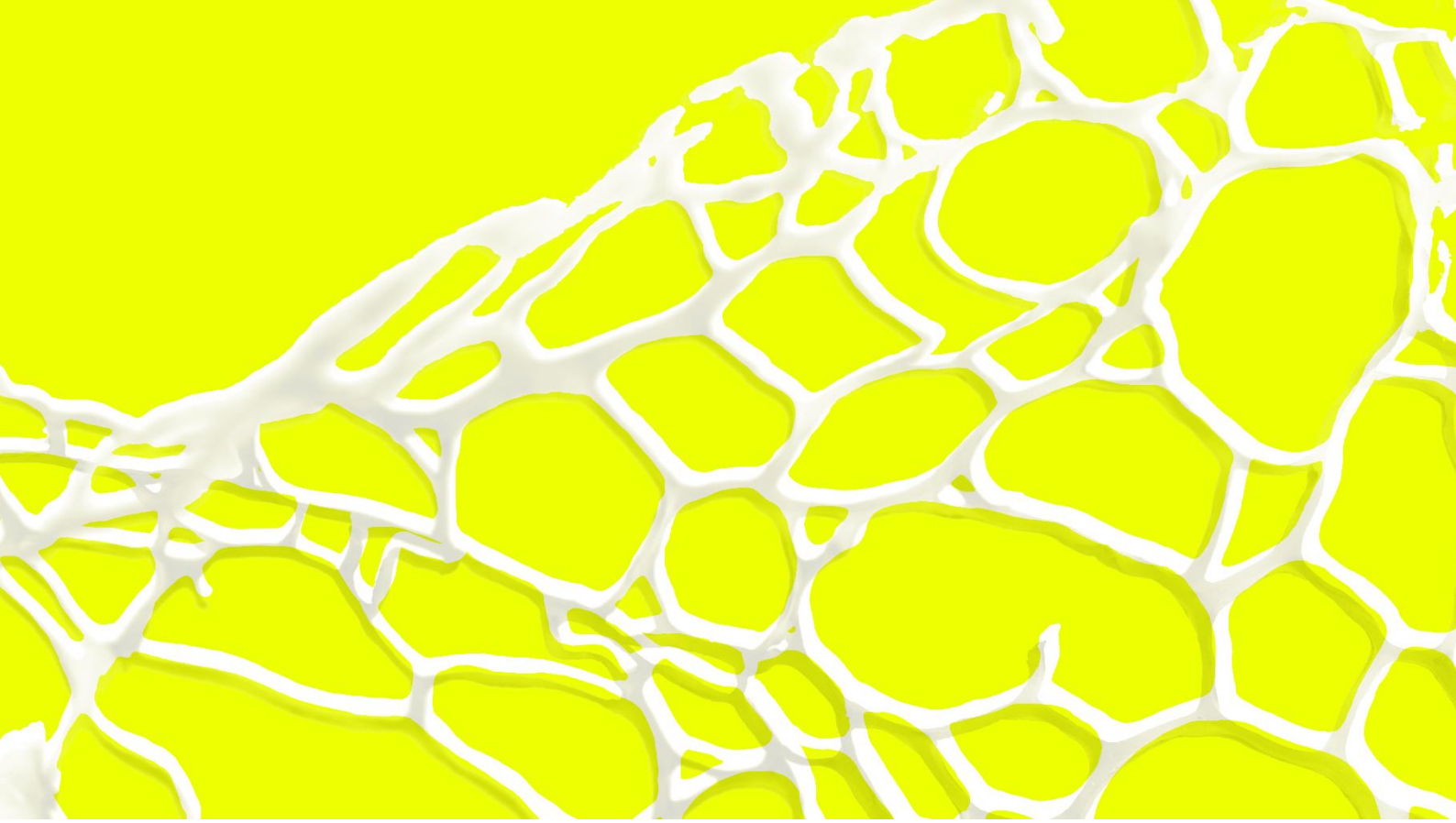

REPORT 2021-2022

AALTO UNIVERSITY BIOINNOVATION CENTER

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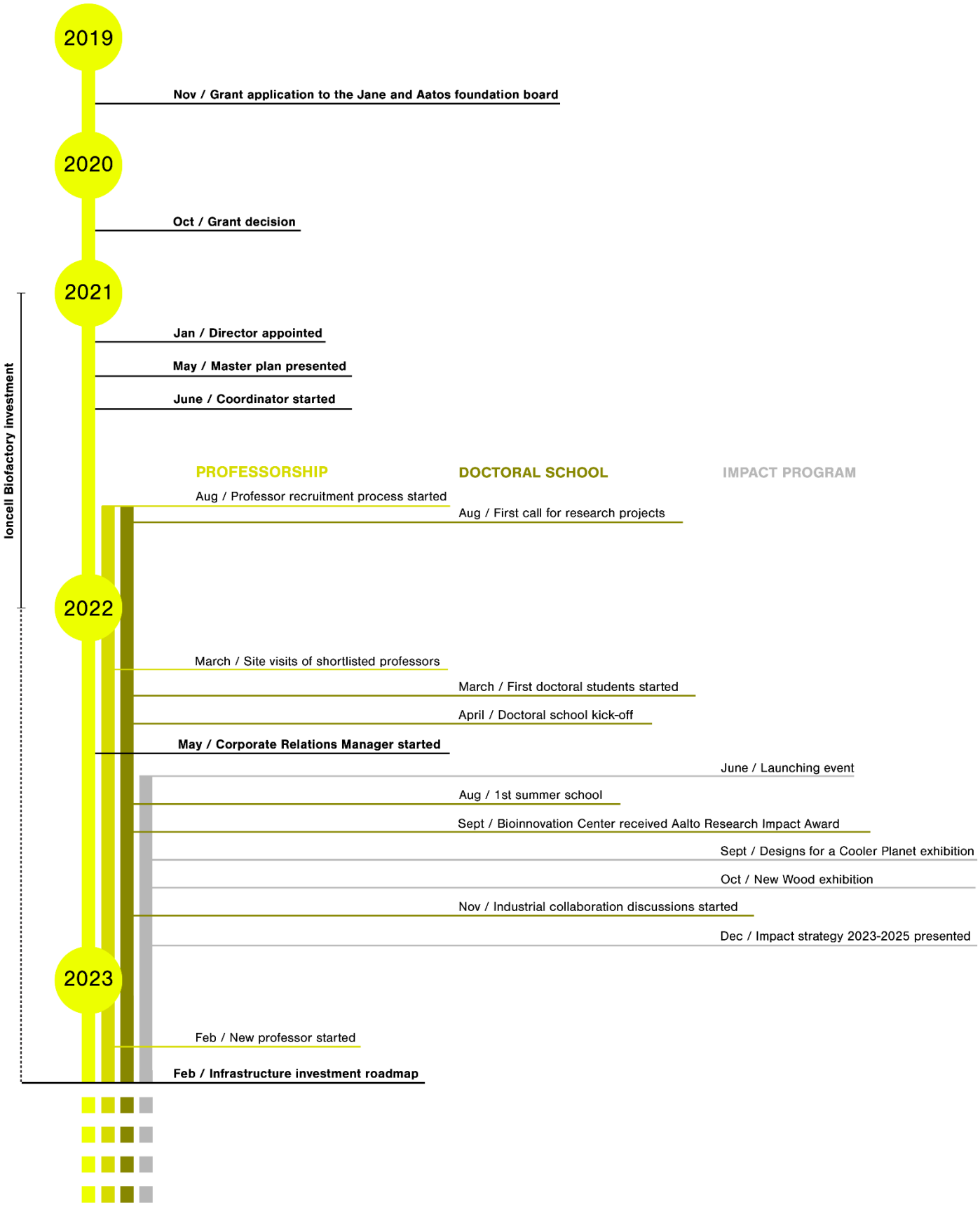
INTRODUCTION

Aalto University Bioinnovation Center is an interdisciplinary research and learning center targeting to accelerate the transition to a circular economy and bioeconomy, and to create opportunities for sustainable economic growth in Finland. The Bioinnovation Center focuses on innovations in sustainable bio-based materials, with special focus on textiles and packaging.

