

Edition 2020 / 2021

**CLIB**

networking biotechnology  
creating sustainability

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## Building foundations for our future economy

Dear CLIB members and friends,

With 2020 we are now entering the last year of the current decade. Especially its second half was dominated by the discussions about climate change – not only within the scientific community but increasingly on political and also societal level. This was strikingly shown by the “Fridays for Future” movement. Whereas man-made impact on global warming is considered a fact by (almost) all stakeholders today, the way how to limit its impacts is still highly controversial. Reducing our global CO<sub>2</sub> footprint is a concordant requirement, but how to achieve this is still under discussion as well. Will it be possible to lower our CO<sub>2</sub> emissions to a sufficient level through technological innovations? If so, will defossilising our energy supply as well as our heating and transport sectors grant a high-enough impact? Or will we also have to base the complete process industry on biobased and recycled carbon? And what about agriculture and stock farming? In the end, all of these sectors will have to contribute to lower CO<sub>2</sub> emissions. This is common understanding nowadays – at least within the European Union. But there is so far no agreement how to facilitate these CO<sub>2</sub> reductions in the different sectors.

Several approaches are currently discussed, ranging from carbon taxation, to an expanded ETS (Emissions Trading System), or a compulsory share of regenerative (i.e. biobased or recycled) carbon within a given product. But which actor in the value chain will be the one to pay a possible carbon tax or an emission allowance e. g. of a coating? Is it the manufacturer of the monomers and the additives? Or is it the one who is doing the formulation of the actual coating? Or maybe the car manufacturer that is using it for his vehicle? Or will it be the consumer buying the final product (e. g. the car) in the end? This discussion becomes even more complicated when translated to liquid fuels or crops.

Whatever solutions we might see, we will have to revamp our whole economy, from linear to circular, from fossil to regenerative. The “European Green Deal”, announced in December 2019, might pave the way to such a transition. Its goal is a climate neutral EU by 2050, achieved through a European Climate Law turning this political commitment into a legal obligation and a trigger for investment. As global solutions are still not foreseeable as of today, this might be the time for Europe to take the lead. But what is the role of our cluster in all of this? Well, biotechnology is playing a decisive role in this change, affecting processes and products for agriculture, food and feed, materials and construction, as well as fuels. Although well-established in certain applications and value chains, biotechnology still needs a lot of research, development, and partnering for biotech to be implemented across the board. The coming decade will show whether biotechnology can widely deliver its promises for more sustainable and regenerative processes and products. And if, or how, it can do so in combination with other solutions like recycling technologies and electrolysis.

In Germany, the end of the lignite mining might become a highly interesting and crucial test case for applying such new technological solutions and economic models. Endowed with almost 15 billion euros over the next 16 years for the state of North Rhine-Westphalia alone, this upcoming structural change might be the acid test to prove that a bio- and circular economy can be implemented successfully. Together with you, the members of our network, we will work to make this transition happen and help build the foundations of our future economy, in NRW, Germany, Europe, and abroad.

In this sense, we are looking forward to a productive and successful year 2020!



*Karl-Heinz Maurer*



*Manfred Kircher*



*Dennis Herzberg*

## CLIB: Networking Biotechnology – Creating Sustainability

CLIB is an international open-innovation cluster of large companies, small- to medium-size enterprises (SMEs), start-ups, academic institutes, and universities, as well as other stakeholders active in biotechnology and the circular- and bioeconomy as a whole. As a non-profit association our members shape the cluster's interests and activities, and we work to promote industrial biotechnology in sustainable processes. We are active since 2008 and have built a strong and trustworthy network since then. Together with our members we are putting our mission into practice – **networking biotechnology, creating sustainability.**

Our membership of about 100 organisations comprises an international share of about 25 % (see figure 1). We are based in Düsseldorf, in the state of North-Rhine Westphalia (NRW): the chemistry and industry heartland of Germany, well connected to the neighbouring chemical regions of the Netherlands and Belgium. We do not see ourselves as a regional, but an international cluster. We aim to network our members within and beyond the cluster in order to initiate new research and business projects. Our goal is to network stakeholders along and across value networks and to identify new opportunities. In this regard, we try to include diverse industries and branches such as biotechnology, chemistry, food and feed, and pulp and paper into our network. At CLIB, we link feedstock owners with technology providers, processing industries, and consumer industries, and this also is reflected in our membership structure.

An innovative field like the bioeconomy also needs scientific excellence. This is why our network also integrates universities with strong track records in basic research while also branching out into applied research and start-ups. Some of them have set up platforms to create novel technologies and to generate new scientific insights crucial for biotechnological processes and products. Our “CLIB-Competence Centre Biotechnology” (CKB, see page 21) offers an integrated infrastructure for the bioeconomy in NRW: From gene and enzyme to process and product. Others of our research and technology organisations (RTO) have a dedicated applied focus, such as the German Fraunhofer Institutes and several of our international RTOs.

An invention only becomes an innovation if it can be implemented and commercialised, and especially start-ups and SMEs benefit from access to a thriving ecosystem comprising experts and facilities essential for bringing an innovation to market. To this end, CLIB seeks to include within its network competence in intellectual property (IP) and legal issues, techno-economic evaluation, process development, and scale-up. Our members also include investors, consultants, infrastructure providers, pilot plants, and other networks.

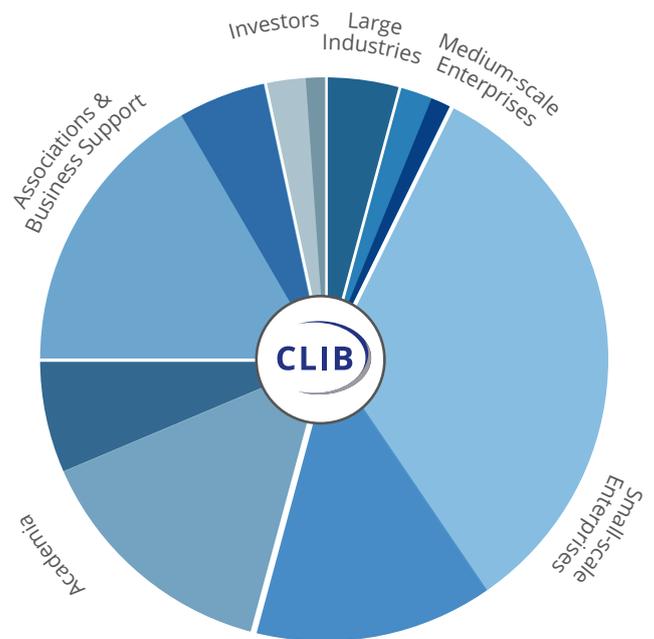


Fig. 1: CLIB members. Categories subdivided in national / international members.

Both the circular- and the bioeconomy are a worldwide trend requiring a global approach. Our members and strong partners in Germany, Europe, Russia, the Americas, China, South-East-, and Australasia are the cluster's links to global markets. We have CLIB contact points at our partners in Brazil, Canada, China, Malaysia, and Russia. It is in these regions, and Europe, that most of our activities are centred.

CLIB is also active in the European public-private partnership BBI JU (see page 18). Closer to home, CLIB has worked to form strong trilateral contacts between its German home state of NRW, The Netherlands, and Flanders. The well-established BIG-Cluster initiative has led to several R & D & I projects, some of them currently being funded by the German Federal Ministry of Education and Research (BMBF) as part of the “Internationalisation of Leading Edge Clusters” funding programme (see pages 22 – 23).



## CLIB Strategy

Over the last decade, CLIB has been perceived as creative, credible, independent, competent, and authentic. Our members appreciate our reliability, neutrality, and competence in the fields of industrial biotechnology, project management, funding opportunities, and networking. As a synthesis of these numerous compliments and as an incentive to become even better in the future, we commit ourselves to our mission statement:

*“As a reliable and competent partner we will deliver value to all our stakeholders, by professional networking within industrial biotechnology, across disciplines, regions, and nations; bringing together the expertise and knowledge needed to create sustainable products and processes, and to support the circular bioeconomy.”*

### Networking biotechnology – creating sustainability:

in four words, this claim summarises the mission of CLIB. In all our discussions with our members, **networking** is our most appreciated core business and strength. As for every cluster, this includes the identification and acquisition of new potential members. At a time when traditional boundaries between sectors are becoming increasingly blurred, it is more important than ever to identify innovative partners who can enrich the network and add to the membership. It is, however, equally important to maintain the existing network and to create additional value beyond the sum of its members.

While few words have been used as frequently in recent years, **sustainability** is still considered the most important driver for CLIB. This is what we measure novel trends, technologies, projects, and ideas by. Industrial biotechnology can be the key to foster sustainability in all of its dimensions: people, planet, and profit. Also, in our work as CLIB team, both terms go hand in hand: a network must be created sustainably in order to meet future require-

### CLIB e. V.

CLIB is a registered association under German law, based in Düsseldorf, NRW. The main bodies of our association are the extended board, the advisory board, and the annual general assembly. Our extended board (see page 33 – 35) has 12 seats, with each group of members (industry, SME, academia, and others) represented by three seats. The extended board meets at regular intervals throughout the year to make strategic decisions, and it elects the executive board of four chairpersons. CLIB receives strategic input from an international advisory board made up of eight experts from academia and industry (see page 36 – 37). The general assembly is called once a year to give members an overview of current activities and strategy and to allow them to comment and provide input. At the CLIB office in Düsseldorf, a staff of seven carries out the cluster work and organisation.

ments. Without strong partners, sustainability cannot be achieved for a complete industry, let alone for a global community.

As a catalyst, CLIB helps to overcome these hurdles more quickly and easily in order to achieve the global circular bioeconomy. Our activities, actions, and projects are centred on five strategic elements that we use to channel our efforts and live up to our mission statement: networking, regulatory framework, technology transfer, scale-up and education (see figure 2).

### Networking

Our networking platform serves as a central repository for project-related information for our members, and acts as a networking tool to prepare our conferences and meetings. Through our networking efforts, we connect our members with one another, along and across value chains, sectors, and disciplines. We also open the cluster to input from external partners and stakeholders, in order to invite new ideas and impulses, thereby providing our members with new opportunities in business, networking, and partnering. At CLIB, we have designed and implemented a structured networking process (see pages 10 – 11) to get the right stakeholders in contact with one another and to provide a fruitful, constructive setting in which to exchange ideas and form project consortia.





Fig. 2: The five elements of the cluster's strategy.

### Framework

Implementation of the bioeconomy and the circular economy needs a supporting regulatory framework on regional, national, and EU levels. CLIB has for years been active at all of these levels to promote the potential of bio-based and alternative feedstocks and bio- (chemical) processes, as well as to help identify technologies and market requirements. Although it is clear that no new sector can survive while being dependent on subsidies, a positive regulatory framework that includes the certification of bio-based products, the use of side streams for the circular bioeconomy, combined chemical-biotechnological approaches, and a focus on cradle-to-cradle product evaluation can speed up the implementation of a sustainable, bio-based economy.

At the moment, there is no level playing field for the circular bioeconomy to compete with existing technologies. The latter have, which have often been directly subsidised, benefitted from regulation and tax benefits, and whose sustainability cost is often being borne by the taxpayer or society as a whole. To help develop to a circular bioeconomy, we need adaptation of new technologies and regulation. Policies should be developed based on facts and allow for timely adaptation to scientific progress (for example with regard to CRISPR novel gene editing technology). To take up these new technologies, industry needs sufficient planning security and a clear regulatory framework in which investments can be made.

### Technology transfer

For a successful bioeconomy, ideas developed in science labs need to be swiftly translated into application. Despite an excellent science scene in NRW, it is still rare for ideas to enter the market. To promote technology transfer, it has proven very important to anchor the idea of entrepreneur-

ship and of creating a spin-off in minds of young scientists at an early stage of their career. We actively support technology transfer from academia to SMEs and industry, for example in the CLIB Competence Centre Biotechnology (CKB). Through our structured networking process, we are able to match technology developers with their downstream value chains and can initiate and evaluate consortia. A very effective instrument for technology transfer can be start-up companies who can explore new grounds flexibly and innovatively. Accordingly, we offer coaching and support to start-ups and give them opportunities to pitch their ideas to relevant stakeholders. We have established ourselves as an important contact point for start-ups. In 2020, we will continue this work within a new project to specifically support start-ups to find the right investors.

### Scale-up

A major hurdle for successful technology transfer is scale-up and demonstration. Even after partners have been found and have all agreed on the further development of a research result, it can be a challenge to scale up a process from the lab to an industrially relevant environment, or even to produce enough sample material for testing a novel molecule or substance. Many ideas and young companies fail in the notorious "valley of death" between laboratory scale and market entry.

In our strategy, we focus on higher-value products, which are relatively easily accessible and can serve as enablers to establish biotechnology in the industry. This lowers the hurdle towards industrial scale and economic feasibility. Even for these relatively small-scale processes however, universities, RTOs, and SMEs don't always have the necessary equipment to achieve the required scale. This is a major hurdle and CLIB is supporting different efforts to overcome it. The CKB is a decentralised organisation to

provide better access to research facilities for academics, speed up process development and interact with SMEs. The Dutch-German Network Circular Bioeconomy also provides support to SMEs by co-financing testing and feasibility studies. Within the HiPerIn 2.0 project we are identifying innovation hurdles to the market entry of high-performance ingredients, we build relevant cross-sectorial networks, and set-up consortia to overcome these hurdles. In addition, we also support enhanced integration with chemical processes and in chemical parks. Furthermore, we always look for additional possibilities to actively support developments to help SMEs and academia to access equipment for testing.

### Education

The most important “resource” for a sustainable circular bioeconomy and its underlying biotechnological landscape are well educated professionals, who are adequately prepared for the challenges ahead. A dedicated education approach is crucial for fields such as biotechnology as well as the circular- and bioeconomy, in which multiple scientific disciplines intersect. Only through specialised initiatives, new professionals can be trained who are experts in their own disciplines but are also able to take a holistic approach to a process, product, or value chain. CLIB especially supports the collaboration of academia and industry in applied research and is working on cross-

border concepts of education in key biobased technologies. For this purpose, new online education concepts are increasingly being used, which have a large international multiplier effect (see page 26).

CLIB provides added value to its members by integrating them into an international network of academia, investors, SMEs, and industry, by building knowledge in relevant topics, markets, and technologies as well as trends in biotechnology and clean technologies. The cluster provides access to specialists in the fields of biology, chemistry, and engineering, and helps to create novel business models through the formation of networks and the analysis of novel value networks in biotechnology and bioeconomy. The formation of tailored consortia, the provision of information on current calls and strategy processes in the field of the bioeconomy and circular economy, and the support of demo or pilot projects and processes help CLIB members to realise new research, demonstration, and innovation projects either in consortia or in bilateral contacts.

In order to fulfil our mission statement, we always seek to ensure that all our projects address two or more of our strategic elements. New projects are measured by how well they fit into the CLIB strategy to add value to our members (see figure 3).

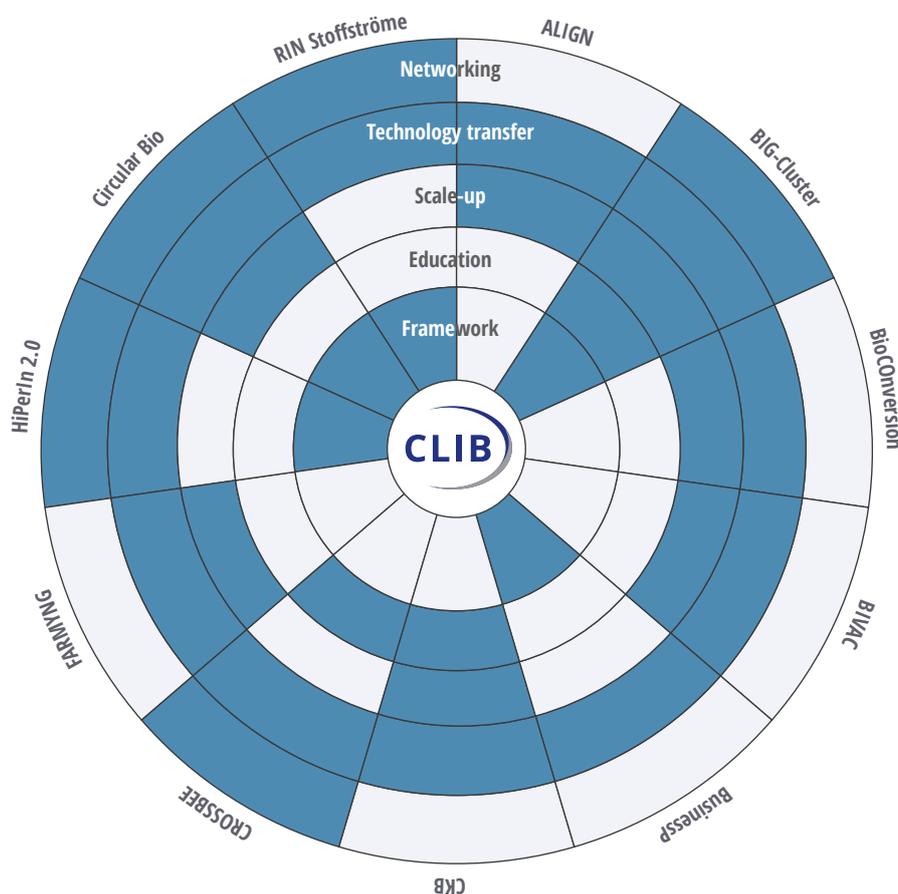


Fig. 3: Classification of projects according to the cluster’s strategic elements. Shades of blue indicate the elements mainly pursued within each project.

## Member Benefits

In the following, we want to highlight some of the benefits we are offering to our members. One important note right at the beginning: every network thrives on the active participation and lively exchange between its members and the organisation. CLIB can only act as a multiplier of your own commitment. The more we are in contact with

our members, the better we can tailor our work to your needs and interests. Please do not hesitate to contact us with your requests. We are always ready to arrange a telephone call, a short visit, or a presentation with your colleagues. Now that your "member duties" have been covered, let us introduce our core benefits.



### CLIB is a networker

We connect our members to each other and create an innovative matrix through carefully chosen additions to our network. Our experience of more than 12 years gives us fast and reliable contacts to partners, experts, and investors. Even in the digital age, personal contact is as important as ever, so we organise numerous events and workshops for our members to meet throughout the year.



### CLIB is a scout

We keep our eyes and ears open for our members. Through our well-developed international and interdisciplinary network, we - as trained scientists - are able to provide information on developments and innovations in the technologies and markets relevant to the circular bioeconomy. We are close to the current and future developments in several initiatives, and keep the wishes and interests of our members in mind.



### CLIB is a globetrotter

We believe that global challenges require international consortia. As one of the BIG-Cluster core partners, we can establish contacts to provide access to Dutch and Belgian partners and fund-raising options. We partner with clusters across Europe and are active in pan-European initiatives. In order to support and further expand the already existing international network, we have, in addition to many other activities, organised delegation trips for our members to many different areas of the world, including China, Brazil, Canada, and Russia.



### CLIB is an advisor

As door opener, we support startups in identifying their intellectual property, developing their business model and finding investors of different risk acceptance and investment volume: we can help young enterprises to cross the infamous "valley of death". We also make efforts to promote and educate future biotechnologists through innovative programs, events, and coaching.

Like many other things, CLIB is in constant evolution. What has not changed over the past years and will not change in the future is our diligence, our trustworthiness, and our enthusiasm to shape the future of the circular bioeconomy together with our members!



#### CLIB is an architect

We turn ideas into projects and innovation into inventions. Not only do we have vast experience in consortium building and grant applications, we can also take the lead and coordinate large projects.



#### CLIB is a catalyst

As a trusted catalyst, we help to identify and reduce existing barriers in innovation processes for the bioeconomy. We bring together "reactants" who would not have taken note of each other under other circumstances.



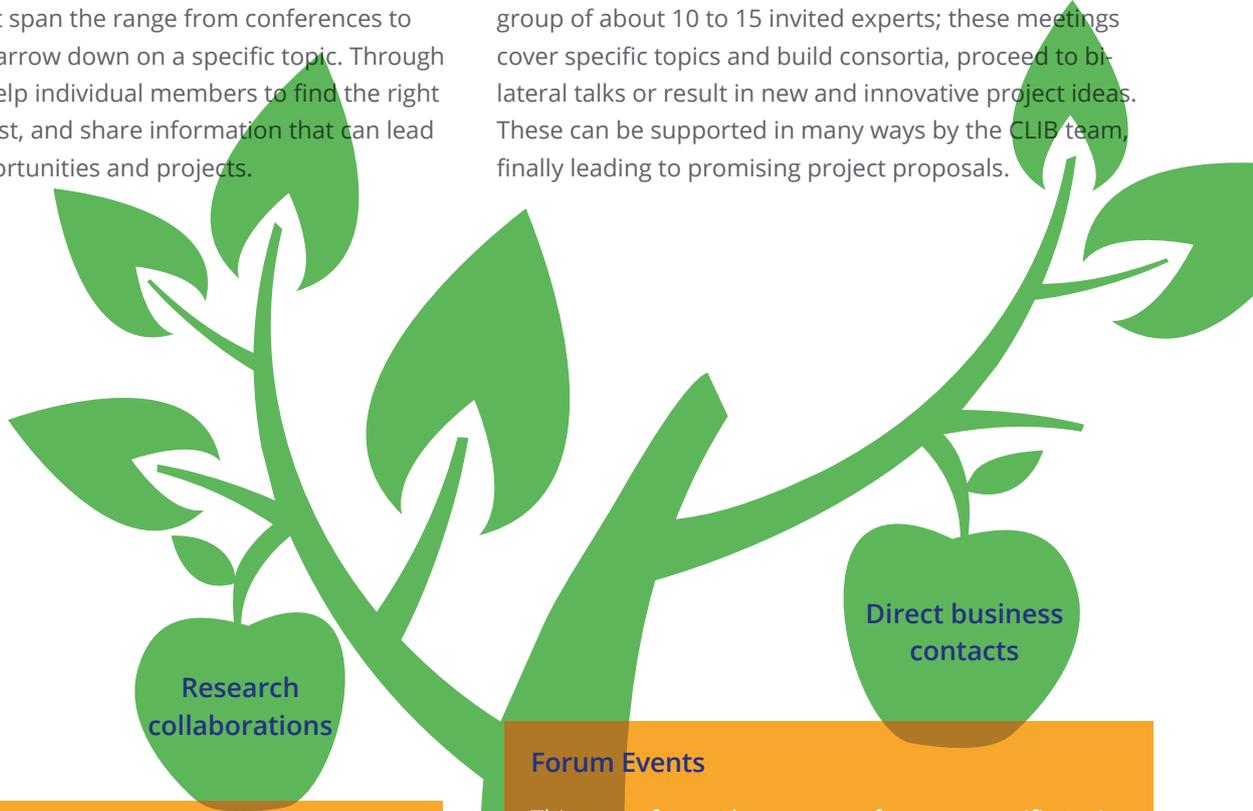
#### CLIB is a translator

Many of our members speak "different languages" – but we have learnt to understand them! We not only mediate between different scientific disciplines and countries, but also especially between industry, science, and investors.

## Structured Networking Process

Our structured networking process is designed to connect our members with one another, along and across value chains, sectors, and disciplines in order to provide a fruitful, constructive setting in which to exchange ideas and to initiate new research and business projects. All this under our claim **networking biotechnology – creating sustainability**. The CLIB team has developed a series of event formats that span the range from conferences to bilateral talks to narrow down on a specific topic. Through this process, we help individual members to find the right partners, build trust, and share information that can lead to new ideas, opportunities and projects.

Our CLIB International Conference showcases emerging trends and connects them to markets. Especially relevant topics are taken up and presented in greater detail during forum events, which usually are attended by 40 to 60 people and are also seen as scouting opportunities for larger companies. They also involve non-members as input-givers. Roundtable meetings are held with a smaller group of about 10 to 15 invited experts; these meetings cover specific topics and build consortia, proceed to bilateral talks or result in new and innovative project ideas. These can be supported in many ways by the CLIB team, finally leading to promising project proposals.



### CIC & CND

Two big events form the framework for the CLIB year. At the beginning of each year, CLIB organises the large CLIB International Conference (CIC), which provides our cluster members, but also all friends and partners of the CLIB network, the opportunity to gain information about new topics and trends, and to exchange ideas about innovative technologies and methods. The conference also offers the possibility to meet face-to-face with the international CLIB family. Before each CIC, the CLIB team identifies the demands of their members and chooses innovative topics to focus on. Through the CIC, a platform for cross-sectoral communication and exchange between different industries and disciplines is created. Afterwards, CLIB analyses the most important topics discussed during the conference and uses this information when planning the subsequent forum events.

