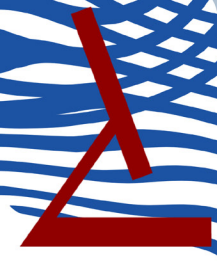
Molecules in Motion

A Pioneer's Path



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Introduction

Hey everyone!

We are thrilled to welcome you to X for the fifth Nanobiology Symposium, during our wonderful Lustrum year. After a year of preparation, we are excited to present four incredible speakers who will share their fascinating work with us.

Throughout the day, our moderator, Gijsje Koenderink, will guide us through inspiring talks and engaging discussions, ensuring that everyone has the opportunity to ask questions and participate.

In addition to the talks, don't miss the company fair, where you can connect with innovative companies like Macrogen, OASYS NOW, SoundCell, and SilicoGene.

We hope you have an amazing afternoon filled with inspiration and new connections. And of course, stick around afterward for some drinks, we'd love to celebrate with you!

With love,

SNP5

Bram, Jenny, Julia, Robin, Tamina, Thijs, and Wibien

Erwin Peterman

Professor of Physics of Living Systems,
Founder of LUMICKS B.V.

Erwin Peterman is interested in understanding how life works at the fundamental, single-molecule level. With his experiments he strives to provide quantitative insights in life processes that can be rigorously tested using physical models. To this end, he applies a multidisciplinary approach including elements from molecular and and optics. The techniques used in his lab are (single-molecule) fluorescence microscopy, fluorescence spectroscopy and optical tweezers.

Current research focuses on the cooperation of motor proteins in intracellular transport in C. elegans cilia, on the mechanics of DNA and DNA-processing proteins, on the dynamics of membrane proteins in living bacteria, and on the development of new instrumentation and approaches to study life at the single-molecule level.

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Pulling on single biomolecules and watching how they cope

"In our lab, we have developed the combination of optical tweezers and single-molecule fluorescence microscopy as a powerful tool to study biomolecules and biomolecular complexes. Combining these two technologies allows holding a sample molecule or complex, extending or deforming it, and measuring forces acting on it, while, at the same time, visualizing it with single-molecule sensitivity. We have applied this approach to different biological systems, including DNA, whole chromosomes, cytoskeletal components and membranes. Our spin-off company LUMICKS b.v. has commercialized the technology and made it available to hundreds of labs worldwide."

Stefan Barakat

Associate Professor, Clinical Geneticist and Experimental Biologist

Dr. Tahsin Stefan Barakat is at the forefront of research on the non-coding genome, an area of genetics that holds the key to many unresolved disorders. While only 2% of the human genome codes for proteins, the vast majority consists of non-coding sequences with crucial regulatory roles. Among these, enhancers play a pivotal part in gene expression, yet their activity remains challenging to predict.

His team has pioneered a powerful approach that integrates chromatin immunoprecipitation with massively parallel reporter assays. Their findings reveal that only a fraction of DNA regions previously associated with enhancers show actual activity, challenging conventional assumptions. Furthermore, enhancer function shifts dynamically during development, with only select elements of "super-enhancers" driving gene expression.

Dr. Barakat's current research is deeply invested in the link between the non-coding genome and genetic brain disorders. By combining functional genomics, patient-derived induced pluripotent stem cells, and cerebral organoid models, his team investigates how enhancer mutations contribute to neurodevelopmental conditions. This work has led to the discovery of novel disorders, including Barakat-Perenthaler syndrome, caused by mutations in UGP2, and Kaya-Barakat-Masson syndrome, linked to YIF1B mutations. His studies not only improve diagnostics but also open avenues for potential therapeutic strategies.

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Finding causes of missing heritability in neurogenetic disorders: exploring the dark matter of the genome

"Despite the powerful tools and technologies available to the field of human genetics, at present more than half of the patients suspected of a genetic cause of their rare disease remain undiagnosed. My lab tries to tackle this "missing heritability" in the context of neurogenetic disorders, where we focus on the one hand on disease modelling using stem cell derived models and zebrafish elucidating new monogenetic disease causes, and on the other hand try to increase our understanding of the regulatory elements contained in the non-coding genome, of which we hypothesize that genetic alterations might solve at least a fraction of that missing heritability.

We do this by applying functional genomics including massively parallel reporter assays and computational analysis to generate atlases of functional regulatory elements in various human brain cells, and interrogating these atlases using convolutional neural networks to predict functional nucleotides within regulatory elements. This provides useful information to prioritize non-coding variants identified by whole genome sequencing. In this talk, I will present a number of examples from both our disease modelling and non-coding genome projects, that together help to shed light on the dark matter of the human genome."

Sara Okhuijsen

Co-founder of OASYS NOW,
Nanobiology Alumna

Sara Okhuijsen is a scientific entrepreneur and co-founder of OASYS NOW, a health tech startup dedicated to revolutionizing healthcare through responsible AI and ethical data practices. Recognized for her impactful work, Sara has won the Women in AI BENELUX Award and the prestigious SLUSH 100 startup competition.

With a background in Nanobiology, Sara's passion lies in developing cutting-edge AI technologies that empower patients, enhance data privacy, and accelerate medical discoveries. At OASYS NOW, she co-leads the development of ELaiGIBLE, an AI-powered tool that streamlines patient pre-screening for clinical trials, saving healthcare professionals countless hours of administrative work.

Her leadership extends to pioneering research in AI for genomics, exemplified by the CoMPai (Confidential Multi-Party AI) framework developed in collaboration with NVIDIA, Erasmus MC, and CISPA Helmholtz Center. This framework facilitates collaborative genomic research while ensuring the highest standards of privacy and security.

