



# 2024 ISBUC Letter to the Deans

Image credit: Freddie Martin

# Message from the ISBUC Steering Committee



The first thing you will notice when you sit down with the 2024 ISBUC Letter to the Deans is its size. This is because 2024 was an absolute bumper year for the ISBUC community!

As the lengthy and extremely impressive research highlights section demonstrates, the University of Copenhagen has firmly established itself as a world-leading powerhouse for pioneering integrative structural biology research. We are extremely proud to report that ISBUC group leaders published six Nature papers, six Nature Communications papers, as well as papers in Cell, Molecular Cell, Nature Chemical Biology and Nature Metabolism during 2024. This truly exceptional output is the result of the boundary-pushing spirit of ISBUC researchers and the research excellence which can be achieved through interdisciplinary collaboration and fearless innovation. It is also a credit to the Deans of the Science and Health & Medical Sciences faculties for their continued commitment to integrative structural biology.

No less impressive, is the many large and prestigious funding grants that ISBUC group leaders received in 2024. These awards recognize the terrific

research being done in ISBUC groups and will help ensure that ISBUC retains its world-leading position for many years into the future.

In addition to funding support, excellent research requires an excellent research ecosystem. As the beating heart of this ecosystem, ISBUC must strive to keep pace with the outstanding quality of research being done by ISBUC researchers. To ensure this, we started the year with a large workshop for ISBUC group leaders. ISBUC has always been a bottom-up initiative; input, engagement and support from ISBUC group leaders is essential for our success.

2024 was the year when ISBUC shifted its gaze outwards and upwards – and the key word that made this possible was *partnership*. In collaboration with Professor Leila Lo Leggio, we hosted a workshop in partnership with MAXIV, exploring novel innovative methods for structural biology made possible by the new MicroMAX beamline. In collaboration with Associate Professor Amelie Stein, we hosted European Rosetta Conference, which is firmly established as Europe's foremost conference for protein design. In partnership with the Bioinnovation Institute, we organised the 2024

ISBUC Innovation Day, where ISBUC researchers met and were inspired by successful spin-outs and industry innovators, both from Denmark and abroad. In partnership with DANEMO, we hosted a PhD course that brought together junior researchers from all six Danish universities for a three-day trip to Hamburg to hear about the state-of-the-art structural biology research being done there and tour some of Europe's most important structural biology facilities. In partnership with the EU-Interreg program HALRIC, ISBUC has facilitated the distribution of small grants to group leaders for innovative cross-border research collaborations.

Like most researchers, alone ISBUC cannot achieve the successes which we can achieve in collaboration with others. We must integrate – with new institutes, infrastructures and partners.

We look forward to reporting on the outcomes of these partnerships for years to come. Until then, we hope you enjoy reading about all the successes within the ISBUC community this year.

Best regards,

Bithe B. Kragelund  
ISBUC Chair  
Faculty of Science



Karen  
Martinez  
SCIENCE

Claus J. Løland  
ISBUC Vice Chair  
Faculty of Health & Medical Sciences



Michael  
Gajhede  
SUND



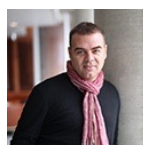
Heloisa N.  
Bordallo  
SCIENCE



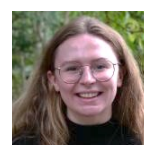
Nikos  
Hatzakis  
SCIENCE



Mette  
Rosenkilde  
SUND



Guillermo  
Montoya  
SUND



Ciara Frances  
Pugh  
SCIENCE





### A breakthrough year for disorder: Kragelund lab redefines IDP function

2024 was an excellent year for the group of **Professor Birthe B. Kragelund (BIO)** which had papers published in *Nature Communications* and *Nature*. Both studies focused on the structural and functional complexities of intrinsically disordered proteins (IDPs), offering major insights into how disorder in proteins enable dynamic regulation of cellular processes.

In *Nature Communications* (2024), the lab uncovered a molecular switching mechanism in the plant transcription factor DREB2A, where splicing and proline-isomerisation modulate its interaction with target proteins. This study provides a compelling example of how plants use structural plasticity in IDPs to integrate environmental signals into regulatory responses, which are crucial for stress adaptation.

In *Nature* (2024) the team challenged a long-standing assumption by showing that disordered proteins can disregard ligand chirality and bind ambidextrously. They showed that in a disordered complex binding occurs irrespective of stereochemistry, hinting at a potential heterochiral past. This paradigm-shifting discovery refines our understanding of molecular recognition and opens new possibilities for designing selective drugs targeting IDPs. Together, these studies redefine the role of structural disorder in biology, not as a lack of form, but as a versatile framework for specificity, regulation, and adaptation across both human and plant systems.



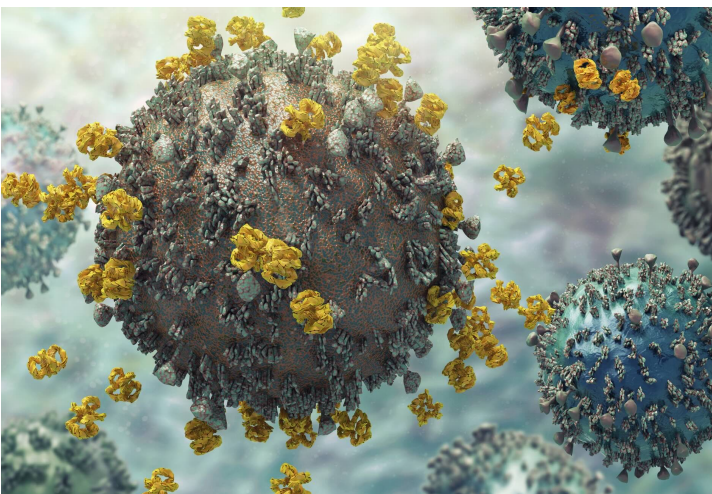
Continuing this work, Kragelund has been awarded a prestigious Semper Ardens Advance grant from the Carlsberg Foundation to explore how early life could have emerged from protein coacervates (see Funding News p.7 for details).

### Membrane lipids shape GPCR function: insights from ACKR3 ligand binding

The lipid composition of cellular membranes plays a crucial role in modulating the function of membrane proteins, including G protein-coupled receptors (GPCRs). In a study published in *Structure* (2024), PhD student Stefanie Eberle and **Associate Professor Martin Gustavsson (BMI)** demonstrate how bilayer lipids influence ligand binding to the atypical chemokine receptor 3 (ACKR3). Their study reveals that membrane lipids modulate receptor conformation and binding kinetics, highlighting a new regulatory mechanism in GPCR biology. This work, selected as an “Editor’s Choice” by *Science Signaling*, emphasizes the importance of the lipid environment in receptor-ligand interactions and may reshape how we approach receptor-targeted drug development.



### Cracking the code of HCV entry: structural insights into viral fusion and immune evasion



The hepatitis C virus (HCV) envelope glycoprotein complex plays a central role in viral entry and immune evasion, yet its structure has long remained elusive. **Associate Professor Jannick Prentø (ISIM)** and collaborators have now uncovered its architecture, revealing an unexpected anti-parallel homodimeric arrangement. Published in *Nature* (2024), this structural insight provides a critical foundation for understanding the fusion mechanism of hepaciviruses and offers a more accurate scaffold for designing next-generation HCV vaccines. The work marks the first structural characterization of a Hepacivirus glycoprotein complex in its prefusion conformation.