Each autumn, CLIB invites all members to the CLIB Networking Day (CND): get to know the other members of the network, and meet old as well as new cooperation partners. After the positive feedback we received in 2019, the CND will now become a permanent fixture in the CLIB event calendar

### Forum Events

This type of event has a strong focus on specific topics and offers a discussion platform that enables all participants to exchange new ideas and innovations on the subjects. Forum events bring together members but also include external stakeholders, which provide an interesting addition and added value to the CLIB network. Topics cover broad fields such as food, feed, cosmetics, home care, or coatings and are discussed on the basis of new technologies, feedstocks, or processes. More structural topics, like the support of start-up companies or education, can also be the subject of a forum. Presentations come from large companies, SMEs, or academia from the CLIB network and beyond. This ensures that at each forum the industry view, new technologies or business ideas, and also cutting-edge science are represented. Forums thus aim to cover the entire value chain, from feedstock suppliers via technology providers to chemical process industry and brand owners. Introducing cross-cutting topics makes these value-chains branch into value-networks.

### Project development

Actors interested in a concrete project idea can be supported by the CLIB team in consortium formation, the more precise specification of a topic, or in the identification of suitable funding opportunities for new project ideas. Finally, we can support the newly formed consortium in writing the proposal to apply for public funding.

R&D&I projects

### Round Table Meetings

Round table meetings usually build on forum events and aim to develop concrete actions to initiate cooperation or collaborations, draft proposals, and projects. Available technologies, industry-relevant applications and cooperation partners are identified by the CLIB team.

Subsequently, discussions are organised in smaller rounds to support the early stage of a direct cooperation. CLIB can act as a mediator of such meetings, highlighting topics, and directing discussion partners in a target-oriented way. Due to the large basis of trust between our members and us, this often happens without an NDA.

Direct business collaborations

Project ideas

### Within an R&D&I project, CLIB can ...

- Support you in drawing up the consortium agreement through its expertise in the CLIB team and in the network;
- Foster the internal communication between the project partners (academic partners, industry, SMEs) and the external communication to stakeholders from the bio-based sector, society, and policy makers by the use of diverse channels (e. g. website content, social media, meetings);
- Spread the innovative outcomes achieved within the project;
- Exploit the project results, e. g. by the assessment of technology transfer models, market chances, and reference customers, or by helping to transfer these results to marketable innovations;
- ... help you make the most of your project!

## In Dialogue with CLIB

### CLIB Networking Day, September 2019

The second CLIB networking day was held directly after the CLIB General Assembly on 4 September 2019. In her opening keynote talk “Possible Contributions of Material Design and Chemo-Catalysis in Future Biorefineries”, Prof. Regina Palkovits from RWTH Aachen University presented several research projects around the question which adaptations in process design are needed when changing from fossil to renewable carbon sources. This switch usually means that the advantage of scale is lost, and that processes may not run at steady-state. Her research group focuses on producing experimental data to perform techno-economic analysis and deciding early on which pathways are worthwhile to be pursued.

Dr. Roland Breves and Thomas Kostka, both from our host Henkel, provided further insights to reasons for switching to bio-based feedstocks or intermediates. In surveys, about a quarter of consumers say they would be willing to pay more for a bio-based product, making them a group of early adopters. Henkel is looking to have more sustainable packaging for its goods, as well as continually improving its products. Thomas Kostka explained that Henkel Ventures seeks to invest strategically, in areas which will be important to the company five to ten years down the line. Henkel, as a multinational with many brands, has 130,000 direct customers and 6,500 customer-facing experts, meaning the company collects a lot of input from its clients.

After lunch, the CND ran in parallel to the final of the CLIB-coordinated student competition G-BiB (see page 26). In two sessions, CLIB members were invited to present their companies and opportunities for collaboration or business with a pitch. The many discussions and chats over lunch and during the breaks showed how active the CLIB community is. We thank Henkel for hosting us at their conference centre, which provided a great meeting space and delicious lunch. The CND will become a fixed event in the cluster’s annual agenda. If you missed out this year, be sure to join us in 2020.

### CLIB Session at the 12<sup>th</sup> International Conference on Bio-based Materials, May 2019

CLIB was the premium partner of the 12<sup>th</sup> International Conference on Bio-based Materials, organised by the nova Institute on 15 and 16 May in Cologne. The CLIB team organised and hosted the session on bio-based fine chemicals in which international experts from academia and industry presented their research and products for emerging markets like food, flavours, body care, and cosmetics.

The session was opened by Dr. Roland Breves from Henkel, who is also a member of CLIB’s executive board. Dr. Breves introduced the requirements biobased materials need to meet in order to be integrated in cosmetic products at Henkel. In addition to availability, cost, and national as well as international regulations, sustainability and consumer acceptance are key factors for Henkel. Babette Pettersen from the US-based SME Ginkgo Bio-works, which designs custom microbes for customers, presented their foundry approach to scale the process of organism engineering using software and hardware automation. Dr. Jacco van Haveren from Wageningen UR / Food and Biobased Research presented his work on biobased surface active ingredients, hydroxy fatty acids, and preservatives and demonstrated the variety of fine and specialty chemicals that can be produced from biobased feedstocks.

Zymergen, another US-based company, was represented by Dr. Cara Tracewell, who impressively showed how Zymergen is mining for enzymes and designing strains by using its large database of genetic diversity, computer science, and automation. Dr. Andreas Worberg from the Danish Novo Nordisk Foundation Center for Biosustainability talked about how to develop a successful bioprocess and how to overcome the valley of death. Dr. Dennis Uebel from ALTANA showed how the company is using bio-molecules as bio-additives, how they are producing additives by biosynthesis and how their bio-experts give support in using biobased feedstocks and analysing additives. Bente Nersten from Borregaard Industries, a Norwegian based company aiming at turning all parts of the wood log into valuable products, talked about their new product SenseFi, a cellulosic texture enhancer. Dr. Marc Struhalla from the



German SME c-LEcta presented their work with synthetic biology and cell-free systems to produce functional food ingredients. Sophie Van Schoubroeck, PhD student at VITO, explained how she is developing a techno-sustainability assessment by using the case study of an algae-based value chain. Hans van Klink from Dutch Sustainable Development talked about the prospects of sustainable production of advanced building blocks from sugar beet.

In 2020, CLIB will support the International Conference on Bio-based Materials again and will be able to offer discounts for CLIB members to visit the conference.

### Visit of a Delegation from China to NRW, May 2019

From 13 to 15 May 2019, CLIB organised a delegation visit for a group of scientists from China visiting NRW. Researchers from QIBEBT, the Nanjing University of Technology, and several associated researchers were eager to learn about activities focusing on biotechnology in North Rhine-Westphalia and to make new contacts among CLIB members to foster future collaboration. The visitors and accompanying CLIB team members visited the Covestro headquarters in Leverkusen to learn about innovative, biotechnologically and chemically synthesized products that the company offers. At Evonik Creavis headquarters in Marl, the group got an impression of how the company is structured, collaboration is fostered and sustainability is pursued. After these two company visits, the day was closed with a typical German dinner at a Brauhaus in Cologne which offered plenty of food and opportunities for intercultural exchange.

On the second day of the delegation trip, CLIB organised a workshop in the framework of the BMC in Cologne where our Chinese visitors had the opportunity to present their own work. The diverse activities in China in the production of biobased products and beyond met the audience's interests and paved the way to further discussions and networking. To complete the visit, the last day focused on academic biotech research in NRW. At IGB-1 of Forschungszentrum Jülich the group learned how photosynthetic bacteria can be used as innovative and sustainable production hosts (introduced by Dr. Drepper) and how microfluidics

can improve the understanding of production processes, by enabling single cell monitoring (Dr. Kohlheyer). At IGB-2, the potential which plants harbour for creating a sustainable and effective bioeconomy was showcased by Dr. Klose. In this context, the algae production site and the automated root phenotyping system were also shown. At RWTH Aachen the groups of Prof. Dr. Schwaneberg and Prof. Dr. Blank were visited. They presented their work on protein engineering by directed evolution, and the production of platform chemicals by organisms subjected to metabolic strain engineering, followed by guided tours through the laboratories.

We at CLIB would like to thank everyone who gave us some of his or her precious time and who helped us to organise a fruitful and interesting delegation trip. And, of course we thank all our Chinese visitors for making the long way to Germany and to share their research focuses with the CLIB community. We are looking forward to making a return visit in late 2020 or early 2021.

### BIOPEN / CLIB Forum "Bio-based Polymers for Textiles", June 2019

Based on the perspective study "Functional polymer and oligomer bio-based products: polymers and bioplastics", prepared within the BIOPEN project, CLIB invited interested stakeholders to a workshop to further discuss the potential of bio-based polymers for textile use. Making the diverse textile industry more sustainable is a huge challenge, but also a chance for new players to develop innovative, bio-based solutions. As yet, only a small percentage of synthetic polymers (which make up half the polymers used in textiles production) are bio-based: while the global polymer production for use in textiles was 43 million tonnes, only 218,000 tonnes were bioplastics. This represents a potential for novel, bio-based solutions, some of which were presented by our speakers at the BIOPEN Workshop / CLIB forum event on bio-based polymers for textiles on 6 June 2019.

After a short presentation of the BIOPEN project and the study by CLIB team members, Dr. Marcel van Berkel gave a snapshot of status, trends, and markets in this field,



prepared by himself and Dr. Willem Sederel, both from Biobased Delta (NL). This cluster organises the annual Natural Fibertastic Workshop. Marcel pointed out the benefits and draw-backs of natural and synthetic fibres, and emphasised that biosynthetic fibres can potentially cause less GHG emissions than fossil-based fibres. At the same time, questions regarding feedstock use, GMO use, and their end-of-life possibilities would need to be addressed.



An industry perspective came from Thomas Michaelis of Covestro. He presented innovative, sustainable, and bio-based polyurethane dispersions for coated textiles; but also gave an overview of Covestro's drivers in sustainability. He emphasised the importance of life cycle analysis (LCA), or other metrics to evaluate a new product or process, but mentioned how time-consuming and costly such analyses are. They are however needed to make business decisions and to convince customers. Developing new polymers for textiles is a highly interdisciplinary endeavour. The newly formed AMIBM (Aachen Maastricht Institute for Biobased Materials) is a research institute spanning the entire value chain: from molecular biology and biobased monomers and polymers, to polymer physics and engineering, to biobased materials for medicine; all supported by a group analysing the sustainability of biobased materials. Prof. Dr. Gunnar Seide, heading the polymer engineering group within ABIBM, presented some impressive work on bio-based additives, such as softeners or flame retardants, colourants, and nucleating agents.

One possible benefit of bio-based textiles is their biodegradability. This has been exploited by the Dutch SME Senbis, which has developed PLA yarn to use in horticultural twine. This allows farmers to sell the plant material at the end of the season to composters, instead of having to pay for the disposal of a horticultural waste mixed with plastics. Senbis is also working on marine biodegradable yarns, which can be used for example for fishing nets.

### Think Tank C1, July 2019

The valorisation of C1 sources is one of the main topics pursued at CLIB. It is one of the three feedstock-to-product flagships of the BIG-Cluster initiative. Carbon monoxide (CO) occurs in large amounts in the exhaust gases of many industries like steel or cement, making it an abundant feedstock for example in the region of Western Europe. The BioCONversion project receives funding from the BMBF to develop a polymer precursor from CO by microbial conversion. Since the possibilities of using C1 feedstocks for the synthesis of both bulk and fine chemicals are varied, CLIB organises Think Tank meetings with experts in C1 conversion technologies from Germany and the neighbouring countries three times a year. Usually 20 to 30 members of this community from academia, SMEs, and industry meet and listen to input talks about a specific topic, current news, and funding options. The participants then discuss possible implications and outcomes and develop ideas for new projects or collaborations.

A novel format was introduced at the July 2019 meeting. Prior to the meeting, all Think Tank members were invited to submit the problems or project ideas they would like to discuss. At the event, CLIB introduced the nine topics collected, out of which the participants chose four to continue with. Besides two technical ideas on electro-biorefinery and biogenic CO<sub>2</sub> production from ethanol or biogas, two non-technical ideas on market demands and social acceptance were chosen. In a following world café format, each topic was assigned to a table host, with the other participants circling around to give input to all ideas. They discussed the problems and hurdles in each topic, articulated the goals to be achieved and the expertise needed. The results of these discussions were presented at the end of the meeting. CLIB is now working with the input in smaller round table meetings to form concrete project consortia.

### HiPerIn 2.0 Forums: Biosurfactants and Digitalisation, November and December 2019

As part of the Exploratory Phase of the HiPerIn2.0 project, CLIB organised two forum events which focused on cross-cutting topics in the bioeconomy: circular economy / sustainability and digitalisation. The first forum, under



the title “Sustainable Personal Care” had presentations covering bio-surfactant production (Prof. Dr. James Winterburn, Holiferm and Dr. Stefan Liebig, Evonik Nutrition & Care), sustainability assessments (Andreas Schonhoff, FZ Jülich), and microplastics (Dr. Melanie Pöhlmann, University of Bayreuth). The challenges in biosurfactant production include the need for co-feeding of sugars and oil to increase yields, as well as the efficient separation of the final product to prevent product inhibition and high downstream processing costs. Both challenges were addressed by the first two speakers: holiferm presented an in-process separation of the sophorolipids and first results of using molasses and waste cooking oil as feedstock. The young start-up, founded by researchers from the University of Manchester, is planning to scale up their production in 2020. As part of a EU-funded BBI project (CARBOSURF), Through metabolic engineering, Evonik has established a high-yield fermentation for a glycolipid with sugar as the sole feedstock.

A more fundamental question in the use of biosurfactants is that of sustainability. While technical challenges in bio-surfactant production and formulation can be addressed by scientists and engineers, sometimes unexpected environmental, economic, and societal impacts can decide whether a new process or product is sustainable or not. To quantify the sustainability, Andreas Schonhoff presented his methods to generate a life cycle sustainability assessment (LCSA). His presentation gave a good overview of the many indicators considered and left the audience with an impression of the enormous complexity of the topic. The last presentation of the forum came from Melanie Pöhlmann, who introduced the new Collaborative Research Centre (SFB) “Microplastic” at the University of Bayreuth. This centre brings together 16 interdisciplinary teams to analyse microplastics in different ways – from determining where it accumulates, to whether it has detrimental effects, to how it can be avoided.

Due to the considerable interest these topics generated, CLIB will pursue both the topic of biosurfactants and of microplastic in further events in 2020.

Digitalisation is a big trend in all industry sectors, and biotechnology is no exception to this. Surveys of our members and partners have shown a considerable interest in how digital innovations will change the way we are doing research, develop products, and work together. Many start-ups, research groups, and networks are working on new tools for biotechnological R&D & I, but getting to know these tools and the people who are driving them, can be difficult. CLIB therefore organised the second HiPerIn 2.0 forum event to introduce some of these innovations and discuss the hurdles and chances of digitalisation.

Klemens Gaida from the digihub Düsseldorf/Rheinland, located close to the CLIB office in Düsseldorf MediaHafen, explained how this MWIDE-funded hub is a matchmaker and accelerator for companies and open innovation. It strives to connect academia, industry, start-ups, investors, and more with each other. Johanna Kleinekorte from the Institute of Technical Thermodynamics at the RWTH Aachen presented her research on identifying sustainable solvents by combining computer-aided molecular design with predictive life cycle assessment. Their service is now also available for companies and groups outside of the RWTH Aachen. Konrad Koch, founder of pantaBio AG, presented their service portfolio and emphasised the potential of standardised processes and methods. The start-up’s digital and smart system aims to simplify the designing of laboratory workflows, and the tracking and sharing of protocols and results. The German Network for Bioinformatics Infrastructure (de.NBI) was introduced by its training coordinator Daniel Wibberg. de.NBI maintains and develops close to 100 software tools and four databases and offers training to support researchers in using these tools efficiently. In 2019 the network gave more than 80 trainings on different topics.

This was just a short review of some of our events organised in 2019. Check the calendar on our website for updates and join interesting events to learn about new developments, enlarge your personal network and find new project opportunities. We also welcome suggestions for new topics from our members.



## Framework

Implementation of the bioeconomy and the circular economy needs a supporting regulatory framework on regional, national, and EU levels. CLIB has for years been active at all of these levels to promote both opportunities as well as the needs of the circular and bioeconomy. This is mainly done through our strong connections with the political stakeholders in NRW and the federal ministries in Germany. But also, our close ties with other German networks and associations like DECHEMA, BIO Deutschland, or BIO.NRW help us to give the bioeconomy a strong voice. Some of our projects with a regional focus like the RIN Stoffströme or the Dutch-German Network Circular Bioeconomy also address the municipal political level. It is in the cities and districts where the foundation of the bioeconomy has to be built. The upcoming structural change in the lignite mining area of NRW is both a demanding challenge as well as an enormous chance. It may result in the transition from the biggest fossil-based power producing region in Germany to a model region for sustainable production and living, based on regenerative energy and the concepts of a circular and bioeconomy. CLIB is engaged in shaping this process that has started in 2019 and will go on until 2036. It will see massive funding with up to 15 bn euros over the course of the next 16 years.

On the European level, CLIB is also present to give its members a voice. As such, we are a founding member of the Biobased Industries Consortium (BIC), the private partner of the Biobased Industries Joint Undertaking (BBI JU) PPP in Horizon2020, and are also active within the Vanguard Initiative “New Growth Through Smart specialisation”. In the latter, CLIB is involved in the pilot project on bioeconomy, specifically in the three demo cases dealing with bioaromatics, waste gases, and biogas. Being part of several Horizon2020 projects (see page 27 – 32) also helps to widen our European network. Without a doubt, the BIG-Cluster Initiative is the most prominent example for our efforts to join forces across borders to push the bioeconomy and to facilitate joint projects and investments.

### RIN Stoffströme

To improve the utilisation of side and waste streams in industry, agriculture, or forestry, the so-called regional innovation network (RIN) “model region for innovative and sustainable material flow” was set up in 2014. The project’s main goal is to improve exploitation of biomass, wastes,

and side streams in the cross-border region of NRW and The Netherlands. The aim of the RIN is to develop feasible concepts for that task through an interdisciplinary approach which also integrates users and society.



That interdisciplinary solutions are required is obvious, when considering how many different scientific areas (e. g., agricultural sciences, biology, biotechnology, chemistry, process engineering, logistics, economics, and social sciences) are addressed. Of course, such interdisciplinary cooperation is a feature of a multitude of research projects and clusters already. But stakeholders such as farmers and representatives from cooperatives, the processing and waste industry, and public administration



are often not yet included in such efforts. The experience within the RIN shows that although including such stakeholders increases the complexity of the work, it can be very rewarding, leading to new approaches and synergies, and even raising new scientific questions.

### Dutch-German Circular Bioeconomy Network

A concept for a circular bioeconomy network linking the Netherlands and NRW with two municipalities as part of the project consortium was developed recently. It was selected for funding by the INTERREG-programme Deutschland – Nederland and starts early 2020. Three core working groups will deal with the topics “regional material flows”, “innovative business models”, and “qualification and training” within a circular bioeconomy. In addition, the

project will offer an innovation coupon scheme for SMEs to further develop their business cases and foster their process development. It further aims to network stakeholders from agriculture, logistics, biotechnology, academia, and the processing industry, as well as municipalities to lay the foundation of a thriving circular and bioeconomy within the cross-border region.



### BIG-Cluster

The BioInnovation Growth mega-Cluster (BIG-Cluster) is a cross-border Smart Specialisation Initiative aiming to make Europe's industrial mega-cluster in the Flanders region of Belgium, The Netherlands, and NRW a global model in comprehensive bio-based value chains. The region has been a powerhouse of industrial innovation for decades and seeks to keep this prominent position in the future bioeconomy. The BIG-Cluster was initiated by the three cluster organisations BE-Basic (The Netherlands), Catalisti (Flanders, Belgium), and CLIB (NRW, Germany) and is backed by Biobased Delta, BIO.NRW, CEF.NRW, Chemelot Brightlands, CleanTechNRW, FlandersBio, and Flanders Biobased Valley.

BIG-Cluster's purpose is to speed up the transition to the bioeconomy and circular economy in the participating regions, to identify and take advantage of critical mass and synergies in public and private R&D as well as in training and education facilities, and to build capacity. One of the long-term goals is to enable pilot and demonstration activities for the production of chemical building blocks and fuels based on alternative feedstocks sourced in the region, such as 2<sup>nd</sup> generation biomass and industrial waste gases. The BIG-Cluster focuses on three feedstock-to-product (F2P) value chains "Aromatics and Fine Chemicals from Woody Biomass" (Biobased Aromatics), "Chemicals from CO and CO<sub>2</sub>" (C1 Bioconversion), and "Aviation Fuel from Various Feedstocks" (Aviation Fuels); and the cross-sectional topic "Circular Economy Education" (Education). In 2018, CLIB initiated three international consortia focused on these topics (see chapter technology transfer and education on the following pages).

These F2P value chains are currently being reviewed and will be expanded and adapted to tackle current needs and still-existing hurdles. The goal is to adopt a novel strategic agenda in 2020.

### CO<sub>2</sub> and CO – Circular economy based on sustainable carbon sources

Within the BIG-Cluster initiative, funded by the German Federal Ministry of Education and Research (BMBF) as part of the "Internationalisation of Leading Edge Clusters" funding programme, CLIB initiated and promoted the development of an internationalisation concept focussing on different key topics in the circular- and bioeconomy. One of these is the conversion of CO and CO<sub>2</sub> into chemicals.

CLIB has brought together more than 50 experts in the context of circular economy based on C1 carbon sources to write the book "CO<sub>2</sub> und CO – Nachhaltige Kohlenstoffquellen für die Kreislaufwirtschaft". The editors Manfred Kircher and Thomas Schwarz, together with the CLIB team, have compiled a German-language specialist literature, which will be published in mid-2020. This book introduces the material use of carbon-containing gas flows, describes the basics of chemical and biotechnological processes for the conversion of CO and CO<sub>2</sub>, and explains the entry into a circular carbon economy.

Climate protection and raw material change require new, sustainable carbon sources for the chemical and fuel industry. In fact, processes that utilise carbon-containing emission and gas streams are now reaching industrial practice. They will also make an important contribution to reduce carbon emissions in Europe and to enter into a circular carbon economy. This book describes the fundamentals of chemical and biotechnological processes for converting CO and CO<sub>2</sub> to chemicals and fuels, and focuses on the different manufacturing industries, industrial sites and regions: Which emission and gas flows offer potential as raw materials? Which processes are already being implemented, tested and developed? Which products can be manufactured from gaseous carbon sources? How can carbon emitting and consuming industries be linked to form new value chains? What is the regulatory framework and what does the ecological footprint look like? These and other questions are discussed in this specialist book.





## BIC

On the EU level, CLIB is present in an advisory role to policy makers regarding the Horizon Europe programme. CLIB is a founding member of the Biobased Industries Consortium (BIC), the private partner of the Biobased Industries Joint Undertaking (BBI JU) PPP in Horizon2020. In this partnership, we see a chance for industry to set out research areas to fill knowledge and technology gaps, to de-risk much needed investment in reaching higher technology readiness levels (TRLs) for biobased processes, and to create a critical mass in bringing the best ideas to bear on innovation in the biobased sector. This means structuring the sector and leading the way to creating a circular bioeconomy in Europe. As a cluster member, we represent several of our SMEs in BIC. We are a member of the programming core team, the newly formed education team, and give active advice on future strategic orientations and work programmes of the PPP.

CLIB was also a founding member of the private partner in the SPIRE PPP, which aims to ensure the development of enabling technologies and best practices along all the stages of large-scale existing value chain productions that will contribute to a resource efficient process industry. Our aim was to make sure that biobased products and intermediates in the process industry are seen as an important way to ensure sustainability, and this was reflected in the SPIRE 2030 roadmap.

## Rheinisches Revier

The structural change in the “Rheinische Revier” has become a defining topic for stakeholders of the bioeconomy and circular economy in our region over the past year. This upcoming process will see the end of lignite mining and initiates a transition from fossil-based to regenerative energy production. It also means a change in economic activity, job opportunities, and land-use changes in the region. A roadmap towards the transformation process, with the aim to establish the Rhenish territory as a future-oriented and sustainable business location, has been developed over the last months, in a process closely supported by CLIB.

By interlinking the concepts of bioeconomy and circular economy in the region, the process of structural change can be given a thematic bracket, through which individual projects can be meaningfully interlinked and efforts by individual actors can be channeled. The active participation

of the public, politics, industry, and the academic world so far clearly shows that there is a great interest across society in using this structural change as an opportunity and as a means to design the future itself. In this, it is essential to use existing network structures so that the dialogue between the actors in and around the Rhenish territory can be started at an early stage. Even if the structural change will foremost affect the area itself, it cannot and must not be seen detached from the surrounding ecosystem in NRW and the neighboring countries of Belgium and The Netherlands. Successful structural change in the sense of a sustainable development of the industrial location and creation of permanent jobs can only be achieved in cooperation with all actors and networks.

Our vision for the region after a successful structural change sees a sustainable economic zone comprising a variety of smart agricultural production on recultivated land, production facilities based on renewable energies, biorefineries connected to existing processes, recycling plants, small-scale production facilities for high-quality ingredients, start-up incubators, and academic institutions. In such a diverse landscape, we see CLIB as the ideal accompanying designer, moderator, and catalyst, always in close exchange with the players in the region and beyond. With the publication of the first version of the economic and structural programme, a first milestone has been reached in creating guidelines for structural change. With the further elaboration of this programme and the first calls for funding, the structural change will remain a main area of action for CLIB in 2020.



