

**Skisser med relevans innenfor  
Bioressurser**

**Tabell: Oversikt over skisser med relevans for området Bioressurser**

Prosjekt-nummer	Prosjekttittel	Søkerinstitusjon	Prosjektleder	Estimert søkt beløp fra NFR
315065	PLANKTONLAB-Mobile Benthos Plattform	SINTEF OCEAN AS (NTNU)	Gunvor Øie	22 200 000
316393	NOR-Openscreen II – The Norwegian node of EU-OPENSREEN ERIC	UiO (UiB, UiT, SINTEF)	Johannes Landskron	45 416 000
316396	Agricultural Robotics and Intelligent Sensing Ecosystem; Robust, Flexible and Scalable Automation for Norway.	NMBU (NMBU, NOFIMA, Østfoldforskning, OsloMet, NVI)	Alex Mason	76 900 000
316403	Life Science Electron Microscopy Center (LSEMC)	UiO (NMBU, UiT)	Norbert Roos	178 644 000
316418	Sustainable infrastructure for scientific living plant collection and advanced greenhouse production	UiO (Trøndelag fylkeskommune - Mære landbrukskole – FoU (Trøndelag County), Norges Bondelag (Farmers Union), Gether AS)	Finn Ervik	18 700 000
316424	BIOSCAN Norway: Enabling next generation biodiversity research	NTNU (UiB, UiO, UiT, NINA, NIVA, IMR, SINTEF Ocean, University of Guelph (Canada))	Torbjørn Ekrem	49 783 500
316432	National Human iPS Cell Biobank	OUS (UiO, HUH/UiB, St.Olavs/NTNU, Biobank Norway)	Joel C. Glover	26 600 000
316440	Centre for Biodiversity genomics	UiO (NTNU, UiB, UiT, OUS)	Kjetill Sigurd Jakobsen	58 480 000
316443	Norwegian Bioscreening Platform for Laboratory Fish	NMBU (UiO, NTNU, UiB, Nord Universitet)	Peter Aleström	92 245 000
316458	Norwegian open infrastructure for high-throughput experimentation and scale-up	UiB (NTNU)	Bengt Erik Haug	104 000 000
316462	Mobile Clean Laboratories for cruises and field works to study Biogeochemical processes of trace elements & microbiology in marine systems.	NTNU (NIVA, UiB, HI, SINTEF Ocean, NORCE)	Murat Van Ardelan	27 570 000
316467	Norwegian Infrastructure for Climate-smart Soil Management - CSM	NMBU (NIBIO, CICERO)	Peter Dörsch	79 000 000
316471	Autonomous Dynamic Integrated Ocean Observing System (ADIOOS)	NORCE	Rune Storvold	123 000 000
316481	National Bioprocessing & Fermentation Centre - NBioC phase 2	NORCE (SINTEF, NOFIMA, UiT, UiB, UiS)	Catherine Boccadoro	69 000 000
316484	Norwegian Node of the Global Biodiversity Information Facility – GBIF-Norway 2022-2026	UiO (NBIC, NTNU Uni.Museum, NINA)	Dag Endresen	33 371 000

316494	Oppgradering av bioproseseringsanlegg for maksimal økonomisk og bærekraftig utnyttelse av marine råvarer	NOFIMA AS	Ragnhild Dragøy Whitaker	23 200 000
316499	COASTWATCH - the Norwegian coastal observing system of systems	HI (IMR, MET, UiB, NORCE, NIVA, APN, NERSC, NVE, RMS, UiO, NINA)	Frode Bendiksen Vikebø	115 000 000
316502	Norwegian Biorefinery Laboratory III	RISE PFI AS (SINTEF Energy, SINTEF Industy, NTNU, NIBIO, NMBU)	Øyvind Eriksen	50 000 000
316514	Norwegian Collections of Marine Life	UiB (NTNU)	Aino Hosia	43 117 000
316536	The Norwegian Nanocellulose Laboratory	RISE PFI AS	Kristin Syverud	26 000 000
316538	Norwegian Marine Robotics Facility II: Autonomous Underwater Vehicle (AUV)	UiB (FFI)	Rolf-Birger Pedersen	73 000 000
316540	Norwegian technology platform for industrial macroalgae cultivation and utilization (MACROTECH)	SINTEF OCEAN AS (NTNU, SINTEF Industri)	Aleksander Handå	170 000 000
316549	Norwegian Telemetry Network	NORCE (NTNU, NMBU, NINA, UiB)	Robert Lennox	133 400 000
316554	Marine fish detection, fish behaviour observations and seabed Investigations package 2021-2025	UiT (IMR, NPI, SINTEF Ocean, Fiskeridirektoratet)	Roger B. Larsen	16 250 000
316559	Museum collections for the future. The Norwegian digitization laboratory for museum specimens at the Arctic University Museum of Norway	UiT	Andreas Altenburger	28 448 000
316560	Endring og oppgradering av SINTEF Oceans mobile anlegg for prosessering av marine råstoffer.	SINTEF OCEAN AS	Bendik Toldnes	9 181 500
316576	Floating solar energy test centre	SINTEF OCEAN AS (NTNU, IFE)	Øyvind Hellan	85 000 000
316580	Power-to-X systems lab at Tiller	SINTEF AS (SINTEF Ocean AS, SINTEF Energy AS, NTNU)	Kyrre Sundseth	42 500 000
316600	Mandatory draft for infrastructure application Center for Land-based Aquaculture, CLA	NORD UNIVERSITET (LetSea, SINTEF Ocean and NCE Aquaculture)	Mette Sørensen	32 500 000
316603	Microalgae platform for Norway	NORD UNIVERSITET (NIBIO, UiT, NIVA, VUC)	Kiron Viswanath	63 350 000
316608	Norwegian Biobank for Nature (NORBINA)	UiO (UiB, NTNU, UiT, NMBU, UiA, NIVA, NIBIO, NVI)	Arild Johnsen	53 117 000
316610	NIBIO-XCT - An integrated X-ray Computed Tomography (XCT) facility for the Ås campus (NIBIO/NMBU/Veterinærhøgskolen)	NIBIO (NMBU, Veterinærhøgskolen, Kimen Såvarelaboratoriet AS)	Adam Vivian-Smith	40 973
316610	NIBIO-XCT - An integrated X-ray Computed Tomography (XCT) facility for the Ås campus (NIBIO/NMBU/Veterinærhøgskolen)	NIBIO (NMBU, Veterinærhøgskolen, Kimen Såvarelaboratoriet AS)	Adam Vivian-Smith	40 973 000

316616	Norwegian Plant Phenotyping Platform	NMBU (UiO, NTNU, UiT, NIBIO)	Morten Lillemo	50 000 000
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**Prosjektnummer: 315065**

**Tittel:** PLANKTONLAB-Mobile Benthos Plattform

**Søkerinstitusjon/partnere:** SINTEF OCEAN AS (NTNU)

**Prosjektleder:** Gunvor Øie

**Kort sammendrag:**

The RI "Norwegian Center for Plankton Technology - PLANKTONLAB" (245937/F50) was granted by the Research Council of Norway (RCN) in 2016. The overarching goal of the centre is to strengthen research and technological development on cultivation and use of planktonic organisms from lower trophic levels, to increase marine biomass production, address climate change mitigations and conduct environmental research. The research activities include various disciplines such as nutrition, physiology, ecotoxicology, biotechnology, ecology, and marine biology. This RI encompasses both cultivation and harvesting methods of planktonic marine biomass from lower trophic levels which can be used both as live feed organisms to serve early life stages of marine fish and crustaceans, or as high-value ingredients for extruded aquafeeds.

With the present RI proposal, the PLANKTONLAB will get an upgrade and extension with a Mobile Benthos Platform (MBP). The R&D activities of the new application encompassing benthic epi- and in-faunal organisms and meroplankton. The existing RI – PLANKTONLAB together with the new RI applied for in this application, the complete RI will include infrastructure that encompasses R&D-activities on both planktonic and benthic organisms on lower trophic levels. This will have huge prospects with regards to food and feed production and environmental monitoring activities. With this application Norway can take key steps to developing new biomarine industries targeting both planktonic and benthic organisms at lower trophic levels. The complete RI will be established at SINTEF and NTNU at Sealab. The benthic platform will be made mobile, that will ensure possibilities for conducting experiments outside the physical location at Sealab.

