SUCCeSS

Annual report 2023

Stockholms universitet

Stockholm University Center for Sustainable and Circular Systems (SUCCeSS) is a center for interdisciplinary research in sustainable and circular systems. The center has now been operational for two years.

Circular processing

Data Driven Circular and Sustainable Design

Sustainable food and water systems

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Layout and graphics: Azote

Note from our Director professor Aji Mathew

As we look back at 2023, the center was finally in the spotlight of attention from both a national and international perspective. This year we successfully hosted the first SUCCeSS Summit and the SUCCeSS post-doctoral researchers started their projects. We also welcomed our new deputy Director Oskar Karlsson. Our coordinator Charlotte left SUCCeSS at the end of 2023 after 2.5 years and we thank her for all contributions.

SUCCeSS Vision

To lead transformative research and engagement on circular and sustainable systems.

SUCCeSS Mission

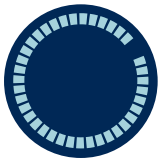
- Provide a stimulating environment for transdisciplinary research on sustainable chemicals and materials.
- Identify and address needs for sustainable chemicals and materials in collaboration with policy makers, industries and civil society.
- Promote interdisciplinary training in the field of circular and sustainable systems.

Research Focus Areas

The ongoing activities at SUCCeSS are designed to establish the center as a leader on transformative research and engagement on circular processing, data driven circular and sustainable design, and sustainable food and water systems.

Circular processing

Research will focus on methodologies that enable circular and sustainable processing of chemicals, materials and products. We aim to impact the production and consumption by reducing resource-use and waste-generation.



Data driven circular and sustainable design

Transdisciplinary research on development of circular systems through design optimization and decision making using digital tools. Using artificial intelligence as machine learning tools for hazard evaluation and screening as well as validation of performance. We also aim to establish processes for data management, data curation, data storage and data sharing and contribute to the development of standards.

Sustainable food and water systems

Transdisciplinary research integrating system understanding, development and validation of circular solutions for sustainable food and water, including blue economy.

”In the world of sustainability, the vast majority of organizations and individuals focus on describing *why* we need sustainability: (climate change, plastics in the environment, persistent chemicals…). There are also many organizations and individuals who discus the *what* of sustainability: (UN SDGs, Circular Economy, Safe and Sustainable by Design…).

And while these efforts to discuss the *why's* and *what's* of sustainability are important and certainly part of SUCCeSS's activities, what makes SUCCeSS different and impactful is the fact that they place an emphasis on the *how's*. Describing the problem and creating ways to measure problems are important, but SUCCeSS is placing a significant effort on creating and disseminating mechanism at the molecular level on *how* to solve these problems.

I am proud to be part of this community and be able to help the wonderful team at SUCCeSS accomplish their goals.”

John C. Warner. Professor and a chemist, inventor, educator, entrepreneur, and the co-founder of Green Chemistry.

Webinars

The SUCCeSS lunch webinar series continued during 2023, with the general structure having one academic and one industrial speaker. The webinars continued to be well attended by 30-100 participants depending on subject. The format works well, but the effort to reach new audiences has not been successful. We will continue the effort in 2024 and see if can increase our engagement.

February 2023

'Biochar - a global solution to carbon sequestration?'

Prof. Niklas Hedin is a professor in Materials Chemistry at MMK, Stockholm University (SU). Title: 'Hydrochars and pyrochars and their upgrading into activated carbon'.

Ludvig Landen is operations manager, innovation and development, at Nordvästra Skånes Renhållning AB. Title: 'Biochar – a global solution to carbon sequestration? - An introduction of possibilities, markets and production'

March 2023

'Toxicity screening and life cycle assessment as a tool for safe and sustainable design'

Dr. Hanna Holmqvist works on the inclusion of toxicity and ecotoxicity indicators in life cycle impact assessment at IVL Swedish Environmental Research Institute. Title: 'Life Cycle Thinking in Safe and Sustainable by Design Assessment'.