## Technology Transfer

Bridging the gaps – transferring technology from academia to industry or from SME to large enterprise – is one of the challenges taken on by CLIB each day.

CLIB brings together stakeholders from academia and industry along the whole value chain in its structured networking process. CLIB moderates the related exchange between academic and industrial stakeholders in order to further the understanding of each other's needs and expectations. One example is to give academia an understanding of market needs, and the required specifications and performance of new products and processes. The goal is to initiate R & D & I projects with defined technology development goals. Moreover, CLIB supports market-oriented technology development by selecting target products in a dedicated process and choosing the appropriate technology approaches, based on market needs. This structured networking process is also showcased on pages 10 – 11.

The exploitation of research results by academic institutions is often limited due to an insufficient technology readiness level (TRL) and a lack of commercialisation strategies. Since the technical and financial risks are high, industry is often hesitant to pick up such ideas for further development. The transfer of research results into commercial applications requires tremendous financial and time efforts as well as diverse scientific and economic expertise. The extraordinary diversity of life science technologies, their areas of application, and the necessary knowledge needed to apply them further complicate technology transfer in this sector.

To bridge this gap and to trigger industrial interest for further development, CLIB supports technology transfer through a multifaceted approach that also involves its strong network of strategic partners. Furthermore, the cluster creates visibility for novel technologies and young companies through presentations at its events and in its publications.



For each project involving technology transfer, a dedicated workflow fitted to the demands of the given topic is developed. CLIB performs value-chain analyses in order to identify available technology approaches, relevant stakeholders, and potential markets. Based on this evaluation, a SWOT analysis elucidates the near-, medium-, and long-term business opportunities of the value chain in focus. To which depth CLIB is able to pursue these analyses depends on its involvement in the individual project and the funding available. As was done in BIG-Cluster, CLIB can help to select one or two technology approaches or concepts of novel value chains with extraordinary potential for commercialisation. For these, tech-transfer strategies

are then developed by evaluating the technology readiness as well as potentials and risks. In addition, CLIB can prepare business models, including calculations of production costs, investments, and revenues as well as estimations of volume availabilities and market shares. Moreover, IP concepts and strategies for further technology developments and strategic partnerships can be designed.

### Novel Value Chains

Catalysing the establishment of novel value chains within the bioeconomy is one of the major tasks of CLIB. Such value chains can form within a given industry or sector, but they are more likely to develop at the boundary of different industrial sectors.

When as-yet individual branches, such as the chemical sector and the pulp and paper sector, start to converge, new value chains will form. This might happen because an enterprise seeks to forward integrate its product portfolio to gain access to later stages of the value chain or to diversify its product portfolio. Examples include agriculture or forestry enterprises starting to develop chemicals in addition to their original products for food and feed or for construction. This is one of the major opportunities of the bioeconomy: creating new business models for agriculture and forestry.

New value chains might also form where previously separate markets start to converge. Examples include the fields of nutraceuticals (convergence of pharmaceutical industry with food industry) and cosmeceuticals (pharmaceutical and cosmetics industry). The nutraceuticals market includes functionalised food and beverages, as well as dietary supplements and is projected to grow at a CAGR of 7.5 % over the period 2019 – 2024<sup>1</sup>. Well-known and developed biotechnology-based examples would be sweeteners as replacements for sugars or valuable fatty acids, e. g. produced by algae.

These often fragmented and still smaller markets are more easy to penetrate by new biotechnological processes not yet developed at large scale. Smaller-scale but high-value products offer the chance to find a niche to be profitable with a new bio-based or biotechnological process, even offering business cases for pilot or demo projects. In this regard, such specialties can be enabling products for long-term markets of bulk chemicals and fuels.

The aforementioned developments typically emerge from market pull. Technology push can also create novel value chains. Especially in rather young ecosystems such as the bioeconomy, technological breakthroughs can be the force behind the formation of completely new services and products. For instance, the ability to utilize gaseous substrates on a commercial scale to produce platform chemicals such as ethanol, opened up new value chains integrating biotechnology, chemicals, and the steel industry.

As mentioned in this example, another kind of market pull also plays an important role: a regulatory framework. While this is not new, it has taken on a new dimension as countries across the globe have committed in the Paris Agreement that anthropogenic global warming should be kept to less than 1.5 °C. Although the process is slow, a rising spectrum of society and individual citizens demanding action on climate change, from demonstrations against lignite mining, to the Fridays for Future strikes or Extinction Rebellion demonstrations, will in the long run lead to regulatory frameworks raising the price of carbon emissions, and limiting the use of fossil-based resources. Although the COP25 in Madrid has to be acknowledged as a set-back in the fight against global warming, the European Union is poised to make its own way. In December 2019, the EU heads of state met in Brussels and agreed to make the union “climate neutral” by 2050. To achieve this aim, the European Commission revealed a “European Green Deal”, which, if it becomes law, will commit at least 25 % of the EU’s long-term budget to climate action. Many companies are already pledging carbon neutrality or at least significant reductions within the decade. Regulation can also play a strong role in forcing new value

chains to emerge through direct interventions. The ban on BPA in certain products has led to a shift in the use of additives for the plastics and coatings industry and we can expect this drive towards substances with less impact on human health and the environment to continue. These regulations often come with long lead times, enabling a slow shift towards new products, but increasingly these are introduced more quickly as with the ban on single-use plastic. CLIB aims to anticipate these regulatory effects, enable members to act on them and with its partners to advise both industry and policy on their effects.

It is in the fields just described that CLIB aims to offer a radar for new developments and opportunities. In close interaction with our members from industry and academia, we try to depict markets that show interesting developments, inform about political regulations, or identify technologies with a high innovation potential. Currently, CLIB focuses on the following near-term markets because they show dynamic growth rates and offer opportunities where biotechnological processes can provide advantages over chemical routes:

<p><b>Personal &amp; home care</b></p> <ul style="list-style-type: none"> <li>• Biodegradability</li> <li>• Cosmetics</li> <li>• Cosmeceuticals</li> <li>• Flavours and fragrances</li> <li>• Surfactants</li> </ul>	
<p><b>Food, feed &amp; nutrition</b></p> <ul style="list-style-type: none"> <li>• Alternative protein sources</li> <li>• Crop protection</li> <li>• Flavours and fragrances</li> <li>• Nutraceuticals</li> <li>• Supplements</li> </ul>	
<p><b>High performance materials</b></p> <ul style="list-style-type: none"> <li>• Adhesives</li> <li>• Coatings</li> <li>• Functionalised surfaces</li> <li>• Packaging</li> <li>• Textiles (fibres)</li> </ul>	

In addition, process technology and education are two focus topics at CLIB because they have the potential to create further technology push for the bioeconomy. We consider bulk chemicals as well as fuels and energy to be long-term markets for biotechnology that we keep an eye on but which are not a priority in our cluster.

<sup>1</sup> Global nutraceuticals market - growth trends, and forecast (2020 - 2025), Mordor Intelligence

## HiPerIn 2.0

One of the strengths of biotechnology is the conversion of functional starting materials into high-quality products. This area of high-performance ingredients ("HiPerIns") ranges from specialty chemicals through the cosmetics and food industry to the pharmaceutical sector. During the original HiPerIn project coordinated by CLIB, essential networks and projects could be initiated in this area from 2016 to 2019. However, global challenges, disruptive innovations, and changing framework conditions have made it necessary to design a revised, science-based concept to shape the next generation of bio-based high-performance ingredients: HiPerIn 2.0. Although HiPerIn 2.0 will still focus on some of the most prominent HiPerIns such as flavours, fragrances, adhesives, and coatings, the rapid change in biotechnology must also be reflected in the project.

During the initial exploratory phase of HiPerIn 2.0, new cross-cutting issues have been identified and evaluated. Examples include the increasing digitalisation of biotechnology, the idea of a circular economy, the end-of-life debate, and increased regulatory requirements. The exploratory phase has provided concrete answers in these areas as helping to sharpen the concept, involving new actors in sectoral boundaries, and making scientific additions to the current approach. To do so, CLIB has used its many years of experience, its scientific expertise and its established network to collect the interests of the stakeholders and merge them into a promising concept for a later realisation phase. In the course of the last six months, CLIB has used a series of events and an online survey to obtain the input of a broad sector-spanning group of stakeholders to focus on the most pressing topics in the upcoming realisation phase. As such, machine learning, biodegradability, and strategies to avoid microplastic pollution will surely be tackled within the project.



### CLIB-Kompetenzzentrum Biotechnologie

Within the first HiPerIn project, CLIB developed a plan for a Competence Centre to combine the necessary experience and speed up technology transfer. The project CLIB-Kompetenzzentrum Biotechnologie (CLIB-Kompetenzzentrum Biotechnologie – CKB) was granted within the research infrastructure initiative by the German state of NRW and started in May 2018. This virtual centre had been proposed by four academic members of CLIB: Bielefeld University, TU Dortmund University, Heinrich Heine University Düsseldorf, and the Forschungszentrum Jülich. The CKB builds on the previously funded separate technology platforms at the institutions, which will now be integrated into a joint centre to develop biotechnological processes in a holistic approach. CLIB anchors this centre within its network and the region. The project is aiming at speeding up technology developments by integrating all process steps allowing for parallel optimisation of the process. It will focus on the three megatrends resource efficiency, raw materials, and health in three work packages, which will all be implemented across the CKB's locations and disciplines.



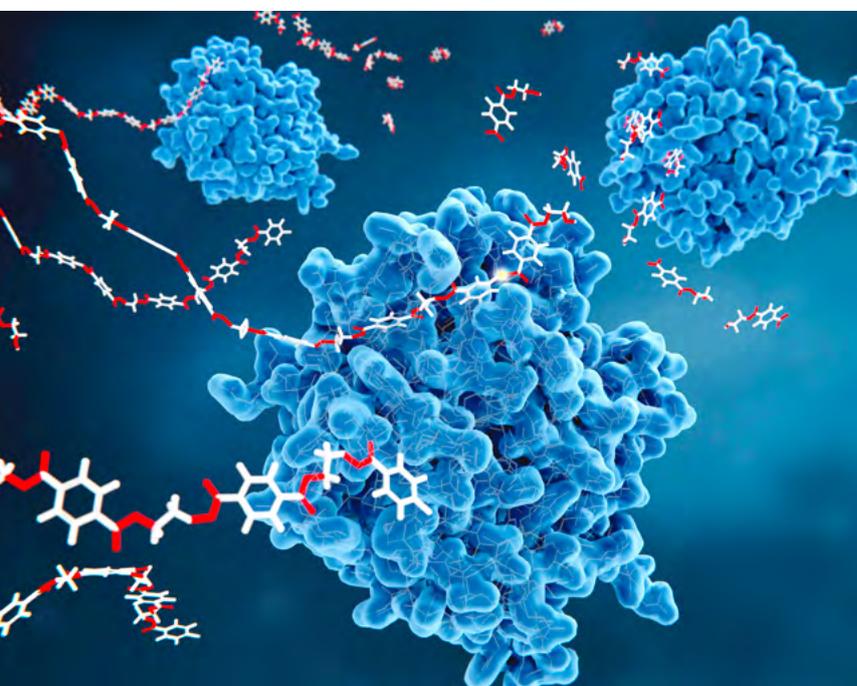
## CKB

CLIB-Kompetenzzentrum  
Biotechnologie

### BioBase4SME

Technology transfer is essential to bring innovations into the market: it is needed to support the development

of ideas generated in the lab into future processes and products. The BioBase4SME project provided crucial support for SMEs who want to upscale their processes. It provided vouchers for a diverse range of services, but also supported SMEs through information events such as workshops, trainings, and forums. During these events, CLIB and all BioBase4SME partners fostered the networking of diverse stakeholders and thus facilitated technology development. By providing partly or fully funded vouchers for technical and non-technical services, the project supported SMEs in bridging the valley of death. Services offered by the project were technical services such as scale-up and industrial proof of concept and non-technical services like business coaching or life cycle assessment.



The BioBase4SME project has actively supported technology transfer by granting more than 73 services to 63 SMEs, giving 19 workshops and 11 trainings for SMEs in Europe and supporting 56 entrepreneurs from eight countries in three one-week innovation biocamps for intensive mentoring and training. Although the project ended in August 2019, a strong relationship has been formed between the consortium partners and CLIB will stay part of this network to connect its members with the service-providers and networks across North-West Europe.



### RIN Stoffströme

Within RIN Stoffströme, novel value chains from side streams of agriculture and processing industries are being investigated. The findings of an INTERREG study that analysed potential resource streams in the cities of Krefeld (DE) and Venlo (NL) and their surrounding areas led to the subsequent project BIVAC (Bio value chains for novel value-added products and compounds) which addresses the implementation of innovative bioeconomy value chains in the region. It was awarded funding within the INTERREG Programme Deutschland – Nederland and has a project volume of 2.4 million EUR. Aiming at resource efficient, environmentally sound, and sustainable production, this industry-driven project addresses the development of novel, economically viable products and processes based on waste streams originating from agriculture (e. g. grass, vegetables), horticulture, forestry, and food industry. Envisioned products include health-promoting food additives, fermentable sugars for the production of high-value compounds like astaxanthin, enzymatically optimized feed-additives, as well as fruit flavours to reduce large-scale on-field production and to lower CO<sub>2</sub> emissions. The consortium brings together partners from industry and academia located at different positions in the value chains of the agricultural and food/feed industry.



A further project is called “Business Case Evaluation: P-Retrieval from renewable sources” (BusinessP), funded by the Ministry of Economic Affairs, Innovation, Digitalisation and Energy of NRW. It deals with the valorisation of phosphates from the press cakes of oil crops. It follows an interdisciplinary approach, analysing the

technical as well as the economic feasibility of this novel value chain. Within the Business-P project, the work group of Dr. A. J. Ruff from Institute of Biotechnology headed by Prof. Dr. U. Schwaneberg at RWTH Aachen University investigates the extraction of phosphorous from rape seed press cake and meal. Their expertise in protein engineering is applied to generate tailor made enzymes for the P-recovery strategy. RWTH provides key data for economic assessments. Prof. Dr. S. Bröring, chair of Technology and Innovations Management in Agribusiness at University of Bonn, analyses the new emerging value chains, valorisation potential, market entry and the patent landscape. CLIB arranges the dissemination by organising workshops that identify valorisation potentials and facilitate a transfer of the generated data into industrial follow-up projects.

### Dutch-German Circular Bioeconomy Network

Several stakeholders of the RIN Stoffströme have developed a concept for a border-crossing network, integrating companies, academic institutions as well as municipalities in Limburg (NL) and NRW. Led by CLIB in Germany and the Bio Treat Center (BTC) in the Netherlands, this project involves nine organisations (two municipalities, three companies, one academic institute, and three networks) working together to create novel value chains in the circular and bioeconomy in the region. It features three core working groups dealing with the topics “regional material flows”, “innovative business models”, and “qualification and training”. In addition, the project will offer an innovation coupon scheme for SMEs to further develop their business cases and foster their process development.

### BIG-Cluster Project BioCOnversion

Increasing greenhouse gas emissions and the associated consequences for the climate and the environment make a change in our thinking not only necessary, but vital. While the fossil energy sector constantly produces large amounts of GHG emissions, those produced as by-products of the



processing industry also come at a constant quantity. Of these, CO-containing process gases from steel mills are among the most relevant industrial side streams. In a paradigm shift, these process gases can be considered valuable feedstock streams. They could feed the biotechnical production of building blocks currently produced from petrochemical processes, such as mid-chain carbon compounds with multifunctional groups. Making these important components and products from waste streams instead of fossil resources would be a major step to establish a sustainable bioeconomy.

The process under investigation in the BioConversion project starts with the primary conversion of CO-containing process gases from the steel mills of ThyssenKrupp Steel Europe into an intermediate through gas fermentation, followed by an enzymatic upgrading to the polymer precursor. In a first project phase, the individual process steps were experimentally tested independently of each other. Now, in the second project phase, the most promising approaches will be combined and the composition of the overall process will be developed step by step. The process performance of the different steps will then be evaluated by techno-economic assessments and life cycle analysis. Based on these results, the overall process will be experimentally validated and further optimised. The final process evaluation will be undertaken from a techno-economic viewpoint along the whole development chain. BioConversion unites several innovative providers of conversion and recovery technologies into a powerful consortium covering the entire value chain – producing a high-value building block from a CO-based, climate friendly process.



## BIG-Cluster Project ALIGN

The production of aromatics is crucial for the chemical industry: they present a significant share of today's chemical building blocks, are used for a wide variety of applications across the chemical industry, and their growth rate is expected to be proportional to GDP growth. Currently, virtually all aromatic building blocks are produced from fossil oil. However, the availability of aromatic hydrocarbons from fossil sources will decrease, as less crude oil will be refined for energy use. Instead, the production of chemical building blocks from (shale) gas increases, but this process has a much smaller BTX (benzene, toluene, xylene) stream. The resulting gap between supply and demand can be met by using bio-based, renewable feedstocks for the produc-



tion of aromatics. This is addressed in the BIG-Cluster project ALIGN. It targets highly functionalised bio-based aromatics, which can be used in many different fields of applications, such as coatings, adhesives, or cosmetics. To produce them it is essential to establish lignin extraction processes which maintain the structure and functionality of lignin, and combine them with innovative chemical and biotechnological conversion routes. Conventional lignin extraction processes are often optimised towards the fractionation and purification of cellulose for pulp production. In this case, lignin is regarded as a by-product with only poor quality, meaning an undefined structure and a low degree of functionalisation. In order to make biorefineries profitable and optimally use the biomass feedstock, it is essential to convert also the lignin into high-value products. The use of lignin extraction processes which maintain the structure and functionality of lignin, in combination with innovative chemical and biotechnological conversion routes enable the production of functionalised bioaromatics.

The ALIGN project not only addresses the issue of using bio-based feedstock instead of fossil-based resources to create products with high market potential, but also demonstrates the successful collaboration of different regions and disciplines to establish an innovative value chain. Partners with great expertise in chemical but also in biological conversion technologies focus on the conversion of woody biomass to lignin and subsequently to bio-based functional aromatics. By bringing together stakeholders from academia (technology providers) and industry (brand owners/end consumers) and by fostering an active communication between these different parties, obstacles in the establishment of the value chain can be quickly identified when they arise. All stakeholders together can then define measures to overcome these hurdles. Such cooperation is crucial when adapting a technology to the industry's needs and when a fast market entry is desired.

## Scale-up and Demonstration

In biotechnology, the path from initial experiment to industrial process bridges many orders of magnitude. While the first trials and screenings often take place at the bench on the microliter scale, cubic meters often have to be fermented in an industrial bioprocess. An increase in volume of over eight orders of magnitude is not uncommon. For clarity: this is equivalent to adapting the weight of a toy car to that of a bucket-wheel excavator. It can easily be understood that scale-up is a major hurdle, especially for the realisation of new bioprocesses.

Apart from these scientific and technical challenges which need to be overcome, financing is also a hurdle. At the latest on the demonstration scale, large financial investments are necessary, which often exceed the possibilities of small businesses. This is one reason why larger biotechnological processes are still rare in Europe. Another reason is the lack of experience regarding important process steps for large biotechnological processes (whereas knowledge about chemical processes is much greater).

To establish biotechnology in the industry, CLIB focuses on higher-value, smaller-scale products, which are relatively easily accessible and can serve as enablers. But even for these relatively small-scale processes, universities and RTOs do not commonly have the necessary equipment of the required scale. CLIB's strategy therefore calls for a timely involvement of the industry in research projects in order to integrate the industrial perspective at an early stage and to identify and develop scalable processes. The regular exchange of experience is vital to ensure that not each project "reinvents the wheel" and wastes valuable time and resources. Additionally, the cluster supports the integration of biotechnological and chemical processes, as well as the realisation of processes in chemical parks. CLIB has considerable expertise in projects helping SMEs and academia to access equipment for testing, for example in the CKB or the now completed BioBase4SME project. In the latter project, CLIB has also been active in helping SMEs to overcome non-technological barriers, for example through access to innovation bootcamps or professional training. CLIB aims to continue this support for SMEs and start-ups, to cross the valley of death between a validated process in pilot scale and the commercial process.

### BIG-Cluster

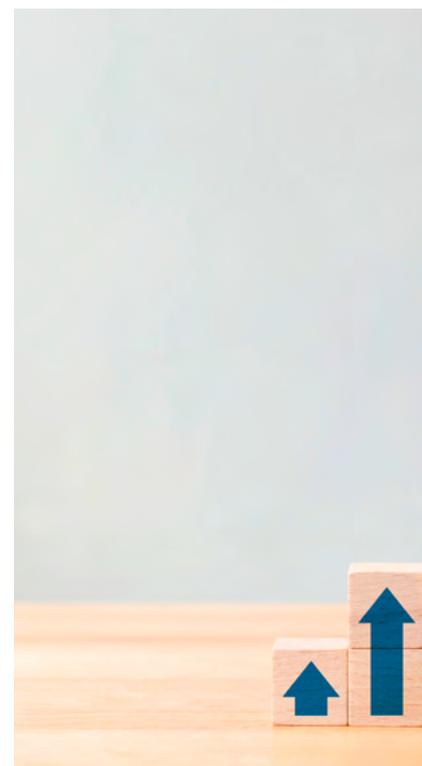
An essential element of the circular bioeconomy is the efficient conversion of renewable non-food resources into chemicals in biorefineries, in order to reduce our dependency on fossil resources and to reduce the carbon footprint of many production processes. The BIG-Cluster region of Flanders, The Netherlands and NRW is Europe's leading industry region with a notably strong chemical industry. The BIG-Cluster initiative aims to establish novel

value chains within the topics "Aromatics and Fine Chemicals from Woody Biomass" and "Chemicals from CO and CO<sub>2</sub>". Within the project BIG-Cluster funded by the German Federal Ministry of Education and Research (BMBF), the implementation phase started in 2018 with the realisation of the projects "ALIGN - Bio-based Aromatics from LIGNin" and "Bioconversion of CO/syngas into a plastic precursor". Both projects aim to establish economically viable biotech processes, ready to be scaled up to commercial scale in the future.

### CLIB-Competence Centre Biotechnology

The CLIB-Competence Centre Biotechnology (CLIB-Kompetenzzentrum Biotechnologie – CKB) aims at offering an integrated infrastructure for the bioeconomy in NRW: From gene and enzyme to process and product. The integration of all process steps – upstream - fermentation - downstream – will shorten the time from idea to market entry and thus enable a faster and more efficient upscaling of biotechnological processes. More than 30 working groups from the Heinrich Heine University Düsseldorf, the TU Dortmund University, the Forschungszentrum Jülich, and Bielefeld University are working on the three megatrends resource efficiency, raw materials, and health. They aim to develop new technologies and protocols to overexpress, secrete, and immobilise proteins and enzymes to make biotechnological processes even more selective and efficient. A bioeconomy needs to be able to use a variety of feedstocks as raw materials, and researchers in the CKB are working to improve the efficiency of conversion and downstream processing. Researchers in the megatrend of health are harnessing and combining the advantages of both biological and chemical conversions by combining muta- and semisynthesis to diversify potentially active products for healthcare and the food market.

In the diverse research projects carried out within the CKB, the scientists aim to integrate individual units of operation. They want to establish a close interaction in order to generate a continuous feedback and whole-process evaluation between feedstock preparation, catalyst and process development, as well as downstream processing. This will enable the CKB to shorten the time to develop a biotech process and drive towards scale-up.





The integration of an industrial advisory board and an IP board ensures that the academic research carried out within the CKB answers market demands and can be commercialised in a comparably short time period.

#### BIG-Cluster Project ALIGN

Aromatics represent a significant share of today's chemical building blocks used for a wide variety of applications in fields such as polymers, adhesives, coatings, resins, surfactants, anti-oxidants, and cosmetics. Currently, aromatic building blocks are mainly produced from fossil resources, but this BTX feed-

stock stream will decrease in future. Also, the development of less toxic, natural molecules to replace toxic, synthetic ones, is strongly supported by consumer demand and regulations. The only large source for biobased aromatics is the abundant natural polymer lignin, but this is currently only used in limited amounts. Conventional lignin extraction processes are often optimised towards the fractionation and purification of cellulose for pulp production, leading to a low-quality lignin. It has an undefined structure and a low degree of functionalisation and is mainly burnt for heat production. However, a biorefinery should seek to also convert lignin into high-value products, in order to optimally use the biomass and to optimise revenue. To date, the production of high-quality aromatics from lignin fractions with a high degree of functionalisation and defined structure is only possible in small scale.