**Prosjektnummer: 316393**

**Tittel:** NOR-Openscreen II – The Norwegian node of EU-OPENSREEN ERIC

**Søkerinstitusjon/partnere:** UiO (UiB, UiT, SINTEF)

**Prosjektleder:** Johannes Landskron

**Kort sammendrag:**

NOR-Openscreen started as a national RI with funding from the NFR in 2016. It consists of four facilities located in Oslo (UiO, NCMM), Bergen (UiB, BiSS), Trondheim (SINTEF) and Tromsø (UiT, Marbio), and represents the Norwegian node of the EU-OPENSREEN ERIC. The RI delivers services in the area of chemical biology, high throughput screening, cheminformatics and bioprospecting to both the public (academic research groups, hospitals) and the private sector, from SMEs to large life science and pharma companies. The different nodes are very specialized with regard to

instrumentation, technologies and services that are made available to the users. UiO is hosting the project and the majority of the networks' chemical compound collection (~70 000 molecules) and offers a broad variety of screening technologies. UiB is specialized on structure-based approaches like fragment screening and the cheminformatics. SINTEF has a strong background in mass spectrometry and metabolomics and UiT is the bioprospecting node, offering pipelines for purification, characterization and screening of natural products mainly from marine sources. In the present application the RI is applying for a phase II funding to implement novel emerging technologies to maintain its cutting edge position.

**Prosjektnummer: 316396**

**Tittel:** Agricultural Robotics and Intelligent Sensing Ecosystem; Robust, Flexible and Scalable Automation for Norway.

**Søkerinstitusjon/partnere:** NMBU (NMBU, NOFIMA, Østfoldforskning, OsloMet, NVI)

**Prosjektleder:** Alex Mason

**Kort sammendrag:**

The establishment of the ARISE Research Infrastructure at NMBU aims to improve the uptake of intelligent automation (i.e. robotics and sensing) within the Norwegian agri-food sector. The initiative promises to bolster the multidisciplinary collaboration of the engineering and biosciences disciplines and provide unparalleled facilities for basic and applied R&D for Norwegian agriculture, and significantly improve new and existing research-based education programmes. This is a sector which prioritises constant improvement of productivity, as well as having a strong desire to improve the quality of the working environment which can be characterised by long working days, tough physical labour and menial or repetitive tasks. Such factors have led to increased difficulty finding workers on farms and at food processing facilities, a challenge made more acute by the 2020 COVID-19 outbreak, where travel advisories or restrictions have further reduced the availability of foreign workers for seasonal activities. Moreover, Norwegian agri-food production entails unique logistical challenges (weather, seasonal variation) in addition to speciality batch-scale production, for example, which contribute to existing automation solutions often being unsuitable. Norway must therefore rise to the challenge of developing robust, flexible and scalable automation systems to suit its own agri-food sector requirements. To achieve this, an approach which considers both production and processing in the value-chain is required. ARISE prioritises three key themes: (1) Crop Farming; (2) Animal Health and Welfare and; (3) Food Processing. In particular, it will focus on aspects related to industrial scale cognitive systems capable of handling heterogenous and flexible materials (e.g. meat, berries), multimode robot operation (i.e. full- or semi- autonomous, collaborative working), as well as the ability to develop new ways of working with and adapting equipment (e.g. virtual or augmented environments: digital twins). In addition, support for disruptive concepts such as mobile automation equipment (e.g. milking, slaughter) should be established to solve or improve logistic and welfare challenges imposed by existing culture. Furthermore, infrastructure to establish and improve traceability in the value-chain will optimise automation solutions and provide feedback to key points in the value-chains (e.g. to improve sustainability through enhanced productivity and reduced waste), enabling the Norwegian agri-food sector to realise Industry 4.0 potential. ARISE will be well placed to provide this opportunity as it builds upon existing expert areas at NMBU, and it particularly exploits the closer relationship enjoyed between NMBU faculties resulting from the relocation of

NMBU's Faculty of Veterinary Medicine to Ås. The initiative also aligns itself with the cross-University strategy to UN sustainability goals, for example "Industry, Innovation and Infrastructure" and "Health and Wellbeing". Additionally, several other external institutions and companies will be involved. This will be described in the full application. All together, ARISE is aiming for research on an international top level.

**Prosjektnummer: 316403**

**Tittel:** Life Science Electron Microscopy Center (LSEMC)

**Søkerinstitusjon/partnere:** UiO (NMBU, UiT)

**Prosjektleder:** Norbert Roos

**Kort sammendrag:**

The proposed infrastructure is of national importance and critically essential among the future technology platforms to be accommodated in the Life Science Building (LSB) that is being built in Oslo. In the new building an area of 650m<sup>2</sup> is being custom-built for, and dedicated to, this infrastructure. The major thrust of this application is to introduce new technologies such as cryo-electron microscopy of single particles (Nobel Prize 2017), which Norway (as the only Nordic country and one of the few European countries) does not offer its scientific community yet. The University of Oslo has declared its intention to implement this technology in the LSB. This type of instrumentation is very expensive and requires a skilled workforce to operate it and we do not see it feasible to establish more than one of these centres in Norway. Combined with the fact that the new LSB has custom built housing for this facility we would argue that UiO is the best place to take care of this infrastructure.

It is clear that cryo-electron microscopy would thrive optimally in a life science electron microscopy environment. It will enable the study of biological specimens from organs, tissues, cells, subcellular structures down to the atomic composition and structure of biological molecules, by offering the complete arsenal of life science electron microscopy techniques and instrumentation.

The proposed infrastructure is therefore building on an existing one, namely the Life Science Electron Microscopy Consortium (LSEMC) core facility that currently is spread across different departments/faculties at UiO and OUS. It will be beneficial to co-localize these activities in the new Life Science Building, thus avoiding duplication of expensive scientific equipment at UiO locally and in Norway nationally. The existing scientific and technical expertise (human expertise) represented at UiO today will provide a robust environment for the integration of cryo-electron microscopy of single particles into a comprehensive life science electron microscopy facility. We also envisage a participation in the ESFRI system of international research infrastructure as well as participation in scandinavian networks, such as cryo-NET.

**Prosjektnummer: 316418**

**Tittel:** Sustainable infrastructure for scientific living plant collection and advanced greenhouse production

**Søkerinstitusjon/partnere:** UiO (Trøndelag fylkeskommune - Mære landbruksskole – FoU (Trøndelag County), Norges Bondelag (Farmers Union), Gether AS)

**Prosjektleder:** Finn Ervik

**Kort sammendrag:**

In Norway, the botanical research on exotic plants as well as the production of important commercial crops like tomatoes and cucumbers rely on greenhouses. The technical energy-solutions of today's greenhouses render both the maintenance of scientific plant collections and the production of crops in greenhouses extremely energy consuming and therefore expensive and dubious from the point of view of sustainability. In order to improve these activities responsibly in the future therefore, we need to implement a technology that is reliable, radically less energy consuming and better serves the need of living plants.

The Natural history museum of Oslo has for the New Exhibition Greenhouse planned a modern energy- and climate-system. Part of this system is in use at Trøndelag County at Mære. It is indeed needed at the largest greenhouse, TØ08, to serve our most extensive and important scientific collections and is needed at Mære to complete a modern R&D infrastructure. Trøndelag County has established «Landbrukets klima og energisenter» (agricultural centre of climate and energy) in Mære as an area for innovation, demonstration, and as a “living lab”. The development of this centre occurs in close cooperation with the national agricultural organisations. As of 2017, the centre has a national role and is funded by the National Budget. Mære participates in more than 20 R&D projects in cooperation with NTNU, SINTEF, NIBIO, NMBU, and firms of relevance.

According to the UN sustainable development goal 13, we shall “ensure sustainable consumption and production patterns”. The ecological footprint of food consumption is the result of the impacts from the production and transport of both the food and production inputs. In relation to other countries, Norway depends on a high percentage of import of both food and food production inputs, and the local production is often energy intensive. The ecological impact of this consumption and production pattern is high both in Norway and in the countries from which we import. Norway therefore should develop its potential for more local and sustainable food production. Through innovation of clean energy solutions that are transferable to most other commercial and scientific greenhouses as well as other buildings, this project targets the Research Council of Norway's main strategy, Research for Innovation and Sustainability 2015-2020 as well as the UN sustainable development goal 7: Affordable and clean energy.

**Prosjektnummer: 316424**

**Tittel:** BIOSCAN Norway: Enabling next generation biodiversity research

**Søkerinstitusjon/partnere:** NTNU (UiB, UiO, UiT, NINA, NIVA, IMR, SINTEF Ocean, University of Guelph (Canada))

**Prosjektleder:** Torbjørn Ekrem

**Kort sammendrag:**

BIOSCAN Norway will provide the infrastructure needed to meet present and future challenges of accurate and large-scale biodiversity research. BIOSCAN Norway will develop and test pipelines for unprecedented analysis of species interactions through the molecular identification of symbiomes in terrestrial, freshwater and marine organisms, as well as procedures for documentation and observation of species community change through time and space. Also, BIOSCAN Norway will implement robust protocols for curation of extracted DNA and reference voucher specimens in Norwegian natural history collections. By expanding and curating a reference library of DNA barcodes of the Norwegian biota, the infrastructure will facilitate species identification, discovery and inventory through DNA barcoding. A particular focus will be on marine biodiversity, and synergistic collaboration with existing and planned infrastructures and Norwegian Centres of Excellence will ensure maximal benefits for all participants. Together with collaborators in the International Barcode of Life (iBOL), BIOSCAN Norway will advance the development of the open access database Barcode of Life Data Systems (BOLD), with tools that enable analyses of species interactions and community change. Finally, the national infrastructure will secure a digital copy of the international BOLD database in Norway.