### ISBUC researchers reveal novel GPCR mechanism in nature metabolism

A collaboration between two ISBUC scientists, **Associate Professor Alexander Hauser (ILF)** and **Professor Mette Rosenkilde (BMI)**, has resulted in a landmark collaborative study in *Nature Metabolism* (2024), which uncovers how genetic variants of the GIP receptor (GIPR) influence metabolic phenotypes via  $\beta$ -arrestin-mediated signaling. This research highlights a novel mechanism in GPCR biology, linking receptor variation to metabolic outcomes. The findings not only advance our understanding of hormone receptor function but also open new avenues for therapeutic strategies targeting metabolic diseases such as obesity and type 2 diabetes.



### SEMORE transforms protein aggregation analysis

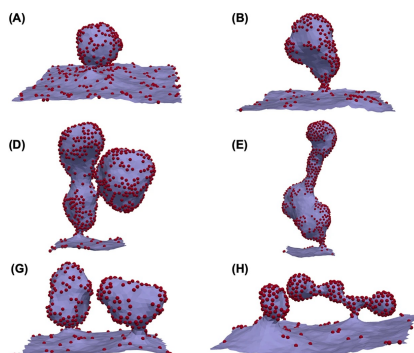
Protein aggregation underlies many neurodegenerative diseases, including Alzheimer's and Parkinson's. In a paper published in *Nature Communications* (2024), **Professor Nikos Hatzakis's (CHEM)** group introduce SEMORE, a machine learning framework designed to automate the analysis of super-resolution microscopy data. The tool combines density-based clustering with morphological fingerprinting to identify and quantify nanoscale biological assemblies. SEMORE enables rapid, system-agnostic analysis, offering new insights into protein aggregation and paving the way for advances in diagnosing and treating complex diseases at the molecular level.

### New 3D model sheds light on ribosome formation

**Associate Professor Eva Kummer (CPR/BRIC)** and collaborators have revealed a high-resolution 3D model of the human ribosome during its assembly in their work published in *Nature Communications* (2024). Using advanced electron microscopy, the team captured snapshots of this essential molecular machine, measuring only 30 nanometres, at various stages of its formation. Their work provides unprecedented insight into how the body's protein-producing machinery is constructed, deepening our understanding of ribosome biogenesis and laying the foundation for future studies of diseases associated with ribosomal dysfunction.



### Pushing the boundaries of biomembrane simulation with FreeDTS



In a major breakthrough for molecular modelling, **Assistant Professor Weria Pezeshkian (NBI)** and collaborators have developed FreeDTS, a powerful new software platform for simulating biomembranes at the mesoscale. FreeDTS is the missing piece in multiscale simulations of biomembranes. It enables fully bottom-up simulations of cellular processes and also allows researchers to take realistic membrane geometries, such as those derived from cryo-electron tomography, and convert them into detailed, molecular-level simulation models. In their paper published in *Nature Communications* (2024) they demonstrate the versatility of FreeDTS through several compelling use cases, while highlighting its broad applicability for future studies. This tool marks an important step toward more accurate, high-resolution simulations of cellular membranes.



### Lipid dynamics as drivers of protein aggregation and neuronal development in Parkinson's disease models

There is increasing interest in the interplay between lipid dynamics and protein aggregation, particularly as both are emerging as critical biomarkers and mechanistic drivers in neurodegenerative diseases. This year, **Associate Professor Céline Galvagnion-Büll (ILF)** and her collaborators made significant contributions to this field through two impactful studies. A *PCCP* (2024) paper revealed how  $\alpha$ -synuclein binds to membranes and aggregates, using small-angle scattering to uncover structural insights relevant to Parkinson's disease. Meanwhile, a study in *BBA - Molecular Basis of Disease* (2024) demonstrated that lipid levels correlate with neuronal and dopaminergic markers during SH-SY5Y cell differentiation. Together, these findings underscore the essential role of lipid environments in both protein aggregation and neuronal development.



### Digesting plant drinks: a path to better nutrition

**Associate Professor Jacob J. K. Kirkensgaard (FOOD/NBI)** and collaborators compare lipid self-assembly and digestion behavior between commercial plant-based drinks and bovine milk. Published in *Food Chemistry* (2025), the study shows that plant drinks form distinct liquid crystalline structures during digestion, diverging significantly from milk. These differences were linked to their fatty acid profiles, offering new insight into how plant-based alternatives behave in the digestive system and paving the way for improved formulation of plant-derived nutritional products.

### Molecular machines in genome maintenance and immunity: Montoya lab's 2024 breakthroughs in Cell and Molecular Cell

2024 was a landmark year for **Professor Guillermo Montoya (CPR)** and collaborators, who published three major studies in *Cell* and *Molecular Cell* that reveal how large biomolecular complexes orchestrate key processes in genome maintenance, epigenetic inheritance, and anti-phage immunity.

In *Cell* (2024), Montoya's team collaborated with the Groth and Thon groups, showing that the fork protection complex (FPC)—a multi-protein assembly traditionally known for stabilizing stalled replication forks—also plays a central role in epigenetic inheritance. By promoting the recycling of parental histones during DNA replication, the FPC ensures the faithful transmission of histone modifications and associated gene expression patterns through cell divisions. Using structural biology, biochemical reconstitution, and chromatin assays, the study uncovered how specific components

of the FPC coordinate histone handover and safeguard epigenetic memory, offering new insight into the coupling between genome duplication and chromatin architecture.

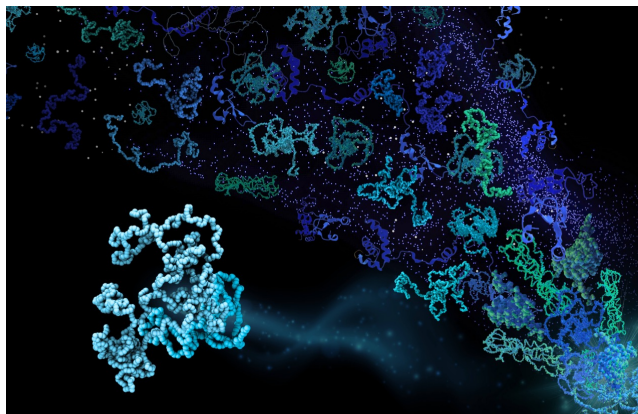
In *Molecular Cell* (2024), the team unveiled the structural dynamics of the type V-K CRISPR-associated transposon (CAST) integration machinery, mapping out the conformational landscape that governs DNA targeting and integration. These results can open the use of CAST in genome editing superseding tools such as CRISPR-Cas nucleases.

In a second *Molecular Cell* (2024) paper, the group determined the singular protection mechanism of a bacterial immune system. The Retron-Eco1, which leads to abortive infection when bacteria is infected by phages. The system forms NAD<sup>+</sup>-hydrolyzing protein filaments that provide bacterial immunity against the bacterial viruses.