The ALIGN project focuses on the scale-up of three different, innovative extraction processes that each lead to a high-value lignin fraction and a pure cellulose / sugar fraction. These lignin fractions differ in their composition with regard to the degree of depolymerisation and functionalisation. From these different lignin derivatives, a wide variety of bio-based aromatics with unique properties can be produced through specific downstream processing strategies, which harbour great potential for a wide variety of applications in the aromatics sector ranging from fine chemicals to bulk products. One of the high-value products is natural vanillin for food and beverages. Project partners will aim to scale-up not only the lignin extraction, but also the production of natural vanillin. They benefit from a close interaction within the project, and the expertise each partner brings. Several project partners already have

experience and equipment to scale-up to industrial scale, while others bring in their background in downstream processing. Direct interactions with companies intending to use the resulting molecules in applications means the consortium is able to plan all steps of the processes holistically and to incorporate economic parameters.



#### FARMYNG

The Biobased Industries Joint Undertaking (BBI JU) is the only support instrument funding the up-scaling of biotechnological processes to an almost commercial scale. Its flagship projects provide funding of between 12 – 20 million euros to consortia which build first-of-a-kind plants at pre-commercial level. So far, BBI has funded 10 flagships, with two more expected to be selected in 2020. CLIB is a member of BIC, the private partner in the PPP BBI.

FARMYNG, a consortium led by the French start-up YNSECT, aims to establish the largest global fully-automated flagship industrial plant to produce premium proteins from beetles (*Tenebrio molitor*) for animal and fish nutrition. CLIB is happy to be one of the 20 partners, which come from eight countries and ensure that the entire value chain needed for such a scale-up is represented. These include feedstock and larvae producers, companies specialising in automation, and labs specialised in the analytics necessary to ensure the identity and good health of the beetles, but also to verify the final product specifications. The consortium also includes end-users who will utilize the final products. YNSECT is the start-up behind the YnFarm™, and has grown from a start-up in 2012 to over 100 employees and 175 USD in investment in 2019. It now coordinates the project, which has 19.6 million euros of funding.

The FARMYNG project is expected to build a fully automated industrial vertical plant for insect-ingredients production: the YnFarm™, able to produce a wide range of sustainable products from beetles: protein meal, oil, and organic fertilizer. It will demonstrate the techno-economic viability of the first full-scale industrial plant for the production of sustainable and alternatively-sourced proteins. It will also establish new bio-based value chains from agriculture by-products to the production of fish feed and pet food products and, in parallel, to valorise insect manure for the production of organic fertilizer. CLIB will, together with the clusters IAR and WPCC, ensure the dissemination of the project's results. CLIB will also analyse how feedstock from beetles can in the long term be used in the chemical industry.

# Fostering Biotechnology by Promoting Interdisciplinarity and Entrepreneurship

The Cluster

Education

The Projects

The People

The Members

## Interdisciplinarity

Biotechnology and bioeconomy are wide-spanning fields, intersecting multiple scientific disciplines and engineering. Future bioeconomy experts will need a broad knowledge of multiple disciplines and have to be able to take a holistic view of a process or technology. These competencies can only be acquired via a tailor-made education approach. CLIB is fostering such training and education by collaborating with different partners from its network.

Within the BIG-Cluster project CROSSBEE (Cross-border Bio-Economy Education), a consortium of nine partners has developed and produced a Massive Open Online Course (MOOC) about Biobased Products for a Sustainable (Bio)Economy, available at edX.

CLIB also serves on the education team of the Biobased Industries Consortium (BIC). This will work towards different education programmes for the bio-based industry in Europe, aiming to meet the demand for students and professionals with the right skills and competences.

The CLIB-Competence Centre Biotechnology (CKB) is coordinated by Bielefeld University. The consortium members Bielefeld University, Heinrich Heine University Düsseldorf, TU Dortmund University, and the Forschungszentrum Jülich were all part of the very successful CLIB-Graduate Cluster Industrial Biotechnology, which ran from 2009 to 2015 and awarded over 120 doctoral degrees. Within the CKB, several doctoral students are active and CLIB is responsible for the scientific exchange not only between the group leaders, but also these students.

CLIB cooperates with the Bioeconomy Science Center (BioSC) in co-organising the Annual PhD Student Day Bioeconomy, which brings together students from all over NRW and is supported by several other graduate programmes.

## Entrepreneurship

CLIB also wants to foster entrepreneurship in Germany and Europe. Innovation and new technologies need young scientists enthusiastic about developing their research into a marketable idea. CLIB is active in promoting such an entrepreneurial spirit and in helping students to learn how to evaluate business ideas from an economic perspective.

CROSSBEE does so via the G-BiB, the Global Biobased Businessplan Competition. This competition for bachelor, master, and PhD students asks the teams to develop an innovative business plan based on a design for a sustainable production process for bio-renewable products. During the competition, the teams learn to write a business plan and pitch their idea, and are individually mentored by experts. The first G-BiB took place in 2017, with students



from Germany, the Netherlands, and Brazil. Winners were the Brazilian team SANergy, which received the Corbion-sponsored award of 10,000 euros at the finals during the 3<sup>rd</sup> Brazilian BioEnergy Science and Technology (BBEST) Congress. In 2019, the G-BiB took place for a second time with several teams from Germany and Belgium. The German team EBS – Engineering Biosurfactants won the G-BiB 2019: a sparring day at the High-Tech Gründerfonds as well as 7,500 euros prize money sponsored by Henkel. In 2020 the G-BiB will be held for a third time and CLIB is planning to include even more countries this time.

The EBS team describes their experience during the G-BiB: *“In March 2019, we, two PhD students from the University of Stuttgart and Fraunhofer IGB, were encouraged by our supervisor to join the G-BiB 2019 competition. The motivation was to build a concept for a business plan, inspired by 10 years of experience in microbial biosurfactants. Shortly after our proposal was accepted, we were tasked with preparing our first pitch. At this point we realised that we did not yet have a name for our company. After days of brainstorming, we finally came up with one that sufficiently described our business idea: EBS – Engineering Biosurfactants. The first pitch took place at CLIB in April, and was followed by several workshops on business planning, self-marketing and pitching. We were joined by a third team member, an MSc student in business chemistry, and improved our business plan with data from market research. Thanks to the guidance of our supervisor, who is an expert in the biosurfactant field, and the intense mentoring organised by the team of G-BiB, we were successful: we were selected as the German finalists. During the finals in September 2019, we had the chance to pitch our business idea in front of a jury of biotech business experts and CLIB members. Our vision for EBS is that our novel biosurfactants will be used in sustainable and environmentally friendly cosmetics and detergents in the market. To follow our vision, we are currently working on technical and regulatory aspects, as well as networking.”*

## Overview of Current CLIB Projects

### ALIGN – Aromatics from LIGNin



Funded by:	German Federal Ministry of Education and Research (BMBF)
Duration & volume:	2018 – 2021, 1.8 M EUR
Partners:	Axxence Aromatic, CLIB*, Fraunhofer CBP, LXP Group, Phytowelt GreenTechnologies, UPM Biochemicals (all DE); KU Leuven, VITO (both BE)
Responsible at CLIB:	Sarah Refai, Tobias Klement, Annika Thamm
Website:	<a href="http://www.bigc-initiative.eu/align.php">www.bigc-initiative.eu/align.php</a>

The ALIGN Project started in April 2018 and combines experts in the field of bio-based aromatics from academia and industry. It deals with the conversion of lignin to bio-based aromatics with a high market value. The consortium consists of three partners with extensive expertise in lignin extraction and depolymerisation (Fraunhofer CBP, KU Leuven, LXP), one partner conducting downstream processing procedures (VITO) and three partners focusing on potential applications (Axxence Aromatic, Phytowelt Green Technologies, UPM Biochemicals).

Project coordination as well as dissemination is managed by CLIB. In the short term, the consortium aims for the production of natural vanillin from lignin. In the long run it is expected that the product spectrum can be broadened, once the optimal lignin extraction / depolymerisation and downstream processing procedures are identified.

### BIG-Cluster – BioInnovation Growth mega-Cluster



Funded by:	BMBF
Duration & volume:	Scoping phase (2016 - 2017), 722,000 EUR Implementation phase (2018 - 2021), 3 M EUR
Partners:	3 dedicated R & D projects with multiple partners CLIB (DE), Biobased Delta (NL), Catalisti (BE) (scoping phase) and seven additional clusters
Responsible at CLIB:	Katrin Kriebs
Website:	<a href="http://www.bigc-initiative.eu">www.bigc-initiative.eu</a>

The BioInnovation Growth Mega-Cluster (BIG-Cluster) is a cross-border “Smart Specialization Initiative” aiming to transform Europe’s industrial mega-cluster in the Flanders region of Belgium, The Netherlands, and the German state of North Rhine-Westphalia into the global leader of the bio-based economy.

Within the BMBF project, the first two years constituted a scoping phase, within which the value chains “C1 gases to chemicals” and “Aromatics from lignocellulosic biomass”, and activities for bio-based education were investigated. In 2018, three projects coordinated by CLIB and funded by the BMBF started: ALIGN, BioCONversion and CROSSBEE.

The BIG-Cluster initiative will not stop there, but will develop a new strategy for 2020.

\*coordinator

## BioCOConversion – Bioconversion of CO into a plastic precursor

Funded by:	BMBF
Duration & volume:	2018 – 2021, 1.5 M EUR
Partners:	CLIB*, Covestro, Fraunhofer IME, Fraunhofer UMSICHT, nova-Institut, Ruhr University Bochum, RWTH Aachen University, thyssenkrupp Steel Europe AG, VDEh Betriebsforschungsinstitut (all DE); TU Eindhoven, Wageningen University (both NL); TU Graz (AU); BBEPP, VITO (both BE)
Responsible at CLIB:	Sarah Refai, Annika Thamm
Website:	<a href="http://www.bigc-initiative.eu/bioconversion.php">www.bigc-initiative.eu/bioconversion.php</a>



The project BioCOConversion started in April 2018 and aims at developing and implementing a sustainable process from carbon monoxide (CO) to a defined polymer precursor by evaluating different technologies. In an international consortium, industrial and academic partners join their high-level, multidisciplinary expertise to develop a microbial bioconversion process comprising the primary conversion of CO/syngas into an intermediate alcohol through gas fermentation and the enzymatic upgrading conversion into the polymer precursor. The project focusses on developing technologies for the individual process steps and on the conceptual design of the overall process. In a first phase, the individual process steps will be independently developed. Then, their performance will be evaluated by techno-economic assessments and life cycle analysis. Based on these results, the overall process will be experimentally validated and further optimised. A final process evaluation will be done from a techno-economic viewpoint along the whole development chain.

BioCOConversion is coordinated by CLIB and unites several innovative providers of conversion and recovery technologies – making a high-value building block available from a CO-based, climate friendly process.

## BIVAC – Bio-value chains for novel high-value products and compounds

Funded by:	INTERREG Deutschland - Nederland
Duration & volume:	2017 - 2020, 2.4 M EUR
Partners:	Phytowelt GreenTechnologies*, CLIB, Rhine-Waal University of Applied Sciences (all DE); Biorefinery Solutions, BioTreatCenter – Greenport Venlo, Grassa, NewFoss (all NL)
Responsible at CLIB:	Dennis Herzberg
Website:	<a href="http://www.bivac.eu">www.bivac.eu</a>



Aiming at resource-efficient, environmentally sound, and sustainable production, this industry-driven project addresses the development of novel, economically viable products and processes based on waste streams originating from agriculture (e. g. grass, vegetables), horticulture, forestry, and food industry. Envisioned products include health-promoting food additives, fermentable sugars for the production of high-value compounds like astaxanthin, enzymatically optimized feed-additives, as well as fruit flavours to reduce large-scale on-field production and CO<sub>2</sub> emissions. In the consortium, partners from industry and academia located at different positions in the value chains of the agricultural and food/feed industry are brought together.

\*coordinator

## BusinessP – Business Case Evaluation: P-Retrieval from renewable sources



<b>Funded by:</b>	Ministry of Economic Affairs, Innovation, Digitalization and Energy of NRW (MWIDE)
<b>Duration &amp; volume:</b>	2018 – 2020, 629,000 EUR
<b>Partners:</b>	RWTH Aachen University*, University of Bonn, CLIB (all DE)
<b>Responsible at CLIB:</b>	Dennis Herzberg, Tobias Klement
<b>Website:</b>	<a href="http://www.biotech.rwth-aachen.de/go/id/omvt">www.biotech.rwth-aachen.de/go/id/omvt</a>

Phosphorous is a finite resource of outstanding economic and social importance, which is currently exclusively obtained by rock mining. Phosphorous is mainly used in fertilizers (80 %) but its higher value-added products or uses are manifold and comprise e. g. melting salts, food additives, metal processing, street construction, or fire protection agents. The reduction of rock phosphorous use and replacement by phosphates from renewable resources would enable the closing of the phosphorous cycle and an efficient P-management. An emerging field is the enzymatic production of green phosphate by processing of feed plant material and food manufacturing side products (oilpress cakes and plant meals).

The aim of the Business-P project is to answer the questions whether, at what cost, and in which valorisation products, processes using organically bound phosphorus, and related recycling strategies of this valuable resource, are economical. Within the Business-P project, the work group of Dr. A. J. Ruff from Institute of Biotechnology headed by Prof. Dr. U. Schwaneberg at RWTH Aachen University investigates the extraction of phosphorous from rape seed press cake and meal. Their expertise in protein engineering is applied to generate tailor-made enzymes for the P-recovery strategy. RWTH provides key data for economic assessments. Prof. Dr. S. Bröring, chair of Technology and Innovations Management in Agri-business at University of Bonn, analyses the new emerging value chains, valorisation potential, market entry, and the patent landscape. CLIB arranges the dissemination by organising workshops that identify valorisation potentials and facilitates a transfer of the generated data into industrial follow-up projects.

### CLIB-Competence Centre Biotechnology



<b>Funded by:</b>	European Regional Development Fund (ERDF) and MWIDE
<b>Duration &amp; volume:</b>	2018 – 2021, 8 M EUR
<b>Partners:</b>	CLIB, Forschungszentrum Jülich, Heinrich Heine University Düsseldorf, TU Dortmund University, Bielefeld University* (all DE)
<b>Responsible at CLIB:</b>	Katrin Kriebs, Annika Thamm
<b>Website:</b>	<a href="http://ckb.cebitec.uni-bielefeld.de">ckb.cebitec.uni-bielefeld.de</a>

The CLIB-Competence Centre Biotechnology is a multi-site joint project fostering a sustainable, resource-efficient economy in North Rhine-Westphalia, performed by Bielefeld University, TU Dortmund University, the Heinrich Heine University Düsseldorf, and the Forschungszentrum Jülich.

The aim of the CKB is to provide an integrated infrastructure for the bioeconomy in NRW: from gene and enzyme to process and product. The CKB will – based on previous experience – build up a multi-site, integrated centre. Through this, it will establish innovative technologies in NRW and bring them to a first scale of application. The CKB addresses the lead markets Life Sciences and Health and fills a gap in integrated process design.

As a subcontractor, CLIB is responsible for the coordination of public relations and the integration into the local, national, and international economy via SMEs and industry.

\*coordinator

## CROSSBEE – Cross-border Bio-Economy Education

Funded by:	BMBF
Duration & volume:	2018 – 2021, 186,000 EUR
Partners:	b.experts GmbH, CLIB*, Ostwestfalen-Lippe University of Applied Sciences and Arts, RWTH Aachen University, SeSaM Biotech GmbH (all DE); Ghent University (BE); Delft University of Technology, Wageningen University (both NL)
Responsible at CLIB:	Katrin Kriebs, Annika Thamm
Website:	<a href="http://www.bigc-initiative.eu/crossbee.php">www.bigc-initiative.eu/crossbee.php</a>



CROSSBEE will tackle the challenge of combining diverse disciplines and expertise in different fields relevant for bioeconomy under the coordination of CLIB within a three year project funded until 2021. CROSSBEE will implement two activities in the BIG-Cluster region:

Within the Massive Open Online Course (MOOC) “Biobased Products for a Sustainable (Bio)economy”, students from all over the world learn bioeconomy basics and discover state-of-the-art biobased product examples. The MOOC was published in January 2019.

Within the student competition Global Biobased Business Plan Competition (G-BiB), the student teams will be individually trained in competencies and skills relevant for entrepreneurship and thus learn to think outside the scientific box.

## Dutch-German Network Circular Bioeconomy

Funded by:	INTERREG Deutschland - Nederland
Duration & volume:	2019 – 2022, 992,000 EUR
Partners:	CLIB*, EE Energy Engineers GmbH, Hochschule Niederrhein - University of Applied Science, Stadt Krefeld, WFG Wirtschaftsförderungsgesellschaft Krefeld, USV Agrar - Unternehmensberatung & Sachverständigenbüro Dr. A. Becker (all DE); Bio Treat Center, Brightlands Campus Greenport Venlo, Gemeente Venray (all NL)
Responsible at CLIB:	Dennis Herzberg, Sabine Kortmann

This project will establish a lively network for the circular and bioeconomy linking the Netherlands and NRW. It is funded by the INTERREG-programme Deutschland-Nederland and features three core working groups dealing with the topics “regional material flows”, “innovative business models”, and “qualification and training” within a circular bioeconomy. In addition, the project will offer an innovation coupon scheme to SMEs to further develop their business cases and foster their process development. It aims to network stakeholders from agriculture, logistics, biotechnology, academia, and the processing industry, as well as municipalities through numerous events, inspired by CLIB’s structured networking process. The network will create new cross-border value chains, business models, and collaborations.

\*coordinator

## FARMYNG – FLAGship demonstration of industrial scale production of nutrient Resources from Mealworms to develop a bioeconomy New Generation



Funded by:	Horizon2020, BBI JU, BIC
Duration & volume:	2019 – 2022, 19.6 M EUR
Partners:	ŸNSECT* (France), 20 project partners from across Europe, including CLIB
Responsible at CLIB:	Tatjana Schwabe-Marković
Website:	<a href="http://www.farmyng.eu">www.farmyng.eu</a>

Beetles are protein-rich and can be sustainably farmed, with a relatively light environmental footprint in terms of production and processing. The use of insect protein is already allowed in pet food and feed for aquaculture. The EU-funded FARMYNG project will develop on an industrial and automated scale the breeding and transformation of the *Tenebrio molitor* insect (mealworm) for the production of animal nutrition and fish nutrition. It will demonstrate a bio-based value chain for sustainable, safe, and premium feed products. The project aims to produce 1,500 tonnes of protein and 400 tonnes of oil per month – rates never before demonstrated in the insect protein production market. CLIB is a project partner, tasked to disseminate the projects results and to support business model development.

## HiPerIn 2.0 – Shaping the next generation of bio-based High Performance Ingredients



Funded by:	MWIDE
Duration & volume:	2019, 59,000 EUR (exploratory phase)
Partners:	CLIB (DE)
Responsible at CLIB:	Tatjana Schwabe-Marković, Katrin Kriebs, Annika Thamm, Tobias Klement

The successor of the HiPerIn project continues the focus on high performance ingredients (HiPerIns), but expands to consider the rapidly changing cross-cutting topics biotechnology is facing nowadays. These include for example challenges of a circular economy and an end-of-life debate, as well as digitalisation and increased regulatory requirements.

With the close involvement of its members and new key players, CLIB aims to make biotechnology able to face these current challenges in a strong and agile manner and to create sustainable business in NRW. Therefore, CLIB carries out a series of scientific research and events (forums, workshops, ...) to identify the most relevant topics, which will be developed later in a planned realisation phase.

\*coordinator

## RIN Stoffströme – Model Region for Innovative and Sustainable Material Flow

Funded by:	Ministry of Culture and Science of the German State of NRW (MKW)
Project term & volume:	1 <sup>st</sup> phase, 2014 – 2016; 2 <sup>nd</sup> phase 2017 – 2020, 450,000 EUR (phase 2)
Project partners:	CLIB*, Deutsche Gesellschaft für Abfallwirtschaft, EnergieAgentur.NRW (all DE)
Responsible at CLIB:	Dennis Herzberg, Sabine Kortmann
Project website:	<a href="http://www.stoffstroeme.de">www.stoffstroeme.de</a>



To improve utilisation of side and waste streams in industry, agriculture, or forestry, the so-called regional innovation network (RIN) “model region for innovative and sustainable material flow” was set up in 2014. The project’s goal is to improve exploitation of biomass, wastes, and side streams in the region. Using this approach, the RIN addresses the grand societal challenges of resource scarcity and climate change.

In order to achieve a better utilisation of biomass as well as side and waste streams, several hurdles must be tackled. Initially, concrete resource potentials in the region have to be defined. In this regard, aspects such as, for example, seasonal availability, energy density, and ownership of the feedstocks must be considered. The RIN Stoffströme also seeks to identify practical hurdles for using biomass and waste streams for the production of intermediates for the chemical industry. A close and continuous dialogue with practitioners from waste management companies, farmers, municipalities, and processing industries is necessary to define these hurdles, which can be of a technical, regulatory, or societal nature.

\*coordinator

## Members of the CLIB Extended Board

### Dr. Karl-Heinz Maurer – Chairman

Karl-Heinz Maurer is Chairman of the CLIB Board. In 2019, he co-founded the start-up Aachen Proteineers. From 2011 to 2019, Dr. Maurer was part of the Senior Leadership at AB Enzymes GmbH, where he held positions including Director of Business Development and Regulatory Affairs, Head of Global Business Organisation (Marketing and Sales), Director of Global Marketing, and Head of Regulatory Affairs and Special Projects. From 1986 to 2010, he worked in different positions in the Henkel organisation (including Cognis Biotechnology), starting in R & D Biotechnology, which he directed from 2000 to 2010 as Director Biotechnology (Corporate, later Laundry and Home Care division).

Karl-Heinz Maurer is a biochemist and microbiologist by training and received his doctorate from the University of Tübingen in 1994. He was co-founder and Chairman of the Board of the Industrieverbund Mikrobielle Genomforschung (now Industrieverbund Weiße Biotechnologie) until 2018. In 2009, he received an honorary professorship from the University of Greifswald.



### Dr. Roland Breves – Vice Chairman



Roland Breves currently is Head of Corporate Microbiology of Henkel AG & Co KGaA in Düsseldorf, which as a corporate function acts for all business units, as Cosmetics, Laundry and Home care and Adhesives. After studying chemistry and obtaining a PhD in microbiology (on chitinases from *Streptomyces*) in Hannover, he worked as a post-doc at the IPK Gatersleben on plant cell wall degrading enzymes.

After joining Henkel in 1997 (initially in COGNIS Biotechnologie GmbH), he was responsible as head of laboratory for the development and expression in *Bacillus* of detergent enzymes. In 2000, he joined the microbiology department as project leader „Smart Hygiene“. Topics were non-biocidal mechanisms against microbes and their negative impacts, e. g. malodour and biofilm formation, as well as prebiotic cosmetics.

In addition to these explorative and classical microbiological topics, the department develops innovative concepts for biomaterials like adhesive bioconjugates. Roland Breves is active in several national and international expert groups (DIN, CEN, DECHEMA, AISE).

### Prof. Dr. Karl-Erich Jaeger – Vice Chairman

Karl-Erich Jaeger received a Staatsexamen in biology and chemistry and a PhD in microbiology from Ruhr-Universität Bochum in Germany. In 1995, he obtained the *venia legendi* for microbiology with a habilitation thesis on bacterial lipases. Karl-Erich Jaeger is co-founder and served as chairman of the management board and member of the scientific advisory board of the biotech company evocatal GmbH (now evoxx technologies GmbH). In 2002, Karl-Erich Jaeger was appointed as Professor for Molecular Microbiology at the Department of Biology of Heinrich Heine University Düsseldorf and director of the Institute of Molecular Enzyme Technology. In 2013, he was additionally appointed as director at the Institute of Bio- and Geosciences IBG-1: Biotechnology of the Helmholtz-Forschungszentrum Jülich.

His research interests focus on bacterial enzymes and fluorescent proteins, their biochemical and structural characterization as well as their biotechnological applications. He has published about 200 peer-reviewed papers, several text book chapters and a textbook; he is co-inventor on about 20 patents and member of various scientific organisations, editorial and advisory boards.



### Hans-Jürgen Mittelstaedt – Treasurer

After his studies of law at the Universities of Bonn and Freiburg, Hans-Jürgen Mittelstaedt worked as an attorney in Düsseldorf from 1988 to 1992. In 1992, he joined the Association of the Chemical Industry (VCI) at the department of environmental legislation.

He held several positions in Frankfurt and Brussels before he became CEO of VCI NRW, the Association of the Chemical Industry in North Rhine-Westphalia. In this position, he is also CEO of BPI NRW, the Association of the Pharmaceutical Industry in North Rhine-Westphalia.

Hans-Jürgen Mittelstaedt is one of the founding members of CLIB and has been holding a position in the extended board since the foundation of the cluster.



### Prof. Dr. Ludo Diels

Prof. Ludo Diels, Dr. in chemistry & biotechnology, works at the University of Antwerp, and is senior advisor Sustainable Chemistry for the Flemish Institute for Technological Research (VITO) in Mol, Belgium. He is the vice-chair of the Industrial Research and Innovation Agenda Group of the Public Private Partnership SPIRE/CCNI (Sustainable Process Industry by Resource and Energy Efficiency/Circular and Climate Neutral Industry) bringing together 8 large industrial sectors (chemistry, steel, cement, minerals, non-ferro, engineering, ceramics, water) and he is member of the SPIRE-BBI JU working group.

