains. This technology is based on phytases: enzymes that release free phosphate by degrading the phosphate storage molecule phytate which is formed in plants. The use of phytases enables an efficient phosphate recovery from various biological sources, e.g. sugar beet residues from sugar production or rapeseed press cakes from oil production. The obtained phosphate can either be directly utilized in premium fertilizer or can be transformed to valorised food or feed additives by microorganisms.

Anna Joëlle Ruff coordinated various projects she had also co-applied for. She was involved in the BioSC projects [P-ENG](#), [PhytaPhos](#), [BioExpresSPro](#), [TPOT](#), [BioSAF](#) und [MoRe-Plants](#). Currently she is involved in the BioSC FocusLab [CombiCom](#).



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2nd BioSC Symposium: Towards an Integrated Bioeconomy

On 28th November 2017, the 2nd International BioSC Symposium took place in Cologne and bundled different expertises on the topic "Towards an integrated Bioeconomy". Around 160 participants were attracted by national, European and international speakers and researchers from the BioSC network, contributing their perspectives and recent research results concerning the bioeconomy.



The high potential and different opportunities of the bioeconomy were highlighted in the vividly presented keynote of Prof. Lene Lange of the Technical University of Denmark. She pointed out that one should not only look for the big one to one substitutions but highlighted the relevance of different types of smaller and local biorefineries and cascading concepts. She added recent research results on the development of relevant enzymes, conversion processes and strategies for product development.

The sessions started with the introduction of the interdisciplinary research concepts of the BioSC FocusLabs ([AP³](#), [Bio²](#), [CombiCom](#), [HylmPact](#) and [greenRelease](#)) as cornerstones of an integrated bioeconomy in NRW. These projects either started in spring 2017 or in the beginning of 2018. The different consortia are working on sustainable agricultural solutions and biobased biorefinery concepts providing different biomolecules, e.g. biosurfactants, with potential applications as agrochemicals or pharmaceuticals.

The following sessions reflected socioeconomic perspectives, strategies for plant production and resource management and green value chains.

Dr. Johanna Kohl from the VTT Technical Research Center of Finland informed about the needs to develop a holistic bioeconomy strategy and technology roadmap considering the understanding of current societal, industrial and consumer needs and aims, but also the technology readiness level of current and future technologies to discover the full bioeconomical potential, visualized in a case study for South Australia. Dr. Frank Tietze, research group leader at the Centre for Technology Management at the University of Cambridge pointed out, that the transformation to a sustainable bioeconomy relies on collaborative work and cumulative innovation and explained the potential role of OpenIP models. Laura Borge, PhD Student at the University of Bonn, completed the socioeconomic session by putting the light on special challenges of

effectiveness of technology transfer in the settings of the bioeconomy.

Concerning the improvement of plant performance, Dr. Anette Wensing from the Julius Kühn Institute in Dossenheim explained the importance of their research on the cultivation and breeding of pest resistant crop varieties, for example for preventing apple trees of fire blight infection, as a sustainable form of plant protection. Prof. Jochen Büchs, head of the chair of Bioprocess Engineering at RWTH Aachen, presented an alternative promising eco-friendly crop protection method out of the BioSC project [PrimACs](#) of substituting synthetic agrochemicals by sustainable chemicals that prime the plant immune system for a better pest and disease control. Dario Leister, Professor at the Chair of Plant Molecular Biology and Botany at the LMU Munich, talked about the importance of understanding the natural photosynthetic light reactions and the role of synthetic biology that might allow the redesign or *de novo* creation of entire, more efficient photosystems that are less susceptible to photodamage and producing fewer harmful reactive oxygen species.

The BioSC project [PectiLyse](#) provides an example of dealing with Green Value Chains, presented by Markus Müller, PhD student at the RWTH Aachen University. The project aims at using pectin derived substrates for itaconic acid production by *Ustilago maydis*. The presentation especially highlighted the **R**espiration **A**ctivity **M**onitoring **S**ystem (RAMOS) for the characterization of shake flask cultivations, where enzyme activity, even at low level, can be quantified by the course of the oxygen transfer rate (OTR). Dr. Eric Déziel of the Institut National de la Recherche Scientifique in Canada presented new solutions for the production of promising biosurfactants, namely rhamnolipids, which present many advantages like low toxicity, enhanced biodegradability and better social acceptability. Still a big challenge is the use of non-pathogenic natural producers of rhamnolipids, where the *Burkholderia* genus is currently investigated for suitable candidates. Dr. Michael Zavrel introduced Clariant's sunliquid® technology for example for the production of ethanol, which offers an economically competitive one-stop-shop-solution flexible to be used to convert different feedstocks and adopt to various plants concepts combining high process yields with low OPEX and CAPEX. In September 2017 a license agreement has been signed with the Slovakian company Enviral for the cellulosic ethanol technology.