The Bioinnovation Center was established in 2021 with a 10.5 M€ grant from Jane and Aatos Erkko foundation. The Center operates in interdisciplinary research fields, facilitates educational efforts in bio- and circular economy at Aalto University, and strives towards ground-breaking new technologies and innovations. The Center's four pillars are the Doctoral School, a new Professorship, a targeted Infrastructure Program, and an overarching Impact Program.

Timeline



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Bioinnovation Center Steering Group

The Bioinnovation Center steering group has professors from all the six Schools of Aalto University. In 2021, Associate Professor Michael Hummel (CHEM) was appointed as the Director of the Center, and Susanna Ahola was recruited as the coordinator.

Kristiina Kruus
Dean, School of Chemical Engineering

Janne Laine
Vice President, Innovation

Michael Hummel
Director of Bioinnovation Center, Associate Professor of Biopolymer Chemistry and Engineering (CHEM)

Pirjo Kääriäinen
Associate Professor of Design and Materialities (ARTS)

Tapani Vuorinen
Professor of Wood Chemistry (CHEM)

Minna Halme
Professor of Sustainability in Business (BIZ)

Jouni Partanen
Professor of Materials to Products (ENG)

Kirsi Niinimäki
Associate Professor of Fashion/Textiles Futures (ARTS)

Markus Linder
Professor of Biomolecular Materials (CHEM)

Juho Rousu
Professor of Computer Science (SCI)

Jorma Kyyrä, Professor of Power Electronics (ELEC)

Susanna Ahola
Coordinator of Bioinnovation Center, Secretary of Steering Group

More information on each member of the steering group can be found at: www.aalto.fi/en/people/firstname-lastname.

eg. https://www.aalto.fi/en/people/kristiina-kruus

Bioinnovation Center Advisory Board

The Advisory Board's main role is to support and guide the functions and development of the Bioinnovation Center. The Advisory Board has five external members from academia and industry, and internal members from the Bioinnovation Center steering group. The Advisory Board does not have formal authority to govern the organization, but it will make recommendations and provide key information and materials to support the success of the Center.

Prof. Elvin Karana, TU Delft, Netherlands

Elvin Karana is Professor of Materials Innovation and Design at the Faculty of Industrial Design Engineering at Delft University of Technology. Her main research interests are materials innovation and design, materials experience, bio-based materials and bio-technology for product design. She has founded the research group Materials Experience Lab, which introduces new ways of understanding and designing (with) materials by combining methods and tools from design, social sciences, materials science, and engineering.

Niklas von Weymarn, CEO, Metsä Spring Ltd

Niklas has a Doctor of Science degree in biotechnology from Aalto University. He has also studied economics and innovation strategies. He has wide experience from R&D and startup companies. At Metsä Group, he first served as Vice-President of Research at Metsä Fibre Ltd, after which he moved to Metsä Group's innovation company Metsä Spring Ltd.

Suvi Haimi, CEO, Sulapac

Co-founder and CEO of Sulapac, a material innovation company with the mission to save the world from plastic waste. Suvi has a PhD in Medical Biomaterials from the University of Tampere. Before founding Sulapac, she worked in leadership positions for 10 years at universities in Finland and The Netherlands.