Prof. Oskar Karlsson is an Associate Professor at the Department of Environmental Science at SU and his research focuses on developmental origins of health and disease with an emphasis on the exposome and underlying molecular mechanisms. Title: 'Molecular research for understanding toxicity of environmental contaminants'

May 2023

‘Perspectives on sustainable and circular textiles’

Prof. Joseph Samec is a Professor in Organic Chemistry at the Department of Organic Chemistry at SU and his research focuses on how to valorise biobased residues and design circular products. Title: ‘Textiles and chemicals from forestry residues’

Prof. Aji Mathew is a Professor in Materials Chemistry at the Department of Materials and Environmental Chemistry at SU and her research focuses on developing biobased materials for functional applications. Title: ‘Textile recycling: Possibilities and challenges’

June 2023

‘Safe and sustainable by design’

Hanna Gustafsson and Lotta Glans from Perstorp. Title: ‘Safe and sustainable by design – an industrial perspective’.

Prof. Helena Lundberg is an Assistant Professor in Organic Chemistry at KTH Royal Institute of Technology in Stockholm. Title: ‘Electricity to replace chemical reagents’.

October 2023

‘Circular opportunities and success stories’

Elin Bergman is known for being the Circular Economy Queen of Sweden. She the COO and spokesperson of the Swedish circular economy network Cradlenet, and is also one of the co-founders of the Nordic Circular Hotspot a collaboration platform for accelerating circular economy in the region.

November 2023

‘Sustainable organic synthesis, perspective from industry and academia’

Johan Karlsson is a strategic sustainability engineer at Cambrex, which is a leading global contract development and manufacturing organization that delivers drug substances, drug products, and analytical services across the entire drug life cycle.

Prof. Belén Martín-Matute is a Professor in Organic Chemistry at the Department of Organic Chemistry at SU and Academy member, in the class for Chemistry, in the Royal Academy of Sciences.

March 20th 2023

Visit by Paul Anastas and Julie Zimmermann

SUCCeSS community had a highly fruitful interaction with Prof. Paul Anastas and Prof. Julie Zimmermann from Yale University, USA. The highlights of the day were the online talks from the experts on ‘Designing a Green Chemistry Future’ moderated by Prof Lennart Bergström, SU. We also had round table discussions and strategy planning, led by Berit Olofsson. This event was attended by an invited group of SUCCeSS Core team, Board members, Postdoc PIs and postdocs. The topic of discussion included strategies for increasing SUCCeSS visibility and planning for an international summit in fall 2023.

From left to right: Prof. Aji Mathew, Prof. Berit Olofsson, Prof. Julie Zimmermann, Prof. Paul Anastas

April 2023

The first NorthTox meeting

SUCCeSS supported the organization of the first NorthTox meeting that was held on 20th-21st of April in Stockholm in Aula Magna at Stockholm University with over 150 participants. NorthTox is a new Nordic collaboration aiming to catalyse the interactions between Nordic toxicologists, and strengthen the toxicology field in the Nordic region. The scientific theme was 'Toxicology in the Anthropocene' focusing on the complex links between planetary health, biodiversity and human health, highlighting toxicology in the transition towards a safe, sustainable society.

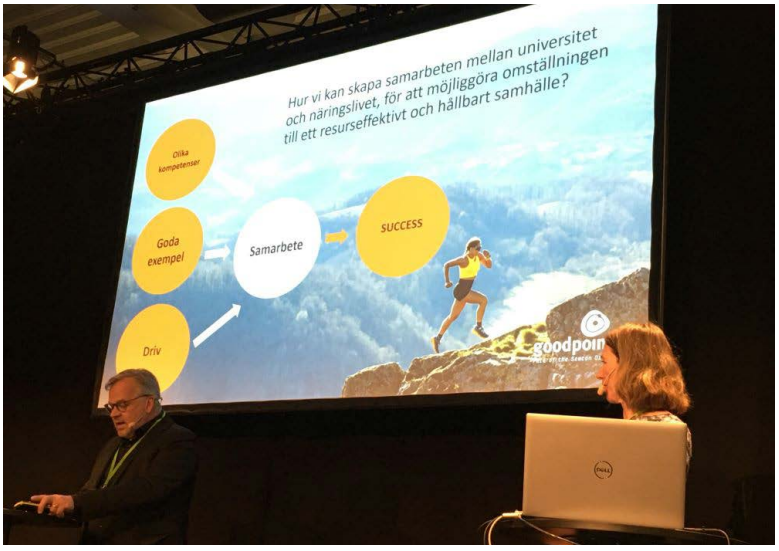
The keynote speaker was Alexandre Antonelli, Professor of Biodiversity at the University of Gothenburg and Director of Research at the Royal Botanic Gardens, Kew in Great Britain. In total, there were 27 oral presentations, poster presentations and panel discussions with high relevance for SUCCeSS. One session focused on Safe and Sustainable by Design (SSbD), which is concept aimed at fostering the transition