These breakthroughs have the potential to be key to fight antibiotic resistance and the implementation of phage therapies to fight antibiotic resistant bacteria. Together, these landmark studies - spanning epigenetic inheritance, programmable genome editing, and bacterial immunity - underscore how cutting-edge cryo-EM and computational modeling can illuminate the dynamic architecture of complex molecular machines, offering transformative insights into genome biology and biotechnology.

### Landmark study maps entire human disordered proteome



Intrinsically disordered proteins (IDPs) lack stable three-dimensional structures yet play crucial roles in cellular function and disease. In a landmark study published in *Nature* (2024), the group of **Professor Kresten Lindorff-Larsen (BIO)** presents the first comprehensive view of conformational ensembles across the entire human disordered proteome, covering approximately 28,000 regions. Using advanced molecular simulations, machine learning and sequence analyses, their work offers unprecedented insight into the dynamic structural landscape of IDPs, laying the groundwork for future functional studies and understanding how disordered proteins are involved in human disease.

### Modeling mutation effects: ISBUC collaboration uncovers molecular insights into protein behavior and disease

In a new collaboration, driven by Fabian Johannes Schuhmann, postdoc at NBI, ISBUC researchers **Associate Professor Heloisa Bordallo (NBI)** and **Assistant Professor Weria Pezeshkian (NBI)** published a study in *The Journal of Physical Chemistry B* (2024), where they applied advanced mathematical modeling to predict the effects of mutations on biomolecular behavior. The research offers new insights into how specific mutations may alter protein function and stability, contributing to our understanding of disease mechanisms at the molecular level. By combining theoretical approaches with biophysical analysis, the study provides a powerful tool for exploring mutation-driven changes in biological systems and supports the development of predictive models in molecular medicine.



### Uncovering the spatial code of GPCR signaling

The spatial organisation of proteins on the plasma membrane is a key factor in how cells interpret and respond to extracellular signals, particularly through G protein-coupled receptors (GPCRs). **Professor Dimitrios Stamou (CHEM)** and collaborators have introduced a novel method to study this organization, published in *Nature Chemical Biology* (2024). Their approach uncovers how the spatial arrangement of GPCRs is essential for decoding extracellular signals. This spatial mapping method will shed light on how signal transduction is regulated by protein clustering, providing a powerful new lens through which to study membrane biology and receptor function in health and disease.



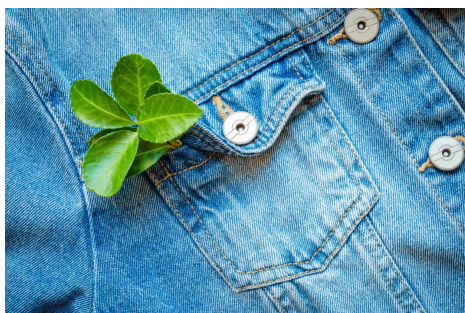
### Stein mixture inference: a scalable approach to variational Bayesian learning with improved uncertainty estimates



Congratulations to **Professor Thomas Hamelryck (BIO/DIKU)** and collaborators for their contribution to *ICLR 2025* with the development of Stein Mixture Inference (SMI), a novel method for variational Bayesian inference. Built on the Stein variational gradient descent framework, SMI tackles a key challenge—variance collapse, which hampers uncertainty estimates in Bayesian neural networks. By combining ELBO optimization with a mixture model of particle-based guides, SMI achieves more accurate predictions using fewer particles. This represents a promising step forward for scalable, uncertainty-aware, safe machine learning. Notably, when applied to protein structure prediction, SMI has the potential to improve the modeling of both epistemic (e.g., noise, data scarcity, model limitations) and aleatoric (e.g., protein dynamics, intrinsic disorder) uncertainties.



### Chemoenzymatic indican for sustainable denim dyeing



Indigo dye, central to denim production, traditionally relies on environmentally harmful chemical synthesis. In *Nature Communications* (2024), **Professor Leila Lo Leggio (CHEM)** contributed to a study to present a sustainable alternative through a chemoenzymatic process for indican synthesis, particularly by engineering a massive stabilization of the biocatalyst. Combining enzyme and process engineering with techno-economic analyses, they develop an efficient, scalable method for light-driven indigo production. This innovation offers an eco-friendly solution for the textile industry, significantly reducing the environmental footprint of dye manufacturing while maintaining industrial viability.

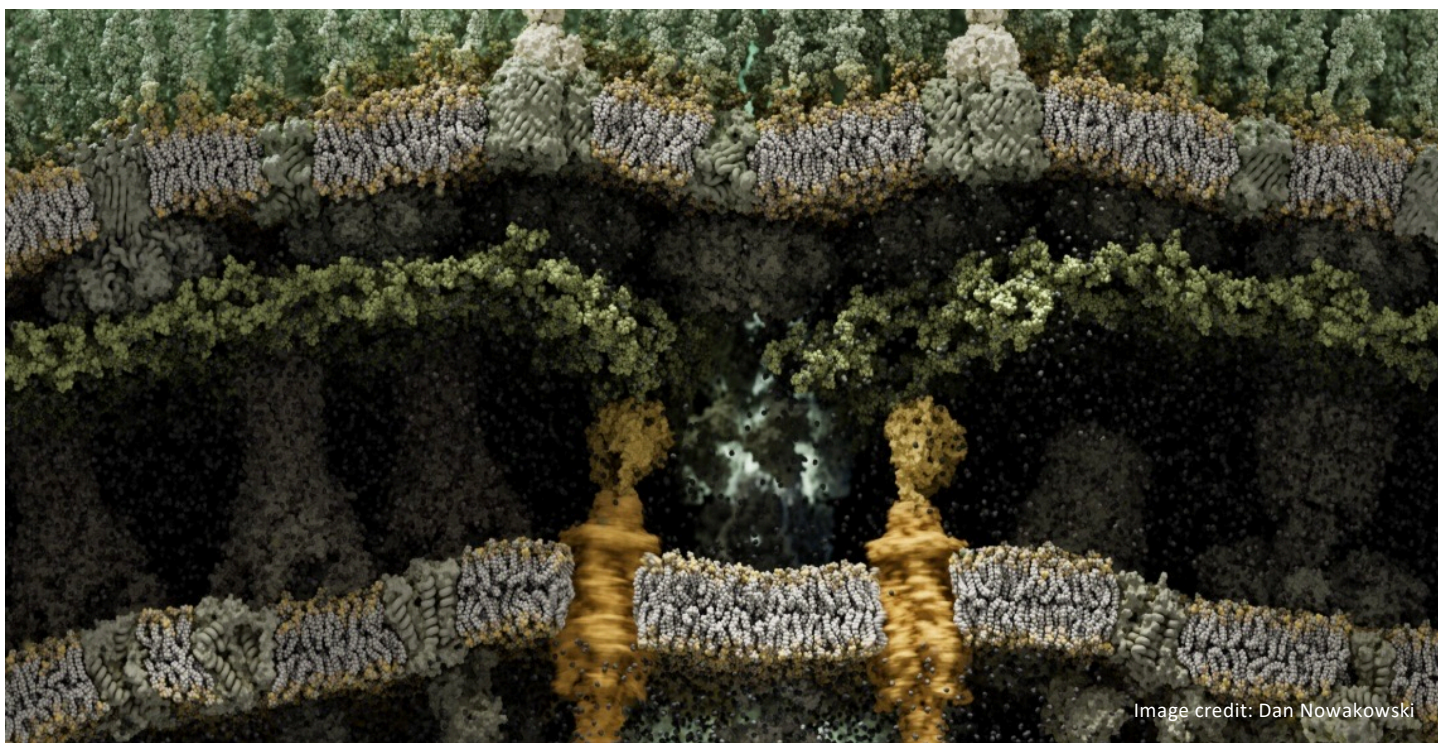
### Uncovering cocaine's grip on the brain: atomic insight into DAT inhibition