Tuomas Mustonen, CEO, Paptic Ltd

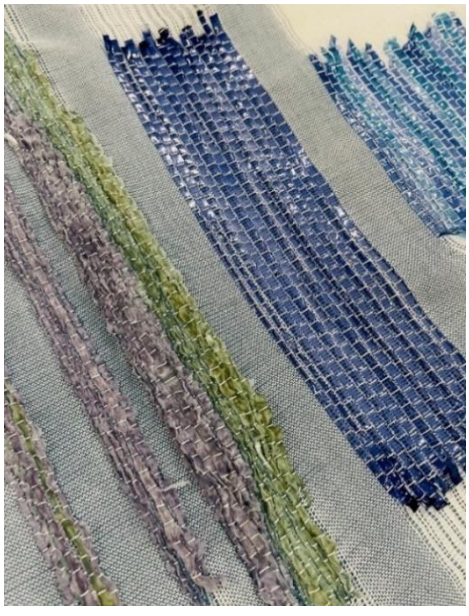
Managing Director of Paptic with a history of working in the paper & forest products industry and research institutes. Tuomas has an MBA degree in International Finance and Global Marketing from Aalto University, and a MSc degree in Industrial Physics from the University of Jyväskylä.

Riikka Paarma, Sustainability Partner, EY-Parthenon

Sustainability Partner at EY-Parthenon. Prior to shifting to EY-Parthenon, Riikka was the Director for Circular Economy at Stora Enso. Prior to Stora Enso, Riikka was the Director for Sustainability Services at Deloitte Finland, and the global co-lead for Circular Economy at Deloitte. She has also led sustainability at Alma Media Corporation. Riikka has a MSc degree from Sustainable enterprising from the University of Stockholm.

DOCTORAL SCHOOL

The Bioinnovation Center Doctoral School (DS) specializes in *interdisciplinary research and doctoral education* to create new innovations that help the transition towards bio and circular economy, and to educate future experts with abilities to thrive and innovate in diverse multidisciplinary teams. The Doctoral School's research projects aim at innovations in line with the main themes of the Center: *sustainable textiles and packaging*. The doctoral school combines fields from all the six Schools of Aalto University, such as chemistry, biomaterial sciences, design, digital production, artificial intelligence, entrepreneurship, and business. The doctoral school is a thematic school for doctoral students coordinated by the Bioinnovation Center.



Color changing textile prototypes by Sofia Guridi and Matteo Iannacchero.

Actions 2021-2022

In 2021, the first call for research projects was opened. The call was open for all the professors at Aalto University. Truly interdisciplinary collaboration was emphasized in the funding criteria. A panel consisting of internal and external experts evaluated the project applications and proposed the top applications for funding to the BIC steering group. The evaluation panelists were Niklas von Weymarn (Metsä Spring), Ainomaija Haarla (Proconsilium), Tomi Erho (Aalto Research and Innovations), Samuli Patala (BIZ), Turkka Keinonen (ARTS), Kristiina Kruus (CHEM), Michael Hummel (CHEM), Tapani Vuorinen (CHEM), Markus Linder (CHEM), Kirsi Niinimäki (ARTS), Juho Rousu (SCI), and Jouni Partanen (ENG). Five projects were funded in the first round. The recruitment for these five doctoral student positions was started. The open and international recruitment resulted in nearly 200 applications from several continents.

Doctoral School projects started in 2022

PROJECT NAME	PIs	DOCTORAL STUDENT	SCHOOLS OF AALTO PRESENTED
CELLUGAMI	Prof. Masood Masoodian Prof. Jarkko Niiranen Univ. Lecturer Kirsi Peltonen	Laureen Mahler	ARTS, ENG, SCI
AIYARN	Prof. Jaana Vapaavuori Prof. Patrick Rinke	Matteo Iannacchero	CHEM, SCI
SUSTAINABLE LIGNIN COATINGS	Prof. Monika Österberg Prof. Pekka Oinas	Sahar Babaeipour	CHEM
COMPUTATIONAL FABRIC	Prof. Kirsi Niinimäki Prof. Simo Särkkä Prof. Yu Xiao, Prof. Jaana Vapaavuori	Sofia Guridi	ARTS, ELEC, CHEM
INTELLIGENT PACKAGING	Prof. Jouni Paltakari Prof. Riku Jäntti	Madhawa Basnayaka	CHEM, ELEC
CELLUMIMICRY	Prof. Michael Hummel Prof. Samuli Patala Prof. Minna Halme	Helena Sederholm	CHEM, BIZ