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A Pioneer's Path: AI, Privacy & Patient Empowerment in Precision

Sara's dedication to responsible AI and international collaboration, including participation in the Dutch government's innovation mission to Japan, continues to drive the adoption of ethical AI practices within the Dutch healthcare ecosystem, attracting talent and investment while building a more equitable, patient-centric future.

Sara's talk will take us through the path she took to bekome an entrepreneur, highlighting the Life & career choices she made along the way to end up doing what she does today. Aditionally she will discuss OASYS NOW's mission and their vision of the future of precision medicine. Including the health and DNA data infrastructure they are building to help patients and fuel precision medicine research.

Ben Feringa

Professor of Synthetic and Physical Organic Chemistry, Chemistry Nobel Prize Winner

Ben L. Feringa obtained his PhD degree at the University of Groningen in the Netherlands under the guidance of Professor Hans Wynberg. After working as a research scientist at Shell in the Netherlands and the UK, he was appointed lecturer and in 1988 full professor at the University of Groningen and named the Jacobus H. van't Hoff Distinguished Professor of Molecular Sciences in 2004. In 2008 he was appointed Academy Professor and was knighted by Her Majesty the Queen of the Netherlands.

Feringa's research has been recognized with a number of awards including the Koerber European Science Award (2003), the Spinoza Award (2004), the Norrish Award of the ACS (2007), the Paracelsus medal (2008), the Nagoya gold medal (2013), ACS Cope Scholar Award 2015, Chemistry for the Future Solvay Prize (2015), The 2016 Nobel prize in Chemistry and the Euchems gold medal. He is among others member of the US National Academy, the Chinese Academy of Sciences, the Royal Society UK and the German Academy Leopoldina. Feringa's research interest includes stereochemistry, organic synthesis, asymmetric catalysis, molecular switches and motors, self-assembly, molecular nanosystems and photopharmacology.

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The Art of Building Small

Exploring across the current frontiers of chemical sciences there is vast uncharted territory to experience the joy of discovery. Far beyond Nature's design, the creative power of synthetic chemistry provides unlimited opportunities to realize our own molecular world as we experience every day with products ranging from pharmaceuticals to displays that sustain modern society. In their practice of the art of building small, chemists in joined efforts with many other disciplines have shown amazing success in the past decades, producing the materials for everyday life including our cars and smart phones. At the dawn of the next revolution nanotechnology holds the promise to go far beyond our current frontiers. Our research program is focused on molecular nanoscience building tiny motors and machines.

An essential feature of life is motion which is evident from the fact that we can walk, talk, see and reproduce. Moving from static molecules and materials to dynamic molecular systems the fundamental challenge is how to control and exploit motion at the nanoscale. "In this presentation the focus is on my journey in the world of molecular nanoscience. Designing molecular machines, the size of which 1 billion of a meter. Science or science fiction? In particular, the synthesis and functioning of molecular switches and motors will be discussed and applications ranging such as smart medicines or responsive materials and artificial muscles. In this lecture the process of discovery and my personal experiences through my scientific career are also presented. I will address how fundamental questions, serendipity and molecular beauty have guided me on this journey."

Moderator: Gijsje Koenderink

Professor at Bionanoscience, Synthetic and Cell biology

Prof. Dr. Gijsje Koenderink's research is centered on the biophysical properties of living cells and tissues, with a particular focus on their mechanical behavior. Her work aims to elucidate how cells and tissues achieve a balance between mechanical strength and dynamic adaptability, which is crucial for various biological processes such as wound healing, tissue regeneration, and the progression of diseases like cancer.

In her laboratory at TU Delft, Prof. Koenderink employs a multidisciplinary approach that combines principles from soft matter physics, biophysics, synthetic biology, and mechanobiology. One of her key methodologies involves bottom-up synthetic biology to construct biomimetic models of cellular components, such as the cytoskeleton, and the extracellular matrix of tissues. These models allow for controlled studies of mechanical properties and behaviors at multiple scales, from individual molecules to entire tissues.

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Prof. Koenderink's team has made significant contributions to understanding the nonlinear and active mechanical properties of cells and tissues. Their research has revealed how structural hierarchies within biopolymer networks govern mechanical responses, providing insights into the physical principles that enable cells and tissues to withstand mechanical stresses while remaining responsive to their environment.

Collaborations with biological and medical researchers are integral to Prof. Koenderink's work, extending the impact of her findings to areas such as cancer metastasis and thrombosis. By investigating how abnormalities in cell and tissue mechanics contribute to these conditions, her research offers potential pathways for developing therapeutic strategies and improving tissue engineering approaches.

Through her innovative and interdisciplinary research, Prof. Koenderink continues to advance the fundamental understanding of the physical mechanisms underlying cellular and tissue mechanics, bridging the gap between physics and biology to address complex biomedical challenges.

Sponsors

We would like to give a special thank you to the Funds and Companies that sponsored this event. Without them, we would not be able to host this amazing symposium.

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A special thanks to
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and
the Bionanoscience faculty
for their kind contributions

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Day Planning

13:00	Doors open / Coffee round
13:30	Introduction by Gijsje Koenderink
13:45	Talk by Erwin Peterman
14:30	Talk by Stefan Barakat
15:15	Coffee Break / Company Fair
15:45	Talk by Sara Okhuijsen
16:30	Talk by Ben Feringa
17:15	Borrel / Company Fair
18:30	End of Event

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