



CRM: baltic macroalgae in global cosmetics

With the help of the ALLIANCE, CRM is developing a new product based on macroalgae extracts. The active compound will be used in cosmetics to protect the skin from free radicals. The company is collaborating with ALLIANCE researchers to find an alternative method of extraction.

The company

The Kiel-based company CRM (Coastal Research & Management) was founded by economics and marine ecology experts in 1994. The company's aim is to achieve the sustainable use of living marine resources through modern environmental management of the coastal zone and through research on marine natural products. CRM has since specialised in developing sustainable mariculture systems and investigating marine natural substances. These include various different seaweed extracts as antiviral and antitumoral agents as well as collagen from marine invertebrates as bioscaffold material. It has established the first certified organic mussel and macroalgae farm in the Baltic Sea, following the principles of Integrated Multitrophic Aquaculture (IMTA). CRM's sister company oceanBASIS, founded in 2001, processes the marine natural resources into extracts which find application in different areas, e.g. as active ingredients for cosmetics and food. As well as selling the natural algae extracts to cosmetics companies as an active ingredient, CRM also has its own line of finished cosmetics products called Oceanwell.

The idea

So far, the active ingredients developed by CRM have been mainly bioactive compounds sourced from algae and collagen from jellyfish. Recently, CRM has been developing a new extract, based on polyphenols found in up to four different species of brown algae (fucales) including *Saccharina latissima* (sugar kelp). The polyphenol-based extract – already identified and tested by CRM – is a powerful antioxidant and can be used in skin care products as a natural "buffer" against harmful free chemical radicals. CRM now hopes to develop these polyphenols into marketable active ingredient. Several challenges remain before the bioactive ingredient can be used in cosmetic products. The main difficulty is presented by the method of extraction, which currently necessitates the use of chemicals that are unsuitable to meet the EU compliance rules for ingredients used in cosmetics. These so-called "simple" extraction methods do not focus on the extraction of a specific

compound, but rather they provide a "representative" cross-section of compounds in the seaweed, depending on the solvent used.



Working with scientific experts within the ALLIANCE allows us to fast-track our product development process.



Levent Piker

CRM – Coastal Research and Management

The allies

CRM is collaborating with ALLIANCE partners to overcome this difficulty. The Danish Technological Institute (DTI), the Royal Institute of Technology from Sweden (KTH) and the University of Gothenburg have all signed up as the initial partners for this project. Chemical extraction experts from some of these scientific institutions aim to help CRM find an alternative method. Once a new method has been found, the second challenge is "upscaling" production of the active compound. Currently, the brown algae from which the polyphenols are being extracted are from wild (sea-based) stock, native to the Kieler Förde. CRM already has extensive experience in the sustainable, organic farming of other species of macroalgae (such as sugar kelp), which it rears in land-based nurseries and then transfers to its farm in the Baltic Sea. The company is now exploring cultivation methods to facilitate larger-scale use of the active ingredient.

These challenges are not insubstantial but the company is optimistic that they can be overcome by a collaborative effort. Based on CRM's experience to date, the resulting Baltic Sea product will appeal to the cosmetics industries both in Europe and globally.



Biovento: a fresh coat of paint - search for algae inhibitors

With the help of the ALLIANCE, Biovento is looking into natural product chemistry and bioactivity testing for its collection of cultivated Baltic Sea microalgae. The aim is to find inhibitors of microalgae growth that could be applied in the maritime industry.

The company

Biovento is a biotechnology start-up based in Gdańsk, Poland. Founded in 2014 by scientist and entrepreneur Natalia Kujawska, the company provides biotechnological research as a service to other companies. Its versatile profile has brought it into contact with sectors as diverse as the cosmetics, pharmaceutical and maritime industries. The company's mission is the development and implementation of innovative technologies. Biovento's Research & Development department continually deepens its knowledge of biology, biotechnology and technological processes. This has a crucial impact on improving its evolving capabilities and results. Not only the final result, but also the production process itself is a focal point of this innovative approach. Sustainability is one of Biovento's key values and its experts create systems that minimise the impact of production on the environment by reducing waste and promoting the most efficient use of resources.

The idea

Biovento has a collection of heterogeneous samples sourced from the Baltic Sea. Collected from aboard ships in the Baltic, the samples contain microalgae along with other organisms such as fungi and bacteria. Biovento's research interest is to study the substances that inhibit the growth of microalgae. This topic is of particular relevance to various actors in the maritime sector, where anti-fouling agents such as microalgae inhibitors have many industrial applications.

The next step in the process is to complete a full taxonomy of the samples – to determine their exact make-up and the properties of each species contained in a sample and thereby identifying those substances that can inhibit the growth of microalgae. To take its idea for product development to the next stage, Biovento therefore needs a partner with expertise in natural product chemistry and bioactivity testing. Only once the exact properties and

bioactivity of the microalgae are known, will Biovento and its collaborators be able to determine an exact application field. The company is therefore sending some of the samples to ALLIANCE partners with more extensive facilities for further testing, whilst continuing to work with the samples in its own laboratories. In the future, Biovento hopes to make use of the inhibiting substances discovered, and is planning research into a method of adding the substances to paints used in the maritime industry.

The allies

Within the ALLIANCE, Biovento is teaming up with experts in natural product chemistry. These range from a fellow blue biotechnology business to a major research institution and a business consultancy in the field (the primary mentor is Pomeranian Special Economic Zone and the secondary mentor is BioCon Valley). They will be helping Biovento develop an extraction method for the qualitative and quantitative study of their microalgae and growth inhibitors. The ALLIANCE will also be focusing their efforts on helping the Biovento case in market research and product development. Assistance with the legal aspects of product development, such as Intellectual Property Rights, is also available to the start-up. With the dynamic team in Gdańsk and the collective expertise of the ALLIANCE partners, Biovento's search for microalgae growth inhibitors is set to become a blue biotechnology success story!



As a start-up, Biovento is benefiting from the broad range of expertise and services on offer within the Alliance."



Natalia Kujawska
Biovento



Geoterma: exploring new uses for geothermal water

With the help of the ALLIANCE, Geoterma is exploring different uses for geothermal water.

Potential applications vary from aquaculture to health. ALLIANCE experts are helping to develop a biological use and a corresponding business model.

The company

Joint Stock Company Geoterma is a Lithuanian state-owned company set up for the purpose of investigating geothermal energy resources, improving its extraction technology and its utilisation for economic activity. JSC Geoterma has built a geothermal heat demonstration plant in Klaipeda on the Lithuanian Baltic Sea coast. This plant supplies heat to the city of Klaipeda's district heating network from December to April each year. The geothermal water, which has a very high mineral content, is drawn from wells more than 1100m deep. The temperature ranges from +38C to +80C. In practical terms, the geothermal heat supplied by this deep geothermal water is used for heating buildings and in the preparation of hot water.

also carried out further testing which has e.g. excluded the presence of harmful microorganisms and determined the level of radiation to be normal.

“ *Becoming part of the ALLIANCE has given us a chance to discover more creative ideas and scientific analysis of our potential.* ”



Sigitas Petrauskas
JSC Geoterma

The idea

So far, the geothermal water supply in Klaipeda has been operational only during the cold months of the year (December to April). To make the operation of the geothermal water facility more sustainable and profitable, Geoterma is exploring potential new activities and uses for the summer and autumn/spring months, when no heating services are needed in Klaipeda. Ideas to valorise the geothermal water and energy range from aquaculture – fish or shrimp cultivation – to health applications such as a thermal spa resort. For these purposes, the geothermal water has been thoroughly analysed. In 2015 it was certified by the National Institute of Public Health-National Institute of Hygiene in Poland to be suitable for use as therapeutic water and as water for swimming pools. Several other institutes have

The allies

JSC Geoterma is collaborating with scientific ALLIANCE partners such as Klaipeda Science and Technology Park (KSTP), the Finnish Environment Institute (SYKE) and the ALLIANCE lead partner GEOMAR Helmholtz Centre for Ocean Research Kiel to develop a biological model for potential uses of the geothermal water. Based on the results of these surveys, Geoterma and the business-experts within the ALLIANCE will develop a business model to transform it into a facility operating all year round. Besides looking at the uses for the geothermal water itself, Geoterma has also taken samples from the water at more than one kilometre depth, from which scientists are attempting to isolate possibly new microorganisms.

Part-financed by

Lead partner

A SUB-MARINER Network project

The SUB-MARINER Network is a flagship project of the EUSBSR



Baltic Probiotics: healthy fish, happy customers

With the help of the ALLIANCE, Baltic Probiotics will test its innovative new aquaculture products. The probiotic products enhance fish health and water quality. ALLIANCE partners will be helping with laboratory experiments in model systems.

The company

Latvian company Baltic Probiotics has a successful track record of developing probiotics-based products to improve animal health. Since its foundation in 2013, the Rucava-based company has so far developed products for a number of applications in this field – uses range from veterinary medicine for domestic pets to animal husbandry such as cattle rearing. These all-natural products contain a powerful blend of beneficial microorganisms (up to 11 per product), enzymes and antioxidants, cane molasses, sea salt and plant extracts. The products promote animal health by improving digestion and boosting the immune system. With several successful products already on the market, Baltic Probiotics has now set its sights on the blue economy.

“ Our products will promote fish health and at the same time reduce the need for antibiotics in aquaculture. ”



Arta Bārdule
Baltic Probiotics

The idea

In a healthy natural ecosystem, about 5%-10% of bacteria are probiotics, balancing out a roughly equal number of potentially harmful pathogens at the other end of the bacterial spectrum. When setting conditions in an artificial ecosystem such as indoor fish

aquaculture, it is important to bear in mind this natural balance. Baltic Probiotics is therefore developing two probiotics-based products for healthy and viable ecosystem formation in aquaculture. One product aims to improve water quality and hinder the spread of harmful bacteria, the other aims to improve fish health and digestion.

Applying the same principles as in the development of their earlier successful products, Baltic Probiotics' scientists are developing these aquaculture products combining microorganisms and probiotics. The product fed to fish will improve digestion and appetite. It will also boost the immune system of fish, making them less vulnerable to diseases and significantly shortening the recovery time after illness. As the second aquaculture product will improve water quality, in combination they will be an environmentally friendly, natural alternative to the use of antibiotics. With the help of the ALLIANCE, Baltic Probiotics hopes to bring both these products to market within two to three years.

The allies

In the ALLIANCE project, Baltic Probiotics is collaborating with the Coastal Research and Planning Institute (CORPI) from Klaipėda, Lithuania. Baltic Probiotics is carrying out initial testing of the products in its own laboratories, fine-tuning their chemical composition. CORPI, meanwhile, is able to offer its more extensive research facilities (including a number of fish tanks) and scientific experts during the second – broader and applied – testing phase. The aquaculture products will therefore benefit from having been tested under various conditions and on multiple species of fish. Adding a further dimension to ALLIANCE involvement, the University of Gdansk from Poland and the Pomeranian Special Economic Zone Ltd. are involved in the development process as “case mentors”. These provide dedicated points of contact for Baltic Probiotics within the project, able to offer advice and represent the company's interests.