A groundbreaking study has provided the first high-resolution structural insight into how cocaine binds to and inhibits the human dopamine transporter (DAT), a crucial protein that regulates dopamine signaling in the brain. Conducted by **Professor Claus Løland (IN)** and collaborators, the research published in *Nature* (2024) used cryo-electron microscopy to capture DAT in complex with cocaine at near-atomic resolution, revealing the precise mechanisms at play. Specifically, cocaine is shown to lodge within the central binding site of DAT, stabilized by key residues such as Phe320 and Asp79, which are critical for substrate recognition and inhibition. Their work enhances our understanding of stimulant action and opens new avenues for targeting DAT in neuropsychiatric disorders.



### Zorya: a proton-driven motor system in bacterial anti-phage defense

The Zorya anti-phage defense system represents a sophisticated bacterial immune mechanism that protects against phage infections. In their work published in *Nature* (2024), **Associate Professor Nicholas Taylor (CPR)** and collaborators reveal the molecular mechanism of the recently discovered Zorya anti-phage defense system in detecting and responding to threats. The Zorya system comprises membrane-embedded ZorAB complexes that function as proton-driven motors, detecting phage attacks and initiating a cascade that includes the ZorD nuclease to degrade the viral genome. This targeted response effectively halts phage replication early in the infection cycle, providing robust immunity to the host bacterium. The structural and mechanistic insights from their work expand the understanding of microbial immunity and may inform future applications in biotechnology and medicine.





### New ESS Lighthouse: illuminating the future of food and medicine

A new interdisciplinary research center - Colloids and Interfaces in Food and Pharma (CalFF) - has been awarded DKK 39.4 million through the prestigious ESS Lighthouse grant from the Danish Agency for Higher Education and Science, as part of the national strategy to leverage the European Spallation Source (ESS). The CalFF Lighthouse aims to pioneer the use of neutron-based techniques to investigate how complex soft matter behaves under real-world conditions, with direct applications in pharmaceutical formulation and sustainable food innovation.

“The purpose of CalFF is to perform cutting-edge research into complex structures in colloid and interface science, focusing particularly on out-of-equilibrium multiphase systems.”  
—Professor Martin Malmsten, Center Director

Led by **Professor Martin Malmsten (PHARM)** and **Associate Professor Jacob Kirkensgaard (NBI/FOOD)** at the University of Copenhagen, as well as Professor Jan Skov Pedersen from Aarhus University, CalFF unites 16 research groups across the University of Copenhagen and Aarhus University, positioning Denmark as a global leader in neutron-enabled soft matter research. The center will integrate small-angle scattering, neutron reflectometry, and tomography with theoretical modeling and advanced data analysis to characterize dynamic nanostructures central to food texture, drug delivery, and more.

“This work will lay the scientific foundation for rational design and control of soft materials in both pharmaceutical and food applications. In collaboration with ESS, CalFF will serve as a national gateway for neutron-based experimentation, empowering new users and catalyzing cross-sector innovation.” — Associate Professor Jacob Kirkensgaard, Principal



Investigator.

Beyond experimentation, CalFF is deeply committed to capacity-building. It will recruit three Tenure-Track Assistant Professors and six PhD students to form the nucleus for further development into an international, interdisciplinary training program focused on neutron science and its applications. By bridging fundamental research with industrial collaboration, CalFF will enable researchers - from academia and beyond - to tackle pressing challenges such as enhancing the stability of biopharmaceuticals or improving the microstructure of plant-based foods.

By capitalising on the unique capabilities of ESS and Denmark's strong academic infrastructure, CalFF sets the stage for technological breakthroughs in how we design, deliver and understand critical everyday materials - from medicine to meals.



### ISBUC collaboration receives DKK 20M to transform neurodegenerative disease treatment

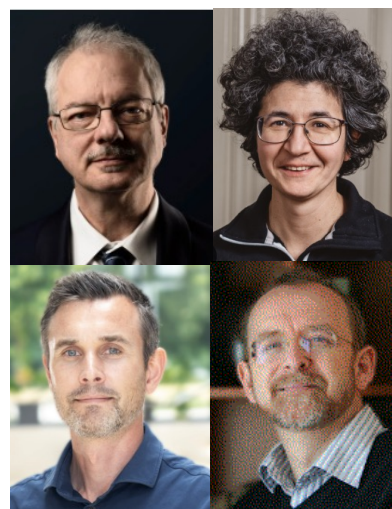


ISBUC is extremely proud to announce that **Professor Nikos Hatzakis (CHEM)** and **Associate Professor Céline Galvagnion-Büll (ILF)** are in a consortium awarded an impressive DKK 20 million from the Lundbeck Foundation for a groundbreaking project aimed at revolutionising drug delivery to the brain. This ambitious initiative will harness cutting-edge nanotechnology to develop advanced delivery systems capable of transporting pharmaceuticals safely and precisely across the blood-brain barrier which persists as a major challenge in treating neurological diseases. By combining expertise in microscopy, biophysics, machine learning and pharmacology, Hatzakis, Galvagnion-Büll and collaborators are developing advanced delivery platforms to transport drugs safely and efficiently across the brain's natural defenses.



### ISBUC researchers awarded funding from Independent Research Fund Denmark

It was a great year for ISBUC researchers **Professor Morten Peter Meldal (CHEM)**, **Professor Leila Lo Leggio (CHEM)**, **Professor Anders Bach (ILF)** and **Professor Morten Jannik Bjerrum (CHEM)** who have been awarded funding from the Independent Research Fund Denmark for DFF-Research Project 1. Morten Meldal received DKK 3,159,124 in funding for his project on controlling cannabinoid receptor CB1-CB2 / 5-HT homo- and hetero-dimerization using novel INAIC ligands. Professor Leila Lo Leggio received DKK 3,167,627 in funding for pioneering work on prodrug production via enzymatic glycosylation, which will involve collaboration with another ISBUC member, Professor Anders Bach. Professor Anders Bach himself received DKK 3,168,000 in funding to develop next-generation anti-inflammatory LUBAC inhibitors through cutting-edge fragment-based drug discovery techniques. And Morten Jannik Bjerrum received DKK 3,146,306 in funding for his innovative research on Oxidative RNA Modifications.