**Prosjektnummer: 316432**

**Tittel:** National Human iPS Cell Biobank

**Søkerinstitusjon/partnere:** OUS (UiO, HUH/UiB, St.Olavs/NTNU, Biobank Norway)

**Prosjektleder:** Joel C. Glover

**Kort sammendrag:**

Since their introduction to the scientific community in 2008, human iPS cells have revolutionized the field of human cell biology by providing an ethically viable source of all human cell types. This is particularly relevant for studying human disease, since iPS cells can form the basis for in vitro disease models at personalized resolution. The generation of human iPS cell-based in vitro disease models is steadily increasing internationally and in Norway. The Norwegian Center for Stem Cell Research spearheaded this approach in Norway through its Core Facility for Human Pluripotent Stem Cells, which has been making patient- and healthy control donor-derived iPS cells since 2012, has developed standardized differentiation protocols for several cell types, and combined this expertise with other technologies to generate microfluidic-based personalized neurological disease models. Research groups in Bergen and Trondheim have followed suit - it is expected that use of iPS cell-based human in vitro disease models will accelerate throughout Norway in the coming years.

iPS cells have also substantial potential as therapeutic agents. International analyses point to the pressing need for utilizing stem cells in future medical therapeutics. Japan has been the prime mover, under the direction of Nobel Prize-winner Shinya Yamanaka. His Center for iPS Cell Research and Application (CiRA) at Kyoto University has established a national biobank of allogeneic iPS cells from



so-called “super-donors” (homozygous for multiple HLA haplotypes) to meet the needs of nearly the entire ethnic Japanese population for clinical grade cells for tissue and organ replacement and repair. Norway has an exceptionally strong starting point for such a biobank, given its genetically relatively homogeneous population and well-organized patient and health registries. In particular, the Norwegian Bone Marrow Donor Registry contains HLA data for a large number of individuals, among which several “super-donors” have already been identified.

The purpose of the National Human iPS Cell Biobank is twofold: 1) to extend and expand Norway’s expertise and capabilities in the area of in vitro human disease modeling, and 2) to capitalize on Norway’s highly favorable position to generate its own allogeneic iPS cell resource, thus providing the Norwegian population with locally produced, characterized, certified and available cells for currently planned and future stem cell-based clinical trials and treatments. To this end, a biobank of iPS cells with a research grade component and a clinical grade component will be established, through respectively 1) coordination of efforts at multiple, transregional institutions currently generating research grade human iPS cells and developing in vitro human disease models from these (Oslo and Bergen to begin with, and Trondheim as next on the list), and 2) an integration of expertise and efforts at the Norwegian Core Facility for Human Pluripotent Stem Cells, the Norwegian Bone Marrow Donor Registry, and the Ex Vivo Laboratory at Oslo University Hospital to create clinical grade iPS cells from already identified super-donors. The National Human iPS Cell Biobank will partner with the existing national infrastructure Biobank Norway, creating a mutually beneficial development, built on prior investment from the NRC, to increase and secure the national availability of personalized cellular material for medical research and therapeutics.

**Prosjektnummer: 316440**

**Tittel:** Centre for Biodiversity genomics

**Søkerinstitusjon/partnere:** UiO (NTNU, UiB, UiT, OUS)

**Prosjektleder:** Kjetill Sigurd Jakobsen

**Kort sammendrag:**

The proposed Centre for Biodiversity Genomics (CEBIGEN) will deliver high quality reference genomes, population genomics data, transcriptome, metagenome and other relevant "genomics" services for all types of research associated with non-human samples. CEBIGEN will provide consultation, run projects from biological samples to analysed genomic data using state-of-the-art pipelines. CEBIGEN will focus its services to all types of biodiversity research implying that it provides complete pipelines for analyses of all kinds of non-human biological samples - ranging from bacteria, microbial eukaryotes, algae, plants, invertebrates and vertebrates. The ambition is to build a national genome centre specialized for the various and diverse needs of research on non-model organisms and non-human models. The need for such a genome centre is driven by threats to biodiversity, ecosystems, climate change as well as the great potential of exploiting genomic information for the benefit of mankind and for developing a sustainable blue-green economy in Norway. An additional driver is the fast emergence and progress of international projects such as the Earth BioGenome (E BP) and related projects aiming at sequencing all existing eukaryotic organisms on earth. Norway needs to relate to these transformative projects, and currently we do not have sufficient capacity regarding

sequencing instruments, bioinformatics and computing to efficiently carry out a full-scale EBP-Norway effort.

**Prosjektnummer: 316443**

**Tittel:** Norwegian Bioscreening Platform for Laboratory Fish

**Søkerinstitusjon/partnere:** NMBU (UiO, NTNU, UiB, Nord Universitet)

**Prosjektleder:** Peter Aleström

**Kort sammendrag:**

The Norwegian Bioscreening Platform for Laboratory Fish (LABFISH) will be a national platform for *in vivo* bioscreening in the life sciences using laboratory fish, i.e. zebrafish (*Danio rerio*) and medaka (*Oryzias latipes*). The platform will deliver advanced high-throughput whole-organism bioassay systems for the Norwegian research community. LABFISH will be a multi-nodal platform, centered at NMBU and UiO in the Oslo region, with additional nodes at UiB in Bergen, NTNU in Trondheim and Nord U in Bodo, and collaborating closely with UiT in Tromsø.

The platform will be used by the Norwegian research community to accelerate the discovery of bioactive small molecules and natural bioresources with commercial potential as pharmaceuticals or as feed ingredients. LABFISH will be also used to systemically study environmental, toxicological and genetic perturbations to assess the impact of pollutants, radiation, drugs and disease-associated genetic, epigenetic, transcriptomic or microbiomic variations. Transgenic reporter lines and xenograft models with cell type- and/or cell state-specific expression of fluorescent or luminescent proteins will enable the rapid quantification of physiological responses relevant for a wide range of diseases in human, veterinary and aquatic medicine. The platform will be established within the new and/or existing model fish facilities at NMBU, UiO, UiB, NTNU and Nord U thereby leveraging and strengthening these major strategic investments in the life sciences by the partner institutions. The equipment and competence installed by LABFISH will bring substantial added value to these facilities and will deliver to national research institutions technology that is competitive at the highest international level. Automated and robotic equipment will be installed in the platform including pipetting robots, embryo and cell sorters, and medium- to high-throughput bioimaging systems. A cryopreservation facility will reduce the numbers of live fish (RRR) needed to maintain multiple laboratory fish lines. LABFISH will operate as an open-access platform on a user-pays principle to partially recoup investment costs and to help ensure operability. LABFISH will be professionally managed by a board, a director, and experienced node managers. This management team will work in close consultation with (1) a user committee including members of the academic, governmental and industrial partners in Norway and Europe, and (2) an international scientific advisory board.

**Prosjektnummer: 316458**

**Tittel:** Norwegian open infrastructure for high-throughput experimentation and scale-up

**Søkerinstitusjon/partnere:** UiB (NTNU)

**Prosjektleder:** Bengt Erik Haug

**Kort sammendrag:**

This application seeks to establish a new national infrastructure platform (NorHTE) that will furnish Norway's research communities in chemistry, materials science, biotechnology, pharmaceuticals, and chemical and energy process engineering with state-of-the-art instrumentation for high-throughput experimentation (HTE) and advanced materials manufacturing. By offering a fast, automated and quality-assured alternative to error-prone manual methods, NorHTE will accelerate the discovery of new molecules and materials for multiple application areas, including electronics, catalysis, renewable feedstocks, therapeutics, diagnostics and energy generation and conversion.

The proposed infrastructure - the first of its kind in Norway - will comprise five integrated platforms for (i) high-throughput experimentation, (ii) flow-chemistry, (iii) real-time analysis, (iv) machine learning, and (v) scale-up. By combining automation, state-of-the-art robotics, chemometrics and machine learning, NorHTE will allow Norwegian scientists to carry out large-scale chemical experiments of far wider scope than is currently feasible, leading to superior products and/or more efficient synthesis routes. The main HTE platform will be located at UiB, with a complementary flow-chemistry platform located at NTNU. The Bergen node will consist of two robotic systems for aerobic and anaerobic synthesis, a system for automated purification, and analytical instrumentation for reaction monitoring and quality control. The Trondheim platform will comprise a suite of flow modules for in-line reaction, analysis, purification and scale-up. Both nodes will be furnished with extensive instrumentation for reaction monitoring, allowing for automated feedback-driven searches in which the most promising conditions for testing are decided on the basis of previously acquired data. The resulting "self-optimising" reactors will massively enhance the efficacy of HTE chemistry, bringing Norway to the international forefront of automated chemical discovery.