Kalundborg Utility: a fresh take on research infrastructure - microalgae facility for hire

With the help of the ALLIANCE, Kalundborg Utility will put its state-of-the-art microalgae cultivation test facility to new use. ALLIANCE partners will help to come up with new concepts and potential users to carry on the work in experimental algal cultivation.

The company

Kalundborg Utility A/S operates a microalgae testing and production facility close to Kalundborg harbour. The town of Kalundborg is situated in north-western Zealand, Denmark, about 90 minutes drive from Copenhagen and Kastrup International Airport. Its location gives Kalundborg Utility access to different types of waters (such as industrial waste waters, municipal waste waters, fresh water and sea water) as well as easy access to the EU-wide transport network.

The microalgae facility's main building is a 10m high, 320m² greenhouse. There is also a separate, three-storey combined control room and a small laboratory facility overlooking the algae greenhouse. The greenhouse contains ten separate algae-reactors, each with a capacity of 4000 litres. These can be operated separately or in various combinations of units, allowing for the possibility of operating all ten reactors as a single unit. Two are of the latest glass-tubular design, supplied by Ecoduna in Austria – the other eight are of the more traditional vertical plastic-unit design. This state-of-the-art facility is further equipped with all the relevant algae test and production technology. The process in any reactor can be logged and monitored online with the additional possibility of observation via webcam. The entire greenhouse or individual reactors can be heated to a specified temperature and light supply can be regulated as needed: daylight with direct sunlight, light-blocking curtains and LED lighting are all on hand.

The idea

Kalundborg Utility would like to take over the facility (which is currently owned by Kalundborg Municipality) and ensure its continued operation. The aim is for the microalgae cultivation facility to be used as a test and research facility for product development by various actors from around the Baltic Sea. The facility's access to a variety of water types offers potential users great flexibility in the range of tests that can be undertaken here – e.g. cultivation tests in various environmental conditions.

Kalundborg Utility is also prepared to offer a range of flexible solutions for rental and usage agreements tailored to the client's specific needs. It would continue to provide heating and lighting for the facility, and its ISO9001-certified technical staff could support the running of the facility for a tenant company. Subject to agreement, it would be possible to hire one or several of the algae reactors and make varying arrangements for tests, production and day-to-day operating. A further possibility would be for the client's own staff members to

conduct the work themselves, following agreed specifications, training and instruction in the relevant operating procedures. All potential IPR-issues would be addressed in separate arrangements and non-disclosure agreements.

“ *Made-to-measure usage agreements are an exciting possibility of ensuring a future for our state-of-the-art microalgae test and cultivation facility* ”



Preben Thisgaard
Kalundborg Utility

The allies

For the investment to go ahead, Kalundborg Utility needs more information about the appeal of the facility to potential clients. What type(s) of organisation could it attract? Could it be run as a business? What scenario would make for a reasonable rental agreement and secure a future for the facility? The company needs expertise at a broad level and the relevant documentation in order to answer these questions. It also needs access to research institutions and companies that might be interested in renting the facility.

This is where the ALLIANCE comes in. The Danish Technological Institute and the SUBMARINER Network for Blue Growth have taken on the case of Kalundborg Utility's algae cultivation facility as case mentors. They can supply both the technical expertise and the broad network needed for the task. The ALLIANCE will make use of its network of actors from around the Baltic Sea Region to identify the types of organisation that would benefit from access to the facility. Not only enabling target group research, the aim is to connect Kalundborg's facility with its first rental clients and to help it establish a sustainable business model. Being quick off the mark will be worth it for potential clients: the company has offered to let out its facility at cost-coverage rate during the course of the ALLIANCE project. This is a fantastic opportunity for anyone wishing to use a first-rate microalgae test facility!



Biome: Baltic Sea mollusk shells for bone tissue engineering

With the support of ALLIANCE, Biome applies Baltic Sea mollusk shells as a mineral resource for the preparation of the bone grafts with the shell material for bone tissue engineering.

The company

UAB "Biome" is a startup company from Lithuania, which creates and develops new materials for biomedical industry. UAB "Biome" was founded in 2014 and has been already awarded for "Commercialization of R&D Results" by Ministry of Education and Science (Lithuania), for "Most Promising High-Tech Business Idea" by Ministry of Economy (Lithuania), for "Lithuania's Most Promising Prototypes of 2015" by Deloitte and selected as a "2015 TIE50 Start-up" at the prestigious TIE50 Silicon Valley's Technology Awards Program (U.S.).

“ I believe this collaboration can create high added value for Baltic Sea Region.” -



Kristina Liese
Biome

The idea

The main concept of Biome is to apply Baltic Sea natural resources, namely mollusk shells, for biomedical uses, precisely for bone regeneration. Mollusk shells are composed of calcium minerals and organic macromolecules. Natural calcium minerals from shells have many advantages due to their biocompatibility and the traces of other valuable inorganic elements, such as magnesium, potassium, iron, strontium, sodium, zinc, bromine etc. Therefore, Biome considers Baltic Sea mollusk shells as an attractive resource for biomedical industry. The main goal is to apply ground mollusk shells for the preparation of 3D polymeric scaffolds for bone tissue engineering in odontology and orthopedics.

Biome applies Baltic Sea mollusk shells as a mineral resource for the preparation of the bone grafts in the composition with cellulose. Mollusk shells are composed of calcium minerals and a small number of organic macromolecules (proteins, polysaccharides).

Natural calcium minerals from shells have many advantages due to their:

- Biocompatibility
- Traces of other valuable inorganic elements, such as magnesium, potassium, iron, strontium, sodium, zinc, bromine etc.

JSC Biomè considers Baltic Sea mollusk shells as an attractive resource for the biomedical industry. The company expects to prepare very promising natural bone grafts with the shell material for bone tissue engineering.

According to "Global Industry Analysts, Inc.", global market for bone graft substitutes expected to reach US\$ 3.2 billion by 2022 growing at a CAGR of 11.6%, this proves the high demand on bone graft in the medical sector. The number of treated skeletal deficiencies steadily increases in a global scale. Effective ways for bone replacements and enhancement of bone formation together with research directed to find ideal biomaterials for grafting purposes, which will feature biocompatibility and production simplicity and economy, are required. So far mollusk shells have been used for commercial products - food supplements - as a natural calcium resource with vitamin D3, other minerals or without them.

The allies

Biome receives the main support from the Klaipėda science and technology park (KSTP), Tartu Biotechnology Park (TBP) and CIIMAR. The offered help encompasses the shell chemical analysis and a support in the business development plan. Moreover, the ALLIANCE mentors provide contacts for raw material suppliers that are helpful for Biome to get access to shells of blue mussels needed for their commercial undertaking. The ALLIANCE partner KTH Royal Institute of Technology in Stockholm provided blue mussels needed for characterization analysis of the chemical composition of blue mussel that was done by Biome in 2017.



Berrichi (Furcella): the secret benefits of algae in natural cosmetics

Berrichi is an Estonian natural cosmetics brand, which combines algae-based antioxidants and super oils that make a perfect blend of vitamins, minerals and fatty acids. The ecological products of Berrichi are developed in cooperation with biochemists and dermatologists - Berrichi combines science and the ancient Asian beauty traditions.

The company

Berrichi brand is manufactured by Furcella LLC that is located in Tallinn (Estonia). The clean and ecological products of Berrichi, such as the facial moisturizers for women and men, are developed and have been researched by the scientists Rando Tuvikene and Marju Robal from the Tallinn University. Berrichi cooperates as well with Tartu Biotechnology Park, Baltic Blue Biotechnology Alliance and Enterprise Estonia.

The first main key component of the products is **furcellaran** that comes from Estonian local company Est-Aqar. The supplier is located on the biggest island of Estonia named Saaremaa. The company is well known all over Estonia for producing **furcellaran** from Baltic Sea and red algae. In the 1960s the most known candy factory Kalev in Estonia started to produce marmelade candies from the **furcellaran** that was produced from Est-Aqar. The second key component of the Berrichi products is astaxanthine that comes from Asia. It is the strongest natural antioxidant in the world that has also very strong natural red pigment which gives red colour to salmon, trout, shrimps and flamingos. The astaxanthine that is used in the products of Berrichi comes from micro algae *Haematococcus pluvialis*. Berrichi uses the vegetable version of the algae for moisturizers to assure that products are sustainable for vegans.

The idea

The idea for Berrichi originates from the founder Berit Joosep and her struggle with her own skin problems with dry and allergic skin. The main idea of Berrichi is the believe that clean and natural ingredients are the best for skin. Algae is known as a cleaner, nourisher and protector of the marine life. Algae-based products have been in the heart of Asian beauty traditions for centuries. Even better for Estonians - the algae from the Baltic Sea is rare, clean and doesn't contain any toxic heavy metals. One of the main key ingredients - astaxanthin - is known as a natural doping for the skin. It is 500 times more powerful than vitamin E and 800 times more effective than CoQ10. **Furcellaran** is a strong antioxidant extracted from the red algae of Baltic Sea that protects skin against free radicals, UV

radiation and stressors. Retinol in one of the ingredients applied in the night moisturizer of Berrichi. It is a powerful fat-soluble vitamin which penetrates into the cell wall and deepest layers of skin. Besides, Berrichi products contain five organic super oils: cacay, kukui nut, avocado, apricot kernel and jojoba oil.

“ The Berrichi products were developed in a close collaboration with the ALLIANCE. The mentors provided contacts to important raw material suppliers and support us further with possibilities of packaging based on algae as the main resource.”-



Janno Joosep

Furcella LLC

The allies

Berrichi products were developed with cooperation of the ALLIANCE partners, such as Tartu Biotechnology Park (TBP), who is the primary mentor of Furcella and Coastal Research and Management (CRM) acting as the secondary mentor. Furthermore, Furcella collaborates with domestic and foreign companies for buying the algae-based products and natural oils. The brand Berrichi is advised by the ALLIANCE mentor Levent Piker, who has given Berrichi good contacts for further raw material suppliers. The retinol from the night moisturizer of Berrichi comes from the German supplier Chem2Market and the natural and organic oils come from All Organic Treasures GmbH (AOT). Berrichi is also applying for the certificate from the NaTrue certification company that is known all over the Europe. In cooperation and support on business development with CRM (Levent Piker) Berrichi is working towards the possibility to pack the products in algae-based tubes or packages.

Photo credit: Terje Atonen ©



BIOFISK: beach cast and residual biomass for new fish feed

Guldborgsund Municipality supports development of new biomass-based within the project "BIOFISK".

The company

Guldborgsund Municipality is a rural municipality with 316 km of coastline, where tons of seaweed wash ashore each year. The municipality depends heavily on tourism and uses many resources to get the beaches ready for the summer season. Guldborgsund municipality has a bio-economy strategy for the valorization of surplus biomass. The municipality has a good infrastructure and a tradition of working closely with land and sea, and the aim is to further support and strengthen local business activity and create new jobs.

The idea

The aim of the project "BIOFISK" is to support development of new biomass-based products and create local jobs by exploring the whole value chain of innovative aquaculture and sustainable fish farming in a local perspective with the island of Falster as a showcase. The project will focus on the potential of beach cast as a cultivation media for insects for feed. This will be done by combining the results of latest research, cultivation techniques and technological development with problematic surplus local biomass, cluster potentials, business development and societal challenges in one best-practice perspective.