### Disorder to design: rethinking the Origins of Life with protein coacervates

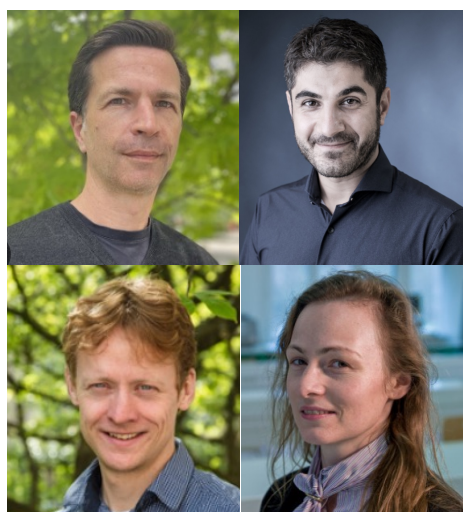
**Professor Birthe B. Kragelund (BIO)** was awarded a prestigious Semper Ardens Advance grant worth 18,601,874 DKK from the Carlsberg Foundation to explore one of science's deepest questions: How did life originate? Kragelund's project investigates whether early life could have emerged from protein coacervates, droplet-like assemblies of mirror-image amino acids, under prebiotic Earth conditions. By recreating these chemical environments, the team aims to discover how primitive proteins might have exhibited the first hallmarks of life. This research builds on the lab's recent Nature publication, which overturned a long-held assumption by showing that intrinsically disordered proteins (IDPs) can bind ligands ambidextrously, challenging the prevailing view of protein-protein interactions and how these proteins may inform the molecular basis of early life processes.



### Galvagnion-Büll secures grant for Parkinson's proteomics research

In addition to the Lundbeck Foundation Grant, **Associate Professor Céline Galvagnion-Büll (ILF)** has also been awarded a Project Grant in Bioscience and Basic Biomedicine from the Novo Nordisk Foundation (3 years, 3.5 Mio dkk) for a project aiming at characterizing proteomic changes in Parkinson's disease (PD). This project aims at identifying proteins whose levels are modified in association with PD as well as proteins involved in the formation of protein clumps found in the brain of patients. These results can be used for the development of new protein-based biomarkers and therapeutic approaches targeted at reverting PD related protein and lipid changes.

### SEECLEAR: Wood formation in near-real time

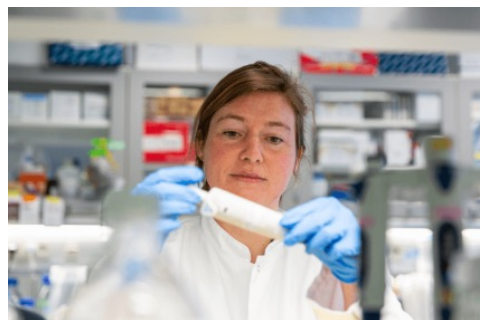


While structural biology is most often applied to human biology and medicine, its techniques offer powerful insights across many fields. A new project led by **Associate Professor Poul Martin Bendix (NBI)** with collaborators **Assistant Professor Weria Pezeshkian (NBI)**, **Professor Staffan Persson (PLEN)** and research scientist **Kalina T Haas (IJPB - INRAE)** demonstrates the power of structural biology within plant science. Wood is one of the most abundant and versatile natural materials, valued for its strength, durability, and wide range of uses - from construction to paper and fuel - yet the molecular processes behind wood formation remain poorly understood.

The highly interdisciplinary team, composed of experts in plant science, experimental biophysics, optics/microscopy, and molecular modeling, has received DKK 4.997.350 in funding from a NNF Exploratory Interdisciplinary Synergy grant for work which aims to elucidate biomolecular and structural cell wall changes that take place during wood formation, specifically focusing on the cessation of primary wall synthesis (a wall structure that surrounds growing cells) and initiation of secondary cell wall synthesis. The findings are expected to lay the groundwork for future biotechnological applications related to wood formation.

### Eva Kummer awarded Leo Foundation Grant to unravel herpes virus machinery

**Associate Professor Eva Kummer (CPR/BRIC)** received a prestigious Research Grant of 4.9 MDKK from the Leo Foundation to investigate the 'Architecture of the herpes virus replication machinery and its inhibitors'. Using cryo-electron microscopy, her team will visualize key protein complexes involved in HSV replication and investigate how new antiviral drugs block their function. The project aims to uncover new therapeutic targets to combat growing resistance to existing herpes treatments.



### Novo Nordisk Foundation Ascending Investigator Grant

**Associate Professor Jannick Prentø (ISIM)** was awarded a prestigious 10MDKK Novo Nordisk Foundation Ascending Investigator Grant in 2024, recognising his innovative work at the intersection of chemical biology and molecular imaging. His research focuses on viral protein structures, and the grant supports his ongoing work characterizing the Hepatitis C virus glycoprotein complex.



### New funding powers time-resolved enzyme research

It has been a great year for **Professor Leila Lo Leggio (CHEM)** who in addition to her DFF-research grant was awarded 2.999.349 DKK from the Novo Nordisk Foundation for the three-year project *Time-resolved studies of the Lytic Polysaccharide MonoOxygenase reactions* which aims to uncover how these enzymes break down complex carbohydrates, with potential implications for sustainable biomass conversion. This research focuses on capturing the fast and complex reactions of certain enzymes using cutting-edge time-resolved techniques, including X-ray crystallography and spectroscopy. The project will advance our fundamental understanding of enzyme catalysis and could impact industrial biotechnology and green energy development.



### Novo Nordisk Foundation Pioneer Innovation Grant



**Professor Knud J. Jensen (CHEM)** was awarded a Pioneer Innovator Grant worth 999.111 DKK from the Novo Nordisk Foundation to develop a new generation of glucose-responsive insulin. His project focuses on designing insulin molecules with a cleavable thiazolidine linker that activates in response to high blood sugar levels. The aim is to create a smarter, safer treatment for diabetes, reducing the risk of hypoglycemia and improving patient quality of life. The research bridges peptide chemistry and drug delivery innovation with strong translational potential.

### Carlsberg Foundation grant powers single-molecule techniques



**Associate Professor Pétur O. Heiðarsson** has received a large infrastructure grant from the Carlsberg Foundation to acquire a state-of-the-art single-molecule confocal fluorescence microscope. This advanced equipment enhances the research opportunities and enriches the infrastructure for structural biology at the University of Copenhagen. The microscope enables multiparameter analysis, allowing researchers to explore the intricate dynamics of protein folding, interactions, and misfolding at the single-molecule level, key to understanding neurodegenerative diseases and cellular mechanisms. This will open opportunities for cutting-edge collaborations within broad areas of biomolecular research.



# Spotlight on innovation & industry



## 2024 ISBUC Innovation Day

In 2024, ISBUC hosted our third meeting to explore opportunities for translation and collaboration with industry. This year, we designed the event in partnership with the Bioinnovation Institute with an aim to inspire the next generation of innovators. We were extremely honoured to host talks by **Lance Stewart** who leads the Translational Investigator Program at the Institute of Protein Design at the University of Washington and has decades of experience in protein and drug discovery research, life sciences partnering, and entrepreneurial start-up activities and **Karin Garre**, a senior executive and managing director with 35 years experience in pharma and biotech industries. In addition, we were thrilled to learn about two exciting spin-outs from the University of Copenhagen, presented by **Guillermo Montoya** and **Mette Trauelsen**. Both spin-outs are supported by programs at the Bioinnovation Institute and were built on research done in ISBUC labs, demonstrating once again the translational power of structural biology!