NorHTE will be open to both academic and industry users across Norway, with users being charged on an hourly rate model. The distinguishing feature of NorHTE which sets it apart from other HTE facilities worldwide is the inclusion of infrastructure for intermediate-scale chemical synthesis up to the 1-kg/day-level, providing users with a complete solution that encompasses both chemical discovery and chemical manufacturing.

**Prosjektnummer: 316462**

**Tittel:** Mobile Clean Laboratories for cruises and field works to study Biogeochemical processes of trace elements & microbiology in marine systems.

**Søkerinstitusjon/partnere:** NTNU (NIVA, UiB, HI, SINTEF Ocean, NORCE)

**Prosjektleder:** Murat Van Ardelan

**Kort sammendrag:**

Why do we need TraceClean mobile Labs: Biogeochemical cycles of trace elements and their isotopes in marine systems and their roles in marine ecology and molecular mechanisms are growing sub-discipline in marine science as well as climate-related processes. Even though various Norwegian research institutes conduct research on the biogeochemistry of trace elements in marine systems, we are still behind the developments in this field. With a focus on field infrastructure, Especially regarding field infrastructures, Norwegian research communities studying trace elements still do not have access to these essential infrastructures. "Better than Patterson's.";

Concentration of bio-essential and toxic trace elements in seawater are extremely low. In order to determine bio-essential and toxic trace elements in seawater, atmosphere, and sediments as precise and accurate as possible, "clean techniques" are essential. Clair C. Patterson pioneered the concept of "trace element clean" laboratories for environmental analyses at the California Institute of Technology. He recognized that measurements of environmental lead concentrations were often erroneously high because of the inadvertent introduction of contaminant lead to the samples (Patterson and Settle, 1976). Currently, we have clean lab facilities in our labs; however, during the cruise and fieldwork every time, we have to build a "clean bobble" to keep the working environment trace clean. Building "clean bobble" is an extremely time and energy-consuming process and also has a high risk of contamination. The clean technique includes all the steps from sampling to analysis. Thus, sampling and immediate manipulation of samples from sea, atmosphere, and sediment should be done in trace element clean laboratories during research cruises and field work. Here we proposed to establish a trace element mobile laboratory research infrastructure to facilitate trace element sampling and experimentation. The establishment phase of the project will fabricate three lab containers that will be built using standard 20 foot shipping containers (20 ft (6.06 m) long, 8 ft (2.44 m) wide, and 8 ft 6in (2.6 m) tall) that are flexible with regards to both mobility by lorries and attachment to research vessel decks and land-based laboratory loading docks. The interior will be outfitted with non-metallic trace element clean materials and positive-pressure HEPA-filtered source air, as well as HEPA laminar flow work benches (ISO 4 and 5, i.e.,  $\leq 10^4$  and  $10^5$  particles  $0.1 \mu\text{m}$  in diameter  $\text{m}^{-3}$ ).

**Prosjektnummer: 316467**

**Tittel:** Norwegian Infrastructure for Climate-smart Soil Management - CSM

**Søkerinstitusjon/partnere:** NMBU (NIBIO, CICERO)

**Prosjektleder:** Peter Dörsch

**Kort sammendrag:**

Norway's agricultural sector is under great pressure to reduce its greenhouse gas (GHG) emissions and has pledged itself to reduce 5 million tons of CO<sub>2</sub> equivalents by 2030, roughly the equivalent of one year's climate forcing by the Norwegian agricultural sector. Despite much focus on how to

estimate GHG emissions from agriculture and to make the sector's GHG savings visible evidence-based approaches to curb nitrous oxide (N<sub>2</sub>O) emissions and to increase soil carbon sequestration remain understudied and techniques to reliably document such mitigations are missing. This despite the fact that soils are anticipated to play an important role in combating climate change. A national infrastructure on soil management seems timely, given soils' role for food security, renewable raw materials and as recipient of waste streams in a circular bioeconomy.

A major barrier for using soils more actively for GHG mitigation in Norway is the lack of data documenting management-specific effects on N<sub>2</sub>O emissions and soil C sequestration under Norwegian conditions. While N<sub>2</sub>O emissions are highly episodic, C sequestration and turnover in soils are slow processes, making it difficult to observe both processes at the same time. The CSM infrastructure is designed to overcome these limitations by providing a network of state-of-the-art research facilities across different scales, ranging from highly instrumented field-laboratories at campus Ås and NIBIO Apelsvoll to mobile GHG measurements units that will be deployed in a nationwide network of agronomic and real-farm field sites to a data infrastructure integrating data for industrial and public stakeholders. Once established, this infrastructure can be used for developing and rigorously testing climate-smart soil management strategies and for deriving region- and management specific emission factors urgently needed to improve national emission inventories.

CSM directly addresses the bio-industry by aligning national agronomic GHG research with the needs of industries engaged in fertilizer production, mining, waste treatment and bioproduction. It serves the farming sector as a whole by providing data for disintegrating emission factors to be used to meet the sector's GHG targets. CSM is proposed jointly by NMBU, NIBIO and CICERO.

**Prosjektnummer: 316471**

**Tittel:** Autonomous Dynamic Integrated Ocean Observing System (ADIOOS)

**Søkerinstitusjon/partnere:** NORCE

**Prosjektleder:** Rune Storvold

**Kort sammendrag:**

ADIOOS is a new infrastructure for development of future in-situ observing systems using a breakthrough in adaptivity and efficiency by utilizing the latest technological breakthroughs in autonomous platforms, communication technology and computing power. A prototype observing system will be set up, designed to serve as a research platform to explore and develop future observing systems based on adaptable infrastructure that can be shaped to numerous applications. ADIOOS will focus on three specific forecasting applications essential for the safe and sustainable exploitation the ocean space environment, these applications are meteorology, emergency response (algae blooms, oil spills) and marine ecosystems (biomass). The infrastructure will contribute to development of new technologies and modeling systems using the latest development in computing power, communication systems, autonomy and artificial intelligence. Even though this is a proposal for a new infrastructure it will also serve as an development platform to established infrastructures where new technologies can be developed and tested before being adopted into regular use in observing systems vital to creating sustainable long term time series such as SIOS (Svalbard Integrated Earth Observation System) and GEOSS (Global Earth Observation System of Systems). The uniquely new feature of this infrastructure is that it will be autonomous, which means operational

models will determine where and when to sample and which resources should be allocated based on analysis of uncertainty and sensitivity to input data in the forecasting, thus reducing uncertainty by doing the sampling where it has the optimal cost benefit effect, thus being an self-optimizing observing system, maximizing benefit while minimizing cost. The infrastructure will serve scientists within geosciences, oceanography, meteorology, marine ecosystems, engineering, cybernetics, information and communication technology, physics and technology. The relevance to this wide range of user groups is the inherent multidisciplinary nature of observing systems where science and engineering development is tightly coupled.

**Prosjektnummer: 316481**

**Tittel:** National Bioprocessing & Fermentation Centre - NBioC phase 2

**Søkerinstitusjon/partnere:** NORCE (SINTEF, NOFIMA, UiT, UiB, UiS)

**Prosjektleder:** Catherine Boccadoro

**Kort sammendrag:**

This application is to establish the second phase of the scaling up and pilot Norwegian Bioprocessing & Fermentation Centre (NBioC), responding to the need for a unique national Research infrastructure (RI) for fermentation research, as described in the Norwegian research infrastructure road map. The implementation of phase 1 of NBioC is currently underway. This first phase is funded by the NFR through INFRA2016 grant (project 270048), with in-kind contributions and industry support, and establishes an infrastructure at NORCE for scaling up of fermentation using sugar-based and gaseous feedstocks. Phase1 covers part of the funding necessary to fulfil the ambition of NBioC and includes funds for establishing laboratories and enabling gas and other fermentation up to 150L scale, as well as securing access to infrastructure and data from an industry enzyme production line. The support sought in the current proposal is to extend this infrastructure to include a 1000L state-of-the-art reactor for fermentation on gas sources including necessary sensors and downstream equipment to enable process optimization, scaling up and product analysis and testing, as well as access and data collection for R&D projects in existing 1 500L reactor for sugar-based fermentation. In addition, a strong infrastructure network will be built between members of the consortium, in this process linking up and upgrading key existing facilities across Norway to boost R&D to higher TRL levels and develop a strong drive towards gas fermentation in Norway. The total budget amounts preliminarily to 89 MNOK of which 69 MNOK is sought funded by NFR. This will finance equipment investment, projects, operation and maintenance as well as development activities for new projects and the NBioC as a whole. The current consortium includes the NBioC partnership from phase 1 and the full application will most likely extend to other universities or infrastructures in Norway or internationally.