BIOFISK initiative hopes to find ways to produce valuable products from the beach cast and attract new companies or stimulate local companies to grow and create new jobs. Apart from creating a business model for local production of sustainable fish feed the model is meant to transform problems with beach cast to business opportunities. If the project is successful, the model could be relevant and applicable to many other coastal places around Denmark and the Baltic Sea.

The strength of the idea is the circular economical approach ensuring that local waste resources are delivering added benefits (new products and jobs) to the local and regional community.

The BIOFISK project aims to:

- Valorize a surplus from local biomass resources.
- Connect the latest research in insect production with protein refining.

- Make fisheries more sustainable.
- Bring jobs and primary production back to depopulated areas.

This project comprises a small-scale pilot for the purpose of developing a business model. Guldborgsund municipality will work closely together with selected local companies in order to develop a business case.

“ Our primary ALLIANCE mentor the Danish Technological Institute conducts an analysis of beach cast biomass, which is very helpful for our undertaking of developing new biomass-based products. ”-

Mette Jørgensen

BIOFISK (Guldborgsund Municipality)

The allies

The municipality needs the support of the Alliance partners to discuss the development of processes and proof-of-concept for the production potential for up-scaled bioconversion of surplus biomass resources for use as valuable compounds including protein as feed. The case BIOFISK benefits from the expertise of the ALLIANCE partners in:

- Analysis and documentation of the nutritional and high value compound content of e.g. beach cast biomass.
- Understanding of EU regulations with regards to products from recycled biomass and food and feed health safety aspects (and how Denmark interprets these).
- Networking, communication and support in dissemination of BIOFISK as a bio-economy showcase to promote the business model in the Baltic Sea Region.
- Clarification of possible Intellectual Property Rights (IPR) issues.
- Input to the business model in the form of modelling or other ways of strengthening the argument for using beach cast biomass as a resource.

The main mentors of BIOFISK are: Danish Technological Institute (DTI), SUBMARINER Network for Blue Growth EEIG and KTH Royal Institute of Technology (KTH).

Photo credit: Danish Technological Institute ©



KosterAlg: farming macroalgae in the clean waters of the Swedish west coast

The newly established Swedish company KosterAlg offers several species of cultivated macroalgae, such as kelp and sea lettuce. As an ALLIANCE partner KosterAlg has benefitted from cooperation with expertise in the area of business and technical development.

The company

The company KosterAlg originates from three research projects with several Swedish universities. The enterprise was set-up by six marine biologists, specialized in marine botany, ecology and chemistry, cultivation and breeding of macroalgae and a sustainable use of marine resources.

With the gathered experience of all involved in KosterAlg, the company has become an important contributor in the development of the Blue Economy, focusing on large-scale and sustainable production of macroalgae.

The idea

The extensive research projects studying macroalgae as part of a biobased society initiated cultivation of macroalgae in Skagerack (on the Swedish west coast) but also in tanks on land using deep-sea water. The cultivations produced an overabundance of biomass and the idea to take care of the surplus not used by the research, offering it as raw material on the market was born. The business idea of the company KosterAlg is to sell the biomass of several species of macroalgae to clients refining the algae to consumer products, such as food, skin/hygiene products and animal feed. The interest from the market has shown that KosterAlg has a great potential to grow and for that needs to establish its own cultivations, both in the sea and in tanks.

“ Cultivation of macroalgae produces high value food and must be the ultimate farming for sustainability - it doesn't need watering or fertilization. The algae take up nutrients and capture CO2 from the sea to compensate for eutrophication and ocean acidification ...and they produce oxygen.”-



Elisabet Brock
KosterAlg

The allies

KosterAlg was selected by the ALLIANCE as a case with partner status in November 2016. The two main mentors are the University of Gothenburg and Danish Technological Institute (DTI).

The ALLIANCE is providing support to KosterAlg in areas of:

- Analysis of chemical compounds.
- Strategies for organic certification and nutritional regulations.
- Business plan development.
- Funding support for harvest, handling and marketing of algae.



SFTec: drying technology for blue bio-economy needs

With the help of the ALLIANCE, SFTec will test and evaluate the enabling potentiality of ModHeat® technology for blue bio-economy needs.

The company

SFTec Oy is a company founded in Finland in 2013 as a spin-off from the University of Oulu. The founders of the company are industry-educated experts from the fields process engineering, circular economy and technology development. Their main product, ModHeat®, is a patented drying technology. ModHeat® enables cost-efficient drying of industrial by-products, wastes and biomaterials. SFTec Oy specializes in handling of demanding materials and together with their partner network they can deliver complete solutions to handle most material handling needs. The company wants to help their customers to achieve savings through material efficiency and to create new circular economy based business. SFTec combines strong expertise to overcome the most difficult challenges of circular economy and sustainable energy production.

“ As a partner of the Baltic Blue Biotechnology Alliance we want to provide, develop and test our unique enabling technology for the bio blue needs. Through the ALLIANCE network we got in contact both with national and international players in the blue bio-economy sector.”



Jani Isokääntä
SFTec

The idea

Bio-based energy production and circular economies involving different kind of material flows have a common need to achieve optimal dryness of materials used. SFTec Oy has developed an innovative solution, ModHeat® (Modular Heating) drying technology that serves this need. The patented technology ensures optimal dryness of all materials, and advanced usability enabled by the user-friendly construction. The modular construction of the dryer allows drying capacity addition based on the actual needs. The automated,

energy-efficient, remote controlled system with a modular structure and scalability provides an attractive solution for every need at the lowest investments.

The key advantages of ModHeat® technology:

- Modular construction
- Mobile usage
- Scalability
- Versatile material handling

SFTec Oy is able to offer to their clients a full testing service with thorough analysis and recommendations to support material efficiency and investment decision making process.

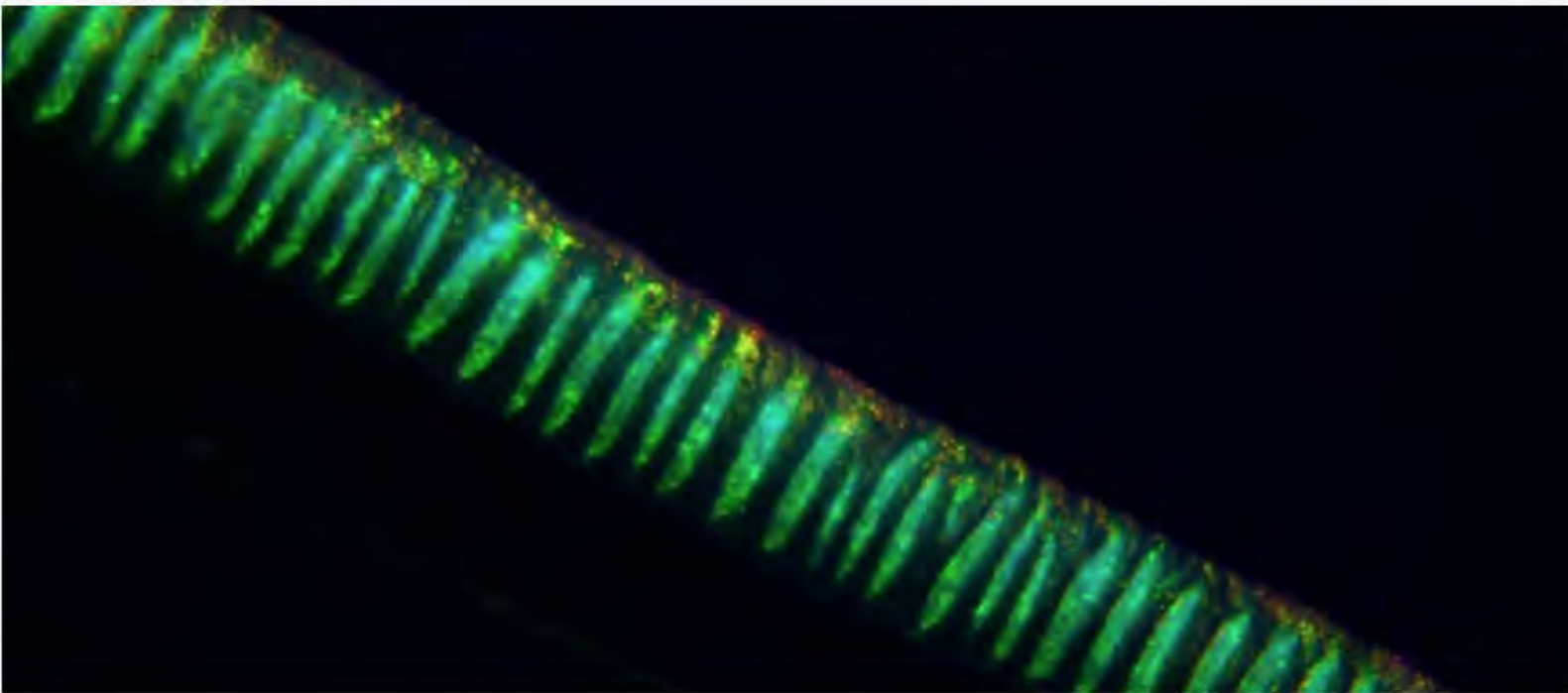
The allies

Being a partner of the ALLIANCE since 2016, SFTec could contact and test the opportunities offered by the drying technology in the blue bio-economy sector. Through the ALLIANCE network and with the support of their mentors, the Finnish Environment Institute (SYKE) and the University of Gothenburg, they got in contact with both national and international players in the sector. This allowed gaining of extended knowledge about the customer needs, as well as offered familiarization with potential customers and applications.

Also, ALLIANCE mentors BioCon Valley and Tartu Biotechnology Park (TBP) have supported SFTec through their contact networks to find the fitting application objects to their technology. The fitting application objects are for instance drying of different kinds of biomass with the proper amount and location of the processed material.

In the course of the ALLIANCE mentorship programme, SFTec Oy will evaluate the technology by pilot testing. They already got the first promising results from drying macroalgae (seaweed) and over 2018 they will continue the trials.

Their main goal for 2018 is to find new potential partners and piloting customers in the blue bioeconomy sector through the ALLIANCE network.



Hoekmine: finding the genes that colour life in the sea

Baltic Iridescence – from macroalgal microbiota to new enzymes and optical materials

The company

Hoekmine is located within the iLab at the Hogeschool Utrecht. The company emerged from the SME MicroDish and works on isolation and genetic modification of microorganisms. Hoekmine BV, based in the Netherlands collaborates with the Vignolini Lab in Cambridge University (UK). Both organizations report the genetic and optical analysis of a bacterium that is the brilliantly coloured Flavobacterium IR1, isolated from an estuarine environment. Hoekmine views microorganisms as complex structured communities with complex microbial structures that can be used to derive new optical materials and compounds. A good example is drugs with new, commercial properties. The company performs research, development and contract research within this area.