He is strongly involved in the set up of a biobased economy in Flanders and Europe, and the collaboration between Europe and India on bioeconomy and water business. He is a founding father of the Shared Research Centre on Bio-aromatics (BIORIZON), BIG-Cluster and the Vanguard Initiative on Interregional Smart Specialisation. He is also working on the combination of bio- and circular economy with a strong emphasis on the use of wood and wood residues (strong focus on lignin) for integrated applications in many sectors with a first focus on construction materials.

### Dr. Thorsten Eggert

Thorsten Eggert is Managing Director of ERBER Enzymes GmbH in Dortmund, Germany. Furthermore, he is responsible for Business Development & Scouting at EFB, ERBER Future Business, the in-house incubator of the ERBER Group located in Getzersdorf, Austria. He studied biology at the Ruhr University Bochum and received his PhD at the Institute for Biology of Microorganisms in 2001. Subsequently, he established the Directed Evolution Research Group at the Institute for Molecular Enzyme Technology at the Forschungszentrum Jülich, which he headed until accomplishing his habilitation in molecular microbiology at the Heinrich Heine University of Düsseldorf in 2007. In 2006, Thorsten Eggert co-founded the company evocatal GmbH. As Managing Director (CEO), he developed evocatal, which was renamed into evoxx technologies in 2016, into a leading provider of enzymes for the chemical and pharmaceutical industries as well as the food and animal feed sector. In 2017, he achieved the company sale to the global enzyme manufacturer Advanced Enzymes Technologies Inc., India. Since 2019, Thorsten Eggert works for the ERBER-Group.



### Dr. Henrike Gebhardt

Henrike Gebhardt advocates the research and innovation interests of Evonik Industries AG in the European policy environment since 2015. She maintains the relationships of Evonik with European institutions and international associations such as CEFIC, SusChem, A.SPIRE aisbl, and Bio-based Industries Consortium (BIC).

Henrike Gebhardt holds a PhD in biochemistry from the University of Cologne, an engineering degree in biotechnology from the Technical University of Berlin, and studied at AgroParisTech (then Institut National Agronomique Paris-Grignon), France and Technion, Israel. Henrike Gebhardt began her professional career within the strategic research unit Creavis of Evonik Industries AG (then Degussa AG) in 2006. As project manager, she was in charge of the development of biotechnological processes for the production of surfactants and nutraceuticals. In 2012, she moved to the Corporate Innovation Unit of Evonik to bundle strategic and communicative aspects of the Bioeconomy and to advocate for the interests of Evonik in EuropaBio, CEFIC, EU-RRM, DIN, and CEN.

### Dr. Claas Heise

Since April 2008, Claas Heise is responsible for technology and innovations investments at NRW.BANK in Düsseldorf, Germany. He heads the venture capital activities of NRW.BANK, including several venture funds focused on the German state of North Rhine-Westphalia, as well as fund-of-fund activities sponsoring a number of regionally focused seed capital funds. From 2006 to 2010, Claas Heise was a partner at Innovature Capital Partners, an advisory and venture capital, secondary services firm. From 2002 to 2006, he was managing director for T-Venture of America. He joined Deutsche Telekom in 1995 and held a variety of management positions. He helped to found the enterprise software start-up TRAIAN and joined TRAIAN in October 2000, where he led the partnership business development efforts. Claas Heise joined T-Venture in Bonn, Germany, in 2001. He received his PhD in physics and worked for seven years in science, including a postdoc fellowship at Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass., USA.



## Dr. Gernot Jäger

Gernot Jäger is heading the Competence Center for biotechnology within Covestro. He joined Covestro (formerly Bayer MaterialScience) in 2012 and held different responsibilities in Innovation Management, Process Research, Project Portfolio Management, and the Competence Center for Catalysis. Up to now, he has contributed in various public committees including GDCh (sustainable chemistry, board) and VCI (renewable resources).

Gernot Jäger studied biotechnology at RWTH Aachen University and received his PhD (summa cum laude) in biochemical engineering from the "Aachener Verfahrenstechnik" in 2012. His research areas include industrial biotechnology, pharmaceutical biotechnology, process development/conceptual design, and bioanalytics.



## Prof. Dr. Georg Oenbrink

Georg Oenbrink studied chemistry at the University of Bremen and received his PhD in 1987 in the group of Prof. Dr. Detlef Gabel. Between 1987 and 2002, he held different responsibilities in Product Management, Application Technology, R & D, and Innovation Management within the Business Line High Performance Polymers at Hüls AG and Degussa AG. From 2002 until March 2010, he was Senior Vice President within the Business Line High Performance Polymers, which became part of Evonik Industries AG in 2007. From April 2010 until August 2017, Georg Oenbrink was Senior Vice President Innovation Networks & Communication within Corporate Innovation of Evonik Industries AG. He is founder and Chief Executive Officer of CREAGO Solutions UG, a business strategy, innovation, and technology management consultancy and service providing company focussing on small and medium sized enterprises. Georg Oenbrink holds a honorary professorship at the University of Applied Science in Aachen.



## Dr. Peter Welters

After studying biochemistry in Germany and doing his doctorate at the Max-Planck-Institute for Plant Breeding Research in Cologne, Peter Welters spent three years at the University of California, San Diego, and two years in Rouen, France, as a postdoc. In 1998, he founded Phytowelt GmbH in Nettetal and in 2002 was appointed CEO of GreenTec GmbH, a spin-off company of the Max Planck Institute in Cologne.

In January 2006, both companies merged to form Phytowelt GreenTechnologies GmbH with Peter Welters as CEO. The company offers contract research in the fields of agrobiotechnology and industrial biotechnology. In addition, the company developed and sales an enantiomerically pure and natural raspberry flavour, R-alpha-Ionon, which is produced in a bio-fermentation process. In 2018, Phytowelt was awarded the "Most Innovative European Biotech SME Award" by EuropaBio in the category of agricultural biotechnology. Peter Welters is also a founding and board member of CLIB and a board member of GFPI.



## Prof. Dr. Volker F. Wendisch

Volker F. Wendisch holds the Chair of Genetics of Prokaryotes at the Faculty of Biology at Bielefeld University. Since 2010, he is member of the board of the university's Center for Biotechnology (CeBiTec) and speaker of its research area "Metabolic Engineering of Unicellular Systems and Bioproduction". He served as Senator of Bielefeld University, Vice-Dean of Biology from 2014-2016, and Dean of Biology 2016-2018. Volker F. Wendisch received his diploma in biology from Cologne University. After having completed his PhD at the Institute of Biotechnology 1 of the Forschungszentrum Jülich in 1997, he worked as postdoctoral researcher at University of California, Berkeley, CA, USA. In 2004, he received the *venia legendi* in microbiology from HHU Düsseldorf. From 2006 - 2009, he was Professor for Metabolic Engineering at the University of Münster. His research interests concern genome-based metabolic engineering of industrially relevant microorganisms, systems and synthetic microbiology. Currently, he coordinates the multi-university ERDF.NRW-funded research infrastructure "CKB - CLIB Kompetenzzentrum Biotechnologie".



## Members of the CLIB Advisory Board

### Dr. Kai Baldenius

Kai Baldenius is a chemist by formation. After having received a PhD from Hamburg University, he spent a post-doc research year at The Scripps Research Institute, and then joined BASF in 1993. At BASF, Kai served in various positions in Research, Process Development, Production, Marketing & Sales. From 2009 to 2018 he led BASF's Biocatalysis research group. In September 2019, Kai has left BASF to become an independent consultant for applied biotechnology. Baldenius Biotech Consulting offers advice to venture capital and young start-ups for best technology positioning.



### Dr. Stefanie Kesting

Dr. Stefanie Kesting is a top leader in finding & building up transformational businesses for companies which need to decarbonize their portfolio. Her track record is more than 15 years of identifying sustainable businesses and making them scalable. She founded and leads on the key global initiatives to transform industries into carbon-neutral strategies and businesses.

As Director Innovation at Uniper, she is since early 2016 responsible for the identification and development of scalable new business for transformation.

Since November 2017, Stefanie is the founding President of CO<sub>2</sub> Value Europe, Europe's key industrial Association dedicated to Carbon Capture and Utilisation (CCU). Stefanie is also a Member of the Advisory Board of the Global CO<sub>2</sub> Initiative, Michigan, USA, since its founding in 2018. Between 2013 and 2016, Stefanie was part of the management team of Connecting Energies, a new E.ON company building sustainable B2B solutions business. Stefanie holds academic degrees in business & management (Dipl.Kffr.) from the University of Cologne, and a PhD in Economics from International University Bremen.



### Dr. Manfred Kircher

Based on more than 30 years experience in chemical industry and bioeconomy, Manfred Kircher works on regional as well as international bioeconomy strategies. His career milestones are biotechnological research and development (Degussa AG, Germany), production (Fermas s.r.o.; Slovakia), venture capital (Burrill & Company, USA), biotechnology partnering, and branding (Evonik Industries AG, Germany) and building the bioeconomy cluster CLIB. Since 2019, he is member of the board of the bioeconomy association „Bioökonomie im Ballungsraum“ (bioeconomy in a metropolitan region). Manfred Kircher is owner of KADIB, a company consulting on important aspects of industrial bioeconomy.



### Dr. Dr. h.c. Christian Patermann

Christian Patermann studied Law, Economics, and Languages in Germany, Switzerland, and Spain and completed his doctoral thesis in law at the University of Bonn in 1969. He entered the German public service in 1971 by joining the Federal Ministry of Science and Education. From 1974 to 1978, he was Science Counsellor at the German Embassy in Washington D.C., USA. He then returned to the Ministry of Research and Technology, where he held many positions in Germany and in international organisations, like ESA, ESO, and EMBL. In 1996, he joined the European Commission, DG Research and Technology and was appointed Director for Environment and Sustainability. In January 2004, he was named Programme Director for Biotechnology, Agriculture & Food Research, where he was responsible for launching the Knowledge based Bioeconomy in the European Commission. He also served for four years as co-chair in the EC-US Task Force Life Sciences and Biotechnology Research. He retired in 2007, but remains active in advising public and private institutions and companies on European affairs and the Bioeconomy. He was a member of the 1st German Bioeconomy Council from 2009 – 2012.



**Dr. Willem Sederell**

Willem Sederell is a chemical engineer and polymer scientist from the University of Technology Twente in Enschede (NL). He completed his education *cum laude* and did a post doc on biomedical materials at Case Western Reserve University in Cleveland, Ohio. In 1977, he started his industrial career with Shell in Amsterdam, and then moved to General Electric where he fulfilled global leadership roles in process, product and application development and marketing. His last role before retiring from his 36 year career in industry was global innovation leader with SABIC. Willem joined Biobased Delta in 2013 as director and chairman. Since April 2016, he is responsible for the international activities within the Board.

Willem is also the founding father of the Green Chemistry Campus in Bergen op Zoom that opened in September 2011. Willem contributed to the transition agenda biomass and food in the Netherlands. For many years, he is member of the Policy Group Innovation of the Dutch Chemical Branch Organization VNCl and member of the Advisory Board of Biorizon, the shared research centre for the development of bio-aromatics.

**Prof. Dr. Ulrich Schwaneberg**

Ulrich Schwaneberg graduated in chemistry (in 1996) and received its PhD (in 1999; supervisor Prof. R. D. Schmid) from the University in Stuttgart. He was, after a post-doc at Caltech in the lab of the Noble laureate Prof. Frances H. Arnold, appointed as Professor at the Jacobs University Bremen in 2002. In January 2009, he moved to the RWTH Aachen University as Head of the Institute of Biotechnology and is since 2010 co-appointed in the Scientific Board of Director at the DWI Leibniz Institute for Interactive Materials. Furthermore, he has been appointed in the board of directors in the Bioeconomy Science Center, serves as Speaker of the RWTH profile area Molecular Science & Engineering and coordinates for the RWTH rectorate RWTHs' bioeconomy activities in the "Strukturwandel". He is a cofounder of the companies SeSaM Biotech & Aachen Proteineers and has a special interest in protein engineering to provide tailored protein building blocks for the biological transformation of material science and production. In 2016, Ulrich received the BMBF-Forschungspreis for the next generation of bioprocesses and has published >260 original manuscripts and is coinventor on >20 patents (mostly with industry).

**Dr. Thomas Schwarz**

Thomas Schwarz was member of the executive board of CLIB until 7/2019. Since July 2019, he serves as CSO/CTO and member of the executive board of bitop AG, Dortmund. He co-founded the company in 1993 and held positions as leader of the R & D department, CEO, and head of the Board from 1993-2009. From 2015 until June 2019, he was member of the executive board of b.value AG. From 2009 to 2014, Thomas was CEO of instrAction GmbH in Mannheim, Germany and from 2014 to 2016 the part-time CSO of the company. He is co-founder of b.experts, b.value AG, and SenseUp.

Thomas Schwarz obtained his PhD from the University of Witten / Herdecke in 1993. He has held a position in the board of BioIndustry e. V. and serves as an advisor for several committees (e. g. NRW Bank). Since 2006, he holds a teaching position in chemical engineering (bioprocess engineering) at TU Dortmund University. He is also working in the field of coaching start-ups and in technology transfer and is a reviewer in two BMBF calls.

**Prof. Dr. Kurt Wagemann**

Kurt Wagemann studied chemistry in Munich and received his PhD in 1989 at the Max-Planck-Institute of Quantum Optics. Since 1989, he headed some of the large departments at the DECHEMA, e.g. for congresses as well as for research management and administration. Beside this, he held the position of the executive director of ProcessNet (a joint venture of DECHEMA and VDI – The Association of German Engineers) in Frankfurt. In 2010, he took over the position of DECHEMA's executive director.

He regularly operates as an expert for the evaluation of research institutions and is currently chairman of the life science jury for the EXIST programme of the BMWi (Federal Ministry of Economics and Energy). He serves as a member of advisory boards of research institutes and networks, e.g. as head of the scientific advisory board energy at the Karlsruhe Institute of Technology. In February 2011, he was appointed honorary professor at the University of Stuttgart, where he fulfils a teaching assignment on "Technical Chemistry and Technical Biochemistry – Biorefineries" since 2006. Furthermore, since 2010, he gives lectures at the University of Magdeburg in the field of "Chemical Processes - Renewable Raw Materials".

## The Team of the CLIB Office



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**Annika Thamm**

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## Large Industry

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Covestro Deutschland AG  
Evonik Industries AG  
Henkel AG & Co. KGaA  
LANXESS Deutschland AG

## Medium-scale Enterprises

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Corbion NV  
Mitsui & Co. Deutschland GmbH  
Pfeifer & Langen GmbH & Co. KG

## Small-scale Enterprises

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Aachen Proteineers GmbH  
Aquila Biolabs GmbH  
Autodisplay Biotech GmbH  
Axxence Aromatic GmbH  
b.fab GmbH  
b.value AG  
Bio Base Europe Pilot Plant BV  
Biomillenia SAS  
Bioprocess Pilot Facility  
biotechrabbit GmbH  
bitop AG  
Blucon Biotech GmbH  
Carbon Minds GmbH  
c-LEcta GmbH  
Concord Blue Engineering GmbH  
Corvay GmbH  
DASGIP Information and Process Technology GmbH  
Dutch DNA Biotech BV  
Ecotradex GmbH  
ERBER Enzymes GmbH  
evoxx technologies GmbH  
Heinrich Frings GmbH & Co. KG  
Holiferm  
INOSIM Consulting GmbH  
Isobionics BV  
Jäckering Mühlen- und Nahrungsmittelwerke GmbH  
Kuhner Shaker GmbH  
LanzaTech Inc.  
LXP Group GmbH  
Mial GmbH  
Neste Germany GmbH  
Nouvellune GmbH  
Phytowelt GreenTechnologies GmbH  
Senbis Polymer Innovations BV  
SenseUp GmbH  
Senzyme GmbH  
SeSaM-Biotech GmbH  
Syngip BV

## Investors and Founders

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NRW.BANK  
Prof. Dr. Detlev Riesner  
Sofinnova Partners SAS

## Infrastructure (Business Support & Networks)

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Arnold & Porter Kaye Scholer LLP  
BCNP Consultants GmbH  
Bio4Business  
Bioindustrial Innovation Canada  
BioIndustry e.V.  
BioRiver - Life Science im Rheinland e.V.  
BlackIP GmbH  
Creago Solutions UG  
Eder Schieschke & Partner mbB  
IBioIC Industrial Biotechnology Innovation Centre  
IP Services  
KADIB - Kircher Advice in Bioeconomy  
Malaysian Bioeconomy Development Corporation  
NC Partnering Ltd.  
nova-Institut GmbH  
PROvendis GmbH  
RatnerPrestia P. C.  
Saint Hyacinthe Technopole  
Schnee Research  
SolarBioproducts Ruhr  
Stolmár & Partner Patentanwälte  
Verband der Chemischen Industrie (VCI) NRW  
Yncoris GmbH & Co. KG

## Academia (Universities & Research Institutions)

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Bielefeld University - CeBiTec  
Bundesanstalt für Materialforschung und -prüfung (BAM)  
Eindhoven University of Technology  
Federal Research Center of Biotechnology RAS  
Flemish Institute for Technological Research, VITO  
Forschungszentrum Jülich GmbH  
Fraunhofer IGB  
Fraunhofer IME  
Fraunhofer UMSICHT  
Fraunhofer WKI  
Heinrich Heine University Düsseldorf  
Hochschule Hamm-Lippstadt  
Hochschule Niederrhein  
Phillips-Universität Marburg, LOEWE-Zentrum für SYNNIKRO  
Novo Nordisk Foundation Center for Biosustainability  
Qingdao Institute of Bioenergy and Bioprocess Technology,  
Chinese Academy of Sciences  
RWTH Aachen  
SCION - New Zealand Forest Research Institute Limited  
TH Köln - University of Applied Sciences  
TU Dortmund University  
Wageningen University and Research



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Internet: [www.aachen-proteineers.de](http://www.aachen-proteineers.de)

Founding year: 2019

Number of employees: 3

## Aachen Proteineers GmbH

Aachen Proteineers is a Start-Up focussing on coating solutions. We have developed a platform technology to adhere various biomolecules to a wide range of surfaces using special peptides. This technology intensifies processes, cuts cost, and achieves very high coating densities in water at room temperature. We tailor these peptides regarding application conditions, surface specificity, and binding strength through protein engineering strategies, such as directed evolution.

We are currently evaluating products for research, diagnostics and process technology markets, and are open to discussing new applications and to exploring them in partnerships.



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Phone: +49 163 2922615

Internet: [www.aquila-biolabs.de](http://www.aquila-biolabs.de)

Founding year: 2017

Number of employees: 11

## aquila biolabs GmbH

aquila biolabs is a German biotechnology start-up company focusing on the development of innovative laboratory devices for the control and analysis of bioprocesses in bioreactors and incubation shakers.

Our founding idea was a product for hassle-free biomass sensing, the Cell Growth Quantifier (CGQ). The CGQ is a sensor-based technology that offers highly parallelized, non-invasive online monitoring of biomass in shake flasks and bioreactors.

Our second product line, the Liquid Injection System (LIS), allows for automated feeding of liquids in shake flasks. This automated miniature pump is the first commercially available technology of its kind and can be used for a broad range of applications.

aquila biolabs was founded in 2014 and was ranked among the TOP 10 start-ups in Germany in 2015.



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Internet: [www.APKS.com](http://www.APKS.com)

Founding year: 1917

## Arnold & Porter Kaye Scholer LLP

Arnold & Porter Kaye Scholer is an international law firm with over 1,000 lawyers in 13 offices around the world. The Frankfurt Biotech/Pharma team has substantial experience relating to partnership alliances, licensing, technology transactions, distribution agreements, strategic partnerships and investments, protection of intellectual property, financing matters, corporate and tax optimized structuring. In our London office, a team of highly reputed attorneys is dedicated to regulatory issues in the chemicals, healthcare and other industries. The firm's clients range from individuals and small/medium sized companies to large international corporations.

About 25 highly experienced attorneys in Frankfurt advise on law areas including Corporate, M & A, Finance, Antitrust, Pharma & Biotech, IP/Patent Litigation, Labor / Restructuring & Business Reorganization, Compliance, Tax, Litigation/Dispute Resolution, Restructuring & Insolvency.



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40225 Düsseldorf

Phone: +49 211 9945 9650

Internet: [www.autodisplay-biotech.com](http://www.autodisplay-biotech.com)

Founding year: 2008

Number of employees: 10

## Autodisplay Biotech GmbH

Autodisplay brings proteins and peptides to the surface of gram negative bacteria. The transport of molecules to the bacterial surface avoids protein expression issues such as inclusion bodies and incorrect folding.

With our proprietary cell surface display technology, we create custom-tailored solutions for our clients. Services include:

1. High-throughput screening of binding interactions and enhanced enzyme activity via FACS.
2. Development of whole cell biocatalysts that combine the benefits of soluble enzymes and classic whole cell biocatalysts - no limitations regarding permeability of substrate or product, yet easy recovery of the biocatalyst for re-use.
3. Functionalisation of solid surfaces with the highest levels of control regarding target molecule orientation. Autodisplay helps prevent the activity loss by-effect which occurs during immobilisation.

## Axxence Aromatic GmbH

Axxence Aromatic was founded in 1986 and is a privately held company with head office in Emmerich, Germany. Over the years our focus has been of the dedication to be one of the most reliable and innovative sources within our prime field of expertise: NATURAL AROMA INGREDIENTS for the flavour & fragrance industry worldwide.

By strategic investments in R & D of both novel natural ingredients and new manufacturing processes, we constantly strive to expand the use of our products in existing and new applications as well as markets. Axxence has around 100 employees. Sales offices and warehousing are present in Germany, France, USA and Japan. Manufacturing and R & D facilities are located in the Slovak Republic.



Tackenweide 28, 46446 Emmerich

Phone: +49 2822 685610

Internet: [www.axxence.com](http://www.axxence.com)

Founding year: 1976

Number of employees: 100

## BCNP Consultants GmbH

BCNP Consultants GmbH is specialized in the industries biotech, chemistry, nanotech and pharma (BCNP). The three divisions of BCNP Consultants are:

### BCNP strategy

On basis of our business analyses (market and competitor analysis, technology comparisons) you are able to design and sharpen your business model, to write the business case and to identify new M&A targets.

### BCNP connect

On the basis of our vivid business networks in the life sciences industry we bring you together with relevant people in order to support you in filling your customer pipeline.

### European Chemistry Partnering

Since 2017 innovators – from chemistry to bio-economy, from engineering to digitisation - have been meeting twice a year: In February at the European Chemistry Partnering and in September at the ECP Summer Summit.



**BCNP**  
Consultants

Varrentrappstr. 40-42,  
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Internet: [www.bcnpc.com](http://www.bcnpc.com)

Founding year: 2002

# BIOTECH MEETS CHEMISTRY

27 February 2020, Frankfurt

4<sup>th</sup> EUROPEAN CHEMISTRY PARTNERING



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[www.european-chemistry-partnering.com](http://www.european-chemistry-partnering.com)



Martin-Luther-Platz 22, 40212 Düsseldorf

Phone: +49 211 13 866 544

Internet: [www.b-value.de](http://www.b-value.de)

Founding year: 2016

Number of employees: 4

## b.value GmbH

The b.value AG invests in biotechnology and chemistry startups and focusses on companies and founder teams in Germany, Austria and Switzerland. Investments specifically focusses on health and nutrition, resource efficiency, and digitization. The goal of the b.value AG is to build a long-term portfolio of fast-growing, young biotech companies, whose product or business model include a disruptive innovation, high scalability, or whose founders and managers are expected to succeed through their entrepreneurial skills. The b.value AG acquires majority and minority interests. In almost all cases, it invests in the Seed Stage together with other co-investors (serial entrepreneurs, business angels, venture capital providers), who share our commitments through know-how and equity investments.



Carlo-Schmid-Allee 5, 44263 Dortmund

Phone: +49 231 55033770

Internet: [www.bfab.bio](http://www.bfab.bio)

Founding year: 2018

## b.fab GmbH

b.fab is specialized in the efficient conversion of CO<sub>2</sub> and hydrogen (H<sub>2</sub>) from renewable energy into biotechnological value chains. CO<sub>2</sub> and water are abundantly available and therefore it is our starting point to build a sustainable bioeconomy. We use formate as our central mediator to bind and store CO<sub>2</sub> and H<sub>2</sub> (made from water) in liquid form. Our bioprocesses start with the feedstock formate and we use Synthetic Biology to design specific pathways and to convert formate into value-added chemicals. Our platform is build on anaerobic and aerobic microbial production hosts to provide flexibility in the process design and adaptation to specific product requirements. b.fab offers strains, bioprocesses and technology licences.