This year, a poster session was part of the the BioSC Symposium for the first time and the best posters were awarded concerning interdisciplinarity, research results and poster presentation. Winners of the poster prizes were Dr. Alexandra Wormit with her colleagues for their research in the project "InducTomE: Induction of secondary metabolites in tomato by-products for extraction and economic evaluation of the model process", Martin G. Höller and coworkers for the research on "*Silphium perfoliatum* and *Sida hermaphrodita* as raw material for the paper and building industry" and Dr. Felix Jakob with the project team working on "Bifunctional Microgel-Based Fertilizers for controlled Foliar Delivery of Nutrients to Plants".

The conference impressively reflected the need for an integrated approach to the field of bioeconomy and successfully provided a platform for interdisciplinary scientific discussion and future cooperation. The 3rd international BioSC Symposium will take place on 12th and 13th November 2018 in Bonn.

TaReCa: Successful follow-up from BioSC project InducTomE

The project partners of the BioSC project InducTomE successfully applied for a follow-up project at the Federal Ministry of Education and Research. TaReCa started in November 2017 and evaluates the potential of biomass residues of bell pepper production as a source of valuable bioactive compounds.



Plant secondary metabolites are essential components of the human diet, utilised as phytomedicines, as industrial raw materials and high-value fine chemicals. Their industrial chemical synthesis is difficult and expensive. Plant biomass residues from agriculture and horticulture could be an alternative source. The BioSC project InducTomE succeeded in obtaining the secondary metabolites rutin and solenasol from green biomass residues of tomato plants after enhancing their accumulation by abiotic stress application.

From November 2017 to October 2020, the cooperation of the BioSC Core Groups at IBMG and AVT-FVT (RWTH Aachen), IBG-2 (Forschungszentrum Jülich) as well as ILR and INRES Horticultural Science (University of Bonn) continues with Dr. Alexandra Wormit (IBMG RWTH Aachen) as coordinator. The BMBF project „**T**ailoring of secondary metabolism in horticultural **r**esiduals and **c**ascade utilization for a resource efficient production of valuable bioactive compounds” evaluates the potential of green biomass residues of bell pepper as a source of secondary metabolites.

At the IBG-2, young bell pepper plants will be analysed under controlled stress conditions aiming towards an enhanced accumulation of flavonoids, e.g. cynaroside which is of interest for the cosmetic, food and pharmaceutical industries, and graveobioside A which has biocidal properties. At the Campus Klein-Altendorf and at the INRES Horticultural Science, effective stress treatments will be implemented in commercial-like greenhouses and physiological effects on reproductive bell pepper plants will be evaluated on the level of leaf and fruit yield. Obtained leaf material from these experiments will be analyzed regarding transcriptional and metabolic alterations in plants as well as abiotic induced changes in biosynthetic pathways at the IBMG. The establishment and optimization of the extraction and processing procedure will be conducted by the Fluid Process Engineers, while bio-economists of the ILR evaluate the market potential of leaf compounds for utilization in the pharmaceutical, cosmetical or dietary sector. Validation experiments in greenhouses under commercial conditions can be conducted at the test center Straelen of the Chamber of Agriculture NRW.

To ensure future industrial exploitation, the scientific work of TaReCa will be accompanied by an industrial advisory board consisting of representatives of the Chamber of Agriculture NRW, Symrise AG, Trifolio-M and Gartenbau Hoffmann. TaReCa will reveal an innovative way to use available resources more efficiently and contributes to a sustainable, efficient and integrated bioeconomy without competing with food production.

4th BioSC Forum on 27th November in Cologne

More than 130 BioSC members joined the internal retreat 2017, the fourth BioSC Forum, to learn about latest developments from BioSC projects and to network with other BioSC members. While the focus of the morning session was on projects financed in the frame of the NRW strategy project BioSC, the afternoon presentations included as well talks about externally funded projects of BioSC consortia and information about national and international funding programmes in the framework of bioeconomy.