**Prosjektnummer: 316484**

**Tittel:** Norwegian Node of the Global Biodiversity Information Facility – GBIF-Norway 2022-2026

**Søkerinstitusjon/partnere:** UiO (NBIC, NTNU Uni.Museum, NINA)

**Prosjektleder:** Dag Endresen

**Kort sammendrag:**

This infrastructure application concerns a continuation of the Norwegian Participant Node in the Global Biodiversity Information Facility (GB IF) as a national research data infrastructure

coordinated by the UiO Natural History Museum in Oslo (UiO-NHM), and operated through a consortium partnership with the Norwegian Biodiversity Information Centre (NB IC), the NTNU University Museum (NTNU-UM), and the Norwegian Institute for Nature Research (NINA). The Global Biodiversity Information Facility (GBIF) is an international research infrastructure with the mission to facilitate free and open access to biodiversity research data online for anyone, anywhere. GBIF is funded and governed by national governments through a membership with a Memorandum of Understanding (MoU). GBIF is endorsed by the Convention of Biodiversity (CBD, 1993), the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES, 2012), and the Sustainable Development Goals (SDG) as the standard mechanism for providing biodiversity species data in response to these international agreements. The CBD, IPBES, and SDG are ratified by Norway, mandating Norway to report national biodiversity species data through GBIF.

Addressing the urgent global loss of biological diversity and degradation of ecosystems is of global concern and adequate policy responses require access to harmonized data across country borders that would not be possible without international cooperation such as a Global Biodiversity Information Facility. GBIF enables international research and informs better decisions to conserve and sustainably use the biological resources of the planet that would not be possible without GBIF. GBIF provides an operational, effective and very cost-efficient mechanism to address this urgent global priority. GBIF operates through a network of national Participant Nodes (where GBIF-Norway provides this role for Norway) and an international secretariat hosted by Denmark and located at the University of Copenhagen.

GBIF-Norway ([www.gbif.no](http://www.gbif.no)) is the Norwegian Participant Node in the international GBIF research infrastructure ([www.gbif.org](http://www.gbif.org)) since 2005. Norway joined GBIF in 2004 and the Participant Node (GBIF-Norway) was established in 2005 at the UiO Natural History Museum as a project funded by the Research Council of Norway.

**Prosjektnummer: 316494**

**Tittel:** Oppgradering av bioproseseringsanlegg for maksimal økonomisk og bærekraftig utnyttelse av marine råvarer

**Søkerinstitusjon/partnere: NOFIMA AS**

**Prosjektleder:** Ragnhild Dragøy Whitaker

**Kort sammendrag:**

Small companies and research institutes that intend to process new marine biomasses often do not have access to large-scale infrastructure that allows cost-effective test-production. In order to test their own process and technology on a larger scale without the risk of large investments, accessible demonstration plants are the key. Biotep is a demonstration plant equipped with a large number of instruments and tools suitable to handle many different marine biomasses ([www.biotep.no](http://www.biotep.no)) where companies can perform test production. Additionally, a cost estimate can be made, and a product prototype can be tested in the market. There is an increased demand in the market for new targeted bioprocessing in addition to environment-friendly and sustainable solutions. Biotep is equipped to meet many of the demands in the market, however there is an increased demand for more effective filter systems and environment-friendly lipid extraction, and in order to provide the industry better services we seek to add this to the Biotep Portfolio. A new ceramic filter system is robust, flexible,

handles thick liquids, and is well-suited for high temperature. Such a system is compatible with existing infrastructure. In addition, Bioteq want to include a supercritical carbon dioxide system. This system is an environment-friendly and green technology and particularly useful for the extraction of non-polar compounds from hard rigid structures such as in microalgae, kelp and seaweed. The system is non-toxic, non-flammable and inexpensive in use, however it requires a high investment cost that is very risky for most companies, particularly right now. With a ceramic filter system and supercritical carbon dioxide system, Bioteq will be able to help new and established companies to meet the new demands in the market and broaden application areas for processing marine biomasses.

**Prosjektnummer: 316499**

**Tittel:** COASTWATCH - the Norwegian coastal observing system of systems

**Søkerinstitusjon/partnere:** HI (IMR, MET, UiB, NORCE, NIVA, APN, NERSC, NVE, RMS, UiO, NINA)

**Prosjektleder:** Frode Bendiksen Vikebø

**Kort sammendrag:**

Research and development associated with environmental monitoring, climate change, marine pollution, blue growth and ecosystem management greatly benefit from accurate descriptions of the physical, chemical and biological state of the ocean. The strongest currents and overall highest variability are found on the continental shelf and along the shelf break, while the complex geometry of the coastline leads to the creation of smallscale circulation features important for nearshore spreading and dispersion. Hence, the coastal regions and the shelf seas are particularly challenging to resolve in numerical models and observe in a representative way. However, increasing levels of activities at the interface between fjords and the coastal sea place a clear demand on the accuracy in predictions of e.g. marine ecosystem connectivity and pollutant exchange. Establishing a consistent research infrastructure enabling a coherent approach through combined coastal observations and ocean modelling is therefore imperative to secure a sustainable pursuit of the goals of the Norwegian government and international obligations, such as the UN Sustainability Development Goals (SDGs). As a consequence, we propose an integrated coastal observing system COASTWATCH at key sites along the Norwegian coast as a much-needed infrastructure supporting research and knowledge-based management as well as Norway's contribution in the European integrated and multidisciplinary coastal observing system – JERICO (currently applying to enter the ESFRI roadmap). In order to adequately address the complex coupled processes inherent of coastal regions and delivering essential ocean variables, our infrastructure will implement a multiplatform-multi-sensor approach integrating observations from fixed platforms, HF radar systems, coastal gliders, ships of opportunity, surface AUVs and a framework for testing and utilizing other observation sources such as satellite-based remote sensing, connected into into Supersites of high societal relevance. This will provide Norwegian and international researchers and managers a permanent source of near real-time information of physical, biogeochemical and biological state of coastal and shelf regions, supporting an ecosystem approach for analytical studies of stressors and impacts. Furthermore, the infrastructure will represent a hub for easy integration of all observation sources in the area (e.g. salmon farms, national monitoring programs) and a model-based extrapolation beyond the key sites to the entire coast through data assimilation and data-driven machine-learning. We will stimulate technology development to better observe the biogeochemical processes and facilitate cross-



disciplinary research on coastal processes and assessment of the combined climate change and human impacts.

**Prosjektnummer: 316502**

**Tittel:** Norwegian Biorefinery Laboratory III

**Søkerinstitusjon/partnere:** RISE PFI AS (SINTEF Energy, SINTEF Industry, NTNU, NIBIO, NMBU)

**Prosjektleder:** Øyvind Eriksen

**Kort sammendrag:**

Norwegian Biorefinery Laboratory - NorBioLab is a national biorefinery research infrastructure, which has gathered the key research groups within the biorefinery area in Norway; RISE PFI, SINTEF Energy Research, SINTEF Industry, Norwegian University of Science and Technology (NTNU), Norwegian Institute of Bioeconomy Research (NIBIO) and Norwegian University of Life Sciences (NMBU). The existing and future infrastructure is well aligned with the strategies of the involved partners and will enable an even stronger cooperation of the partners in joint national and international projects. These projects are aligned with the coming EU New Green Deal and the UN sustainability goals for affordable and clean energy (Goal 7) and climate actions (Goal 13). Since the establishment in 2014, NorBioLab has evolved into the most advanced and versatile infrastructure in Norway for valorization of biomass and other renewable feedstocks. The key elements for the success of NorBioLab are the high competence, the well-established cooperation and well-developed relations between the NorBioLab partners. The competence of the partners within biomass- and biotechnology-related topics has enabled the development of a highly advanced infrastructure sought after both by research groups and industrial stakeholders. The importance of the NorBioLab infrastructure with equipment for analysis and conversion of biomass to green chemicals and biofuels is further emphasized by its use; more than 80 different research projects benefitted from the infrastructure in 2019. Some of the projects are integrated or support large prestigious Center-type national projects such as Bio4Fuels (an "FME"), Foods of Norway (an "SFI"), iCSI (Industrial Catalysis Science and Innovation, an SFI) and the Norwegian Seaweed Biorefinery Platform (SBP-N). Norwegian land-based and sea-based industries, including the bio-based industries, are facing an important transformation. We must create more value out of our bio-produced feedstocks, and we need to reduce the environmental impact and carbon footprint from the use of fossil raw materials by developing more sustainable processes. Thus, the need for NorBioLab the coming years is undeniable, including the development of existing infrastructure and installation of new, advanced research tools. There is a continuing requirement to strengthen all areas of NorBioLab to maintain its relevance for both researchers and industry.