In 2022, the doctoral student recruitment was completed, and the selected students started their research projects. In addition, the Bioinnovation Center steering group approved the application of Prof. Michael Hummel, Prof. Minna Halme and Prof. Samuli Patala for the project CelluMimicry.

The DS students and PIs gathered twice in semi-annual meetings: a DS kick-off meeting in April, and researcher meeting in October. The research projects were presented to the academic and professional community at the Bioinnovation Center launching event on June 1st, 2022.

The DS curriculum is based on the Aalto University doctoral program curriculum. In addition, the Bioinnovation Center organizes or co-organizes an annual Summer School for the students. In 2022 the Summer School was called “Nordic Biomaterials Innovation with CHEMARTS” (5 ECTS). The 2-week intensive course was organized in collaboration with Aalto University’s CHEMARTS summer school and focused on combining biomaterial science and design. The course involved lectures and invited talks, workshops, guided laboratory exercises, a project work, an excursion, and social program. The Bioinnovation Center students participated in two separate workshops organized by Aalto Ventures Program (the entrepreneurship education program at Aalto University): Impact from research and teamwork. The Bioinnovation Center doctoral students’ project work and prototypes from this course were presented in Designs for a Cooler Planet exhibition at Aalto University in September/October 2022.

To establish collaboration with industry and research institutes, Dr. Elli Käpylä was appointed as the Corporate Relations Manager.

PROFESSORSHIP

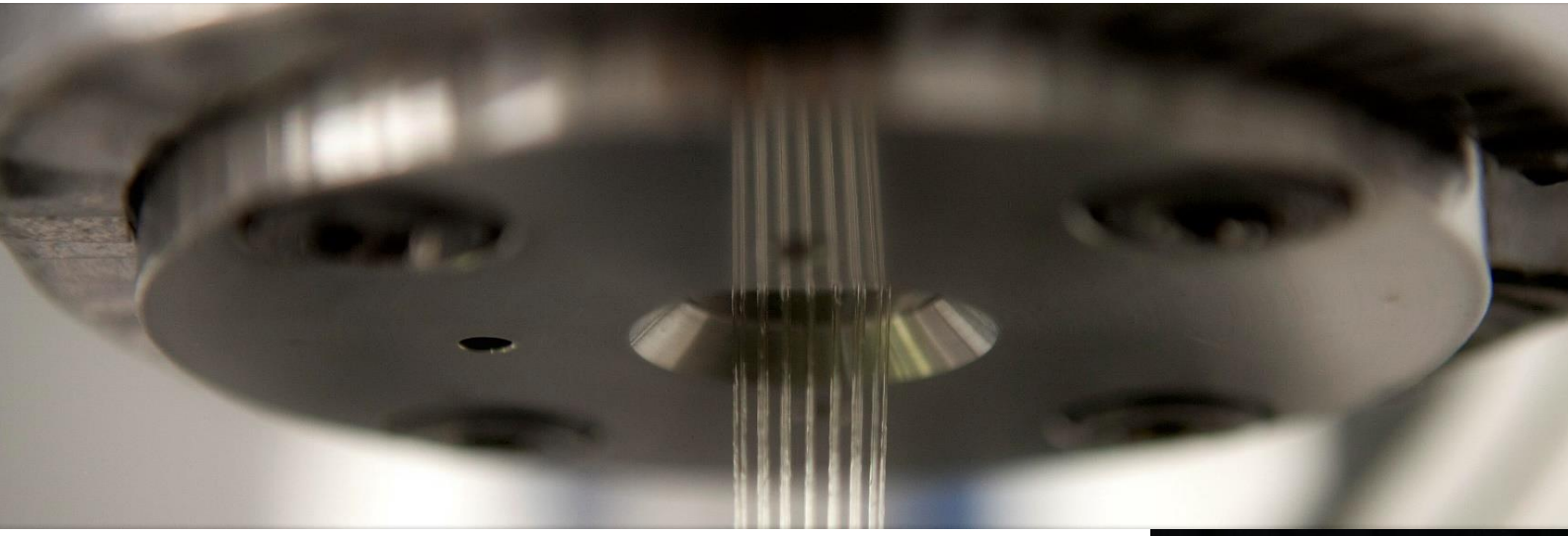
The vision of the Bioinnovation Center also encompassed a new professorship to provide strong expertise in materials research and circular economy, and to proactively network with stakeholders such as experts in the field of bio- and circular economy and creative industries, large companies, and start-ups. This new professor shall release the interdisciplinary potential in bioinnovation development from research ideation to commercialization in the context of circular economy and sustainability to have a social, environmental, and economic impact in wider perspective.