In the first talk, new results from the project [PhytaPhos](#) were presented by Ana Alejandra Robles Aguilar (FZJ). The consortium achieved to develop thermally resistant enzymes which facilitate the extraction of phosphate from sugar beet residues. Subsequently, Katja Koschorreck (HHU) gave insights into the project [BioDeg](#). The project partners successfully tested combinations of lignin- and cellulose-degrading enzyme sets for plant biomass degradation. In the course of the project [BiFuProts](#), presented by Caspar Langenbach (RWTH), a fusion protein was developed, which attaches to the leaf surface and can protect the plant from diseases, e.g. Asian soybean rust, due to its antimicrobial properties. Subsequently the first poster session took place.

After the coffee break several projects were presented that cover besides experimental approaches as well theoretical or modelling approaches. Vera Jäger (HHU) presented a fast, simple and economic method for enzyme immobilization, which was developed within the [CatIBs](#) project. The project [HiQFlux](#), which just started one year ago, succeeded to develop a metabolic model which can significantly increase the quality of flux estimations, presented by Birgitta Ebert (RWTH). Tobias Ploch (RWTH) demonstrated the implementation of a framework for multi-scale biorefinery process, which was developed in the project [BeProMod](#).

After the lunch break Vera Göhre (HHU) started with her presentation about the project [PlaMint](#) which aims to characterize the communication between plants, e.g. oil seed rape, and fungi, e.g. *Verticillium longisporum* and could already identify important plant factors and signals. As last BioSC project of the day, [SPREAD](#) was presented by Elena Pestsova(HHU). In field trials and in the greenhouse the project partners are currently analysing new *Silphium* variants with promising properties.

As one of two new programme items, the BioSC Forum this year as well included presentations about follow-up activities of BioSC members. Based on the results from BioSC projects, external funds were

raised, e.g. on national level in the BMBF calls “Bioeconomy International” or “Tailor-made biobased ingredients for a competitive bioeconomy” and on a European level in the frame of an ERA-NET Industrial Biotechnology. Furthermore, several projects successfully submitted patent applications.

During the afternoon poster session, previously presented SEED and BOOST FUND projects as well as the new BioSC FocusLabs presented their approaches. The FocusLabs will have a significant function in terms of thematic profiling of the BioSC.

As a further new programme item representatives from external funding agencies were invited to introduce current funding opportunities in the frame of bioeconomy. Stefan Rauschen from the National Contact Point Bioeconomy (NKS) fostered on the recently published Horizon2020 programme for the years 2018-20. Funding opportunities of the central coordinating agency in the area of renewable resources (Fachagentur für Nachwachsende Rohstoffe, FNR e.V.) was presented by Susanne Baars. During the subsequent get-together both representatives were available for further questions regarding the funding programmes.

Finally, the winners of the Supervision Award 2017/18 were honoured. This year, Dr. Ulrich Krauss (HHU) and Dr. Markus Schwarzländer (Bonn) each received the 25.000 € prize for excellent supervision of master and PhD students.

As in the years before, the 4th BioSC Forum was very well visited and demonstrates the successful transition from the first BioSC funding period into the second one. Fruitful discussions during the talks and the poster sessions represented the huge interest of participants on bioeconomy topics.

Successful 2nd NRW-wide PhD Day „Future Bioeconomy“

What is bioeconomy and what are the career opportunities within this modern and interdisciplinary field? These questions were in the focus of the 2nd PhD Day NRW „Future Bioeconomy“ that took place on 1st of December in Bonn. The goal of this meeting was to gather young scientists from different scientific fields and locations in NRW. About 50 PhD students from Aachen, Bonn, Cologne, Düsseldorf, Jülich and Münster came together.



The event was jointly organised by six different scientific institutions from the state of North Rhine-Westphalia (NRW), who offer a graduate training programme on a topic related to bioeconomy.

Prof. Ulrich Schurr (IBG-2 Plant Sciences, Forschungszentrum Jülich) gave a general introduction about bioeconomy and its social relevance resulting in first discussions with the audience. Prof. Michael Feldbrügge (Institute for Microbiology, Heinrich Heine University Düsseldorf) supplemented the first

session with a report about his research projects in the context of a sustainable bioeconomy. He considers research as a driving force for a successful bioeconomy. The thematic focus changed in the second session of the event and was directed towards career opportunities in the field of bioeconomy. The invited guests Dr. Christian Dumpitak (iGRAD, Heinrich Heine University Düsseldorf), Charles van der Haegen (Zero Emissions Research and Initiatives) and Dr. Wilfried Blümke (Evonik Technology & Infrastructure GmbH) reported about their own as well as about alternative career paths in the field of academia, entrepreneurship and industry followed by an interactive panel discussion with the audience. The poster session and the final get-together provided further possibilities for deeper discussions.

Based on first feedback from the participants the 2nd PhD Day NRW „Future Bioeconomy“ was an interesting and useful information event and a stepping stone towards the establishment of an own scientific network.