**Prosjektnummer: 316514**

**Tittel:** Norwegian Collections of Marine Life

**Søkerinstitusjon/partnere:** UiB (NTNU)

**Prosjektleder:** Aino Hosia

**Kort sammendrag:**

The Norwegian Collections of Marine Life (NorMa) encompass curated and continuously developed reference collections of physical specimens of multicellular marine organisms (fish, invertebrates and macroalgae), associated tissue and DNA samples, voucher photos, and corresponding metadata. Data

on the collections will be aggregated in a collection database linked to relevant external data repositories, and made searchable and accessible through a public online portal providing a single point of access. In addition to the physical collections, data, and IT infrastructure, NorMa will constitute a hub for marine biosystematics expertise and promote taxonomic and systematic research based on the collections. The infrastructure will contribute to better utilization of the substantial resources used on marine research and monitoring through providing longterm storage, curation and research access for material collected by partners and stakeholders. NorMa will contribute to improved documentation, transparency and repeatability of biodiversity studies, including analysis of eDNA and metabarcoding applications, through providing comprehensive reference collections. NorMa will also offer dissemination and knowledge-transfer regarding the collections and marine biodiversity in general to academia, research and industry stakeholders, as well as the general public.

**Prosjektnummer: 316536**

**Tittel:** The Norwegian Nanocellulose Laboratory

**Søkerinstitusjon/partnere:** RISE PFI AS

**Prosjektleder:** Kristin Syverud

**Kort sammendrag:**

Nanocelluloses are isolated cellulosic fibres or crystals with dimensions in the nanometer range. This group of cellulosic materials has gained a lot of interests during the last 15 years because of the potential beneficial use in many applications. Norway is one of the countries being in the forefront regarding research and industrialization. Although some types of nanocelluloses are industrially produced, this field of science is still immature. Hence, many breakthroughs regarding utilization are foreseen. Nanocellulose is expected to play a significant role in the transition to more biobased products. The Norwegian nanocellulose laboratory (NORCELLab) will (1) provide internationally leading laboratory facilities to secure that Norwegian nanocellulose research stays in the international forefront and (2) facilitate realization of the high commercial potential in utilization of cellulose-based nanomaterials. Our vision is that the NORCELLab shall be the fundament for developing new, and further improve and upscale existing processes for production of nanocellulose and nanocellulose derivatives, as well as developing novel applications of nanocellulose in a wide range of fields, for production and commercialization in Norway. The main goal is that NORCELLab shall be a national infrastructure for nanocellulose research, accessible to national and international stakeholders, for the development of processes for sustainable production of nanocellulose and nanocellulose derivatives, and applications thereof. The laboratory will comprise three categories of infrastructure: i) production and processing of nanocelluloses, ii) production of nanocellulose-based materials and structures and iii) characterization of nanocellulose and structures made thereof. NORCELLab will comprise highly sophisticated and specialized equipment within these three categories.

**Prosjektnummer: 316538**

**Tittel:** Norwegian Marine Robotics Facility II: Autonomous Underwater Vehicle (AUV)

**Søkerinstitusjon/partnere:** UiB (FFI )

**Prosjektleder:** Rolf-Birger Pedersen

**Kort sammendrag:**

Cutting-edge, international marine research relies on the access to a multitude of high-technology equipment that includes remotely operated vehicles (ROVs), and autonomous underwater vehicles (AUVs). Funding for a ROV was granted in 2013 and it is now timely to develop an AUV that is specifically dedicated for marine research and to challenges in marine management. The AUV will be fitted for operations over a range of ocean and coastal vessels - including the new polar research vessel. The infrastructure project is aiming to develop an AUV capable of imaging the seabed in unprecedented resolution, and detecting a wide-range of oceanographic parameters, beyond the present state-of-the-art. The AUV will also be capable of diving to 6000 m depth, and it will have a range of close to 600 km. This opens new opportunities for marine research and management, and it will be an important step towards ship-independent marine monitoring. The AUV will be scalable and modular and capable of carrying a unique set of acoustic, optical, physical and geochemical sensor packages. We anticipate that the infrastructure will contribute significantly to national and international R&D framework, by delivering unique data for the following basic and applied marine research areas: 1) deep-sea geodynamics and hydrothermal activity, 2) marine mineral resources; 3) under ice and polar research, 4) marine geohazards, 5) ocean circulation, ocean mixing processes, air-sea interaction and ecosystem dynamics; 6) seabed fluid flow and future climate; 7) CO2 capture and storage; 8) pelagic ecosystems and their resources, and 9) benthic ecosystems and environmental change. By linking excellent R&D groups across institutional, disciplinary and sector boundaries, we expect that the project will lead to new synergies and to marine technology development.

**Prosjektnummer: 316540**

**Tittel:** Norwegian technology platform for industrial macroalgae cultivation and utilization (MACROTECH)

**Søkerinstitusjon/partnere:** SINTEF OCEAN AS (NTNU, SINTEF Industri)

**Prosjektleder:** Aleksander Handå

**Kort sammendrag:**

Cultivation of the oceans is required to meet demands for food, feed, materials, and energy for a growing global population. Norway, with one of the world's longest tempered and productive coastlines, can take a leading role. The **Norwegian technology platform for industrial macroalgae cultivation and utilization (MACROTECH)** will provide research groups and industry with **6 nodes** to facilitate testing and development of enabling technologies in order to scale up the macroalgae value chain: **1) Land farms, 2) Sea farms, 3) Simulation and surveillance, 4) Vessels and logistics, 5) Preprocessing and storage and 6) Processing and products.** With 10 years of RCN-funded research accomplished, Norway has created an interdisciplinary knowledge basis on macroalgae cultivation biology and technology, processing, and product development, to make significant steps towards industrial cultivation. The annual global production of macroalgae has exceeded 30 million tons and is mainly based on manual labor. The results of the RCN-funded knowledge platform **MACROSEA (SINTEF-lead, [www.macrosea.no](http://www.macrosea.no))** indicate that Norway has the potential to produce 70-220 tons of macroalgae per hectare. Mid-Norway alone has the possibility to cultivate in the order of 20 million tons (fresh weight), which in turn results in 2 million tons of dried raw materials. Large food and feed companies are ready to invest in macroalgae-based products, but neither product formulas nor the biomass supply chain exists at industrial scale. The RCN-funded knowledge platform

**Norwegian Seaweed Biorefinery Platform (NTNU-lead, [www.seaweedplatform.no](http://www.seaweedplatform.no))** will advance research on processing and product development to unlock this potential. MACROTECH will provide research infrastructure to enable the development of new and standardized technologies for upscaling and cost reduction along the macroalgae value chain. Integrating new macroalgae knowledge centres such as MACROTECH with research environments and industry will promote world-leading innovation clusters, advance research and accelerate industrial growth. Industrial scale production of macroalgae may be a major contributor to innovative and climate-friendly solutions, a green transition, and the movement towards a low-emissions society to fulfill the Paris Agreement. Investment in a research infrastructure is a prerequisite for success.

**Prosjektnummer: 316549**

**Tittel:** Norwegian Telemetry Network

**Søkerinstitusjon/partnere:** NORCE (NTNU, NMBU, NINA, UiB)

**Prosjektleder:** Robert Lennox

**Kort sammendrag:**

The oceans are increasingly accessible due to the availability of new technologies that facilitate marine biological and oceanographic monitoring. Telemetry is a tool for animal monitoring that has greatly enhanced the capacity to observe processes within the ocean and understand drivers of change. Higher resolution data on the distribution, behaviour, physiology, and demography of marine animal communities contributes to better marine spatial planning including siting of aquaculture, fisheries policy, and marine industry operations. Because global positioning systems cannot penetrate through water, most aquatic telemetry uses acoustics, in which a tag emits a sound detected by a receiver, providing an indication of the tagged individual's position. The quality of data returned by acoustic telemetry is therefore highly dependent upon the distribution of the receiver array; an animal cannot be detected where there are no receivers. Large-scale telemetry networks have emerged in Canada, Australia, the United States, South Africa, Denmark, Belgium, Great Britain and other countries with coordinated marine tracking efforts. Norway is home to many economically important and vulnerable species that are tracked using acoustic telemetry, including salmon, trout, cod, eel, tuna, various sharks, and more. A coordinated effort to maximize the potential information can greatly enhance the information yielded by acoustic telemetry. A Norwegian Telemetry Network would be an array of fixed infrastructure available to aquatic researchers in Norway to investigate the patterns and drivers of animal movement. This proposal details an ambitious plan to combine the capacity of some of the country's most active and experienced telemetry users to establish an infrastructure project that will have long-term benefits to industry, policy, science, and society in Norway.