towards earlier assessment of potential hazards and risks of chemicals and materials. The European Commission has recently adopted the Joint Research Centre-developed framework for SSbD, which sets the basis for the operationalization of the concept. Oskar Karlsson, Deputy Director of SUCCeSS, was the chair of a session centered around new strategies and methods for toxicology testing. Modern toxicology aims to rely more on new approach methodologies (NAMs) for chemical testing and regulation, rather than traditional animal testing strategies. The SUCCeSS community was represented on site in Aula Magna, and were also able to join the meeting online for free.

April 2023

The Nordic Sustainability Expo

The Nordic Sustainability Expo is the Nordic region's largest meeting place for sustainable development, and a great opportunity to network with sustainably stakeholders. Professor Berit Olofsson, chair of the SUCCeSS board, and Magnus Boman, CEO of sustainability consultancy firm Goodpoint and member of the SUCCeSS board, gave a talk on the theme "Circular processes - cooperation SU & the business world" at the Expo.



August/ September 2023

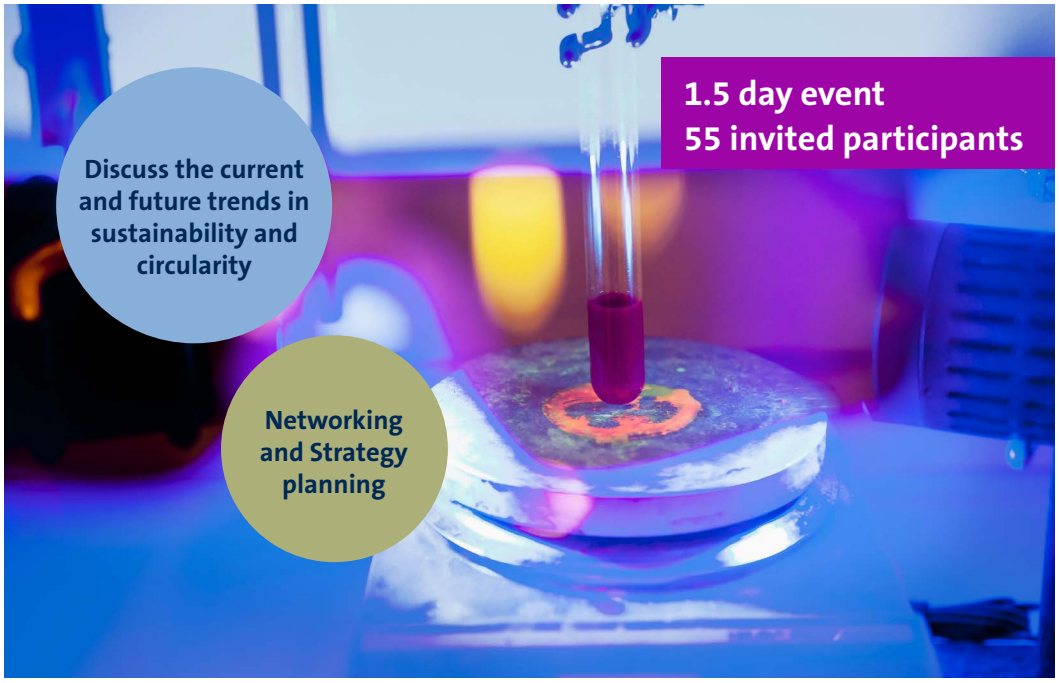
SUCCeSS Summit

31st of August to 1st of September 2023

The SUCCeSS Fall summit was a conference with the intention to exchange ideas and increase the international visibility of SUCCeSS.

The event brought together the SUCCeSS Advisory Board, SUCCeSS Leadership and Board, SUCCeSS post-doctoral researchers, other post-doctoral researchers, PIs, invited international experts, representatives of large programmes/centers (Mistra Safechem, Mistra Terraclean, WWSC, WISE, PRISMAS, Finncerres), 12 SU PIs as well as industries and policy makers.

The highlights from the event included talks from international experts in the fields of sustainability and circularity, panel discussions, talks from the SUCCeSS Advisory board members, speed talks on sustainability science from and poster presentations by PhD students and post-doctoral researchers.