**ISBUC INNOVATION DAY 2024**

A day for the structural biology communities in both Academia & Industry to come together and find out about the latest translational structural biology innovations

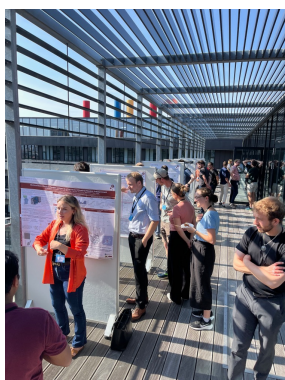
3rd September 13.00 - 17.00 Faculty Club, Building 16, 6th floor, Panum Building

**KEYNOTE SPEAKERS**

- **Lance Stewart** (University of Washington)
- **Guillermo Montoya** (University of Copenhagen)
- **Karin Garre** (Pharma Executive Leader)
- **Mette Trauelsen** (SOLID Therapeutics)

**REGISTER BY 29.8.2024**

**& A POSTER SESSION**



## The ISBUC Industry Advisory Board

In 2024, we established the ISBUC Industry Advisory Board. The mission of the board is to create a dialogue between the structural biology research communities working in academia, industry and innovation. Together, we plan to explore opportunities and develop programs for facilitating cross-sectoral collaborations, opening up new career paths for young scientists and helping researchers to take the leap into translation and innovation. The board includes representatives from several of ISBUC's most important industrial partners and will meet with the ISBUC Steering Committee once a year to discuss strategies and activities for deeper collaboration.

### Members

Anette Müllertz, *Bioneer*  
Eva Johansson, *Novo Nordisk*  
Iben Nikolajsen, *Bioinnovation Institute*  
Lars Olsen, *Novonesis*  
Louise Clemmensen, *Ferring*  
Peter Holme Jensen, *Cambiotics*  
Randi Westh Hansen, *Symphogen*  
Simon Erlendsson, *Novo Nordisk*  
Sune Christensen, *Novonesis*

## Exploring science careers in and out academia

YOU ARE INVITED TO

**The Junior ISBUC Lunch Talk**  
And pizza party!



With: Camilla Thorlaksen, Development Scientist, Novo Nordisk  
On: From physical stability to chemical stability and everything in between




9th of October, 2024  
12.00 - 13.00  
Meeting room 7.15.149  
Lil 15 Mansa Tower  
Panum Building  
Blegdamsvej 3B  
2200 København

Are you interested in structural biology?  
Do you want to meet students from other departments?  
Do you eat pizza?  
Then come join us!


The Junior ISBUC Lunch Talks are a space for young structural biologists at UCPH to connect with senior researchers working in both academia and industry. Each month, we invite recently established independent researcher to discuss their research, talk about their careers, and give guidance for junior researchers interested in securing a permanent position. Each year, the program of talks includes several industry researchers – including many Junior ISBUC alumni. These talks give junior researchers an insight into what it is really like to do research in industry and what all those different job titles mean.

YOU ARE INVITED TO

**The Junior ISBUC Lunch Talk**  
And pizza party!



With: Johanna Katarina Sofie Tiemann, Senior Data Scientist, Novonesis  
On: 'My journey from academia to industry – a continuous passion in discovery'



9th April, 2024  
12.00 - 13.00  
Room 1.2.03  
Biocenter  
Ole Maaløes Vej 5  
2200 København N

Are you interested in structural biology?  
Do you want to meet students from other departments?  
Do you eat pizza?  
Then come join us!

## Professor Brian Kobilka awarded Honorary Doctorate at University of Copenhagen

**Professor Brian Kobilka** from Stanford University School of Medicine has been awarded an honorary doctorate by the University of Copenhagen, recognising his extraordinary contributions to the field of molecular pharmacology. This prestigious honor celebrates Kobilka's groundbreaking research on G protein-coupled receptors (GPCRs), a large family of membrane proteins that play a crucial role in cellular signal transduction and are targets for a wide range of therapeutic drugs. His meticulous structural and biochemical studies, particularly using X-ray crystallography to reveal the architecture and activation mechanisms of GPCRs, have fundamentally transformed our understanding of how cells perceive and respond to external stimuli. In 2012, this pioneering work was recognized with the Nobel Prize in Chemistry, which he shared with Robert Lefkowitz. Kobilka's honorary doctorate not only highlights the global impact of his research but also reflects the University of Copenhagen's commitment to honoring excellence in life sciences and fostering international collaboration at the highest level.



## Eva Kummer selected as EMBO Young Investigator

**Associate Professor Eva Kummer (CPR/BRIC)** has been selected as an EMBO Young Investigator. Her research focuses on mitochondrial genome maintenance and gene expression. This prestigious program supports young principal investigators with networking opportunities and funding to advance their research careers.



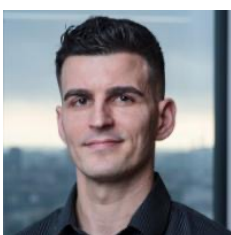
## Kristian Strømgaard awarded the Danish Academy of Natural Sciences' Industry Prize



**Professor Kristian Strømgaard (ILF)** has been honored with the Industry Prize 2023 by the Danish Academy of Natural Sciences. The award recognizes his significant contributions to pharmaceutical innovation and entrepreneurship, including the co-founding of Avilex Pharma and advancing drug discovery in neuroscience.

## Anders Jahre Award for Young Researchers awarded to Nicholas Taylor

**Associate Professor Nicholas Taylor (CPR)** has received the Anders Jahre Award for Young Researchers. His research provides structural insights into the molecular mechanisms of membrane transporters and bacterial motility, enhancing our understanding of molecular movement across cell membranes.



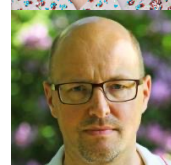
## Weria Pezeshkian awarded 7<sup>th</sup> MGMS Frank Blaney Award

**Assistant Professor Weria Pezeshkian (NBI)** was the winner of the 7<sup>th</sup> MGMS Frank Blaney Award 2024 Awarded by The Molecular Graphics and Modelling Society (MGMS). This is awarded to a young researcher for significant contributions to the field of Molecular Modelling.



## ISBUC scientists take leading positions in prestigious organisations

**Associate Professor Heloisa Bordallo (NBI)** became a member of the ISIS Science Advisory Committee and joined the organizing committee for the ICNS 2025 conference. **Professor Knud Jensen (CHEM)** was elected President of the European Peptide Society, overseeing 2,300 members worldwide, and opened the 37<sup>th</sup> European Peptide Symposium. **Associate Professor Alexander Hauser (ILF)** became the Junior Chair at the CAG in Precision Psychiatry and the Danish partner in the international Biodiversity2Drugs project.



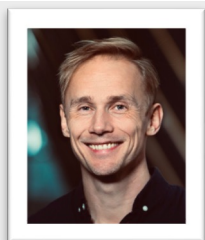
## ISBUC promotions: Céline Galvagnion-Büll and Thomas Hamelryck

Big congratulations to **Céline Galvagnion-Büll** who has been appointed as a tenured Associate Professor in Biophysical Pharmacology at the Department of Drug Design and Pharmacology, and **Thomas Hamelryck** has been appointed Professor at the Department of Biology.