**Prosjektnummer: 316554**

**Tittel:** Marine fish detection, fish behaviour observations and seabed Investigations package 2021-2025

**Søkerinstitusjon/partnere:** UiT (IMR, NPI, SINTEF Ocean, Fiskeridirektoratet)

**Prosjektleder:** Roger B. Larsen

**Kort sammendrag:**

It is our goal that the “Marine fish detection, fish behaviour observations and seabed Investigations package 2021-2025 (MARINVEST)” shall be of benefit for marine science and education in a broad perspective, i.e. enhancing our international position in marine science. UiT - The Arctic University of Norway aims to provide state of the art infrastructure and electronic equipment for teaching and scientific purposes on board our research vessels. Apart from giving our own students and scientists good working conditions, UiT aims to offer national and international co-partners adequate technical resources for precise data-recording and observations in marine science. Despite the continuous upgrading of infrastructure at UiT, including our research vessels<sup>1</sup>, some of the basic electronics and associated software commonly used in education and the development of marine science needs to be upgraded. In particular hydroacoustic instruments used for the detection of marine organisms, biomass estimation of marine resources and trawl monitoring equipment must all be functional in order to meet high scientific requirements. The demand for improved and new scientific equipment is growing as new fields of interest for teaching and science emerge. An in-depth understanding of ecosystems and the growing interest for mesopelagic species, their locations and biomass assessments (and management) will demand improved technical instruments on our research vessels. An accurate positioning system for seabed operations and high precision instruments for close range study of life at large depths are requested by various research groups. Currently, the production and negative effects from plastic debris, micro-plastics and ghost fishing occurring as a result of lost and discarded fishing gears (LADFG) are the subject areas attracting obvious attention from students and many scientists. Studies on fish behaviour and locating lost equipment, lost fishing gears and various debris can be improved by the use of simple remote operated vehicles. UiT aims to equip our research vessels with state-of-the-art electronics in order to enhance teaching and improve knowledge-building in marine science. The equipment within the package we describe will be operated and maintained by UiT technicians.

**Prosjektnummer: 316559**

**Tittel:** Museum collections for the future. The Norwegian digitization laboratory for museum specimens at the Arctic University Museum of Norway

**Søkerinstitusjon/partnere:** UiT

**Prosjektleder:** Andreas Altenburger

**Kort sammendrag:**

Many museum specimens and historic material is stored in archives and museum collections around Norway. Some of the material might degenerate due to insufficient research capacity or sensitivity of the material or the specimens. To keep the material for the future, a comprehensive digitisation effort is necessary. The Arctic University of Norway wishes to establish a national digitisation infrastructure that allows high throughput digitisation of specimens in natural history collections, the archaeological collections, and the ethnological collections in order to systematise and annotate the

collections and make the data accessible according to the FAIR principle (findable, accessible, interoperable and reusable). This infrastructure will allow museums and other research environments in Northern Norway to improve research quality to highest international levels and open up for new international collaborations. Digitizing museum collections gives a huge potential for new methods and crossdisciplinary research using state of the art digitisation equipment. Modern equipment can enhance visible detail in specimens. Digital specimens reduce the risk of loss or damage and allow for safe long-term storage and accessibility. Online access to digitized specimens allows for research from anywhere in the world, minimizing the need to ship and handle physical objects. Digitized specimens will enable researchers to select specimens relevant to their research, omitting the need to request large numbers of specimens. In addition to the benefits for research, digitized specimens offer new and more interactive possibilities to present specimens and museum objects to the public. Online access to museum collections increases the number of people who can view the specimens and the number of specimens that can be investigated. Last but not least, digitized specimens offer new possibilities for citizen science.

**Prosjektnummer: 316560**

**Tittel:** Endring og oppgradering av SINTEF Oceans mobile anlegg for prosessering av marine råstoffer.

**Søkerinstitusjon/partnere: SINTEF OCEAN AS**

**Prosjektleder:** Bendik Toldnes

**Kort sammendrag:**

Mobile Selab is a small but complete and flexible processing facility, where any kind of (rest) raw material can be processed into oil and protein concentrate in cooperation with SINTEF. Customers are mainly businesses from the fishing industry, who wish to better utilise and profit from their rest raw material. Other research projects can also be run to test parameters or interesting finds from ground research in smaller scale labs and optimize processes. After more than a decade of being sent out in the field to perform large scale processing tests, the infrastructure needs upgrading

**Prosjektnummer: 316576**

**Tittel:** Floating solar energy test centre

**Søkerinstitusjon/partnere: SINTEF OCEAN AS (NTNU, IFE)**

**Prosjektleder:** Øyvind Hellan

**Kort sammendrag:**

Floating solar energy (FPV) is in rapid development, with close to 2 GWp of capacity deployed based on existing technological solutions. FPV represents a niche in which Norwegian industry has natural advantages through a strong technology base in solar cell technology, materials technology in general, offshore structures, marine operations and power grids. There is a growing Norwegian industry, with companies such as Ocean Sun, Moss Maritime, Sunlit Sea, Current Solar, Equinor and Glint Solar developing new, improved technologies and solutions for FPV. Several large Norwegian energy companies are also considering investments in the technology in their projects, including Statkraft, Hydro and Scatec Solar. To support this emerging industry in its innovation process, there is a need for an industrial scale test area to test full scale operations of FPV systems. Such test sites will complement the use of numerical models and laboratory experiments with scaled models, allowing for more costeffective development of new mooring, floater, mounting and interconnect solutions

and demonstrate the performance and resilience of the FPV power plants, SINTEF, NTNU and IFE wish to establish a test centre for FPV with two nodes: one for sheltered environmental conditions in the Grenland area and one for exposed marine environment on the Trøndelag coast. The objective is to establish an infrastructure that puts Norwegian industry, Norwegian research and education in a unique position internationally. The infrastructure will provide important information on the properties of floating solar energy systems but will also be adapted to support experiments and development of other types of ocean renewable energy. It will provide both design and operational experience for product development and will help to demonstrate and qualify technology and installations for an international market. The aim is to combine innovation and concept development with theory, method development, laboratory studies and full-scale data collection and measurement. This, in a wide range of scientific fields, i.e. (1) performance and reliability of solar modules in marine environments, (2) impact on the marine ecosystem of structures covering large sea surfaces, (3) development of next generation marine structures (lightweight, massively modular structures) and (4) control system and digitization of marine and maritime structures (digital twin). Full-scale test installations like this form a central element in the plans for the upcoming Ocean Space Center and will also support the SFI Blues (next generation of marine structures), FME SUSOLTECH and other national research programmes. The initiative is supported by the Norwegian Solar Energy Cluster and their member companies, including Equinor, Scatec Solar, Ocean Sun, Moss Maritime.

**Prosjektnummer: 316580**

**Tittel:** Power-to-X systems lab at Tiller

**Søkerinstitusjon/partnere:** SINTEF AS (SINTEF Ocean AS, SINTEF Energy AS, NTNU)

**Prosjektleder:** Kyrre Sundseth

**Kort sammendrag:**

The use of hydrogen and hydrogen-based energy carriers are gaining momentum both nationally and internationally, as a pillar to decarbonize transportation and the energy system towards 2050. Recently, GWscale hydrogen initiatives have been taken by several countries in Europe, boosted by the upcoming Covid19 EU Recovery Plan. Norway has world leading industry and research institutions with vast potential for value creation from development and future export of hydrogen technology and hydrogen and H<sub>2</sub>-energy carriers. This proposal outlines a Power-to-X (P2X) pilot-scale systems infrastructure at Tiller in Trondheim for hydrogen and ammonia. The proposed infrastructure will facilitate for pilot-scale (100 – 1 000 kW) testing of electrolysis systems, ammonia and bio-oil processing, and end-use of hydrogen and ammonia in fuel cells and gas turbines. The proposed infrastructure will thereby complement existing infrastructure to create full test facilities along the entire value chains for hydrogen and ammonia. The value chains are carefully selected in dialogue with Norwegian industry to ensure the relevance and future utilization of the facilities. The proposed infrastructure will allow Norwegian research institutions and industry to reduce costs, and to improve technology performance and lifetime of P2X systems. Focus is put on strategically important areas where Norwegian industry has competitive advantages, such as electrolyser technologies, ammonia, and systems engineering. Currently, there is no such pilot infrastructure available, neither in Norway nor in Scandinavia. Even in the European domain such infrastructure is fragmented. While proof of concept has been demonstrated in most relevant technology areas, pilot scale validation and system optimization are crucial to provide for eventual market implementation. As an integral part of the proposed P2X-infrastructure, education of Master and PhD candidates

(primarily linked to NTNU) is foreseen. Through open access, the infrastructure will be pivotal for generating innovation projects, increasing competence levels and boosting the industry's competitiveness.