Universitätsstr. 27, 33615 Bielefeld

Phone: +49 521 106 8700

Internet: [www.cebitech.uni-bielefeld.de](http://www.cebitech.uni-bielefeld.de)

Founding year: 1998

Number of employees: 150

## Bielefeld University – Center for Biotechnology (CeBiTec)

CeBiTec is one of the largest faculty-spanning central academic institutions at Bielefeld University. Its purpose is to bundle the biotechnological activities and research projects at the university, to foster cross-linking of research approaches and technologies from different research fields, and to develop innovative projects within its two main research areas 'Large Scale Genomics and Big Data Bioinformatics' and 'Metabolic Engineering of Unicellular Systems and Bioproduction'.

The availability of comprehensive technological infrastructure as being provided by CeBiTec's Technology Platforms is crucial for a successful scientific work. The Graduate Center creates an inspiring interdisciplinary environment for high-level academic training of graduates. Furthermore, the CeBiTec considers itself as a central communication platform and a 'think tank' of the university with respect to initiatives and activities with a dedicated biotechnological perspective.



## Bio Base Europe Pilot Plant

Rodenhuizekaai 1, 9042 Gent  
Belgium

Phone: +32 9 335 70 01

Internet: [www.bbeu.org/pilotplant](http://www.bbeu.org/pilotplant)

Founding year: 2008

Number of employees: 70

## Bio Base Europe Pilot Plant

Bio Base Europe Pilot Plant is an open innovation pilot and demonstration facility for process development, scale-up and custom manufacturing of biobased products and processes from lab to multi ton scale. A wide and flexible spectrum of modular unit operations combined with a team of highly trained and experienced engineers, process operators and technicians facilitates the translation of biobased laboratory processes into viable industrial processes.

Bio Base Europe Pilot Plant has successfully performed 200 projects for more than 100 companies and has been involved in over 30 public projects. It currently coordinates SmartPilots (Improve policies in support of shared pilot facilities and their users) and BioBase4SME (Bio-innovation support for entrepreneurs throughout North-West Europe).

## Bio4Business

Your reliable partner for scouting, bioprojects and consultation.

Featuring:

“Window to China” - provides you with competent and up-to-date information on Chinese bio R & D, based on press releases, reports, and professional network information in Chinese language. Overcome the language barrier and stay informed about the growing biocommunity of China!

Other features:

- „Window to Japan” - newsletter, website and database
- „Profiler” - whom are you talking to in China and Japan?
- „Customer search” - an evidence-based approach to marketing

# Bio 4 Business

Jagdweg 3, 70569 Stuttgart  
Phone: +49 711 3280468  
Mobile: +49 171 5314099  
Internet: [www.bio4business.eu](http://www.bio4business.eu)

## Bioindustrial Innovation Canada

As a not-for-profit organisation, Bioindustrial Innovation Canada (BIC) supports Ontario and Canada become globally recognized leaders in the field of sustainable technologies. With a vision to create jobs and economic value sustainably for Canada, BIC provides critical strategic investment, advice and services to business developers of clean, green and sustainable technologies. In Sarnia and Lambton County, a true hybrid cluster has developed around sustainable chemistry, based on fostering partnerships and bringing the right individuals together from industry, colleges, universities and governments to support the development of the cluster.

In 2016, BIC established the Centre for Commercialization of Sustainable Chemistry Innovation (COMM SCI) initiative program, which acts as a hub for the commercialisation of sustainable chemistry and bio-based innovation. BIC's proven expertise in commercialisation is the differentiator that will enable us to build a stronger and more sustainable Canada.

**Bioindustrial  
Innovation Canada**<sup>®</sup>  
*A Sustainable Chemistry Alliance*

1086 Modeland Road, Sarnia,  
Ontario, Canada N7S 6L2  
Phone: + 1 226 778 0020 Ext 237  
Founding year: 2008  
Number of employees: 8

## BioIndustry e. V.

BioIndustry e.V. is a registered association whose main purpose is to activate, concentrate and develop biotechnological competencies in the Ruhr region. The key aspects of BioIndustry's activity are industrial biotechnology and bioprocessing technologies, microstructure technology, X-omics and bioinformatics. As a networking service cluster of 50 companies, research and training institutes, technology centres, biotechnological service providers and public business development organisations, the associations objective is to generate product- and process-innovations. This objective will be met by supporting the active transfer from ideas to market.

**BioIndustry**  
Netzwerk kompetenter Partner

BMZ Dortmund, Otto-Hahn-Str. 15  
44227 Dortmund  
Branch office: Universitätsstr. 136,  
44799 Bochum  
Phone: +49 234 9783660  
Internet: [www.bioindustry.de](http://www.bioindustry.de)  
Founding year: 2000  
Number of employees: 1

## Biomillenia SAS

BIOMILLENIA, a France-based privately held company, is a leading technology solution provider for the development of novel green chemistry products. BIOMILLENIA's disruptive BIOMILLENIA DIMENSION 300X platform, based on licensed technology that was developed by Harvard University, the BROAD Institute and ESPCI Paris, uniquely combines advanced genomics and bioinformatics technologies with microfluidics-based ultrahigh-throughput screening. This unique technology platform delivers novel microbes, production strains and enzymes for manufacture of chemicals and natural products at throughputs and speeds several orders of magnitudes higher than with traditional methods. BIOMILLENIA “Unlocks Nature's Potential” for cost-competitive and sustainably manufactured novel biology-based products for a better life.

# Biomillenia

10 Rue Vauquelin, 75005 Paris, France  
Phone: +49 175 1925335  
Internet: [www.biomillenia.com](http://www.biomillenia.com)  
Founding year: 2014  
Number of employees: 1-10



### BIOPROCESS PILOT FACILITY

Alexander Fleminglaan 1, 2613AX Delft  
The Netherlands

Phone: +31 15 5150 200

Internet: [www.bpf.eu](http://www.bpf.eu)

Founding year: 2012

Number of employees: 40

### Bioprocess Pilot Facility B.V.

The Bioprocess Pilot Facility B.V. is a unique open access facility, situated at the Biotech Campus Delft, The Netherlands. Companies and knowledge institutions can upscale new sustainable production processes by converting bio-based residues into useful chemicals or fuels and production processes for food and pharma.

The facility has been specifically designed to enable the transition from laboratory to industrial scale.

- Pretreatment of biomass on benchscale and pilot scale.
- Downstream processing, chemical processing (ATEX)
- Fermentation from 10 l up to 4 m<sup>3</sup>. (ATEX, GMO)
- Food grade pilot plant.

The upscaling of the lab process can be proven on pilot scale with a good prediction of the process on commercial scale.



Life Science im Rheinland e.V.

Merowingerplatz 1a, 40225 Düsseldorf

Phone: +49 211 3160610

Internet: [www.bioriver.de](http://www.bioriver.de)

Founding year: 2004

Number of employees: <10

### BioRiver - Life Science im Rheinland e.V.

BioRiver - Joining forces for Life Sciences & Biotechnology

Founded in 2004, BioRiver - Life Science im Rheinland e.V. is fully committed to representing the Life Sciences sector in the bioregion Rhineland as an independent industry organisation. The essential aims of BioRiver are to build a strong network within the biotech sector, to improve the political and economic conditions as well as to market the bioregion Rhineland and its members. Thanks to the strong profiles of the partners in the network, it has been possible to initiate various collaboration projects and gain direct access to experts in both business and academia.



Volmerstr. 9, 12489 Berlin

Phone: +49 30 55578210

Internet: [www.biotechrabbit.com](http://www.biotechrabbit.com)

Founding year: 2011

Number of employees: 25

### biotechrabbit GmbH

biotechrabbit GmbH was founded in 2011 in Henningsdorf; already 4 years later, in 2015, a second research and production site was opened in Berlin / Adlershof. biotechrabbit is a team of top class scientists, experienced managers and business developers who are determined to offer highest quality products and services for diagnostic companies and life science research. We value the relationships with our partners and customers and are driven to exceed current limitations with flexibility, innovation and highly customized solutions to match specific requirements.

biotechrabbit's offering includes enzymes for molecular diagnostics, antibody generation and production, high-capacity protein fermentation, lyophilization for diagnostic test kits and pharma, highly parallel, cell-free protein synthesis, mRNA for therapeutics, site-directed amino acid incorporation for labeling or cancer biotherapeutics and a full molecular biology products catalog.

Our way of doing business combines the passion and pure curiosity of excellent researchers with the agile spirit of true entrepreneurs.



Extremolytes for Life

Stockumer Str. 28, 58453 Witten

Phone: + 49 2302 914400

Internet: [www.bitop.de](http://www.bitop.de)  
[www.ectoin.net](http://www.ectoin.net)

Founding year: 1993

Number of employees: 37

### bitop AG

bitop AG is a biotechnology company focused on products based on extremolytes, a group of natural protective molecules responsible for the stress resistance of extremophilic microorganisms. bitop develops and employs fermentative and biocatalytic bioprocesses for extremolyte production.

The company offers innovative medical devices based on the extremolyte Ectoin® in the areas of allergy, dermatology, respiratory diseases and dry epithelia with scientifically confirmed efficacy and tolerability. Furthermore, bitop offers extremolyte products like Ectoin®, Glycoin®, and 28Extremoin® as cosmetic active ingredients as well as hydroxyectoin as biostabilizer for diagnostics and life sciences.

## BlackIP GmbH

The main focus of the consulting company BlackIP GmbH is on intellectual property. BlackIP is building bridges between stakeholders 'speaking different languages', developers, scientists, and engineers, and includes expertise on intellectual property rights. The company offers support in the organisation / re-organisation of internal patent systems and training for employees, monitors technology fields with respect to patent-relevant activities of competitors, conducts research and analyses, and offers the service of an external patent department.

BlackIP supports clients throughout the whole process, starting with the early development phase, then monitoring intellectual property processes together with the client's attorneys and experienced attorneys from BlackIPs network, and ending with the exploitation of these rights.



In den Baumäckern 5a, 76865 Insheim  
Phone: +49 6341 93 55 442  
Fax: +49 6341 987 568  
Internet: [www.black-ip.de](http://www.black-ip.de)  
Founding year: 2016  
Number of employees: 5

## Blucon Biotech GmbH

BluCon technology platform is a so-called second generation biomass conversion technology. BluCon is a platform for complete, one-step conversion of non-food feedstocks to carbohydrates used in the production of fuels and chemicals. The BluCon platform is based on its patented, proprietary extremophilic anaerobic bacteria and offers significantly improved process economics compared to other second generation conversion processes.

BluCon converts various non-food biomass ranging from grasses and straw to agricultural and wood residues and can therefore be applied around the globe.



Nattermannallee 1, 50829 Köln  
Phone: +49 1719562401  
Internet: [www.blucon-biotech.com](http://www.blucon-biotech.com)  
Founding year: 2017  
Number of employees: 5

## Bundesanstalt für Materialforschung und -prüfung (BAM)

The Federal Institute for Materials Research and Testing (BAM) is a research facility under the authority of the Ministry of Economics and Technology. Its competences are to improve safety and reliability in chemical and materials technologies through research, testing, analysis, and information.

The division Biodeterioration and Reference Organisms performs research and development in the field of i) materials protection against biological deterioration and ii) biotechnology with bacteria. We are especially interested in biotechnology and molecular biology of bacteria from extreme environments. Our expertise in molecular biology with extremophiles comprises a wide range of technologies to manipulate metabolic pathways with the goal to improve productivity of strains currently used in industry.



Unter den Eichen 87, 12205 Berlin  
Phone: +49 3081041410  
Fax: +49 3081041417  
Internet: [www.bam.de](http://www.bam.de)  
Number of employees: 1660

## Carbon Minds GmbH

Carbon Minds focuses on the development and distribution of databases for Life Cycle.

Assessment of chemical products as well as consulting and trainings in this field. The company strives to enable the transfer of novel and innovative LCA methods into industrial applications.



Neue Weyerstr. 2, 50676 Köln  
Phone: +49 1573 7975079  
Internet: [www.carbon-minds.com](http://www.carbon-minds.com)  
Founding year: 2019  
Number of employees: 4



Perlickstr. 5, 04103 Leipzig  
 Phone: +49 341 355 214 0  
 Internet: www.c-lecta.com  
 Founding year: 2004  
 Number of employees: 50

### c-LEcta GmbH

c-LEcta is a leading industrial biotechnology company, using best-in-class biotechnologies to efficiently provide customized enzymes and microbial strains to industrial applications. Scientific excellence is combined with in-depth commercial and regulatory know-how to bring innovative and competitive bioprocessed products into scale. Besides our in-house project and product pipeline we have a strong focus on strategic cooperation with industrial partners.

Moreover, c-LEcta is an established enzyme supplier, manufacturing unique, quality-controlled enzyme products on large technical scale.



Königsallee 6-8, 40212 Düsseldorf  
 Phone: +49 211 320364  
 Internet: www.concordblue.de  
 Founding year: 1997  
 Number of employees: 160

### Concord Blue Engineering GmbH

Concord Blue is a waste management company that transforms nearly any form of local waste into a variety of clean, renewable fuels. Concord Blue has developed a revolutionary closed-loop system that efficiently and cost-effectively produces the highest quality sustainable energy with virtually no pollutants. Unlike other available waste-to-energy processes, Concord Blue's unique technology benefits the environment, fulfilling all international, EPA and European regulations for renewable energy and air emissions.



Arkelsedijk 46, 4206 AC Gorinchem  
 The Netherlands  
 Phone: +31 183 695695  
 Internet: www.corbion.com  
 Founding year: 2013  
 Number of employees: 2,000

### Corbion NV

Corbion is the global market leader in lactic acid, lactic acid derivatives, and a leading company in emulsifiers, functional enzyme blends, minerals, vitamins and algae ingredients.

We develop sustainable ingredient solutions to improve the quality of life for people today and for future generations. For over 100 years, we have been uncompromising in our commitment to safety, quality and performance. Drawing on our deep application and product knowledge, we work side-by-side with customers to make our cutting edge technologies work for them.

At Corbion, we live our brand promise "Keep creating", through our science, clear understanding of the markets we serve, and of course through our creative people.

Corbion's strategy and every aspect of our operations are built around advancing sustainability and applying high ethical standards, whether this relates to the management of our global supply chain, responsible procurement of our raw materials, or the safety and wellbeing of our people.



Sophienstr. 6, 30159 Hannover  
 Phone: +49 511 449895 0  
 Internet: www.corvay.de  
 Founding year: 2002  
 Number of employees: <10

### Corvay GmbH

Since 2002 Corvay provides consulting and project management services. We are proud to look at a successful track record, e.g. BioRegioN, Vakzine Projekt Management, Direvo Industrial Biotechnology. Corvay actively supports Sino-German collaboration in biotechnology.

Now Corvay has built a specialty chemicals business, marketing and selling specialties from Chinese and Indian suppliers. Long chain aliphatic diacids are sold under the brandname Himount Europe, long chain diols and diamines complete this portfolio, which also covers specialty enzymes and vitamin D.

Our success factors: high performance over many years, broad operational expertise in biotechnology, enzymes, vaccines, pharmaceuticals, and internationality, international management experience plus an efficient business network.

## Covestro Deutschland AG

Covestro is a world-leading supplier of high-tech polymer materials: innovative, sustainable, and diverse.

We are serving key industries (such as automotive, construction, and electro / electronics) around the globe with technologically leading processes. Our products and application solutions are used in many areas of modern life.

In line with our vision "To make the world a brighter place," we work on solutions to the challenges of our time. Alternative raw materials (such as biomass) and alternative production concepts (e.g. via biotechnology) are the basis for various new innovation-driven products and production processes.

With approximately 16,770 employees Covestro posted sales of 14.6 billion euros in 2018. It has some 30 major production sites worldwide that operate in a safe, efficient and eco-friendly way. The product range includes the high-performance polymer polycarbonate and precursors for polyurethanes that are used to produce foam.



Kaiser-Wilhelm-Allee 60, 51373 Leverkusen

Phone: +49 214 6009 2000

Internet: [www.covestro.com](http://www.covestro.com)

Founding year: 2015

Number of employees: 16,770

## CREAGO Solutions UG

CREAGO Solutions UG offers strategy & innovation management consultancy and support for small and medium sized companies (SMEs). We act as classical consultants as well as interim managers or service provider for our clients.

We are also offering startup mentoring & consultancy with a strong focus on strategy & business model development, value proposition and customer & market fit. Beside this, we are also supporting medium sized companies in internal entrepreneurship initiatives.

CREAGO Solutions especially offers a strong experience and knowledge in open innovation approaches, cross industry innovations, creating innovation ecosystems and lean startup methodology.

CREAGO Solutions has a strong focus on startups and SMEs within the chemical industry, biotechnology and plastic industry. Our service is based on long-lasting practical experience within a multinational specialty chemicals company and we are part of a strong network of well known and experienced partners and industry experts.



**CREAGO Solutions**

Experience based Solutions

Haverlandweg 101a, 48249 Dülmen

Phone: +49 2594 99 1723

Internet: [www.creago-solutions.de](http://www.creago-solutions.de)

Founding year: 2017

Number of employees: 1



**CREAGO Solutions**

Experience based Solutions

## Our experience - your success



### Our Clients:

- Small & medium sized enterprises
- Family owned companies
- Startups



### Our expertise & competencies:

- Classical innovation & technology management
- Open innovation & Cross industry innovation
- Innovation ecosystems building
- Lean startup (esp. BMC & VPC)



### Our offerings & services:

- Strategy & innovation management consultancy
- Startup consultancy and mentoring
- Entrepreneurship initiatives & support



### Our Focus:

- Chemical industry
- Biotechnology industry
- Plastics industry
- Additive Manufacturing



Rudolf-Schulten-Str. 5, 52428 Jülich

Phone: +49 2461 980 0

Internet: [www.dasgip.com](http://www.dasgip.com)

Founding year: 1991

Number of employees: about 70

## DASGIP Information and Process Technology GmbH

DASGIP has been an industry-leading supplier of benchtop bioreactor solutions for the biotech, pharmaceutical and chemical industries as well as academia and research institutions since 1991. Our parallel bioreactor systems for the cultivation of microbial, plant, animal and human cells utilize industry-standard benchtop glass and single-use bioreactors.

DASGIP's best-in-class configurable control systems and state-of-the-art bioprocess analyzers deliver unparalleled functionality coupled with user-friendly design for optimal bioprocessing. Our proven solutions for interconnectivity to 3rd party bioprocess analyzers, supervisory control systems and DoE tools, combined with our best-in-class control systems, enable migration strategies for optimization of legacy benchtop bioreactor equipment.

The outstanding DASGIP bioprocess solutions support QbD-driven process development. As of January 2012, DASGIP is an Eppendorf company. DASGIP is headquartered in Jülich (Germany) and has operations throughout Europe, North America and Asia.



Padualaan 8, 3584 CH Utrecht  
The Netherlands

Phone: +31 (0)88 066 6194

Internet: [www.ddna-biotech.com](http://www.ddna-biotech.com)

Founding year: 2015

Number of employees: 21

## Dutch DNA Biotech BV

Dutch DNA Biotech (DDNA) started in 2015 as a management buyout from The Netherlands Organization for Applied Scientific Research (TNO) with the mission to contribute to the society by developing sustainable fungi-based production processes for innovative products.

DDNA is focused on the development of fungal strains and fermentation processes for the production of proteins and organic acids.

DDNA has a mixed business model; in addition to contract research DDNA develops proprietary technology which is out-licensed.

The R & D team consists of molecular biologists and fermentation experts; eight of them have a PhD. The CSO, Professor Peter Punt, holds a chair at Leiden University. DDNA has a seasoned management. The company is based at the Science Park of Utrecht University, The Netherlands.



Sankt-Göres-Str. 34a, 40489 Düsseldorf

Phone: +49 172 6317254

Internet: [www.ecotradex.com](http://www.ecotradex.com)

Founding year: 2014

Number of employees: 5

## Ecotradex GmbH

Ecotradex GmbH is focused on facilitating innovations and business development for bio-based, renewable and recyclable materials. This is realized through three fields of activity: offering suitable machine building solutions for mechanical processing of bio-based raw materials, trading in bio-based materials, and innovation consulting in the bio-based field. We offer, for example, packaging materials development based on bio-plastics and cellulosic fiber based solutions to replace plastics based on fossil feedstocks.



Elisabethstr. 34, 80796 München

Phone: +49 89 278 148 0

Fax: +49 89 278 148 50

Internet: [www.eder-ip.de](http://www.eder-ip.de)

## Eder Schieschke & Partner mbB

The chemical department of the intellectual property law firm Eder Schieschke & Partner mbB has specialized in representing clients in the field of organic chemistry, biochemistry and biotechnology before the European Patent Office, the German Patent and Trademark Office, the German Patent Court and the European Intellectual Property Organization in all areas of intellectual property law.

Amongst obtaining patent rights, utility model rights and trademark rights Eder Schieschke & Partner mbB's expertise is also directed to license agreements, preparation of invalidity, infringement and freedom-to-operate studies, as well as German employee law.

As a member of CLIB, Eder Schieschke & Partner mbB is supporting the Cluster with the realization of IP coaching seminars for start-ups and SMEs.

## Eindhoven University of Technology

Eindhoven University of Technology (TU/e) is a research university, founded in 1956, specializing in engineering science & technology. The Department of Chemical Engineering and Chemistry aspires to be an academic institution for education and research in chemical science and engineering of the highest international standard. The aim is to generate and to develop technology and scientific knowledge relevant for the long-term needs of society.

Scientific curiosity and the use of newly generated knowledge are the main driving forces behind the continuing enhancement of our expertise in (electro-)chemical reactor engineering, multiscale & multiphase modelling, process intensification, membrane processes and heterogeneous catalysis



Groene Loper 5, 5612AE Eindhoven,  
The Netherlands  
Phone: +31 402479111  
Internet: [www.tue.nl](http://www.tue.nl)  
Founding year: 1956  
Number of employees: 3,239

## ERBER Enzymes GmbH

ERBER Enzymes is a spin-off company of EFB, ERBER Future Business GmbH, ERBER Group's in-house incubator.

ERBER Enzymes GmbH is headquartered in Dortmund, Germany, and with our focus on microbiological and enzymatic solutions we address selected food and feed markets.

According to our customers' needs, we develop suitable specialty enzymes or microbial strains in close cooperation with our sister companies at ERBER Group or in direct cooperation with leading market participants. In line with the core competencies within the group, we focus on food and feed safety; however, we also walk new paths in markets ERBER Group has not yet addressed.



Otto-Hahn-Str. 15, 44227 Dortmund  
Phone: +49 231 9865 2845  
Internet: [www.erber-group.net](http://www.erber-group.net)  
Founding year: 2018  
Number of employees: 8

## Evonik Industries AG

Evonik stands for appealing businesses and innovative strength. Around 80 percent of our sales come from market-leading positions. We work in a results-focused corporate culture that is geared to profitable growth and increasing the value of the company.

Our strengths include the balanced spectrum of our business activities, endmarkets, and regions as well as close collaboration with our customers. More than 36,000 employees are bound by a claim: No product is so perfect that it couldn't be made better.



Rellinghauser Str. 1-11, 45128 Essen  
Phone: +49 201 177 01  
Internet: [www.evonik.com](http://www.evonik.com)  
Founding year: 2007  
Number of employees: approx. 36,000

## evoxx technologies GmbH

evoxx technologies GmbH, a German industrial biotechnology company, is focusing on the development and production of industrial enzymes. As European subsidiary of the global enzyme manufacturer Advanced Enzymes Technologies Ltd. a comprehensive product portfolio of enzymatic solutions for human nutrition, animal nutrition, bio-processing, and pharma industries is offered.

Product development is based on the proprietary technology platform covering the whole value chain from early enzyme and process development to industrial scale production and product deregulation. evoxx industrial partners and customers benefit from the unique metagenomics libraries, the enzyme development skills and tech transfer, and production capabilities. evoxx is located on the Creative Campus in Monheim am Rhein and on the Biotech Campus Hermannswerder in Potsdam.



Alfred-Nobel-Str. 10, 40789 Monheim am Rhein  
Phone: +49 2173 4099-40  
Internet: [www.evovx.com](http://www.evovx.com)  
Founding year: 2006  
Number of employees: 40



FEDERAL RESEARCH CENTRE  
«FUNDAMENTALS OF  
BIOTECHNOLOGY»  
OF THE RUSSIAN ACADEMY  
OF SCIENCES

Leninsky prospect, 33, Bld. 2,  
Moscow, 119071, Russian Federation

Phone: +7 495 9545283

Internet: [www.fbras.ru/en](http://www.fbras.ru/en)

Founding year: 2014

Number of employees: 500

## Federal State Institution Federal Research Centre «Fundamentals of Biotechnology» of the Russian Academy of Sciences

Russian Academy of Sciences was organized through merging the A.N. Bach Institute of Biochemistry RAS (INBI RAS), the S.N. Winogradsky Institute of Microbiology RAS and the Centre «Bioengineering» RAS.