PhD Training Day „Discussing (in) Science“

The workshop „Discussing (in) Science - Basics of Interdisciplinary Communication and Collaboration“ addressed doctoral researchers who particularly wanted to improve their communication skills in interdisciplinary discussions, meetings and debates, as well as their individual presentation style. All together 8 PhD students of the BioSC attended the 3rd PhD Training Day in Cologne.



The workshop on 29th November 2017 strongly focused on dynamic communication situations and the skills necessary in these situations. An additional aim was to strengthen the awareness of the PhDs for specific challenges in interdisciplinary communication contexts. The participants had the opportunity to reflect and refine their individual presentation style and to test the theoretical skills during a series of discussion and presentation exercises.

The workshop was rated by the participating doctoral students as very helpful for the further development of their presentation and communication skills, especially in a cross-disciplinary working environment such as the bioeconomy.

Events and calls

Events (selected)

BONARES Conference 2018: Soil as a Sustainable Resource

26.-28. February, Berlin

Host: Funding initiative "**Boden als nachhaltige Ressource** für die Bioökonomie", BMBF

[More Information](#)

ECO-BIO 2018

04.-07. March 2018, Dublin

Hosts: Elsevier; BE-Basic Foundation

[More Information](#)

Deutsche Biotechnologietage 2018

18.-19. April 2018, Berlin

Hosts: BIO Deutschland; Arbeitskreis BioRegionen in Deutschland

[More Information](#)

Global Bioeconomy Summit

19.-20. April 2018, Berlin

Host: German Bioeconomy Council

[More Information](#)

26. European Biomass Conference

14.-17. May 2018, Copenhagen

Host: Joint Research Centre of the European Commission

[More Information](#)

14. International Conference on Renewable Resources and Biorefineries

30. May - 02. June 2018, Ghent

Veranstalter: Ghent University, ITN GreenChem, POM West-Vlanderen

[More Information](#)

3. BioSC Spotlight „Phosphorus recovery and cycling“

5. June 2018, Aachen

Host: Bioeconomy Science Center

7. International Bioeconomy Conference

06.-07. June 2018, Halle

Host: Science Campus Halle

[More information](#)

3. International BioSC Symposium „Towards an Integrated Bioeconomy”

12./13. November 2018, Bonn

Before: 5. BioSC Forum (Internal retreat), 12.11.2018 in Bonn

Host: Bioeconomy Science Center

Calls (selected)

Horizon 2020: Working programme 2018-2020

In autumn 2017 the [Horizon 2020 Work programme for the years 2018 to 2020](#) was published. Section 9 of the Societal Challenge 2 (SC2) Work Programme covers food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy.

[More Information](#)

Sustainable and multilateral research cooperation between researchers from Europe, Latin-America and the Caribbean countries (ERANet-LAC) (BMBF)

08. March 2018 (first phase)

The aim of the Joint Call is to initiate sustainable and multilateral research cooperation between researchers from Europe, Latin-America and the Caribbean countries. Topics cover, among others, Biodiversity, Biorefinery and Bioeconomy, e.g. "Intermediate and/or High-Added Value Bioproducts."

[More Information](#)

ERA-NET Cofund on Sustainable Crop Production SusCrop (BMBF)

04. April 2018 (first phase)

The main purpose of the Call is to improve the sustainability and resilience of crop production within the European Research Area (ERA) by supporting trans national research projects on this topic.

[More Information](#)

Call „Bioeconomy International” (BMBF)

16. April 2018 (first phase)

Proposals can be submitted in frame of the following modules: (1) Bioeconomy International - Basis (BI-Basis), (2) Bioeconomy Germany/Argentina (Bio-GerArg), (3) Bioeconomy Germany/São Paulo (Bio-Ger/SP).

[More Information](#)

„Ressourceneffiziente Kreislaufwirtschaft - Innovative Produktkreisläufe” im Rahmenprogramm „Forschung für Nachhaltige Entwicklung - FONA3” (BMBF)

26. April 2018 (first phase)

Mit der Förderrichtlinie verfolgt das Bundesministerium für Bildung und Forschung (BMBF) das Ziel, mit Hilfe von Forschung und Entwicklung Beiträge zur Umsetzung einer ressourceneffizienten Kreislaufwirtschaft zu leisten. Dabei müssen Produktkreisläufe mit Hilfe von Innovationen geschlossen und die dafür erforderlichen Geschäftsmodelle, Designkonzepte und digitalen Technologien bereitgestellt werden.

[More Information](#)