**Prosjektnummer: 316600**

**Tittel:** Mandatory draft for infrastructure application Center for Land-based Aquaculture, CLA

**Søkerinstitusjon/partnere:** NORD UNIVERSITET (LetSea, SINTEF Ocean and NCE Aquaculture)

**Prosjektleder:** Mette Sørensen

**Kort sammendrag:**

The planned infrastructure to be established by the Partners focus on three important pillars:

1. Research carried out on land-based research under controlled conditions in small units give results for a limited life cycle of the fish. The new infrastructure will offer research addressing post smolt production in seawater RAS covering the entire life cycle from tanks on land to on growth and harvest in sea. This will give opportunities to study the biology, welfare and economy in new production systems of salmonids.
2. The infrastructure is planned with multiple smaller RAS units to enable replicates. Possibilities to study effect of treatments in replicates is currently not existing. The new facilities will allow research on optimal temperatures and salinities as well as effects of feed types and production on biofilter and water quality
3. The new facilities can also easily be reconstructed to cater for research on IMTA or to cater for research on circular bio economy, exploiting biological production in side streams from the system.

**Prosjektnummer: 316603**

**Tittel:** Microalgae platform for Norway

**Søkerinstitusjon/partnere:** NORD UNIVERSITET (NIBIO, UiT, NIVA, VUC)

**Prosjektleder:** Kiron Viswanath

**Kort sammendrag:**

The potential of microalgae as a driver of a biotechnology-based industry is well recognized now. Many varieties of microalgae are among the fast-growing photosynthetic organisms on the planet. Although these microorganisms represent the largest biomass in the ocean, they are minimally tapped for industrial purposes including for food or as sources of high-value products. Phototrophically grown microalgae can outcompete traditional food crops due to their high productivity per surface area, potential for cultivation in the sea or onshore and high nutrient value suitable for use in food and feed, without compromising the use of agricultural land and freshwater. On the other hand, the use of microalgae for carbon capture and bioremediation is another interesting industrial application – not only can they help reduce industrial emissions, but also produce valuable biomass. Norway has not made significant strides in establishing microalgae-based ventures, even though there is an understanding of the vast industrial potential for these microorganisms. Significant progress can be achieved in microalgae biotechnology only if there is an established applied research in this field. Though there are groups in different Norwegian institutions that perform research on microalgae, remarkable breakthroughs can be achieved only through trans-disciplinary collaborative efforts. This infrastructure project proposal aims to bring together research environments that study microalgae so that their pooled scientific expertise can be utilized by exploiting the newly acquired research infrastructure and generating knowledge that can be easily



adopted directly or indirectly by the industry. The proposed infrastructure investment will act as a springboard for the success of microalgae-based industrial initiatives.

**Prosjektnummer: 316608**

**Tittel:** Norwegian Biobank for Nature (NORBINA)

**Søkerinstitusjon/partnere:** UiO (UiB, NTNU, UiT, NMBU, UiA, NIVA, NIBIO, NVI)

**Prosjektleder:** Arild Johnsen

**Kort sammendrag:**

The use of genetic resources is ubiquitous in biological research today, and there is an urgent need to implement the FAIR principles (findable, accessible, interoperable, reusable) to the archiving of biological material used in both Norwegian and international research. So far, the FAIR principles have been adopted to facilitate open access to research results, raw data, metadata, analysis code, software, and scientific publications through various research infrastructures and data repositories. In contrast, the archiving of the physical samples, such as tissues, DNA extracts, whole specimens and environmental samples, have not been structured in the same way. Here, we propose a national infrastructure for archiving non-human biological samples in a distributed biobank, making cryopreserved samples and associated data available for biological research institutions that use biological samples in genetic, genomic and other molecular research, also embracing the One Health perspective and the UN sustainable development goals. The infrastructure will have nodes at each of the four largest university museums (Oslo, Bergen, Trondheim, Tromsø), and each node will serve biology/biodiversity institutions in its region. There will also be affiliated biobank facilities at institutions outside of the university museums. In order to establish the biobank module nationally, there is a need for investing in storage facilities (-80°C freezers and containers with liquid nitrogen), DNA extraction robots, development of a database infrastructure, and personnel. The new infrastructure will complement several existing and planned infrastructures for Norwegian bioresources, DNA sequencing and bioinformatics, and improve their impacts and synergies through a collaborative and interactive network.

**Prosjektnummer: 316610**

**Tittel:** NIBIO-XCT - An integrated X-ray Computed Tomography (XCT) facility for the Ås campus (NIBIO/NMBU/Veterinærhøgskolen)

**Søkerinstitusjon/partnere:** NIBIO (NMBU, Veterinærhøgskolen, Kimen Såvarelaboratoriet AS)

**Prosjektleder:** Adam Vivian-Smith

**Kort sammendrag:**

Nano- and micro-scale X-ray Computed Tomography (XCT) has become an exceptionally important tool for the non-invasive visualization of complex specimens in both materials science and in biology. This offers a non-destructive method to probe both living and fixed material from a variety of sources and resolve their internal structures, often in stunning detail, resolution and depth (ie. to micrometer and sub-micrometer scale). Examples include (1) visualizing soil porosity and measuring the fine root structure, (2) imaging modifications to woody tissues, (3) imaging plant development like enclosed buds and (4) in the anatomical visualization of living insect specimens. Several international institutes are also now using nano- and micro-XCT for whole plant phenotyping, in time-series, using instruments that have a scanning deck large enough to accommodate whole plants and with specific

environmental conditions. Plant biomass can now be evaluated above and below ground. We require and propose a facility for 3D X-ray Computed Microtomography (XCT) facility at the Ås NIBIO/NMBU campus to service the imaging of life science subjects, soils and materials science. The equipment and location at Ås campus is ideal for servicing the Life Science cluster and augmenting advances in the Bioeconomy. This facility will have a small set of four controlled environmental rooms alongside two XCT instruments to provide broad control over the parameters such as light, temperature and humidity. A bank of smaller cabinets will be provided for holding samples, or culturing growth. The facility will have a computing equipment to reconstruct, segment and analyse the data offline. That equipment will be a GPU accelerated and be capable of visualization with Virtual Reality (VR). The facility will be run together with a dedicated technical staff member. Two other pieces of equipment a standard 2D x-ray (eg Facitron Multifocus, for seeds, leaves) and a handheld X-ray fluorescence spectrometer (XRF) for the elemental analysis of different materials (eg. in soil)

**Prosjektnummer: 316616**

**Tittel:** Norwegian Plant Phenotyping Platform

**Søkerinstitusjon/partnere:** NMBU (UiO, NTNU, UiT, NIBIO)

**Prosjektleder:** Morten Lillemo

**Kort sammendrag:**

A stable Norwegian food production based on national resources is important for **food security** and supported by governmental policies. The Norwegian food production is currently challenged by **changing climatic conditions** and **technological developments** that call for faster and more effective development of new cultivars and production systems in order to meet current and future challenges.

The aim of this proposal is to build a **national platform for plant phenotyping (*PheNo*)** to serve the research needs in the “green” sector. State-of-the-art research facilities will be established at the Norwegian University of Life Sciences (NMBU), the University of Oslo (UiO), the Norwegian University of Science and Technology (NTNU), The Arctic University of Norway (UiT) and the Norwegian Institute of Bioeconomy Research (NIBIO) in close collaboration with the agricultural, horticultural and plant breeding industry. *PheNo* will serve as a Norwegian node in the ESFRI roadmap project EMPHASIS.

High-throughput and high precision platforms for phenotyping of plants in controlled conditions and relevant production environments (fields, polytunnels and greenhouses) will be established as a **distributed national infrastructure** building on the complementary strengths and unique competences brought in by the collaborating research partners: **Field-based plant phenotyping and robotics** at **NMBU** (robotic and UAV-based plant phenotyping, digital field trial operations, polytunnels for creating semi-controlled field conditions, multispectral laser scanner for field and greenhouse), **basic plant research** at **UiO** (advanced growth chambers and small plant phenotyping system, multispectral laser scanner for greenhouse phenotyping), Internet of things (IoT), **data science** and **machine learning** at **NTNU** (field and plants conditions sensing/monitoring using IoT, vision sensors and computational resources), **data storage** and **data management** at **UiT** and **applied plant production across the whole country** by **NIBIO** (Robotic and UAV-based plant phenotyping, multispectral laser scanner for field and greenhouse).