The Research Centre of Biotechnology RAS carries out basic and applied research in the fields of biochemistry and biotechnology, microbiology, genomics, bioengineering and genetic engineering, biocatalysis, system and structural biology, biogeotechnologies, bioremediation, agrobiotechnologies, food quality and safety.

The Centre is the key member of the Russian Technology Platform «Bioindustry and Bioresources–BioTech2030». The Russian National Contact Point on Biotechnology, three core facilities, an accredited testing laboratory, and an experimental greenhouse are functioning at the Centre.



### Fraunhofer IGB

The Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB develops and optimizes processes and products in the fields of health, sustainable chemistry and environment. Main topics in the sustainable chemistry field are biobased chemicals and materials, the utilization of CO<sub>2</sub> and chemical recycling as well as modular plant construction and demonstration.

In the area of Industrial Biotechnology we focus on establishing, optimising and scaling up processes that take place with the help of enzymes or microorganisms. In some cases, the desired conversion also becomes possible through combination with chemical transformation processes. In the development of the conversion processes under laboratory conditions and the optimisation of the biocatalysts, the focus is already on scaling up the processes and processing the products. At the Fraunhofer Center for Chemical-Biotechnological Processes CBP, the Leuna branch of the institute, infrastructure and pilot plants are available to scale up processes to production-relevant dimensions.

Nobelstr. 12, 70569 Stuttgart

Phone: +49 711 970 4167

Internet: [www.igb.fraunhofer.de](http://www.igb.fraunhofer.de)

Founding year: 1953

Number of employees: 337



### Fraunhofer IME

The Fraunhofer Institute for Molecular Biology and Applied Ecology IME conducts research in the field of applied life sciences from a molecular level to entire ecosystems. By strategic orientation along the value chain, the Fraunhofer IME follows the mission to take innovative products closer towards the market, to develop enabling technologies, and provide scientific services to partners from academic institutions and industry.

In the area of industrial biotechnology, the Fraunhofer IME offers research in the field of directed evolution, classical strain improvement, metabolic pathway engineering, and fermentation. Besides scientific expertise, we possess state-of-the-art facilities for high-throughput screening, enzyme production & purification, fermentation process development, and protein crystallization and modelling.

Forckenbeckstr. 6, 52074 Aachen

Phone: +49 241 6085 0

Internet: [www.ime.fraunhofer.de](http://www.ime.fraunhofer.de)

Founding year: 1959

Number of employees: approx. 600,

incl. international locations



### Fraunhofer UMSICHT

Fraunhofer UMSICHT is a pioneer for sustainable energy and raw materials management. The institute provides scientific results and transfers them to business, society, and politics. The dedicated team researches and develops sustainable products, processes and services.

We offer process engineering research and development services as well as products and processes incl. industrial property rights. These help to meet the increasing demands for affordable sustainability and innovation in chemistry, petro-chemistry and refinery. Our know-how encompasses the areas of fine and specialty chemicals (organic acids, peptides, sugars, surfactants), polymers (monomer syntheses, polymerization, polycondensation) as well as chemical mass products (alcohols, naphtha) and biofuels (diesel, kerosene). Biomass, synthesis gas and selected residues constitute the portfolio of raw materials from which we suggest process-specific solutions. Know-how regarding the upstream and downstream processing as well as product formulation round out our expertise.

Osterfelder Str. 3, 46047 Oberhausen

Phone: +49 208 8598 0

Internet: [www.umsicht.fraunhofer.de](http://www.umsicht.fraunhofer.de)

Founding year: 1990

Number of employees: 465 (352 in Oberhausen and Willich, 113 in Sulzbach-Rosenberg)

## Fraunhofer WKI

The Fraunhofer Institut für Holzforschung, Wilhelm-Klauditz-Institut (WKI) works as closely and as application-oriented with the companies of the wood and furniture industries and the supplier industry as it does with the construction industry, the chemical industry and the automotive industry. Virtually all procedures and materials, which result from the research activities of the Institute, are used industrially.

WKI has extensive competence in the areas of intermediates preparation from biosourced raw materials and polymer synthesis. The focus was laid on the modification of vegetable oils, saccharides, utilising building blocks generated by industrial biotechnology, and the utilisation of lignin for various applications for generating coatings, adhesives, sealants and elastomers.

WKI stands for R&D along the value chain, starting with monomers to end-use applications.



Bienroder Weg 54 E, 38108 Braunschweig

Phone: +49 531 2155 329

Internet: [www.wki.fraunhofer.de](http://www.wki.fraunhofer.de)

Founding year: 1946

Number of employees: 175

## Flemish Institute for Technological Research, VITO

Within "Sustainable Chemistry", VITO focuses on process intensification and replacing fossil with sustainable resources. Key is the integration of conversion with separation processes to improve overall efficiency and sustainability: *in situ* product recovery within biocatalytic processes, biocatalyst immobilization, and novel separation approaches (membranes are often integrated in these processes) are some of our developments in this field.

Using alternative resources (like CO<sub>2</sub> or biomass) requests different approaches to deliver high added value products: mild disclosure, (scCO<sub>2</sub>) extraction, fractionation and biocatalytic processes, (bio)electrochemical reactions with CO<sub>2</sub>. VITO is one of the partners involved in the inventories and strategic research agenda for "Sustainable Chemistry" especially in the Flemish (CATALISTI) and European context (BIG-Cluster, SPIRE, BBI, SusChem), but also on a global level (India). VITO is also founding partner of Biorizon, a shared research center for bio-aromatics.



Boeretang 200, 2400 Mol, Belgium

Internet: [www.vito.be](http://www.vito.be)

Founding year: 1990

Number of employees: 750

## Forschungszentrum Jülich GmbH - IBG-1: Biotechnology

IBG-1: Biotechnology is a leading institute in the field of microbial biotechnology and biocatalysis. Multipurpose microbial production platforms (e. g. *C. glutamicum*, *P. putida*) are used for the production of industrially, nutritionally or pharmaceutically relevant products (bulk / fine chemicals, natural products, enzymes/proteins) from renewable carbon sources. Methods of synthetic biology are used for establishing novel concepts in strain development and engineering of metabolic pathways. Moreover, multi-step enzyme cascades for cell-free biosynthesis are developed.

Process development is based on lab automation systems combined with extensive digitalization. IBG-1 runs an extensive "omics" platform (sequencing, proteomics, metabolomics and fluxomics) for strain characterization and a single-cell analysis lab. Microbial cultivation facilities range from microfluidic devices over parallelized mini bioreactor systems up to pilot plant scale. Lab investigations are tightly integrated with mathematical modelling, data analysis, experimental design and process optimization.



Wilhelm-Johnen-Straße, 52425 Jülich

Phone: +49 2461 61 3294 (Prof. Bott)

3118 (Prof. Wiechert)

Internet: [www.fz-juelich.de/ibg/ibg-1](http://www.fz-juelich.de/ibg/ibg-1)

Founding year: 1977

Number of employees: 120

## FRINGS

The company Heinrich Frings GmbH & Co. KG is a worldwide supplier of machines, equipment and components for process technology in the industry sectors food, biotechnology, and the chemical industry as well as environmental technology with special focus on fermenters and bioreactors.

FRINGS not only supplies customized systems for each application, but also offers assistance and consulting services. FRINGS has extensive know how and experience concerning process optimization and product development. For downstream processing FRINGS delivers membrane filtration systems (crossflow filtration) for many different industrial sectors.



Heinrich Frings GmbH & Co. KG

Boschstr. 32, 53359 Rheinbach

Phone: +49 2226 8929-400

Internet: [www.frings.com](http://www.frings.com)

Founding year: 1878

Number of employees: 70



Heinrich Heine  
Universität  
Düsseldorf

Forschungszentrum Jülich GmbH,  
Wilhelm-Johnen-Straße, 52428 Jülich  
Phone: +49 2461 61 3716  
Internet: www.iet.uni-duesseldorf.de  
Founding year: 1986  
Number of employees: 40

## Heinrich Heine University Düsseldorf - Institute of Molecular Enzyme Technology (IMET)

The Institute of Molecular Enzyme Technology (IMET) of Heinrich Heine University Düsseldorf is located on campus of the Forschungszentrum Jülich as part of the Institute of Bio- and Geosciences IBG-1: Biotechnology which holds a leading position nationally and internationally in the field of basic research and biotechnological applications of microorganisms.

The IMET is directed by Prof. Dr. Karl-Erich Jaeger and currently employs about 40 people. Five groups cover the scientific topics "Bacterial Cell Factories" (Dr. Andreas Knapp), "Bacterial Enzymology" (Dr. Filip Kovacic), "Bacterial Photobiotechnology" (Dr. Thomas Drepper), "Molecular Biophotonics" (Dr. Ulrich Krauss), and "Natural Product Biosynthesis" (Dr. Anita Loeschcke/Dr. Stephan Thies).



Marker Allee 76-78, 59063 Hamm  
Phone: +49 2381-8789-115  
Internet: www.hshl.de  
Founding year: 2009  
Number of employees: 388

## Hochschule Hamm-Lippstadt

Founded in 2009 Hamm-Lippstadt University of Applied Sciences has developed rapidly, currently counting 6.200 students in 14 Bachelor and 10 Master degree programs. The focus is on the students, professional and individual development is supported by practice-oriented teaching which is oriented towards the needs of the changing society and the dynamic working environment.

Mentoring between scientific and practical experts, research marketing and reporting, founding, inventions and industrial property rights, promotion of cooperations between science, companies, and institutions are the main tasks. With cooperative doctoral studies, the HSHL offers the opportunity for a further scientific qualification in research projects for qualified graduates of Master degree programs.



Henkelstr. 67, 40589 Düsseldorf  
Phone: +49 211 797 0  
Internet: www.henkel.com  
Founding year: 1876  
Number of employees: 50,000

## Henkel AG & Co. KGaA

Henkel operates globally with a well-balanced and diversified portfolio. The company holds leading positions with its three business units - Laundry & Home Care, Beauty Care and Adhesives - in both industrial and consumer businesses thanks to strong brands, innovations and technologies. Founded in 1876, Henkel looks back on more than 140 years of success. Henkel's preferred shares are listed in the German stock index DAX. The DAX-30 company has its headquarters in Düsseldorf, Germany.

Henkel employs more than 50,000 people worldwide, over 80 percent of whom work outside of Germany. As a recognized leader in sustainability, Henkel holds top positions in many international ratings and rankings. In the fiscal year 2016, the company reported sales of approx. 18.7 billion euros and an operating profit of around 3.2 billion euros (adjusted for one-time gains/charges and restructuring charges).



Greenheys Building, 61 Pencroft Way  
M15 6JJ Manchester  
UK

Phone: +44 (0)7981 056 471  
Internet: www.holiferm.com  
Founding Year: 2018  
Number of employees: 5

## Holiferm

Holiferm develops holistically improved fermentation technology giving massive fermentation and downstream cost reductions for biosurfactant production.

We are a technology development company that holds proprietary technology developed by our founders at The University of Manchester, UK. Our technology uses gravity separation to recover insoluble lipids as they are produced by fermentation and has been demonstrated to pilot scale with sophorolipid biosurfactants, doubling titre and productivity and reducing costs by >50%. Holiferm's technology has been demonstrated to double the state of the art for two of the most economically important KPIs of the sophorolipid production process, reaching titres >800 g/l and productivities >5 g/l/h, leading to large reductions in the cost of production.

## Industrial Biotechnology Innovation Centre

The Industrial Biotechnology Innovation Centre's (IBioIC) role, as a specialist in the Industrial Biotechnology (IB) sector, is to stimulate the growth of the IB sector in Scotland to £900 million by 2025. IBioIC connects industry, academia and government, and facilitates collaborations, provides scale-up capabilities, creates networks, and develops skills.

IBioIC supports transition into IB by helping companies to understand the benefits and opportunities, overcome any barriers and to make sure our members are in touch with the right people to guide them through the technology and its consequent translation and implementation in their business.



121 George Street, Glasgow G1 1RD  
UK  
Phone: +44 141 548 3192  
Internet: www.IBioIC.com

## INOSIM Consulting GmbH

INOSIM Consulting GmbH is a German company providing sophisticated technological advice and simulation services for process industries and biotechnology.

Our engineering and simulative methods for the design and optimization of biotechnological processes allow setting up the mass and energy balances of a process, applying as little experimental and process data as possible. Thereby, alternative process ideas can be evaluated in both process design and scale-up as well as in the optimization of existing processes and plants. Looking at the complete process and plant with all interdependencies in-between helps to develop resource-saving processes and production plants. Besides the resource efficiency, production costs and capacity can, of course, be included in the rating as well.



Joseph-von-Fraunhofer-Str. 20, 44227 Dortmund  
Phone: +49 231 970 025 0  
Internet: www.inosim-consulting.com  
Founding year: 2010  
Number of employees: 5

## IP Services

The international protection of Intellectual Property (IP) is of great importance for successful collaboration and commercialization. The successful protection of biotechnological inventions e.g. representing one part of a complete value chain requests a sound experimental set-up from the initial idea to patent filing. IP Services assists throughout the process of translating ideas into valuable Intellectual Property Rights.

Based on a 17 year experience in a biotech company working as project manager and IP manager in the field of recombinant expression in yeast, I started my own business in 2005.

The objective is to represent the interface between a company and a law firm and providing any IP service needed by small or mid-sized biotech companies on a cost efficient basis and independent of the company's location.

The service comprises assessing the value of a company's technologies, collaboration with R & D, IP searches, definition of patent filing strategy, analysis and maintenance of IP portfolio, patent application processing, cooperation with law firms, preparation for due diligence (M&A processes), IP administration, cost control, and IP training.



Unter Linden 35, 50859 Köln  
Phone: +49 221 790 077 30  
Internet: www.weydemann.net  
Founding year: 2005  
Number of employees: 1

## Isobionics BV

Isobionics is an ingredients company, producing and selling a range of natural products in the Flavour & Fragrance market using its proprietary platform technology based on fermentative production of terpenes.

This technology can produce many compounds that occur as components of plant essential oils, such as Citrus oils (Lemon, Orange, Grapefruit). Current products include Valencene, Nootkatone, Beta-Bisabolene and Beta-Elemene. Sandalwood oil, Patchouli oil, and other building blocks for the Flavour & Fragrance industry are under development.

The current supply chain of many natural compounds is unstable and characterized by high volatility regarding availability, quality and pricing. With our proprietary fermentation technology we create stability and a cost price advantage.



Urmonderbaan 22, 6167 RD Geleen  
The Netherlands  
Phone: +31 433 02 02 12  
Internet: www.isobionics.com  
Founding year: 2008  
Number of employees: 10



## Jäckering Mühlen- und Nahrungsmittelwerke GmbH

The Jäckering group of companies has developed over 100 years (date of foundation 1910) into a group of various activities:

- Wheat starch production (ca. 300.000 tons wheat input per year)
- Machinery production (grinders and dryers on the basis of air turbulence mills under the brand name ULTRA ROTOR)
- By-product-recycling in the PVC industry
- Logistics and warehousing

Vorsterhauser Weg 46, 59067 Hamm

Phone: +49 2381 4220

Internet: [www.jaeckering.de](http://www.jaeckering.de)

Number of employees: 100

Most of the activities of Jäckering are located in the harbor of Hamm (the second largest public canal harbor in Germany), with neighboring companies in the businesses of vegetable oil production, animal feed compounding as well as a petrochemical harbour for mineral oil, heating oil, etc. Jäckering plans to move into the biotechnological production of raw materials for the chemical industry on the basis of its by-products, this could be biobased plastics, beta-carotene, or any other glucose-based fermentation product. Research is already carried out together with leading universities, institutes, and a technical application center is under construction.



## Kuhner Shaker GmbH

The Kuhner Shaker GmbH distributes shaking machines and application technologies for shaken bioreactor systems. Moreover, we produce and develop innovative feeding technologies for microtiter plates, shake flasks and spin tube bioreactors. The product portfolio covers bench top shakers, industrial shaking machines for GMP environments as well as the feeding technologies FeedPlate, FeedBead and FeedTube.

Kuhner Shaker is driven by a personal and trustful contact to our customers. Based on a long-term experience and our expert knowledge regarding shaken bioreactors we are capable to offer individual and custom-made solutions. As partner of the science, we actively contribute to academic research projects.

Kaiserstr. 100 , 52134 Herzogenrath

Phone: +49 2407 554 88 22

Internet: [www.kuhner.com](http://www.kuhner.com)

[www.feedingtechnology.com](http://www.feedingtechnology.com)



## LANXESS Deutschland GmbH

LANXESS – at the heart of the chemical industry

LANXESS is a leading specialty chemicals company with sales of EUR 7.2 billion in 2018. The company currently has about 15,400 employees in 33 countries and is represented at 60 production sites worldwide. The core business of LANXESS is the development, manufacturing and marketing of chemical intermediates, additives, specialty chemicals and plastics.

LANXESS is listed in the leading sustainability indices Dow Jones Sustainability Index (DJSI World and Europe) and FTSE4Good.

Kennedyplatz 1, 50569 Köln

Phone: +49 221 8885 0

Internet: [www.lanxess.com](http://www.lanxess.com)

Founding year: 2005

Number of employees: 15,400



## LanzaTech Inc.

Founded in 2005, LanzaTech has developed a fully integrated gas to liquid technology platform that produces fuels and chemicals from gas resources. The potential feedstock ranges from industrial waste gases (steel mills, refineries and phosphorous plants) to biomass syngas (MSW, organic industrial waste, and agricultural waste); as well as biogas.

LanzaTech employs a strong technical team based in the USA, China and Europe and has a rapidly growing patent portfolio. With agreements now in place across a variety of sectors internationally, including steel, aviation, refining and chemicals, LanzaTech's technology is being scaled to commercial production.

8045 Lamon Avenue, Skokie, 60077 IL USA

Phone: +1 847 324 2400

Internet: [www.lanzatech.com](http://www.lanzatech.com)

Founding year: 2005

Number of employees: 120

LXP is a tech company, active in the field of industrial biotechnology. The objective of the company is the development, marketing and licensing of technical solutions for the economic and ecological processing of plant residues on the basis of closed carbon and mineral cycles. Our mission is to maximize the ecological and economic efficiency of biotechnological processes.

The core technology is based on a patent protected pre-treatment process called LX-Process. This process provides alternative /2G-carbohydrates/-sugars and is easy to integrate into biotechnological processes. It allows the conversion of virtually all carbohydrates of lignocellulosic non-food materials to chemicals or biofuels. Additionally, sulphur free lignin is obtained.

Alte Dorfstr. 14a, 16348 Marienwerder

Phone: +49(0)3337 / 3774140

Internet: [www.lxp-group.com](http://www.lxp-group.com)

Founding year: 2009

Number of employees: <10

## KADIB - Kircher Advice in Bioeconomy

KADIB offers comprehensive expertise in Industrial Bioeconomy. We provide consultancy in positioning profitable chemical and energy value chains in your Political, Economical, Societal, Technological, Legislative and Ecological (PESTLE) environment. KADIB provides advice and moderates decision-making:

- Analysing the Bioeconomy Potential
- Designing strategic Bioeconomy Concepts
- Implementing Bioeconomy Strategies
- Focusing on Markets, Technologies and Business Opportunities
- For Industries, Research Institutes, Governmental Agencies

KADIB works through its unique network of senior experts. KADIB is a member of CLIB (Cluster Industrial Bioeconomy) and BioBall (Bioeconomy in Metropolitan Regions).



Kurhessenstr. 63, 60431 Frankfurt am Main

Phone: +49 69 95104772

Internet: [www.kadib.de](http://www.kadib.de)

Founding year: 2014

Number of employees: 1

# Bioeconomy Advice



### **Our Track Record** (selected projects)

- Analysis:** Bioeconomy in Hesse  
Client: Hessen Trade & Invest GmbH  
Published by the Ministry of Economics of Hesse in 2017\*
- Concept design:** BioBall: Bioeconomy in Metropolitan Regions  
Client: Provadis School of International Management and Technology AG  
BioBall raised EUR 20 million R&D funding in 2019\*\*
- Implementation:** Governance of multinational Bioeconomy-Initiative  
Client: CLIB-Cluster e.V.  
Governance developed and implemented in 2018\*\*\*

\* [https://www.technologieland-hessen.de/mm/mm001/Biokonomie\\_in\\_Hessen\\_final\\_screen.pdf](https://www.technologieland-hessen.de/mm/mm001/Biokonomie_in_Hessen_final_screen.pdf)

\*\* <https://www.provadis-hochschule.de/angewandte-forschung/innovationsraum-bioball/>

\*\*\* <https://www.bigc-initiative.eu>



Level 16th, Menara Atlan, 161 B, Jalan Ampang  
50450 Kuala Lumpur, Malaysia

Phone: +603 2116 5588

Internet: [www.bioeconomycorporation.my](http://www.bioeconomycorporation.my)

Founding year: 2005

Number of employees: 250

## Malaysian Bioeconomy Development Corporation

Bioeconomy Corporation is the lead development agency for the bio-based industry in Malaysia, under the purview of Ministry of Science, Technology, and Innovation (MOSTI).

Bioeconomy Corporation is:

- Owned by the Minister of Finance Incorporated & Federal Lands Commissioner
- Governed by the Biotechnology Implementation Council
- Advised by the Bioeconomy International Advisory Panel, chaired by the Honorable Prime Minister of Malaysia.

Bioeconomy Corporation is responsible for executing the objectives of the National Biotechnology Policy (NBP) and acts to identify value propositions in both R&D and commerce and to support these ventures via financial assistance and developmental services.



Mittellinie 199, 26160 Bad Zwischenahn

Phone: +49 17663362920

Internet: [www.mial.eu](http://www.mial.eu)

Founding year: 2014

Number of employees: 9

## Mial GmbH

Mial GmbH is a producer of organic *Chlorella* at its production facility in Bad Zwischenahn. Using *Chlorella* and other microalgae as a source for the development and production of new active pharmaceutical ingredients, Mial positions itself as a developer of new nutraceutical formulations. Mial places a special interest in the development and use of novel carbohydrate mixtures, derived from various microorganisms. The complex mixtures may act as ingredients for nutraceutical, cosmetic and veterinary applications.

Additional R&D interests are in the discovery and manipulation of new pigment production pathways in selected microalgae.



**MITSUI & CO.**

Herzogstr. 15, 40217 Düsseldorf

Phone: +49 211 9386418

Internet: [www.mitsui.com/de](http://www.mitsui.com/de)

Founding year: 1954

Number of employees: 179

## Mitsui & Co. Deutschland GmbH

Mitsui & Co. Deutschland GmbH is a subsidiary of Mitsui & Co., Ltd., one of the most diversified and comprehensive trading, investment and service enterprises which covers a wide range of industries: Metals, Machinery & Infrastructure, Chemicals, Nutrition & Agriculture, Energy, Lifestyle, and Innovation & Corporate Development. We currently comprise 135 sites in 66 countries/regions and a network of approximately 44,000 talented people worldwide. In every arena, Mitsui & Co. provides high added value services and solutions that truly reflect our customers' needs. Our job is to imagine new businesses and bring them to life. Creating new value for this era and innovating for the next.



Uusikatu 24 G 70, 90100 Oulu, Finland

Phone: +358 40 552 8880

Internet: [www.ncpartnering.com](http://www.ncpartnering.com)

## NC Partnering Ltd.

We favour renewable over finite-supply, but prefer those technologies that require little or no subsidies to thrive; commercially viable concepts will ultimately stand the test of time. We believe the best long-term effects are achieved when each component in biomass is utilised to its full potential.

With respect to wood, this means preferring advanced value chains over simple usages. Our vision calls for a Biofuture that goes beyond traditional solutions. We see danger in over-simplified calls for anything renewable, and prefer an integrated approach to biomass and biotechnology. There are immense opportunities open to those who want to take today's bioeconomy to the next stage - the Biofuture, but only if innovation and commercial sense advance hand in hand! Our newest tool for driving bio-innovation is the BioFutureFactory™, of which more on our website.

## Neste Germany GmbH

Neste (NESTE, Nasdaq Helsinki) creates sustainable solutions for transport, business, and consumer needs. Our wide range of renewable products enable our customers to reduce climate emissions. We are the world's largest producer of renewable diesel refined from waste and residues, introducing renewable solutions also to the aviation and plastics industries. We are also a technologically advanced refiner of high-quality oil products. We want to be a reliable partner with widely valued expertise, research, and sustainable operations.

In 2018, Neste's revenue stood at EUR 14.9 billion. In 2019, Neste placed 3<sup>rd</sup> on the Global 100 list of the most sustainable companies in the world.



Fürstenwall 172, 40217 Düsseldorf

Internet: [www.neste.com](http://www.neste.com)

Founding year: 2019

Number of employees: 6

## Niederrhein University of Applied Sciences Institute for Modeling and High Performance Computing (IMH)

More and more companies and research projects analyze and optimize technical systems via computational fluid dynamics (CFD). The IMH applies CFD to very complicated geometries with focus on two-phase flows and program. Furthermore, the IMH programs and parallelizes additional software for commercial software programs.