A position entitled *Sustainable Bioproducts Innovation* was opened by the School of Chemical Engineering in 2021. A multidisciplinary recruitment committee, which consisted of professors from four different Schools at Aalto University and the Vice President for Innovation Janne Laine, was assembled. In the search for the best possible candidate, great emphasis was put on experience in research on sustainable bioproducts that involves users and business, clear capability for interdisciplinary research with experience in the transition of research to commercialization, and capability to create collaboratively new multidisciplinary research networks. The recruitment committee was supported by five external, internationally renowned expert evaluators.

Dr. Luana Dessbesell

By spring 2022, the committee identified Dr. Luana Dessbesell as the best candidate amongst initially 54 applicants. The proposal was accepted by the Dean of the School of Chemical Engineering. Prof. Dessbesell will start in this position on February 1st, 2023. Her role is to enhance the research and teaching that fosters the concept of true interdisciplinarity envisioned by the Bioinnovation Center, to take an active role in the Bioinnovation Center doctoral school, to strengthen the collaboration between Aalto University's fields (technology, design, and business) related to biobased materials, and to promote and develop collaboration between Aalto University and external stakeholders.

Dr. Luana Dessbesell was selected as the Professor for Sustainable Bioproducts Innovation.



INFRASTRUCTURE PROGRAM

The Bioinnovation Center's Infrastructure Program provides funds for strategic investment in research infrastructure to support and promote developments at Aalto University in the field of bioeconomy towards commercialization.

The first investment of 2.3 M€ was dedicated to the upscaling of the Ioncell® technology which was developed jointly at the University of Helsinki and Aalto University. Under the lead of Prof. emeritus Herbert Sixta (Aalto University) and Prof. Ilkka Kilpeläinen (University of Helsinki) their research teams have established a new process to turn wood pulp and cellulose waste material such as cotton textile waste into high quality textile fibers. Both professors were recently awarded with the prestigious Marcus Wallenberg price in honor of their groundbreaking contributions to sustainable textiles and bioeconomy.

Through the investment funding of the Bioinnovation Center it was possible to upscale the spinning technology. A pilot plant was designed, built, and finally commissioned in 2022 at Aalto University. The new infrastructure allowed a transition from batch mode into continuous operation with a production capacity of 10 kg fibers per day. This allows to address critical challenges connected to upscaling. Being able to demonstrate the scalability was crucial to bring further investors onboard. In addition, the increased production capacity opened collaboration possibilities with different yarn and textile producers, retailers, and brand owners.

A prototype made of Ioncell fibres produced in the pilot plant. Photo by Diana Luganski.

Ioncell Oy

In spring 2022, Ioncell Oy was founded. The technology development is now led by the new CEO Antti Rönkkö.
For 2023, the Bioinnovation Center envisions investments into research infrastructure critical for ongoing developments in the field of sustainable textiles and packaging.