SUCCeSS
A center for interdisciplinary research and education in circular and sustainable
SUCCeSS
Stockholm University

Erica Zeglio, Assistant Professor and WISE Fellow, Department of Materials and Environmental Chemistry (MMK), Stockholm University.


SUCCeSS
The technology can be used to replace a wide variety of fats

SUCCeSS post-doctoral projects

During 2023, the three SUCCeSS-funded post-doctoral researchers started their projects. The project call was aimed towards early-career PIs (<12 years since PhD), proposing novel collaborative projects to promote interdisciplinary research, with the inclusion of external stakeholders. The post-doctoral researchers are already active and we expect to see more of them in 2024!

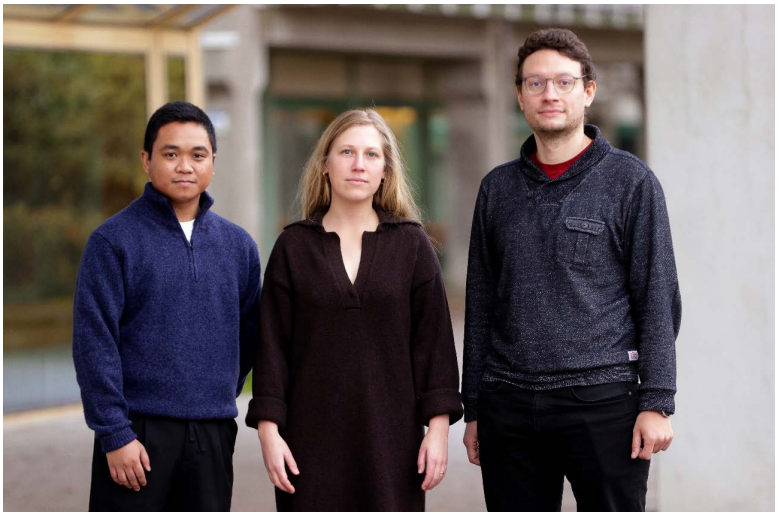
‘Design of chemical reagents for fast and sensitive detection of pesticides in water and food’

PIs: Anneli Kruve, Berit Olofsson and Miguel Rivero Crespo

SUCCeSS focus areas: Sustainable food and water systems and Data driven circular and sustainable design.

Dr. Henrik Hupatz is a SUCCeSS post-doctoral researcher with a PhD in organic chemistry from Freie universität in Berlin, where he spent his first years in academia. Henrik will be able to combine his knowledge in organic chemistry with machine learning and mass spectrometry to get the best outcome from those interdisciplinary chemistry worlds.

The project focuses on in-silico design of chemical reagents for detection of polar pesticides such as glyphosate. The aim is to improve the sustainability of the process of designing chemical reagents as well as the reagents synthesis. The research question arises from the fact that generative models of interest here are extrapolating models. Therefore, it is essential to choose, design, and adjust the machine learning models that can extrapolate to the chemical space of interest. The workflow for model



From left to right: Dr. Joeselle Serrana, Dr. Linnea Cederholm, Dr. Henrik Hupatz

training and testing is set up as of the end of 2023 and the first numerical results will be available in January 2024.

The project is currently in the first phase; adjusting the machine learning tools for the needs of generative machine learning models that will be used for the in-silico design.

'Forest materials: opportunities and obstacles for a circular economy in Sweden – FORCES'

PIs: Marlene Ågerstrand, Tiina Häyhä and Mika Sipponen

SUCCeSS focus area: Circular processing

Dr. Linnea Cederholm is a SUCCeSS post-doctoral researcher with PhD in polymer technology from the Royal Institute of Technology (KTH) in Stockholm. Linnea aims to explore the potential of forest materials as enablers of a circular economy on a more systematic level.

Circular economy is promoted as a key strategy to transform our societies into communities where humans can live and thrive within the planetary and social boundaries. In Sweden, where 70% of the land is covered by forest; high hopes are

placed on forest-based materials and their potential in replacing fossil-based materials. Simultaneously, a vivid debate is taking place regarding the different environmental benefits that forests can give, exposing several conflicting interests. The aim of this project is, therefore, to assess opportunities and obstacles for forest-based materials in a sustainable circular economy by utilizing a system thinking methodology, including technological, regulatory and socio-ecological sustainability aspects.