“ *The marine environment is being mined for drugs, but this work shows that we can also search for colours which is big business. Now we begin to understand the genes involved, and how they form living structures that manipulate light, we can alter this bacteria to make new optical materials inspired by nature, in addition to understanding the role in life.* ”

“ *The ALLIANCE was extremely useful to support our business development including help ranging from provision of samples of algae from the Baltic Sea to advice on commercial developments - small companies need a European network like this that amplifies their reach.* ”



Colin Ingham
Hoekmine

The idea

Hoekmine has isolated an iridescent Flavobacterium IR1 and developed its genetics and a proprietary method of fixation to allow structural analysis. Sulphated algal polysaccharides, such as fucoidan, trigger iridescence, and IR1 tends to organise on marine macroalgae. The idea is to screen Baltic macroalgae for iridescent microorganisms, to unravel the resulting structures and possibly modify underlying genes in order to create new colours and determine the nanostructures, which form the basis of the colour.

These structural colours might be valorised in different areas such as:

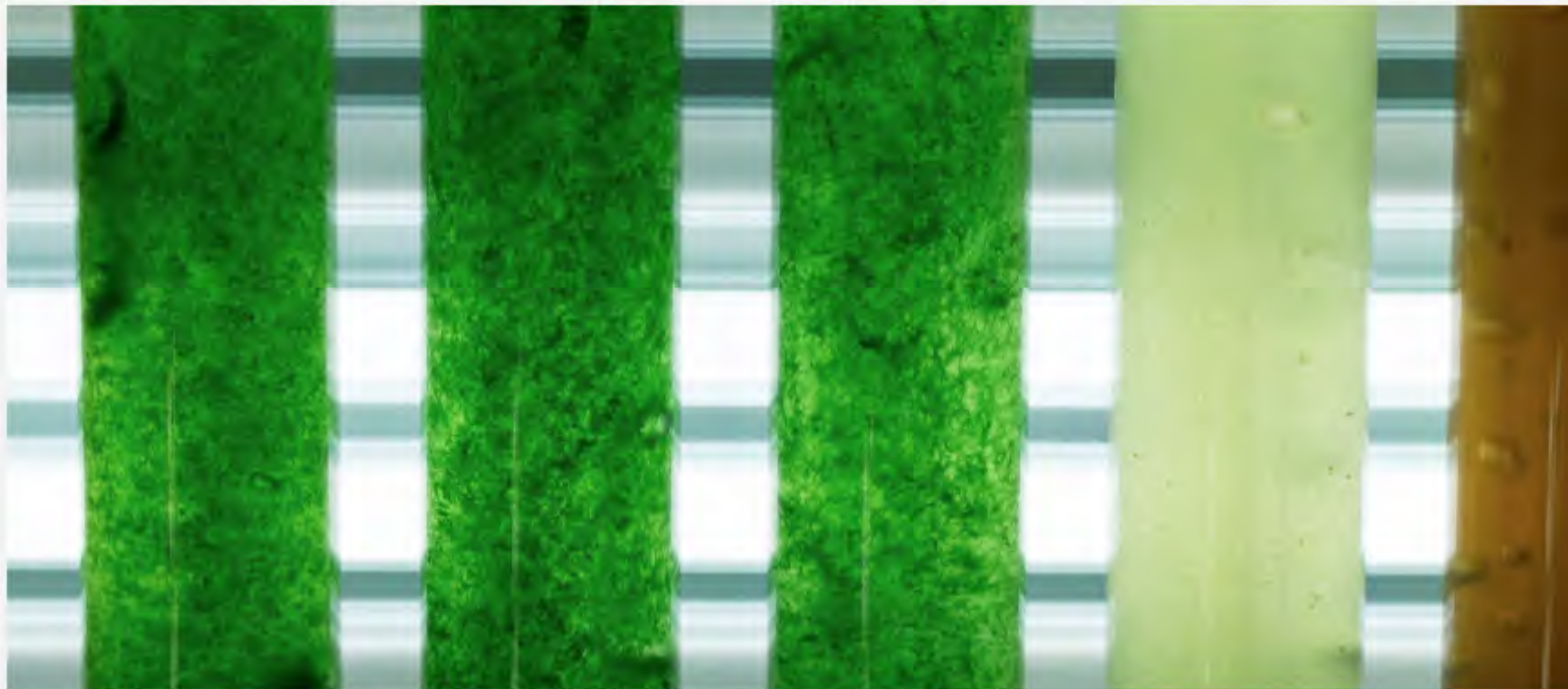
- fabrics
- cosmetics (by copying the nanostructures of interest into cellulose)
- banknotes
- security (tracking of items by very sophisticated barcodes)
- automotive industry (paints for cars).

Another aim of Hoekmine is to identify and valorise fucoidan processing enzymes as additional business opportunities.

The allies

Hoekmine as a beneficiary of the ALLIANCE's mentoring programme, has worked with the ALLIANCE partners, Tartu Biotechnology Park and CleanTech Latvia, for developing the next steps of the business plan. Furthermore, thanks to the Finnish Environment Institute (SYKE), Hoekmine signed Material transfer agreement (MTA) for transfer of algae from Finland to the Netherlands. With the support of the ALLIANCE (primary mentor is GEOMAR Helmholtz Centre for Ocean Research Kiel and the secondary mentor is Scottish Association for Marine Sciences), Hoekmine managed to make mutants with altered colors, which were then optically characterized at Lab in Cambridge University.

Photo: C. Ingham. A 5 mm long streak of Flavobacterium IR1 on an agar plate showing an intense, green banding pattern as this living, self-organising structure catches the light. If the observer shifted their angle the dark stripes would become light and the black areas reveal their colour in turn.



JAMK: closed energy and nutrient cycle in the microalgae cultivation

ALLIANCE helped to address the challenges in microalgae biomass production using liquid from biogas production.

The company

JAMK Institute of Bioeconomy (BTI) is part of the initiative for bioeconomy innovation ecosystem called Tarvaala Bioeconomy Campus. JAMK acts as a pre-commercial undertaking. The team has seven years of experience in automatic monitoring of water quality and flow rate and strong and long experience of energy efficiency and business models especially in agriculture.

“The idea is a comprehensive biorefinery where energy and nutrients are recycled in the most cost-effective way. We are very happy to cooperate with international partners in the ALLIANCE” -



Tarja Stenman
project manager, JAMK

The idea

The idea has been based on two years of experiments studying the nutrients uptake of wetland algae. The field experiments showed that controlled growing conditions give more reliable results. On the other hand, growing algae in the closed systems is very expensive. Developing closed energy and nutrient cycle systems, e.g. in photobioreactors (PBR), could be the solution for cost-effective microalgae cultivation for water purification and production of eco-efficient products (especially in the biogas field).

The primary idea is to develop closed energy and nutrient cycles for microalgae cultivation in a biorefinery concept that comprises of a photobioreactor (PBR) and a biogas plant. The PBR produces high added-value products and also microbial biomass that is recycled to the biogas plant and converted into energy, nutrients and CO₂ that are recycled back to the PBR and also added-value fuels and chemicals for the market. The targeted market segments are poultry feed, high-value substrates and fuels. Separation experiments have been tested up to pilot scale through filtering the soluble nutrients from the biomass.

The allies

JAMK is mentored by the Finnish Environment Institute (Syke) and the Danish Technological Institute (DTI) and receives also support from the Tartu Biotechnology Park (TPB) and the Submariner Network (assistance when it comes to the “new openings in networking, cooperation and new project partnership in nutrient recycling, recycling economies & bioeconomics”). Based on the fact that most of the JAMK’s partners are Finnish e.g. in fields of biogas, bio waste treatment, new bioproducts, agriculture, renewable energy or other research institutions as University of Turku, VTT Technical Research Centre of Finland, Natural Resources Institute Finland (Luke) before joining the ALLIANCE, JAMK is now happy to have the opportunity to work with international partners thanks to the ALLIANCE network.

JAMK especially values collaboration for selection and culturing microalgae groups and species relevant for the northern environmental conditions and cooperation for optimizing water extraction from the algae biomass.



Maresome: Innovative products with antibacterial and wound healing effects on a base of marine organisms

Institute of Marine Biotechnology e.V. (IMaB) is developing new pharmaceuticals and formulation for wound dressing without antibiotics.

The company

Institute of Marine Biotechnology e.V. (IMaB) was founded by microbiologists, pharmacists and doctors from Greifswald under the BioRegio Initiative 1996 (now BioCon Valley – Initiative for Life Science and health economy of Mecklenburg-Vorpommern). IMaB is the founding member of BioCon Valley. The IMaB is dedicated to support research and development in the field of marine biotechnology. The IMaB research programme ranges from the isolation of novel microorganisms to functional genomics. Key issues include: discovery of new antimicrobial compounds, drug development based on marine natural products, proteomics of marine bacteria, cold-adapted enzymes and expression systems.

The idea

Approximately 4 million people in Germany suffer currently on chronic, not curative wounds. A special problem at chronic wounds represents the settlement of multi-resistant pathogens. IMaB wants to develop new formulations for orthopedic socks, wound dressing or novel ointments which effectively accelerate the wound healing and prevent or reduce infections on the base of microparticles of algae (Maresome®) from the Baltic sea. The idea based on two existing EU-Patents EP1480661 and EP2162121 was already realized in a special prophylaxis cream against MRSA.

Maresome stands for micro particles obtained by patented manufacturing process. The particles come from the Baltic Sea microalgae biomass. The microalgae were identified and cultivated by the scientists from Greifswald.

Maresome is also an ingredient of cosmetics, these products have skin-caring qualities. Moreover, the physiological skin flora is protected from bacterial attack when applying

cosmetics of this kind.

“ Access to relevant networks around the Baltic Sea for informing about Maresome® and its products is the main support we expect from the ALLIANCE.”-

Dr. Gerold Lukowski
Institute of Marine Biotechnology e.V.

The allies

The ALLIANCE mentors BioConValley GmbH and the Pomeranian Special Economic Zone (PSEZ) support IMaB with consulting, networking and elementary business development support. IMaB works with two companies producing cosmetics and medical devices in Germany. The ALLIANCE network provides furthermore very valuable access to the rest of the Baltic Sea Region.

Needs

IMaB needs are:

- Partners of novel antibacterial and nontoxic algae in vivo
- Partners for the large scale (100-1.000 l) cultivating of marine biomass
- Partners for developing innovative application form, including novel wound dressing formulations
- Partners for marketing

Power Algae: turning CO₂ from waste into resource with microalgae

Microalgae for extraction of valuable compounds for feed and chemical industry. Through the ALLIANCE the case owner got access to valuable information about microalgae cultivation.

The company

Power Algae was launched in 2013 by two doctoral students at the University of Tartu, Estonia. Since 2015 the company has been actively collaborating with the Estonian University of Life Sciences, and this brought it to a new level. So far, Power Algae has been positioning itself as technology developer, but there is an intention to expand the scope and make main business out of using the technology that has been developed.

The idea

Initially the focus was put on developing equipment for doing research about microalgae, but this work led to search for industrial applications. The technology that is under development today is focused on sequestering carbon dioxide directly from flue gas and using it for accelerating growth of microalgae in the photobioreactors. The microalgae that grows inside these 'biological filters' is used for extracting several valuable compounds for feed and chemical industry. The technology runs according to the principles of industrial symbiosis and takes into consideration the specifics of harsh Nordic climatic conditions. The system includes several sensors that allow remote monitoring.