## Meet the new faces of ISBUC

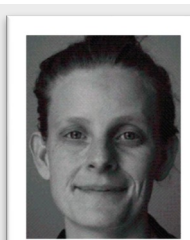
As the ISBUC community continues to grow, we would like to take this opportunity to introduce you to some of the new group leaders of ISBUC.



**Pétur O. Heiðarsson**

*Associate Professor*  
Department of Biology

**Research spotlight:** Pétur studies transcription factors, focusing on pioneer factors that regulate gene expression and cell fate decisions. Using single-molecule techniques and biochemistry, they map the structure and dynamics of these factors, particularly in chromatin remodelling and cell reprogramming. His recent work on intrinsically disordered proteins (IDPs) offers new insights into transcription factor function, with potential applications in gene regulation and disease modeling.

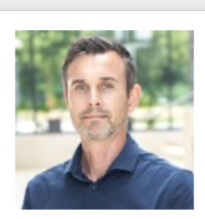


**Signe Mathiasen**

*Tenure Track Assistant Professor*

Department of Biomedical Sciences

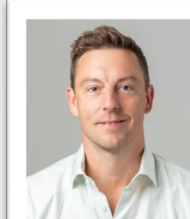
**Research spotlight:** Signe investigates the signalling and biological roles of Adhesion G protein-coupled receptors (GPCRs). These large, multifunctional proteins play key roles in synaptic stability and intracellular signalling. By combining molecular biology, advanced signalling assays, and single-molecule microscopy, her team explores how mechanical stress and ligand binding modulate receptor function—work that may reveal new targets for treating neuropsychiatric diseases.



**Anders Bach**

*Professor*  
Department of Drug Design and Pharmacology

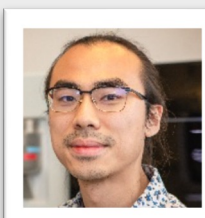
**Research spotlight:** Anders studies small-molecule inhibitors targeting protein-protein interactions (PPIs) linked to oxidative stress, inflammation and CNS disorders. His lab applies fragment-based drug discovery to explore targets like Keap1 and NOX2, building on his earlier work designing PSD-95 inhibitors. With a background in medicinal chemistry and experience in translational research, his work bridges early-stage drug discovery and therapeutic development.



**Jannick Prentø**

*Associate Professor*  
Department of Immunology and Microbiology

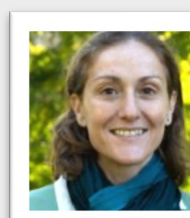
**Research spotlight:** Jannick investigates how positive-stranded RNA viruses, including hepatitis C virus (HCV), evade immune responses. His team integrates structural biology techniques such as cryo-EM and molecular dynamics with experimental virology to study viral entry and antibody neutralization. Their recent work revealed the structure of the native HCV E1/E2 glycoprotein complex, a discovery that provides crucial insight into how the virus escapes immune detection.



**Victor Cheng Yin**

*Tenure Track Assistant Professor*  
Department of Pharmacy

**Research spotlight:** Victor Cheng Yin's group develops innovative proteomics approaches to investigate protein modifications and interactions in complex biological systems. By integrating mass spectrometry with advanced biochemical techniques, his research aims to uncover regulatory mechanisms underlying health and disease. Recent work focuses on improving sensitivity and specificity in protein analysis, enabling deeper insights into cellular signaling and drug response.



**Rosa Laura Lopez Marques**

*Professor*  
Department of Plant and Environmental Sciences

**Research spotlight:** Rosa's research focuses on understanding the role of lipid flippases in plant adaptation to biotic and abiotic stresses. Her work aims to apply this knowledge to develop crops resilient to environmental challenges, supporting future food production. Her group uses a combination of molecular biology, biochemistry, advanced bioimaging, and high-throughput analysis tools, to investigate the mechanism, regulation, and physiological functions of lipid flippases.

## ISBUC hosts European Rosetta Conference

In 2024, ISBUC was proud to host European Rosetta Conference in collaboration with **Associate Professor Amelie Stein (BIO)**. This hugely successful, sold-out event brought together over 340 participants from across the globe to showcase the very latest advances in protein modelling and design. With rapid developments in computational methods, including deep learning and large-scale data from high-throughput screening, protein science is evolving at breakneck speed, making conferences like this essential for knowledge exchange. Reflecting these developments, this year's conference was themed *Knowledge Transfer for Modern Protein Modelling and Design*, with a focus on equipping participants with the skills needed to assess and apply emerging tools in their own work. The landmark conference featured a combination of plenary lectures from inspiring keynote speakers and practical workshops which aimed to facilitate the transfer of knowledge and tools to a broad audience of scientists working in the field. A vibrant and truly international gathering, the conference attracted a dynamic mix of both junior and senior researchers working at the forefront of the field, along with a huge contingent of industry researchers. We warmly thank RosettaCommons and the Novo Nordisk Foundation for their generous support, which made this incredible conference possible.



### Keynote speakers

Alena Khmelinska, *Ludwig Maximilian Uni. of Munich*  
 Amy Keating, *MIT Biology*  
 Clara Schoeder, *Leipzig Uni.*  
 Dek Woolfson, *Uni. of Bristol*  
 Donald Hilvert, *ETH Zurich*  
 Elodie Lane, *Sorbonne University*  
 Jens Meiler, *Vanderbilt and Leipzig Uni.*  
 Joanna Slusky, *Uni. of Kansas*  
 John Karanicolas, *Fox Chase Cancer Center*  
 Joseph Mathew Rogers, *UCPH*  
 Kresten Lindorff-Larsen, *UCPH*  
 Matt O'Meara, *Uni. of Michigan*  
 Mohammed Alquraishi, *Columbia Uni.*  
 Noelia Ferruz, *Centre for Genomic Regulation*  
 Ora Schueler-Furman, *The Hebrew Uni. of Jerusalem*  
 Pietro Sormanni, *Uni. of Cambridge*  
 Possu Huang, *Stanford Uni.*  
 Rocco Moretti, *Vanderbilt Uni.*  
 Sarel Fleishmann, *Weizmann Institute of Science*  
 Sergey Ovchinnikov, *MIT*  
 Tanja Kortemme, *Uni. of California, San Francisco*  
 Tina Perica, *Uni. of Zurich*



### Best Poster Awards

**Christopher Frank** (Dietz Lab, Technical Uni. of Munich): *Machine learning methods for the design of large proteins*

**Dina Listov** (Fleishmann Lab, Weizmann Institute of Science): *A fully computational design of high-efficiency Kemp eliminase*

**Holly Ford** (Anderson Lab, Uni. of Bristol): *Computational design and biochemical characterisation of a molecular wire*

**Victor Klein-Sousa** (Taylor Lab, Uni. of Copenhagen): *Towards a complete phage tail fiber structure atlas*



# ISBUC and DANEMO partnership

## What is DANEMO?

For the past two years, ISBUC has been hosting DANEMO at the University of Copenhagen. DANEMO is a research support centre funded by the Danish Ministry for Research and Education which helps to build bridges between Danish research institutions and the European Molecular Biology Laboratory (EMBL) and the European Molecular Biology Organization (EMBO). EMBL and EMBO have long established themselves as a European powerhouse of scientific innovation and leadership, particularly within structural biology. Through this partnership, ISBUC has been able to build bridges with the many world-class facilities and infrastructures for structural biology experimentation which are housed at EMBL and to connect with research leaders and groups who are pioneering new innovative techniques such as time-resolved crystallography, cryo-ET, and 3D imaging. In particular, we have leveraged this opportunity to create career opportunities for junior researchers, culminating in June 2024, when we took 30 young structural biologists from across Denmark to Hamburg.