Based on this pre-study, we will conduct semi-structured interviews with producing companies within the forest-based sector. The interview study will explore these actors' perception of circular economy, and what role(s) the actors see themselves playing in the transition to a sustainable circular economy.

Focus will be put on the stage of innovation, on trends in terms of product categories/applications, and on the basis for the decision making during the innovation process. The aim is to, thereby, identify technological, regulatory and sustainability synergies/discords.

'Safe water reuse in a changing environment, microbial degradation of contaminants in European rivers'

PIs: Malte Posselt ACES, Elias Broman DEEP and Benoît Dessirier BSC

SUCCeSS focus area: Sustainable food and water systems

Joeselle Serrana, originally from the Philippines, is a SUCCeSS post-doctoral researcher and has also studied in Japan, Canada and now finally he has joined us at SU. Joeselle is a molecular ecologist, interested in freshwater ecology and microbiome research and say that with this project, he has found three PI's covering all the topics in his upcoming work.

Increasing water reuse is at the heart of Europe's climate change adaptation strategy to encounter water scarcity. Sustainable and safe reuse is hampered by a complex mixture of contaminants that reach the recipient waters due to

From left to right: Dr. Linnea Cederholm, Dr. Elias Broman, Dr. Joeselle Serrana

their incomplete elimination in wastewater treatment plants (WWTPs). Studying the structural and functional dynamics of the microbiome, and how each step, from field collection to laboratory processing and batch incubation experiments, influences the microbial profile of the collected environmental sample would provide important insights into standardizing or updating the guidelines for field campaigns and sample processing, with the behaviour of the environmental microbiome in mind.

We have already generated molecular sequence data and obtained estimates of biodegradation rate constants to jumpstart our project plans. Characterizing the seasonal bacteria and eukaryotic community profile, and their association with biodegradation will shed light on our lack of understanding of the influence of changing environment on biological communities, which, in turn, influence their metabolic capabilities or adaptations to degrade contaminants due to exposure. In another activity, we used bioinformatics to assess the biodegradation potential of environmental microbiomes by mining sequence information from public metagenomic data for genes and enzymes that are potentially involved in degradation pathways, e.g., petroleum hydrocarbon and plastic degradation, and biosurfactant production.

Major external grants awarded to SUCCeSS PIs

We congratulate Anneli Kruve on securing the ERC Consolidator Grant and Mika Sipponen on getting the ERC Starting Grant and becoming a Wallenberg Academy Fellow. We are proud to have you as part of the SUCCeSS community.

Anneli Kruve aims to evaluate and discover toxic chemicals in the environment but also in consumer products that have not yet been identified. This will allow the structural identification of the chemicals that truly matter by developing a set of machine-learning approaches for structure generation and evaluation.