The case aims to provide a microalgae research photobioreactor, which can be upscaled and used in a meta-system of industrial symbioses composed of CO₂ sequestration by microalgae, and valorization its produce as a component for nutrients, cosmetics, etc. The first lab-scale photobioreactor prototypes are already in use at the Estonian University of Life Sciences and lab-scale tests have proven initial feasibility. An upscaled pilot is in planning in collaboration with an Estonian oil-shale oil producer, who could use the technology for both increasing their profitability and reducing their negative environmental impact.

The following needs of Power Algae were addressed to the ALLIANCE:

- Help in clarifying market and defining customer needs
- Partners in phases of the algae value chain that follow the algae farming in bioreactor: companies who process algae biomass, who provide algae biomass processing equipment/technology
- Partners, who use algae-based ingredients for developing high-end products
- Strategic partners for internationalization
- Funding for growth and expansion

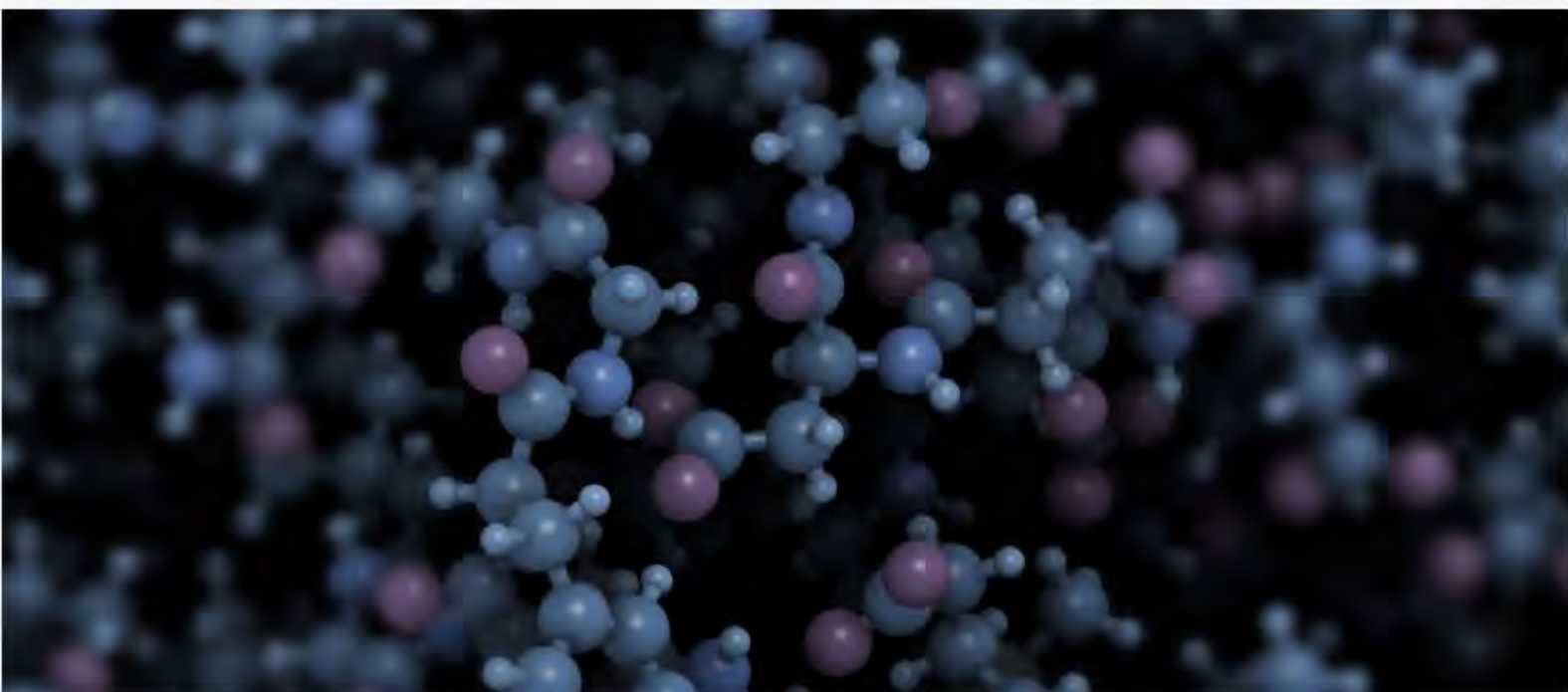
“ The economically viable solutions to the great challenges can only be achieved by collaborative and interdisciplinary networks. We are advised on issues related to microalgae cultivation and receive business development from the ALLIANCE”.-



Liina Joller-Vahter
Power Algae

The allies

Power Algae joined the ALLIANCE mentoring programme in 2016. The main mentors in the network are Finnish Environment Institute (SYKE), who advises predominantly on issues related to microalgae cultivation, and Tartu Biotechnology Park (TBP) that provides support in business development and offers networking-matchmaking opportunities.



Enzymicals: marine strains as promising sources for producing novel lipases and galactosidases

Use of enzymes for complex chemical synthesis is popular in low temperature industrial processes.

The company

Enzymicals, founded in 2009, specializes in providing integrated solutions for biocatalytic applications. Enzymicals focuses in customization and production of enzymes as well as in their application for making fine and specialty chemicals. Dedicated to design, develop and implement cost-effective, sustainable and scalable chemo-biocatalytic routes – Enzymicals offers recognized expertise in the use of enzymatic processes for complex chemicals synthesis for its three business segments:

- provides state of the art solutions in developing, optimising and piloting robust chemo-enzymatic processes for the production of fine & specialty chemicals.
- manufactures a range of chemicals as chiral building blocks, intermediates and specialty chemicals as well offer custom synthesis on request.
- offers a broad selection of recombinant enzymes suitable for research, development, production and diagnostics as well as a tailor-made protein expression and optimization service.

The idea

Enzymicals AG offers a broad biocatalytic toolbox and an outstanding resource of enzymes suitable for research and development, production, and diagnostics. The company has strong expertise in developing and piloting biocatalytic processes on customer demand. Marine microbial strains are seen as a promising source of extremophiles for discovering

new cold-temperature lipases and galactosidases with various applications in the industry. Furthermore, apart from enzymes, Enzymicals deliver other specialty and fine chemicals, like chiral building blocks, with a production capacity from analytical to kilogram scale. The product range includes secondary and tertiary alcohols, carboxylic acids, lactones, esters and amines with a very broad range of industrial applications.

“ Given the high market demand for industrial enzymes and the astonishing extremophilic properties of marine microbial strains, we are now able to offer more novel enzymes to our customers. With the help of the ALLIANCE, we are able to include enzymes in the internal screening”. -

Dr. Ulf Menyes
Enzymicals AG

The allies

Enzymicals wishes to identify new enzymes, and more specifically lipases and galactosidases, which are functioning under cold temperatures. The company is aiming to adapt the quality assays, describe the special characteristics and include new enzymes in internal screening tests. Enzymicals cooperates with BioCon Valley and Danish Technological Institute (DTI) as main mentors within ALLIANCE. More recently, a cooperation with the Finnish Environmental Institute (SYKE) is envisaged to exploit their strain collection. Additionally, the University of Flensburg is helping out with their network.



MBF: Movable Biogas Factory

Utilization of excessive aquatic biomass via transfer on-site.

The company

Movable Biogas Factory (MBF) is represented by 2 core people:

Ritva Nilivaara-Koskela

MScs in Biotechnology and Organic Chemistry. Experienced in water chemistry and treatment, interested in bioprocess development and innovation.

Kirsi Hyry

MSc in Tech. Computer Science. Product management and business development professional with 20 years of experience. Motivated in water renovation innovations.

MBF is on the idea development stage. The needs and possibilities of MBF were discussed with a local research institute. The business model, technical development and implementation are on early stage of development. MBF is looking for potential collaboration partners. They need further support and insight whether the movable biogas factory idea has potential, and how to move the idea forward.

The idea

MBF aims to utilize excessive aquatic biomass. The current problem is: eutrophication creates excessive aquatic biomass (water plants, macroalgae, rough fish and sediments). Biomass utilization is unattractive due to transportation costs. Biomass is piled on shore and nutrients return to Baltic Sea.

MBF offers a solution to this problem: MBF utilizes low-value biomass collected from beaches, sporadic fishing, algae/mussel cultures or renovation of drainage basin. MBF is transferring the biogas process on-site, then the biomass is processed into biogas and utilized again e.g. as fertilizers. The benefit MBF offers: MBF utilizes excessive low-value biomass and decreases nutrients to counteract eutrophication. MBF is independent during the process and avoid transportation costs of raw material.

The unique selling proposition of MBF is:

- Minimization of transportation costs.
- Proximity to raw material source.
- Local usage of end-products.
- Suitability for small scale projects.
- Suitability for periodical usage.

"Through the ALLIANCE we are trying to connect with other actors in biogas sector in Baltic Sea Region."

Ritva Nilivaara-Koskela

Movable Biogas Factory

The allies

The mentors of MBF are KTH Royal Institute of Technology (KTH) and Finnish Environment Institute (SYKE). MBF entered the ALLIANCE mentorship to proceed in R&D, engineering specifications and get help in finding financing during 2017/2018. Some piloting activities might be implemented during the ALLIANCE mentoring, leading to conceptual design of system and prototyping in 2018/2019.

The needs of MBF are:

- Validation of the business model; costs, clients and revenue.
- Concept development: how to build and manage the service concept?
- Technical Development; small scale process development with a cooperation partner (container size), automation development, local utilization of biogas and rejects.
- Pilot research: which biomass fractions are available and viable for the MBF, pilot project for validating the concept with minimum effort.

Organic Seaweed: a natural organic sunscreen extract from seaweed

The Danish company aims to revolutionize the sunscreen market with a new sun protection based on seaweed.

The Organization

Organic Seaweed - Ebeltoft Vig Ltd. is a small company, which cultivates 14 tons of kelp each year from own coastal seaweed farm. Established in 2015, it was the first farm with organic seaweed in Denmark. Since September 2016 their organic kelp tablets have been available on the market (primarily in Denmark).

Apart from the organic dietary supplements, Organic Seaweed uses seaweed as a basis for high-value products. The main mission is to continue to make products that are sustainable and good for the environment and for you!

The company is a primary producer of organic seaweed with an extensive knowledge about seaweed. Organic seaweed made test material on a 14-day basis to create a starting point for research on how much phlorotannin content is in the organic seaweed at any one time.

The company has been already approached by cosmetic companies (also non-organic) and distributors who would like to buy the seaweed extract, once it is available.

The idea

Currently the seaweed of Organic Seaweed is used for organic dietary supplements. The idea under the ALLIANCE is to develop a natural organic sunscreen extract from seaweed. This product could replace the chemical and physical filters used as sunscreens today, the product would be free of carcinogenic, mutagenic, reprotoxic (CRM) substances. Furthermore, the developed extract would be not allergenic and would reduce negative environmental impacts.