Professors Ilkka Kilpeläinen (middle) and Herbert Sixta (right) received the Marcus Wallenberg award from Carl XVI Gustaf (left).

IMPACT PROGRAM

The Impact Program's target is to *maximize the scientific and societal impact* of the Bioinnovation Center. The Impact Program activities involve communication actions, events, exhibitions, open lectures, and network collaboration. The main target groups of the Impact Program's actions are 1) academic and professional community, 2) decision makers, and 3) children and youth. In 2022, the impact program's main message was to inform about the Center itself: the vision and focus of the Bioinnovation Center and its targets and actions. In network collaboration the target is not only to promote Bioinnovation Center, but the multidisciplinary of Aalto University in general and its bio-based innovations.

The Impact Program's actions started in 2022. Webpages and LinkedIn account were launched, and the visual identity of the Center was created. A Bioinnovation Center launching event was organized on June 1st, 2022 in A-Grid at Aalto University. At the launching event, the journey of the Center from an idea to reality was presented to the academic and professional community, an overview of the Center was given, and the first 5 research projects were presented.

University Lecturer Kirsi Peltonen (right) presenting Cellugami project origami prototypes to Katariina Kemppainen (left) from Metsä Spring at the Bioinnovation Center launching event. Photo by Kristina Tsvetkova.

The Bioinnovation Center is participating in network collaborations. The Center joined the Ellen MacArthur foundation network, an international network focusing on circular economy, and the New Wood (Uusi Puu) network, a Finnish network focusing on promoting new wood-based innovations. Bioinnovation Center was presented in several New Wood exhibitions and events in 2022. In October, the Bioinnovation Center participated in a New Wood event and exhibition where new wood-based innovations were presented to the members of the Finnish parliament. The exhibition was also presented in Brussels at the "Behind the Bio Bubble" event.

The Bioinnovation Center was presented at the Aalto University's *Designs for a Cooler Planet* exhibition in September/October 2022. The exhibition presented the Center's idea and targets, as well as Summer School mini projects of the doctoral school students. As a part of Designs for a Cooler Planet event, an open lecture targeting high school students was organized in collaboration with Aalto University Junior. The lecture "Shimmering wood" was given by Noora Yau, an Aalto University designer and researcher behind the shimmering wood innovation.

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OUTLOOK

The Bioinnovation Center has chosen annual themes for coming years to get a better focus and to maximize the impact. The theme for 2023 is Interdisciplinary collaboration. Collaboration with industry will be established through joint projects and a mentorship program. The target is to launch several joint projects with national and international industry partners, such as forest product manufacturers, as well as research organizations (e.g., VTT, Luke). The project development phase will take place in spring 2023 and the joint projects are targeted to begin in early summer/fall 2023. The plan is to engage partner companies both in planning of the research topics as well as the supervision of the doctoral student. The involvement of companies and external research organizations in the research projects will strengthen their societal and industrial relevance. Through involvement in the doctoral school, the partner companies can also help provide relevant training for future industry experts and the students can make important connections for their future careers.

With the grant from Jane and Aatos Erkko foundation, Bioinnovation Center can take in total 10-12 fully funded doctoral projects (6 students have already started in 2022). The prospective jointly funded industrial projects can increase the total number of students in the doctoral school up to 15-20. The doctoral school funding for each student is for 4 years. Students started in 2022 and 2023 will graduate in 2026 and 2027, respectively.

In 2023, collaborations will be done with FinnCERES Flagship and Liber Center of Excellence by organizing a joint summer school. In addition, network collaboration will be continued, and Impact Program activities will be done together with other Aalto University organizations, such as Aalto University Junior, Radical Creativity, and Aalto Networking Platform. In the coming years the focus of the actions will be shifted more towards innovations and commercialization. In 2024 the annual theme will be Fostering Innovations, and in 2025 the theme will be From Research to Business.

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