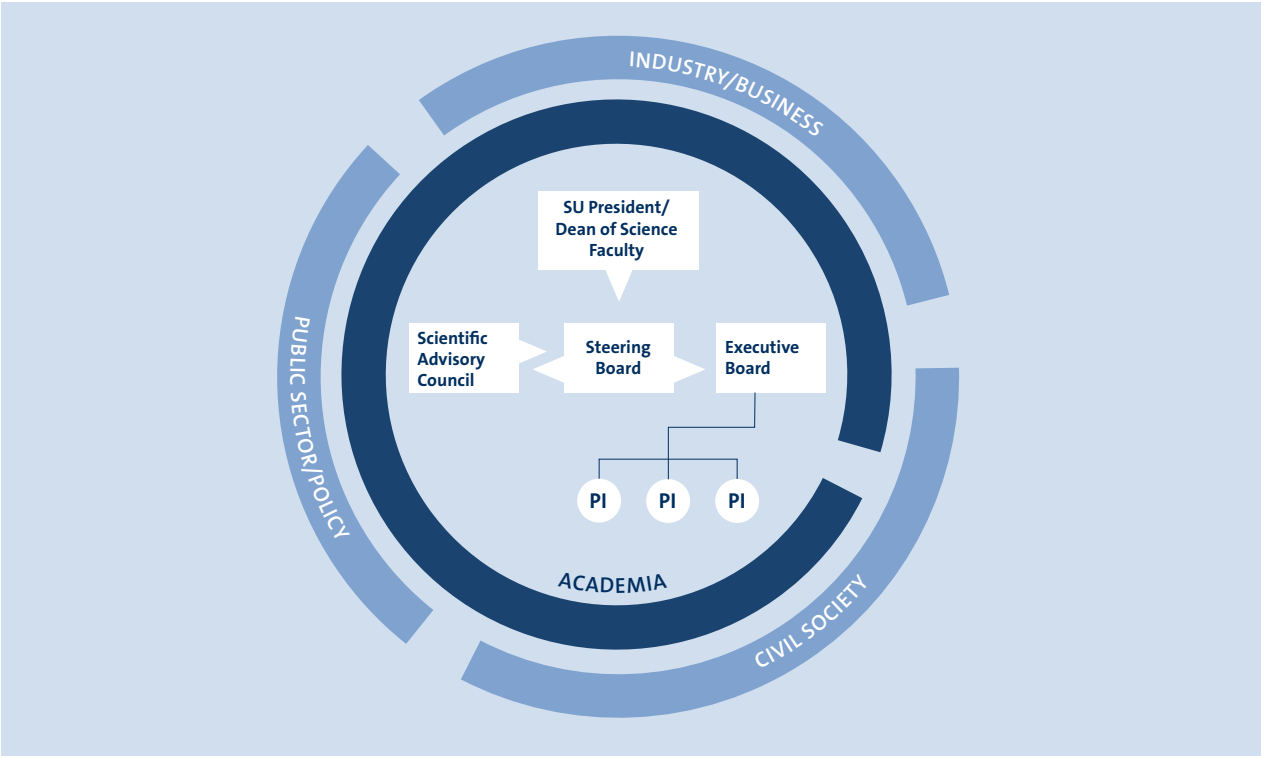
Mika Sipponen aims to study sustainable lignin-based materials that combine function and design for recycling. He also has an interdisciplinary research perspective across chemistry, engineering, and life sciences.

Nobel Symposium Application

One of the conclusions at the SUCCeSS Summit was to submit an application to host a Nobel Symposium on sustainability research. The application was submitted in October, with Berit Olofsson as main applicant, on the topic “Chemistry for Sustainability: Fundamental Advances”.

CircuLab

SUCCeSS also supported the application for infrastructure funds for CircuLab from WISE with Aji Mathew and Belén Martín-Matute as main applicants. CircuLab will be an AI-integrated platform to optimize the synthesis, processing and applications of sustainable materials and an open hub for academia, start-ups and industries. CircuLab will enable new research and collaborative work within the SUCCeSS network, including Berit Olofsson, Xiaodong Zou, Joseph Samec, Mika Sipponen, Lennart Bergström, Jiayin Yuan, Nicole Pamme, Anneli Kruve, Oskar Karlsson, Radovan Krejci and creates a strong collaborative environment involving Department of Materials and Environmental Chemistry, Department of Organic Chemistry, Department of Environmental Sciences and SciLifeLab.



SUCCeSS Organization

During 2023, Magnus Breitholtz and Oskar Karlsson joined the organization. We thank the board for their hard work and welcome a new board in 2024.

From left to right: Prof. Oskar Karlsson, Prof. Aji Mathew, Charlotte Boegård

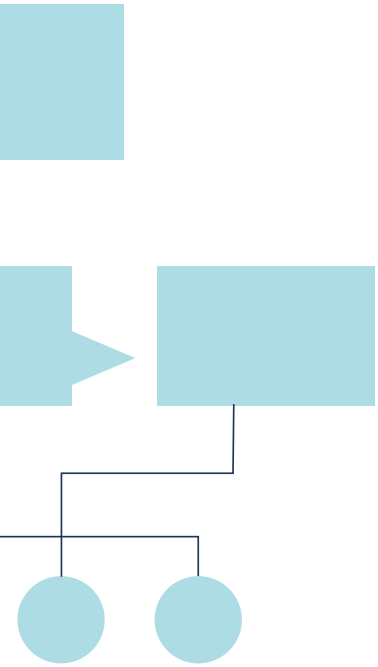
The Executive Board

- **Aji P Mathew**, Director, Professor in Materials Chemistry at SU. Research focus on sustainable and biobased functional materials processing, characterisation and applications.
- **Oskar Karlsson**, Deputy Director, Associate Professor in Environmental Chemistry at SU. Research focus on developmental origins of health and disease with an emphasis on the exposome and underlying molecular mechanisms.
- **Charlotte Boegård**, Coordinator, MSc Analytical Chemistry