**Hochschule  
Niederrhein**

University of  
Applied Sciences

Reinarzstr. 49, 47805 Krefeld

Phone: +49 2151 822 5038 (-4728)

Internet: [www.imh.hsnr.de](http://www.imh.hsnr.de)

Founding year: 2005

Number of employees: 5

## Nouvellune GmbH

Nouvellune GmbH is active in the development and sales of special bio-based ingredients and bio-active compounds in Germany, Switzerland and Austria. This includes the development, production and sales of Pro- & Prebiotics (Food & Feed), Extracts, Special Branded Ingredients, APIs, Vitamins & Minerals, but also vegan meat substitutes produced through High Moisture Extrusion through its brand "Stemmler". In addition, the company is researching in the area of alternative proteins because of its passion for sustainability. Last but not least, Nouvellune belongs to a larger conglomerate of companies named Phytonet AG, which is active in the above areas in 8 countries in Middle East & South East Asia, whereas Sourcing, Trading, Regulatory and Local Market Access play an additional role.



nouvellune<sup>®</sup>

Kurfürstenstr. 27, 50678 Köln

Phone: +49 221 222 05 192

Internet: [www.nouvellune.com](http://www.nouvellune.com)

Founding year: 2015

Number of employees: 5

## Novo Nordisk Foundation Center for Biosustainability

Why not use the smallest factories to make the biggest possible amounts of high-value chemicals and pharmaceuticals – biosustainably? The Novo Nordisk Foundation Center for Biosustainability is doing exactly this by developing new technologies for engineering microbes, turning them into cell factories, which are designed for efficient production of a specific compound in a commercially competitive way. The Center is part of a cluster of research centers that aim at attracting the world's best researchers, and thereby creating the basis for an internationally oriented and innovative research environment of the highest quality to benefit society



The Novo Nordisk Foundation  
Center for Biosustainability

Kemitorvet 220, 2800 Lyngby  
Denmark

Phone: +45 45 25 80 00

Internet: [www.biosustain.dtu.dk/english](http://www.biosustain.dtu.dk/english)

Founding year: 2011

Number of employees: 253



## nova-Institut GmbH

Applied research for your needs. As a private and independent institute, nova has over two decades of experience in the bio- and CO<sub>2</sub>-based economy, conducting research projects and consultancy as well as conference management and dissemination.

nova experts come from a wide range of backgrounds, including material sciences, economics, chemistry, biology, environmental sciences, biotechnology and physics. This gives nova a unique understanding of the bio- and CO<sub>2</sub>-based economy, markets and trends and enables it to support your business. nova surrounds, strengthens and completes scientific and engineering work by linking it to feedstock, markets, sustainability, circular economy and policy.

nova offers research and consulting in the areas of raw materials, techno-economic valuation, markets, sustainability, dissemination, B2B communication and policy as well as in-depth psychological market research and strategy development. A new focus is on renewable carbon strategies that support companies in the transfer from fossil to renewable carbon: Biomass, CO<sub>2</sub> use and recycling, whereby chemical recycling is a new topic of the nova-Institut.



Industriestr. 300, 50354 Hürth

Phone: +49 2233 4814 40

Internet: [www.nova-institute.eu](http://www.nova-institute.eu)  
[www.bio-based.eu](http://www.bio-based.eu)

Founding year: 1994

Number of employees: 27

## Pfeifer & Langen GmbH & Co. KG

Pfeifer & Langen operates five sugar factories in Germany. Sugar beets grown by farmers are processed to white sugar and the by-products sugar beet pulp and molasses. These products and intermediate products such as thick juice can be used as carbohydrate sources for biotechnological processes.

Pfeifer & Langen supplies sugar and sugar specialities for the food industry and consumers. The production process of Pfeifer & Langen starts when the sugar beet seed is sold to the farmers and ends when the sugar is placed on the shelves of groceries. We are looking for opportunities to use our expertise in the process chain beginning with agriculture and ending in the food retail trade for new processes and products connected with biotechnology.

As of recently, Pfeifer & Langen entered the field of natural functional carbohydrates.



## Pfeifer & Langen

Aachenerstr. 1042a, 50858 Köln

Phone: +49 221 4980 0

Research Facility: Dürener Str. 40, 50189 Elsdorf

Internet: [www.pfeifer-langen.com](http://www.pfeifer-langen.com)

Founding year: 1870

Number of employees: 2,300

## Philipps-Universität Marburg LOEWE-Zentrum für Synthetische Mikrobiologie, SYNMIKRO

Philipps-Universität in Marburg is the oldest university in the world that was founded as a Protestant institution. It has been a place of research and teaching for nearly five centuries. Its broad range of arts and humanities, and its experimentally challenging scientific work, constitute an ideal platform for interdisciplinary cooperation.

The Philipps-Universität Marburg and the Max Planck Institute for Terrestrial Microbiology have established a center for Synthetic Microbiology, SYNMIKRO, supported by the state of Hesse within its excellence program LOEWE. In SYNMIKRO, research groups in the areas of microbiology, genetics, medicine, cell biology, chemistry, physics, mathematics, informatics, and bioethics are working together in an interdisciplinary approach focusing on basic research in synthetic biology on all levels of microbial function, ranging from the development of regulatory circuits, genetic codes and metabolic pathways to the synthesis of new minimal cells and microbial communities.



Hans-Meerwein-Straße, 35043 Marburg

Phone: +49 6421-28-24401

Internet: [www.synmikro.com](http://www.synmikro.com)

Founding year: 2010

Number of employees: 120

## Phytowelt GreenTechnologies GmbH

Phytowelt GreenTechnologies GmbH is a young, innovative company offering contract research and production in plant and industrial biotechnology worldwide. Our tissue culture and genetic engineering know-how assists our clients for the optimization of plants as well as utilisation of secondary metabolites and enzymes for industrial use.

Phytowelt routinely applies key technologies such as *in vitro* cultivation of plants, cell fusion, transformation technologies as well as plant analysis and molecular marker assisted breeding. Our approach to link plant and industrial biotechnology is maximizing the synergy from our platform technologies phytodiversity and phytomining to support the aroma and pharmaceutical industry and other users of secondary metabolites and enzymes of plants. Phytowelt GreenTechnologies was created in January 2006 as a merger of Phytowelt GmbH and GreenTec GmbH (created in 1997), a spin-off company from the Max-Planck-Institute for Plant Breeding Research, Cologne.



## phytowelt

Kölsumer Weg 33, 41334 Nettetal

Phone: +49 2162 77859

Internet: [www.phytowelt.com](http://www.phytowelt.com)

Founding year: 1998

Number of employees: 25



„Wir haben mit einer Idee unser Start-up sauber ins Rollen gebracht.“

Fördern, was NRW bewegt.

Tanja Nickel und Katharina Obladen, Gründerinnen von UVIS, desinfizieren Handläufe von Rolltreppen mit UVC-Licht. Die erste Finanzierungsrunde des Start-ups sicherte die NRW.BANK mit einer Unternehmensbeteiligung im Rahmen des Förderprogramms NRW.SeedCap Digitale Wirtschaft.

Die ganze Geschichte unter: [nrwbank.de/uvis](https://nrwbank.de/uvis)



**NRW.BANK**

Wir fördern Ideen

## NRW.BANK

NRW.BANK is the state development bank of North Rhine-Westphalia. It essentially orients its equity products on the business life cycle. The program "NRW.SeedCap" doubles initial investments of business angels in innovative start-ups under the same conditions. The "NRW.BANK.Seed Fonds Initiative" and the "NRW.BANK.Venture Fonds" invigorate early-phase funding in NRW. Within the "win NRW.BANK Business Angels Initiative" private investors (business angels) support young entrepreneurs with capital and know-how. The "NRW.BANK.Venture Center" is a specialist advisory unit for business founders from universities and research institutions as well as innovative startups.



Kavalleriestr. 22, 40213 Düsseldorf  
Friedrichstraße 1, 48145 Münster  
Phone: +49 211 91741-0  
Internet: www.nrwbank.de  
Founding year: 2002  
Number of employees: 1,397

## PROvendis GmbH

PROvendis acts as a professional service provider in the entire field of IP management for more than 30 universities and extra-university research institutions as well as for companies and start-ups.

We provide an exclusive access to licensable inventions of approx. 20,000 scientists from the areas of medicine, natural sciences and engineering.

Our Life Sciences Team consists of experienced innovation managers with professional expertise in the fields of biology, chemistry, medicine and pharma. They identify suitable partners, negotiate license agreements and promote long-term research collaborations.



Schlossstr. 11-15, 45468 Mülheim an der Ruhr  
Phone: +49 208 94105 0  
Internet: www.provendis.info  
Founding year: 2001  
Number of employees: 36

## Qingdao Institute of Bioenergy and Bioprocess Technology Chinese Academy of Sciences

The Qingdao Institute of Bioenergy and Bioprocess Technology (QIBEBT), Chinese Academy of Sciences is one of China's primary national research institutions for renewable energy and green materials, focusing mainly on research and development of the resources, technologies, products and processes for bio-based energy and materials. QIBEBT currently has a staff of 800, 470 of whom are full-time employees and 330 are graduate students. The institute offers PhD, Master and Postdoctoral programs in biology, chemical engineering and technology, and material science and engineering. The institute attaches high importance to promoting international cooperation and has more than 170 global partners including Boeing, Shell, P & G and Total.



No.189 Songling Road, Laoshan District,  
Qingdao, 266101, P.R.China  
Phone: +86 532 80662640  
Internet: english.qibebt.cas.cn  
Founding year: 2009  
Number of employees: 470

## RatnerPrestia P.C.

RatnerPrestia, founded in 1981, is a U.S. based intellectual property law firm with significant clients headquartered around the globe. RP has four offices, three in the US and one in Munich, that seamlessly provide a transatlantic team of experts. RP has specialists in the field of biotechnology in USA as well as in Germany and additionally has a great network of biotech specialists in Asia. The firm has insight in the companies needs in terms of IP management and handles clients of all sizes and experience, from consulting with inventors through application drafting and patent procurement, to obtain protection for their ideas and enforce their rights.



Altheimer Eck 2, 80331 München  
Phone: +49 89 1250121 62  
Fax: +49 89 1250121 89  
Internet: www.ratnerprestia.com  
Founding year: 1981  
Number of employees: 5 in DE, ca. 100 in USA



Worringer Weg 1, 52056 Aachen

Phone: +49 241 8024176

Internet: [www.biotec.rwth-aachen.de](http://www.biotec.rwth-aachen.de)

Founding year: 2008

Number of employees: 38

## RWTH Aachen - Lehrstuhl für Biotechnologie

We are experts in biocatalyst engineering with a focus on directed protein evolution. We are developing novel random mutagenesis methods (SeSaM: Sequence Saturation Method), high throughput screening systems and computational programs to manage the complexity of protein sequence space.

Based on our core competencies in directed protein evolution we founded a company (SeSaM-Biotech) and collaborate with leading companies in the field of industrial biotechnology. With our expertise we aim to understand structure-function relationships of biocatalysts and functional biomaterials in order to solve significant problems in industrial biocatalysis.



Saint-Hyacinthe  
Technopole

1000 Dessaulles, J2S 8W1 Saint-Hyacinthe, Quebec, Canada

Phone: +450-774-9000

Internet: [www.st-hyacinthetechnopole.com](http://www.st-hyacinthetechnopole.com)

Founding year: 2003

Number of employees: 14

## Saint-Hyacinthe Technopole

Saint-Hyacinthe Technopole manages economic development on the city of Saint-Hyacinthe's territory. Its mission is to attract new industrial and commercial businesses, as well as promote and develop tourism. One of the Technopole's main tasks is to attract potential investors to the Maskoutan region. It works closely with investors to help get their projects set up in our area and ensure their success. It also manages and develops the technology park, the City of Agri-Food, Veterinary and Agri-Environmental Biotechnology. The Technopole is in charge of managing and selling lots in the industrial parks. The Technopole also helps established businesses in the city centre with their development projects, namely by securing financing packages and guiding them.



P. O. Box 1104, 63461 Maintal

Phone: +49 6181 9455 262

Founding year: 2002

Number of employees: 1

## Schnee Research

Schnee Research sees itself as a mediator between financial markets (e.g. investors) and small to mid-sized companies in different areas (e.g. biotech, chemical industry). Having worked for some years as analyst in the financial industry (independent research house, and rating agency), I now keep strong ties to the chemical industry from my background as a trained chemist (Dipl.-Chem.) and to biotech from my thesis work. My business activities in the area of white biotechnology are focused on evaluation and scouting. I focus on the analysis and evaluation of privately owned as well as listed biotech companies or their development projects.

I was contracted as independent specialist by an investment bank to consult and assist a white biotechnology company in obtaining funding. Schnee Research offers two different services directly or via its cooperation partners fairesearch (pure-play financial research) and Breslin. As a consequence, Schnee Research can span an investment bank's value chain with its entire network. The services of Schnee Research are closer to the money market than to production.



49 Sala Street, 3010 Rotorua,  
New Zealand

Phone: +64 7 343 5899

Internet: [www.scionresearch.com](http://www.scionresearch.com)

Founding year: 1947

Number of employees: 300

## SCION - New Zealand Forest Research Institute Limited

Scion is a New Zealand Crown Research Institute that specialises in research, science and technology development for the forestry and wood-derived materials: tree improvement, wood-related bioenergy, industrial biotechnology and high-value manufacturing. Scion is developing biorefinery processes to create new green chemicals and biopolymers from renewable resources, with a focus on lignocellulosic biomass: soft wood.

We develop microbial and enzyme-based processes that can be used by industrial partners for the production of valued compounds, enzymes and other biological products.

Scion is New Zealand's centre of expertise in bioplastic research and development: production and manufacturing of biopolymers as plastics, adhesives, coatings, foams, pulp/packaging, and fibre-composites.

## Senbis Polymer Innovations B.V.

Senbis Polymer Innovations is a privately-owned company that supports its customers with applied (bio)polymer research. The young organization is building upon 25 years of experience in polymer research, as it used to be the former R&D department of AKZO and Diolen.

Besides contract research, analysis and production for SMEs to multinationals, Senbis develops and produces its own products typically made from biopolymers. Examples are compostable yarns (PLA) for the horticulture industry, biodegradable fishing nets or trimmerlines. The company also has a strong focus on (mono)filaments for 3D printing. Please contact us if we can support you in developing your biodegradable application.



Eerste Bokslootweg 17, 7821AT Emmen,  
The Netherlands

Phone: +31 591 69 2117

Fax: +31 591 69 3456

Internet: [www.senbis.com](http://www.senbis.com)

Founding year: 2016

Number of employees: 11

## SenseUp GmbH

SenseUp develops and optimizes microbial strains for industrial amino acid production. Using its revolutionary metabolite-sensor based screening technology, SenseUp offers strains with superior productivity, massive IP-generation and short development times. The SenseUp-Technology is currently adapted to non-GM compatible natural evolution, enabling unique optimization of probiotic microorganisms in near future.

As a spin-off from Forschungszentrum Jülich, SenseUp combines decades of experience in microbial strain-development with novel disruptive technologies.



c/o Campus Forschungszentrum,  
Wilhelm-Johnen-Straße, 52428 Jülich

Phone: +49 2461 61 5529

Internet: [www.senseup.de](http://www.senseup.de)

Founding year: 2015

Number of employees: 10

## Senzyme GmbH

Senzyme GmbH is innovatively operating in biotechnology and develops and produces technical enzymes and other additives for applications in bioenergy, biorefinement, as well as in the food and feed industries.

The company has long and substantial experience in the cultivation of fungi using solid-state fermentation as the preferred method. Senzyme GmbH maintains a quality management system and guarantees the effectiveness and quality of all its processes and products. The company always welcomes cooperations with scientific institutions and other companies.



Gierlichsstr. 6, 53840 Troisdorf

Phone: +49 2241 2715 2000

Internet: [www.senzyme.de](http://www.senzyme.de)

Founding year: 2000

Number of employees: 30

## SeSaM-Biotech GmbH

As an 'all-in-one' protein engineering service provider, SeSaM-Biotech improves industrial enzymes for various industry sectors like the chemical, dish&fabric, feed and food sector.

Our expertise covers a range of enzymes including amylases, lipases, esterases, cellulases, glucose oxidases, laccases, monooxygenases, phytases, proteases, pectinases, polymerases and isomerases which we already have improved towards e.g. higher activity, thermal resistance or many other characteristics. With our cutting-edge technologies for mutagenesis (e.g. SeSaM-Technology, OmniChange), computational modelling of enzymes, and individually adapted screening assays we follow our vision:

To provide our clients with 'Quality Enzyme Solutions' to make their products eco-friendlier, more cost effective and more valuable.



Quality Enzyme Solutions

Forckenbeckstr. 50, 52074 Aachen

Phone: +49 241 938 569 79

Internet: [www.sesam-biotech.com](http://www.sesam-biotech.com)

Founding year: 2008

# SOFINNOVA PARTNERS

17 Rue de Surème, 75008 Paris, France

Phone: +33 1 53 05 41 00  
Internet: [www.sofinnova.fr](http://www.sofinnova.fr)  
Founding year: 1972  
Number of employees: 22

## Sofinnova Partners

Sofinnova Partners is a leading European venture capital firm specialized in Life Sciences. Based in Paris, France, the firm brings together 12 highly experienced investment professionals from all over Europe, the US and China. The firm focuses on paradigm shifting technologies alongside visionary entrepreneurs.

Sofinnova Partners seeks to invest as a founding and lead investor in start-ups and corporate spin-offs, and for more than 40 years has backed nearly 500 companies creating market leaders around the globe. Today, Sofinnova Partners has over 1.3 billion of funds under management.



Westring 303, 44629 Herne

Phone: +49 2323 956 5863  
Internet: [www.solarbioproducts.com](http://www.solarbioproducts.com)  
Founding year: 1965  
Number of employees: 20

## SolarBioproducts Ruhr c / o Wirtschaftsförderungsgesellschaft Herne mbH

SolarBioproducts Ruhr was founded by the business development agency Herne in cooperation with the Photobiotechnology group (Ruhr-University Bochum). SolarBioproducts Ruhr aims to intensify research projects, develop innovative ideas and bring together different fields of study.

We offer outstanding experience in the field of green biotechnology, including in-depth knowledge of biocatalysts from photosynthetic microorganisms. Our team is interested in collaborations across a broad range of fields. Our experience in gene expression and genetic manipulation is applicable in the field of renewable energy, but also for bioeconomical alternatives for industrial applications like the use of microorganisms as chassis for the production of chemical compounds or high-value products.

# Stolmár & Partner

## Intellectual Property

Blumenstr. 17, 80331 München

Phone: +49 89 2323670  
Internet: [www.stolmar-ip.com](http://www.stolmar-ip.com)  
Founding year: 2004  
Number of employees: 40

## Stolmár und Partner

Stolmár & Partner is a full service IP law firm with offices in Munich, Düsseldorf and Geneva.

A primary focus of S & P's practice is life sciences, Biotech, Pharma, green chemistry, sustainable chemistry, where we provide assistance to our clients in creating, prosecuting and enforcing our clients's valuable IP, but we also give advice in complex licensing topics, IP Due Diligence, Freedom-to-Operate scenarios, document protection and arbitration in DIS based proceedings, ICCC and WIPO proceedings. Our technically and legally highly qualified attorneys understand the technology of our clients and that IP does matter and provide with their sound experience also services before various national patent offices, including the European, the German, Swiss, Austrian, Italian and French Patent- and Trademark Offices as a truly European one-stop-shop for IP. S & P clients range from Research institutions, start-up companies to multinational DAX, KOSPI, JPX and Fortune 500 companies.



Burgemeester Lemmensstraat 360,  
6163 JT Geleen, The Netherlands

Phone: +31 653230676  
Internet: [www.syngip.com](http://www.syngip.com)

## Syngip BV

Syngip is a next generation carbon capture biotechnology company. Syngip engineers carboxydrotrophic bacteria to produce biochemicals and biofuels from syngas and carbon waste gases (gases containing CO and/or CO<sub>2</sub>, H<sub>2</sub>). Currently, the main focus lies on the development of microbial biocatalysts for the production of light olefins.

Especially the major target isobutene is an important building block for plastics, rubbers and fuels. Global consumption of isobutene is over 15 million tons per year. Production of isobutene from syngas or industrial waste gases is a very innovative approach to reduce climate destroying greenhouse gases, enable a circular economy and offer an alternative to petrochemical production routes. Syngip has been acquired in 2017 by Global Bioenergies, who already developed an isobutene production process from sugar in *E. coli*.

## TH Köln - University of Applied Sciences

The TH Köln - University of Technology, Arts, Sciences offers students and scientists from Germany and abroad an inspirational study and research environment in the social, cultural, engineering, and natural sciences. Currently there are more than 24,000 students from about 120 countries enrolled in over 90 bachelor's and master's programs of 11 interdisciplinary faculties.

Climate change and scarce resources are some of the major challenges mankind will be facing in the coming decades. The faculty of Applied Natural Sciences at Campus Leverkusen engages itself in chemical and biotechnological research projects to address these 'great challenges' and actively contributes to the advancement of science and economy.

# Technology Arts Sciences TH Köln

Gustav-Heinemann-Ufer 54, 50968 Köln

Phone: +49 221 8275-3051

Internet: [www.th-koeln.de](http://www.th-koeln.de)

Founding year: 1973

Number of employees: 1,700

## TU Dortmund University - Department of Biochemical and Chemical Engineering (BCI)

The Department of Biochemical and Chemical Engineering (BCI) at TU Dortmund University is the largest and one of the most successful engineering departments in Germany. It is active in all areas of biochemical and chemical engineering. The strength of the department is its multidisciplinary, linking various research areas, from fundamentals (e.g. thermodynamics, biochemistry) to (bio)process engineering, thus covering all stages of integrated (bio)process development. The department has a track record of bringing together academia and companies for the design and optimization of safe, environmentally friendly and sustainable processes and products for the chemical, pharmaceutical, and related industries. BCI is a partner in the CLIB-Kompetenzzentrum Biotechnologie (CKB) network.



Emil Figge Str. 66, 44227 Dortmund

Phone: +49 231 755 2338

Internet: [www.bci.tu-dortmund.de](http://www.bci.tu-dortmund.de)

Founding year: 1969

Number of employees: 200

## Verband der Chemischen Industrie e. V. - NRW

The "Verband der Chemischen Industrie e. V. NRW" (the Chemical Industry Association in North Rhine-Westphalia) represents the politico-economic interests of more than 500 NRW chemical companies and NRW subsidiaries of foreign enterprises in contacts with politicians, public authorities, other industries, the world of science, and the media.

VCI NRW represents about 30% of the entire German chemical industry, an industry that realised sales of 50 billion euros in 2018 and employed some 110,000 staff. A main focus of the last years was the interlinking of industry and science especially in the area of biotechnology. The association's policies are shaped by a presidential council which works in an honorary capacity and the VCI NRW executive management



Völklinger Str. 4, 40219 Düsseldorf

Phone: +49 211 67931 43

Internet: <http://nrw.vci.de>

Founding year: 1945

Number of employees: 9

## Wageningen University and Research

To explore the potential of nature to improve the quality of life.

Wageningen University and Research is a joint venture between the Wageningen University, which focuses on education and fundamental research, and Wageningen Research which conducts applied research directly for industry. In CLIB, the WUR is represented by five academic chair group - Bioprocess Engineering, Microbiology, Systems and Synthetic Biology, Environmental Technology and Biobased Commodity Chemistry - and by the applied research centre Food & Biobased Research (WFBR).

The groups study microbial processes intra-cellular, cellular, inter-cellular, reactor, and environmental scale with a strong link to the chemical industry. The generated knowledge at the University is translated into application, by WFBR, for production and biorefinery of pharmaceuticals, healthy food ingredients, bulk chemicals, and biofuels.



Droevendaalsesteeg 4, 6708 PB Wageningen  
The Netherlands

Phone: +31 317 480100

Internet: [www.wageningenur.nl](http://www.wageningenur.nl)

Number of employees: 8,254

# YNCORIS

## Industrial Services

Industriestr. 300, 50354 Hürth (Köln)

Phone: +49 2233 48 6343

Internet: [www.yncoris.com](http://www.yncoris.com)

Founding year: 1997

Number of employees: 850

### Yncoris GmbH & Co. KG

Yncoris places particular emphasis on the engineering of individual plants - from process development and conceptual design to basic and detailed engineering, regardless of whether we just carry out sub-services or take over the general planning for every stage. Yncoris does not supply one-size-fits-all solutions. Instead, we adopt a flexible approach and gear ourselves towards the specific requirements of the current project stage - step-by-step. Thanks to a broad range of diverse engineering fields and an extensive selection of methods, we can guarantee the highest degree of flexibility with regard to content.

The Chemiepark Knapsack near Cologne in Germany also offers companies a scale-up platform and access to know-how for bio-based production and integration into existing value chains. The innovative capacity of the Chemiepark Knapsack, solid infrastructure, plug&play services, as well as less bureaucracy and red tape all offer huge benefits for your company to commercialize your product.

## Contact

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