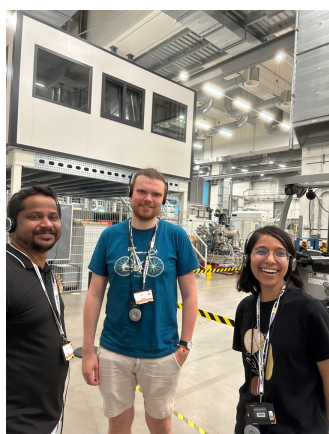
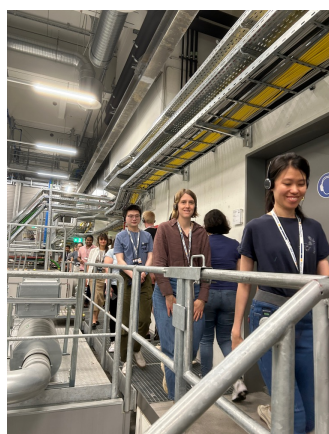
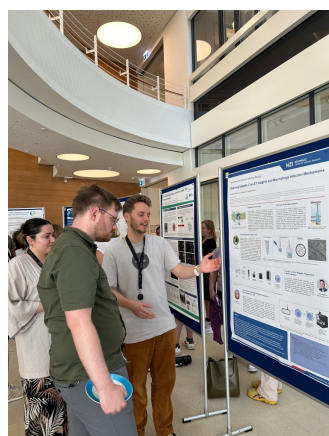
## DANEMO & ISBUC excursion takes structural biologists from across Denmark to Hamburg to explore EMBL's research facilities and opportunities



In June 2024, DANEMO brought 30 PhD students and postdoctoral researchers from Danish universities on an inspiring three-day scientific excursion to Hamburg. The students visited the world-class research infrastructures for structural biology located in Hamburg, including DESY, the European XFEL, and Center for System and Structural Biology's Cryo-Electron Microscopy labs. The trip also offered a unique opportunity to learn about cutting-edge tools in structural biology, including synchrotron radiation, x-ray crystallography, cryo-electron microscopy, x-ray imaging, and time-resolved experiments to study molecular structures, through talks by leading structural biologists based at EMBL Hamburg, including **Arwen Pearson**, **Thomas R. Schneider** and **Meytal Landau**. In addition, participants got to learn expand their knowledge in other relevant areas of life

science where there is major potential for interdisciplinary collaboration. This included a lecture from EMBL team leader **Elizabeth Duke**, in which the participants got to learn the science behind X-ray imaging.

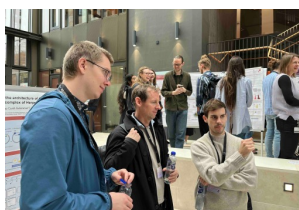
A poster session was also conducted in collaboration with local junior researchers, where the participants had the opportunity to present a poster, enhancing networking and collaboration between Denmark and Hamburg. The trip brought together students from diverse life science fields, successfully fostered new connections through networking and deepened participants' understanding of interdisciplinary research opportunities and the impressive infrastructure for structural biology located just a few hours from Denmark in Hamburg.





### The 2024 ISBUC Annual Meeting

The 2024 ISBUC Annual Meeting took place on Friday October 25<sup>th</sup> and featured four outstanding and inspiring keynote talks by **Mei Hong (MIT)**, **Arne Elofsson (Stockholm University)**, **Sonja Lorenz (Max Planck Institute for Multidisciplinary Sciences)** and **David Drew (Stockholm University)**. As always, the day also gave us a glimpse into the excellent research happening here at UCPH through poster sessions and flash talks. Special congratulations go to Research Assistant **Mira Doombi (Kummer Group, BRIC)** who took home the Junior ISBUC Prize for Best Flash Talk and to PhD Students **Kristine Walløe Salomon (Løland group, IN)** and **Jesper Elmsted Dreier (Galvagnion group, ILF)** who won the Junior ISBUC Best Poster prizes. We would also like to acknowledge and thank the Novo Nordisk Foundation for making this event possible through their generous support.



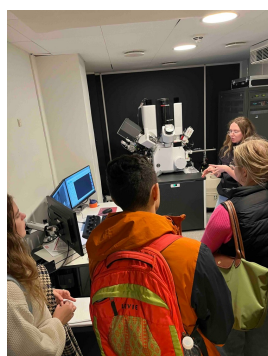
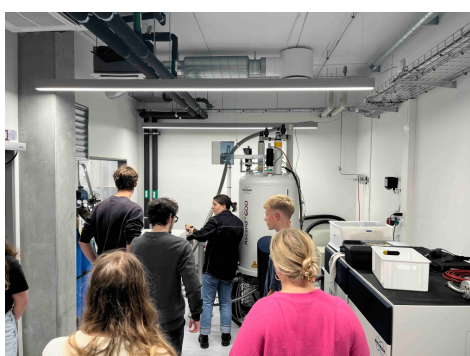
### MicroMAX workshop

In March, ISBUC teamed up with **Leila Lo Leggio (CHEM)** and scientists from MAXIV to host a workshop on the new MicroMAX beamline. Participants learnt about the new scientific questions this beamline will open up and also got to meet one-on-one with instrument scientists to explore potential projects. Already this has resulted in several new projects for ISBUC scientists!



### Junior ISBUC gives gymnasium students insight into life in the lab

Forskerpraktik is an innovative research mentoring program connecting students from Nørre Christianshavn Gymnasiums with researchers at the University of Copenhagen. This year, Junior ISBUC was proud to host three groups of visiting students and supervise their mini-research projects. One of the projects, guided by PhD candidates Arriën Symon Rauh (BIO) and Annette Juma Skæfergaard Nielsen (BIO), explored the potential for ancient retroviruses as innovative drug delivery systems, the students investigated how structures, such as GAG proteins and capsid formations, could be repurposed for medical applications. Forskerpraktik provides an invaluable opportunity to expand horizons beyond their regular curriculum. As one participant from Nørre Gymnasium reflected, "It was super fun to do a project together with some nice people and to get some more in-depth thoughts on subjects that are not found in the gym."



### Junior ISBUC & Young Medicinal Chemists host joint symposium

ISBUC's mission is to promote innovative, interdisciplinary research that integrates multiple methods. We have always been a bottom-up organization: a scientist-led initiative, that aims to spur new collaborations and connections between scientists across departments and faculties. It was therefore extremely fitting that Junior ISBUC and the Young Medicinal Chemist organizations should organize a joint symposium to learn about each other's research and the available methods in each discipline, forge new connections and explore potential areas for collaboration. The day was a huge success and featured talks by PhD students, postdocs and assistant professors.