The Steering Board

- **Berit Olofsson**, Chair, Dean of Chemistry and Professor of Organic Chemistry at SU. Research focus on sustainable organic synthesis using hypervalent iodine chemistry.
- **Line Gordon**, Vice Chair, Curt Bergfors Professor in Sustainability Science, Director of Stockholm Resilience Centre (SRC) at SU. Research focus on the sustainability and resilience of the biosphere through food and water.
- **Andreas Duit**, Professor in Political Science at SU. Research focus on environmental politics and policy.
- **Jonathan Martin**, Professor in Environmental Analytical Chemistry at SU, SciLifeLab Faculty and Director of National Facility for Exposomics. Research focus on nontarget mass spectrometry for studies of the exposome.
- **Lennart Bergström**, Professor in Materials Chemistry at SU. Research focus on materials chemistry directed towards applied surface and colloid science related to sustainable materials.

From top left to bottom right: Prof. Berit Olofsson, Prof. Line Gordon, Prof. Andreas Duit, Prof. Jonathan Martin, Prof. Lennart Bergström, Magnus Boman, Prof. Regina Lindborg, Prof. Magnus Breitholz, Sadaf Saeedi Garakani



- **Magnus Boman**, owner and executive director at Goodpoint, a consulting firm focused on sustainability.
- **Regina Lindborg**, Professor in Geography, especially Natural Resource Management at SU. Research focus on sustainable agricultural, including ecosystem services and biodiversity conservation.
- **Magnus Breitholtz**, Professor in Environmental Science and Analytical Chemistry at SU and Chair of the SU Environment Council. Research focus on ecotoxicology and risk assessment of chemicals.
- **Sadaf Saeedi Garakani**, student representative, PhD student in Materials Chemistry at SU.

Senior Advisors

The senior advisors of SUCCeSS support the center through active discussions, providing seminars and teaching on master level courses.

In January 2023 we welcomed professor John Warner as an external advisor to SUCCeSS. Professor John C. Warner has spent his life working to ensure that all practicing chemists will one day have the necessary skills to invent truly sustainable.

In November 2023 Elin Bergman, Cradlenet, also joined the center as an external advisor. She is COO and spokesperson of the Swedish circular economy network Cradlenet, and is also one of the co-founders of the Nordic Circular Hotspot a collaboration platform for accelerating circular economy in the region. Elin will help broadening SUCCeSS' scope and network, and also be part of setting the SUCCeSS strategy for the coming years.

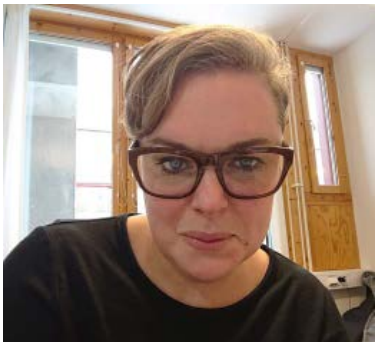
> "Elin brings complementary expertise to the chemistry core of SUCCeSS. I am very much looking forward to working with her, to learn from her expertise on circular economy and broaden the focus of SUCCeSS"
>
> *– SUCCeSS chair, professor Berit Olofsson*

From left to right: Prof. John Warner, Prof. Tanja Zimmermann, Prof. Paul Anastas

- Paul Anastas, Professor, Director of the Center for Green Chemistry and Green Engineering at Yale University, USA, is world renowned as one of the founders of Green Chemistry.
- John Warner, Professor, has spent his life working to ensure that all practicing chemists will one day have the necessary skills to invent truly sustainable technologies. John is a chemist, inventor, educator, entrepreneur, and the co-founder of Green Chemistry.
- Tanja Zimmermann, Professor, Director at EMPA, the Swiss Federal Laboratories for Materials Science and Technology, research focus on applied wood materials and nanocomposites.
- Elin Bergman, COO and spokesperson of the Swedish circular economy network Cradlenet, and is also one of the co-founders of the Nordic Circular Hotspot a collaboration platform for accelerating circular economy in the region.

Elin Bergman

Thank you and goodbye



At the end of 2023 the center coordinator Charlotte Boegård left SU to work on another project. We thank her for all her contributions to the center.

The SUCCeSS board was appointed for the period 2021-2023, and a new board has been appointed for 2024-2026. We thank the board members for their excellent work!

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