It is well known that brown algae contain phlorotannins that protect against harmful UV-A and -B sun rays. These active substances would be extracted by Organic Seaweed and used by their cosmetics clients in their products.

The need for a natural plant-based sunscreen is growing, as both the tradition chemical and physical filters are met with skepticism from consumers' side. Organic Seaweed is aware that an extraction of a natural sun-filter from brown algae is possible. However, the technology and know-how to achieve a natural organic sunscreen which is cleared of CRM substances must be combined to obtain a marketable product.

“ I received support not only from my ALLIANCE mentors, but I also made a valuable contact to another ALLIANCE “case” involved into the cosmetics sector.” -

Mette Albrechtsen

Organic Seaweed

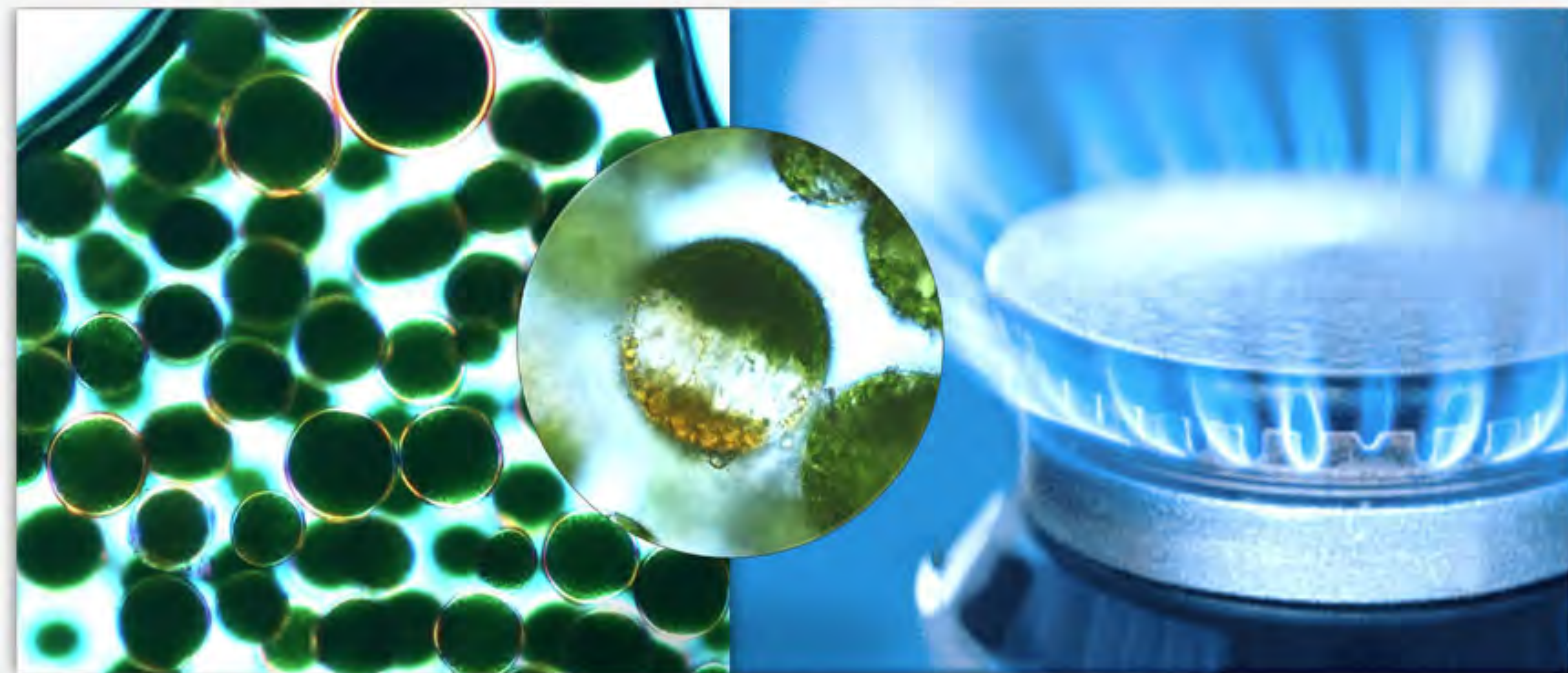
The allies

The supporters of Organic Seaweed are the ALLIANCE mentors Danish Technological Institute (DTI) and University of Gothenburg (UGOT). Organic Seaweed cooperates also with one ALLIANCE case partner Coastal Research Management.

The analysis made by UGOT of harvested seaweed shows a good content of phlorotannin. A new collaboration regarding Organic Seaweed existing product TANG (seaweed) tablet and harvesting of biomass for the German market via Coastal Research Management portfolio is possible and shows best practice example of the ALLIANCE network.

Organic Seaweed needs help to:

- document the content of phlorotannin our brown algae and its effect in protecting against harmful sunrays (UV A & UVB)
- find a method to suitably extract the bioactive substance from seaweed (choice of method, execution and documentation)
- protect the bioactive substance for storage (choice of method, execution and documentation)
- test the product for sun protection factor (SPF) and allergic reactions
- IPR/patenting
- understand EU regulation and requirements under applicable laws of ecology and cosmetics
- build up a network of relevant actors that will help get this product to market



Uni Gdansk biomass "case": from biomass to biogas

The Polish researchers at University of Gdansk are developing a technology for microalgal biomass production.

The Organization

The case "Uni Gdansk-Biomass" is a group of researchers studying various aspects of microalgal ecophysiology and genetics at the Institute of Oceanography, University of Gdańsk. The team consists of highly qualified scientific staff having many years of experience in the cultivation of microalgae and maintaining a unique collection of Baltic algae strains. The core people are:

- Case owner - Marek Klin, PhD student
- Adam Latała, Professor
- Filip Pniewski, PhD
- Aleksandra Zgrundo, PhD

The idea

By combining the features of rapid growth of algae and their susceptibility to stress factors, we gain access to a great source of biomass produced during photosynthesis, our greatest natural ally in capturing atmospheric carbon dioxide and its transformation into a source of energy.

Among the biofuels possible to be produced from algal biomass, biogas fulfills the conditions of a most attractive fuel in the region. Also, it is easily convertible into electrical energy, the basic power supply for modern technologies. Anaerobic digestion by means of which biogas is produced depends on the biochemical composition of the substrate used. Research shows that the biochemical composition of algae is strictly determined by culturing conditions and can be improved (i.e. energetic lipids content) by the controlled application of stress factors.

Despite its potential, the performance and efficiency of microalgal biomass as a feedstock is not yet sufficiently tested. Given the rapidly advancing technology of cultivation and

possibility of costs reduction using environmental waters or wastewater, reconsideration of microalgal biomass as a biogas substrate is highly recommended.

Progress of the case „Uni Gdansk-Biomass” within the ALLIANCE mentoring:

- New strains have been isolated and their growth characteristics examined.
- Further biochemical analyses are ongoing to predict the fermentation potential of obtained biomass (carbohydrates and proteins content).

“ The ALLIANCE is a catalyst for cooperation between individuals willing to move forward with interesting projects in blue biotechnology. Personally, it gave me the chance to get contacts and gain experience during internship which I would never have got as a single scientist. ” -



Marek Klin
case "Uni Gdansk-Biomass"

The allies

The ALLIANCE mentors of the case are University of Gdansk (UG) and Danish Technological Institute (DTI).

The current needs are:

- Batch Biochemical Methane Potential tests of biomass from single or mixed strains.
- Cumulative methane production estimation over time.
- Chemical analysis of a mixture of gases produced on biomass.



EHP: real-time environmental monitoring solutions for the aquaculture

EHP ENVIRONMENT Ltd. offers real-time monitoring stations as environmental buoys, water flow and quality monitoring stations for continuous environmental monitoring solutions.

The company

EHP Environment is a Finnish company that has developed a solution to monitor online water flow, level, quality and weather parameters. The monitoring data user interface is an internet browser at a device that is connected to internet. The company has been already existing on the market for more than ten years. It has been operating mostly at energy-, waste management-, heavy industries- and mining sectors. The online environmental monitoring solutions and recording of data from sea water is the next sector EHP would like to position themselves.

EHP ENVIRONMENT is specialist on online Real-time environmental monitoring solutions. EHP produces online Real-time monitoring stations e.g. environmental buoys, water flow and quality monitoring stations for continuous environmental monitoring. The monitoring data is seen real time at EHP's internet data service. EHP has delivered over 1000 online Real-time monitoring stations to its clients who are mostly located in Northern Europe.

The idea

The importance of aquaculture has recently increased in contributing human nutrition globally and it is also promoted in EU's Blue Growth Strategy. When the actions are expanded, the sustainability of aquaculture needs to be guaranteed. Cost efficient real-time monitoring at aquaculture sites, using fit-for-purpose sensors and innovative data is very much required. The sensors at the EHP buoy monitor the wished water quality parameters (for example pH, turbidity, oxygen, conductivity, chlorophyll, temperature, water flow speed & direction, water level).

The market monitoring solutions for aquaculture is of interest for European end-users and also globally the demand on this kind of products is growing. Observations of the aquaculture sites with data that is provided to the user as web-service is highly wanted.

“ With the help of the ALLIANCE, we could kick-start the monitoring, so far our products have been used mainly at landbased industries' environmental monitoring purposes.”-

Jaakko Seppälä



EHP ENVIRONMENT Ltd.

The allies

EHP cooperates with the Finnish Environmental Institute (SYKE) and the Coastal Research and Planning Institute (CORPI) as their mentors. EHP needed consulting in different issues related to measurements and SYKE was able to help to answer the specific questions. EHP works also with the ALLIANCE case "Kalundborg Utility", Preben Thisgaard the case owner of Kalundborg Utility provided contacts to the lake Tissø, Denmark and suggested a kick-start by testing EHP buoys for that (fresh water quality monitoring). EHP is also interesting in receiving new contacts from the Estonian market to position themselves stronger there.

Photo credit: EHP ENVIRONMENT Ltd.©



Vetik: hidden treasures of a red seaweed

With the help of the ALLIANCE, Vetik is developing different valuable products from a red seaweed. Examples are red pigments with fluorescent, antitumor, antioxidant properties that could be used in biotechnology, medicine, cosmetics and food industries. Since 2017, ALLIANCE partners are supporting Vetik both in the production and business development.

The company

Vetik is a new Estonian start-up founded in 2017. The company has access to a unique source of wild red seaweed (*Furcellaria lumbricalis*) located in the sea area of the West Estonian Archipelago, between two of the biggest islands of Estonia - Saaremaa and Hiiumaa. The resource of this algae wild stock is estimated at 150,000 tons and *Furcellaria* has been harvested in Estonia since 1960 without any detectable effect on the raw stock. Two of the cofounders have been harvesting and selling dried seaweed since 2009. Now that Vetik has three scientists in the core team, their aim is to use the full potential of this seaweed in a sustainable way. To make this possible, Vetik has gathered key experts from Estonia and abroad as partners.

The idea

The main priority of Vetik is to develop a competitive process for large scale extraction of R-phycoerythrin (R-PE) from red algae. This red pigment can be an alternative to existing food colorants. It has antitumor and antioxidant properties which makes it valuable in cosmetics and pharmacy industry. Additionally, due to its fluorescent properties, high purity R-PE is largely used in the field of biotechnology. To fully exploit the potential of the seaweed, Vetik is developing processing technologies to use 100% of the algae material to produce different valuable products, like seaweed extracts, fertilizer etc.

“The cooperation with ALLIANCE enables access to testing facilities and guidance for business development. All this allows us to find the suitable markets and application for our product and leads us to good partners”.



Valmar Kasuk
Vetik

The allies

For achieving the goals, Vetik is collaborating with ALLIANCE partners such as Tartu Biotechnology Park (TBP), CRM - Coastal Research & Management (CRM), Furcella, GEOMAR Helmholtz Centre for Ocean Research Kiel (GEOMAR), Finnish Environment Institute (SYKE) and SFTec Oy. The ALLIANCE partners provide testing for seaweed drying, crushing, and pigment extraction technologies. Vetik is also receiving guidance for cost estimations (to build a large-scale production line) and support for business development, finding the right markets, networking and matchmaking for useful contacts and potential collaboration partners.



Uni Gdansk bloom “case”: from bloom to smart bioproducts

The Polish researchers at University of Gdansk are developing an industrial process that turns cyanobacterial blooms from the Baltic Sea into bioplastics.

The company

A group of researchers at University of Gdansk is working on ideas oriented towards practical use of algae (ecology, cultivation, collections) on one hand and IT and engineering on the other hand. The current project of the team with which the researchers are dealing while being involved into the ALLIANCE is smart use of the bloom biomass.

The idea

The business idea bridges two urgent problems of global interest together and is of high importance in the semi-enclosed Baltic Sea – these two problems are: plastic pollution and eutrophication. The researchers from Uni Gdansk aim to develop an industrial process to turn cyanobacterial blooms into bioplastics or biomaterials that could replace some of popular non-degradable plastics threatening the existence of the earth ecosystems. In recent years it was shown that cyanobacteria can produce biopolymers as e.g. polyhydroxyalkanoate (PHA) in amounts up to 60% of cdw and poly-β-hydroxybutyrate (PHB) up to 77% of cdw. Furthermore, microalgae have been demonstrated to be a suitable material for development of various bioproducts.

Currently, cyanobacteria are used in aquaculture, wastewater treatment, food, fertilizers, production of secondary metabolites including exopolysaccharides, vitamins, toxins, ethanol, hydrogen, enzymes and pharmaceuticals. Several strains of cyanobacteria were found to accumulate PHA. They can be used as a substitute for nonbiodegradable petrochemical-based plastics and are able to degrade oil components.

The samples were taken during massive blooms of cyanobacteria from the Gulf of Gdansk (Southern Baltic Sea) between 2011 and 2016. The samples for qualitative and quantitative analysis were preserved with Lugol's solution and examined with a light and inverted microscope. The samples for biomass analysis were freeze-dried. The element analysis included ICP-OES, carbohydrates content – UV-VIS, quantitative determination of proteins – elemental analyses and lipid analyses, as well as qualitative and quantitative analyses of polyhydroxylic acids (PHA) GC-MS.

“Although no internal ALLIANCE partner could help us, the service needed by us was outsourced to an external company working with the ALLIANCE, this action helped us to move forward with our business idea.”-



Aleksandra Zgrundo

University of Gdansk

The allies

The case with the title “From bloom to smart bioproducts” was selected by the ALLIANCE as 4th generation case in November 2017 and was assigned to the University of Gdansk as primary mentor and the Submariner Network as secondary mentor. Later it received also support from the Pomeranian Special Economic Zone Ltd. (PSEZ).

The ALLIANCE partners are providing support in:

- feasibility analysis
- business model canvas
- identifying key partners and developing value chains
- finding partners for harvesting
- handling and marketing of algae.

At the present stage the researchers' team needs to enhance the biomass to make it more resistant in order to have properties that would suite a wide range of applications. To achieve this undertaking, an expert knowledge from the field of material design and industrial processing is mandatory. Moreover, the team expects to receive a range of algal based plastic masses that will have parameters fulfilling the safety and health requirements along with features as attractive texture, color and smell. Additionally, a life-cycle-analysis is required to ensure that prospective products will go through a process of critique to meet requirements set for environmentally friendly products. The case needs help in assessing the potential volume of sales and market value of products developed from bloom biomass.

Photo credit: University of Gdansk.©



LoondSPA: natural spa cosmetics from Estonia

The LoondSPA cosmetics include the Värskä lake mud and mineral waters from South Estonia, these powerful mineral resources have not been used in the cosmetics industry so far.

The company

The LoondSPA company is run by two team members: Nelli Kerde and Liina Reinsaar. Being active in the entrepreneurship more than 10 years is Nelli responsible for sales. As Liina has extensive experience in communication she deals with marketing. With great passion both team members are also involved in the product development, it's their mission to spread the innovative use of Värskä lake mud and mineral water in cosmetics due to its proven excellent features for skin.

The brand of the company LoondSPA called loond° originates from a belief to a pure and strong nature that feeds the body, spirit and mind in its naturalness. In Estonia, the word "loond" meant "nature" in past times. Therefore, based on the deep meaning of this ancient word the whole loond concept is lively and breathable, and part of everyone. The strengths and reliefs of loond are hiding in it and waiting for a discovery.

The loond° mission is to share the strength of the strong plants and natural resources that grow in northern, clean and harsh climate. The products nourish the skin with beneficial ingredients, help to relax, make a break and take time for yourself. loond° wants to keep the clean and untouched nature surrounding us and provide its refreshment for future generations as well

The idea

loond° products are inspired by the pure Nordic nature. Northern Europe, with its sparse population and clean air, has excellent natural conditions to guarantee the purity and high quality of the raw material. The raw material comes from the upper North latitudes of the Earth, where the growth environment is rough, but the nature is tougher and stronger. LoondSPA has chosen the best ingredients and natural resources that are ecologically clean. loond° products are divided into product lines according to the occurrence latitude of the main raw material – the key component.

loond° has worked together with scientists and Wellness Spas to create the natural cosmetics that would bring you closer to the Nordic nature, where the air is cleaner and plants are durable!

“ Being in the ALLIANCE means for us getting help in business development, define better the markets we target, get support in networking and matchmaking to reach out to the suitable collaboration partners. Our mentors have already opened up some new collaboration opportunities for us in Germany, with only our own efforts we would not be so far so soon.” -

Nelli Kerde



LoondSPA

The allies

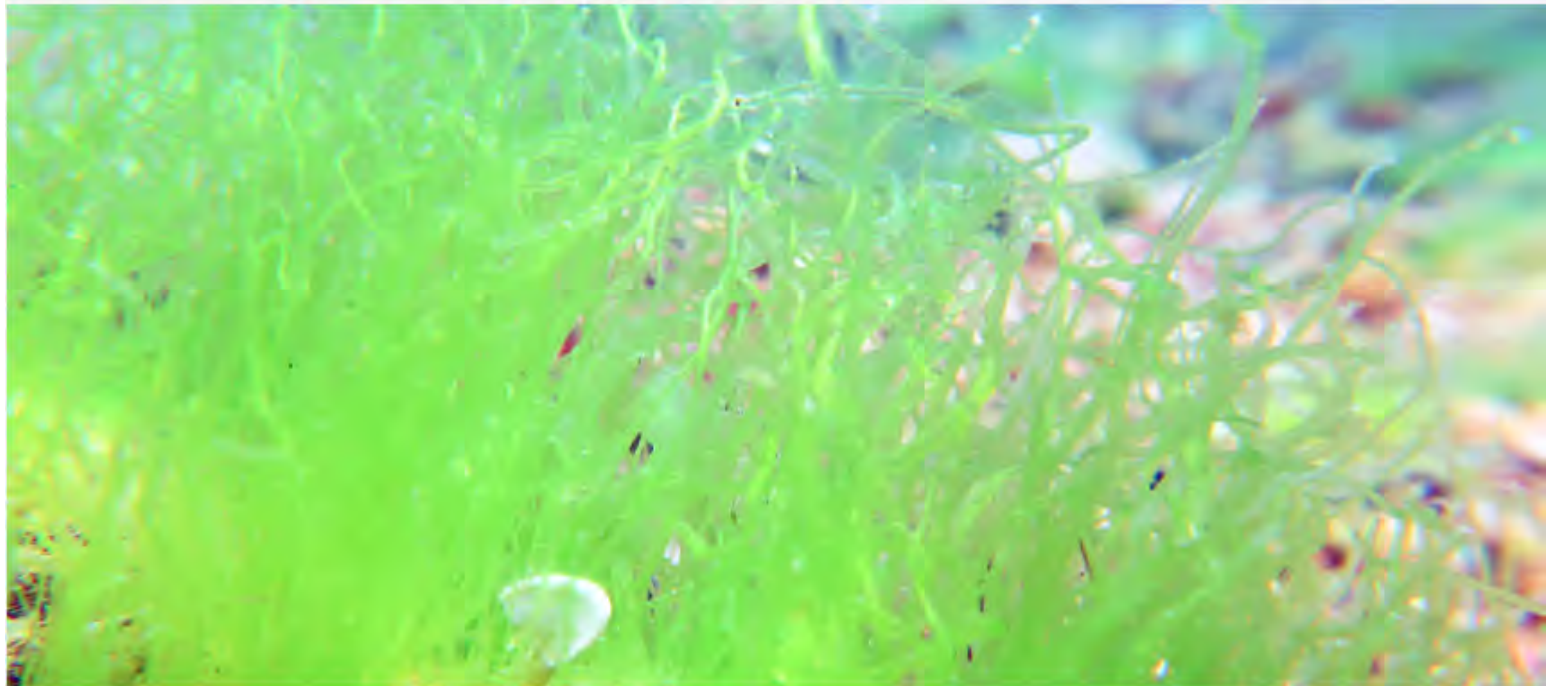
Six Estonian wellness spas have already tested the first simplified pilot products. The aim is to develop a proper spa product line that have bigger packages for wellness spas and smaller for retail clients.

LoondSPA aims to take all the good things out of the mud and mineral water mix and use these in high quality cosmetics products. During spring 2018 LoondSPA has started, together with local scientists, chemical tests to elaborate the potential of the raw material in cosmetic products.

The cooperation needs that LoondSPA addressed the ALLIANCE, are:

- Chemical tests (active components from mud), dermatological trial and the products self-life test.
- Extended knowledge about mineral water potential application for other products e.g. facial water or mist.
- Help in product development.
- Business support.

The mentors of LoondSPA are Tartu Biotechnology Park (TBP), GEOMAR Helmholtz Centre for Ocean Research Kiel (GEOMAR) and Coastal Research & Management (CRM).



Phytolinc: a photobioreactor linked to land-based recirculating aquaculture system

Phytolinc develops a photobioreactor (PhytoBoX) for cultivation of microalgae. The system is linked to any existing land-based recirculating aquaculture system (RAS).

The company

PHYTOLINC is a spin-off from the University of Cologne, Germany. The team, with a strong background in biology, aquaculture and finance, is developing an innovative photobioreactor for microalgae production. The membrane system enables highly efficient cultivation as well as the production of new algae species. PHYTOLINC develops a system for aquaculture purposes, as well as microalgae mass production. Currently, the startup is funded through a German-European startup program and is upscaling the lab scale prototype to industrial scale. PHYTOLINC aims to make microalgae production economic and ecologically sustainable to benefit from the great potential of algal products. For a feedback orientated product development, the startup is always looking for cooperation partners.

cultivation methods (suspension cultures) are unsuited for algae-aquaponic-systems. The solution to this issue is a surface-based cultivation method. Water and algae are separated through a micro membrane, such that the biomass grows directly on the layer surface. In addition to the possible integration as aquaponic-system, the technique has further advantages including:

Water and space saving

Space saving and easily extendable thanks to a modular design
Up to 90% less water consumption.

Optimized gas exchange

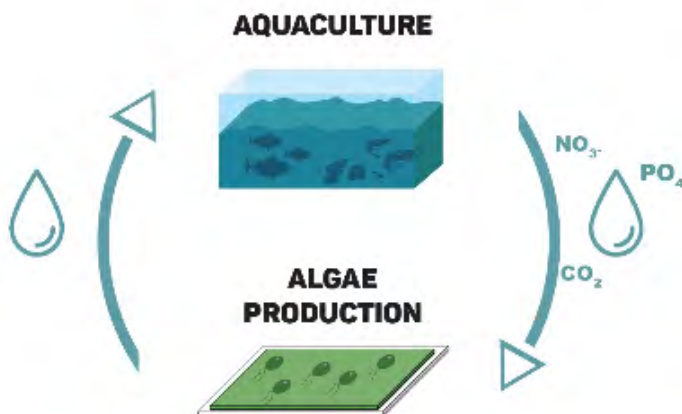
Algae cells are directly exposed to the atmosphere, which accelerates the CO₂ exchange.

Optimized lighting

Higher growth rates, as algae cells are well exposed to the light source.

Expansion of the algae portfolio

Restriction of water movements enables the cultivation of high value algae species e.g. sessile algae species as dinoflagellates that are likely to increase the growth and survival rates of marine organisms.



The idea

The PhytoBoX, the photobioreactor of PHYTOLINC, will be a microalgae cultivation system that can directly be linked to any existing land-based recirculating aquaculture system (RAS). By doing so, PHYTOLINC can recycle the available nutrients, decrease the water usage for algae cultivation significantly and hence provide a very ecological and economic cultivation technique. Aquaculture farmers will easily be able to extend their product portfolio with algal products. Due to the mixing of algae and process water current

“ We benefit from the established ALLIANCE network in the field of aquaculture and enjoy the expertise in microalgae production.”



Arne Maercker

Phytolinc

The allies

Being a partner of the ALLIANCE since 2018, PHYTOLINC has already established valuable contacts to aquaculture companies. The team is actively supported by the mentors BioCon Valley and Lars Jørgensen from the Danish Technology Institute (DTI). With their profound background in microalgae production as well as their broad network, PHYTOLINC is happy to take advantage of their expertise.

The main goal of the cooperation between the ALLIANCE and PHYTOLINC is to set up a first pilot production system during the program.



Department of Seaweed: a transdisciplinary platform for exploration of seaweed

Treating seaweed as a sustainable resource of the future and gather together experts from different fields who work with seaweed as material is the main goal of the platform.

The Organization

The founding members of Department of Seaweed (DoS) are:

- Julia Lohmann (Professor for Design at Aalto University in Helsinki, Finland)
- Violain Buet (Studio for the research and creative development of macroalgae, Auray, France)
- Jon Lister (Designer – Maker, New Zealand)
- Rolf Kellner (Architect and City Planner, Hamburg, Germany)
- Jana Hinners (Biologist, Edinburgh, UK)
- Miryam Pippich (Designer, Oslo, Norway)
- Gero Grundmann (Designer and Illustrator, Helsinki, Finland)
- Florian Andrews (Circular Economy, Hamburg, Germany)

The DoS is a transdisciplinary platform for the exploration of seaweed as a sustainable resource. It is dedicated to certain values in order to achieve the status of the transdisciplinary platform:

- The DoS is a broad, transparent, accessible, inclusive, global, co-creative and collaborative institution.
- The DoS is doing research for understanding, making and design. Openness for everything and innovation are objectives.
- The DoS is open to the whole range of algae and seaweed: from macro algae to phytoplankton.
- The DoS is dedicated to the ideas and patterns of sustainability. It works eco-system and regional based, local oriented, and with the perspective of long term for the seaweed and mankind. The DoS supports the ideas of circular economy.
- The DoS will treat all matters with respect, because seaweed might be a resource for future solutions, things and products. Seaweed is a natural occurring material with a long heritage in ingredients, knowledge and skills.

The idea

The DoS sees macroalgae as a lens for understanding the presence and looking to the future. Besides the concrete research and development of algae as a creative material - as a possible replacement for leather, textile, wood, paper and plastic - the DoS creates future scenarios, gained from a network of perspectives of participants from different disciplines. In this way it is possible to recognize whether these are dystopias or utopias and which of them can be transferred as case studies to the use of other natural resources. Together, they have set themselves the goal of testing new forms of cooperation on the basis of

algae, building up a body of knowledge for sustainable design with algae and countering the 'gold rush', in the course of which algae are praised as the new oil, with a nuanced discourse and local action in the global network.

The DoS produces content in dialogue with experts from science, justice, crafts, politics, philosophy and the material use of algae as a material.

DoS organizes successfully workshops with various guests and other public events. The DoS is to become an expanding network of experts, project partners and guests.

Read more

“ Through the ALLIANCE we aim to find new partners for our transdisciplinary platform. We also want to learn from the Submariner Network experience when it comes to creation of the proper legal form.” -

Florian Andrews

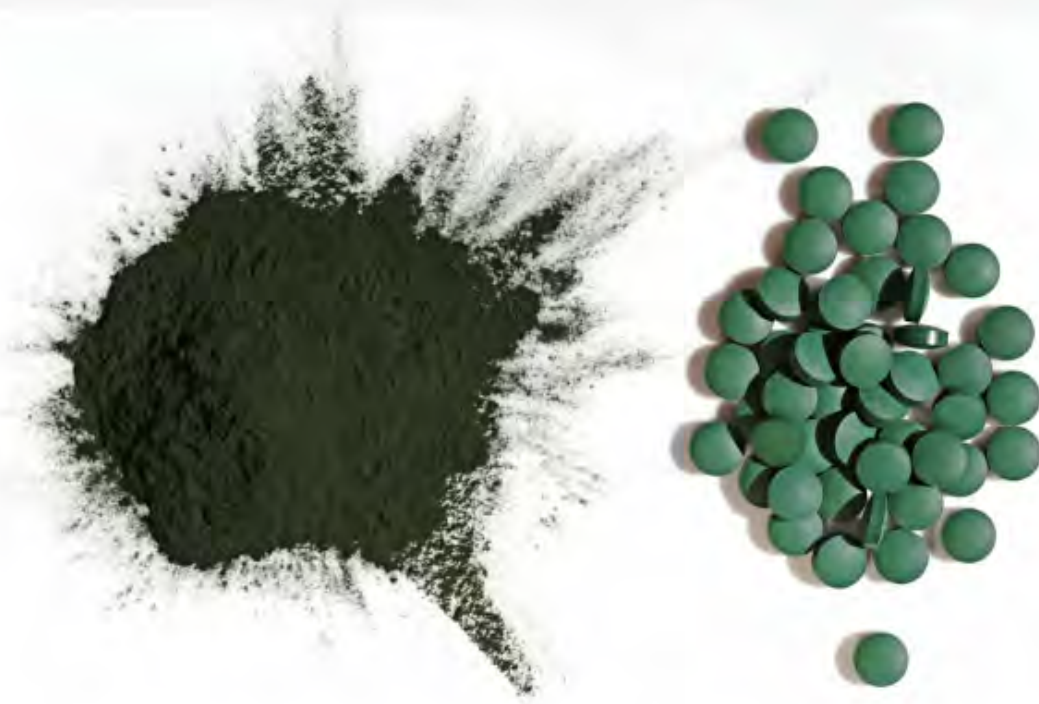
Department of Seaweed

The allies

DoS cooperates mainly with Submariner Network when being involved into the ALLIANCE. For a national outreach abroad, the following ALLIANCE partners offered help to DoS: Royal Institute of Technology (KTH), Finnish Environment Institute (SYKE), Tartu Biotechnology Park and GEOMAR Helmholtz Centre for Ocean Research Kiel. KosterAlg could potentially deliver the seaweed.

The main needs of DoS are:

- Support in legal advice to set up the association ("Verein") and the limited company ("GmbH")
- Help in business advice to set up the business (e.g. crowdfunding, Yearly Editions of Art & Design, Business Incentives/Workshops/Inspirational talks)
- Organizational support for strengthening and expanding the network
- Financial support for meetings



Biotrino: bioscience start-up discovers a type of algae rich in proteins

The Danish company Biotrino utilizes microorganisms to produce proteins and fats. This way of gaining the proteins is faster and more efficient than animals and plants – without using any toxins.

The company

Biotrino ApS is a bioscience start-up founded in 2018 on the ideas of innovating foodstuff ingredients - the vision is to become a recognised leader of the transition from high to low carbon footprint ingredients and tackle global challenges within food, health and environment.

The initial research of Biotrino, partly conducted in the Danish Technical University (DTU) and assisted by fellow DTU researchers, has been targeted alternative ways of providing proteins organically, economically and with potential of very large-scale industrialisation.

The idea

Animal farming is the most common source of protein for human consumption. According to the Danish Society for Nature Conservation 82 % of the crop area (which makes up 62% of Denmark) is used for animal feed like grains, corn, rape and grass. Only 9,5 % of agricultural crop area is dedicated to grow human food. Nutritional energy is lost when grains are used for feeding farm animals as opposed to consumption by humans. It takes approximately 7 kilos of grains to produce 1 kilos of beef. Beef contains 25% protein, it means it takes 7*4=28 kilos of grains to produce 1 kilos of animal-based protein.

Biotrino has discovered a species of the *Chlorella* algae that contains more than 60%

protein (2-3 times more than that of meat). Moreover, it contains omega-3 fat in addition to different vitamins and minerals. Apart from that, Biotrino has discovered a novel way to grow the algae, making the production less expensive and scalable.

The initial potential customers are Health Food vendors positioning *Chlorella* as a supplement. Later Biotrino will position *Chlorella* as a food ingredient, targeting small food producers, like ice cream manufacturers, bakeries or fruit juices makers.

“ We team up with the Danish Technological Institute from the ALLIANCE and enjoy their experience about the growth of microalgae, as well as expertise in the first phase of running a start-up.” -

Søren Hedegaard

Biotrino ApS

The allies

Biotrino is collaborating with the Danish Technological Institute (DTI) as their main ALLIANCE mentor. DTI has broad experience with growing microalgae, and their expertise allows the start-up to move faster, and avoid unnecessary mistakes in the first phase of the development.