

## Biophysicist in Profile

OLE MOURITSEN



Ole Mouritsen

*Ole G. Mouritsen*, professor of biophysics at the University of Southern Denmark and director of its MEMPHYS Center for Biomembrane Physics, grew up in a small town on the island of Funen, in the middle of Denmark. As a child, Mouritsen was interested in exploring things unknown to him. “I remember that I wanted to be a plumber like our neighbor,” he says. “I spent many hours in his workshop tampering and tinkering with all sorts of metal plates and tubes.” His family supported his inquisitive mind, encouraging him to study a broad range of subjects, explore all of his talents, and to be open to all opportunities available to him.

Following high school, he entered Aarhus University unsure of what he wanted to focus on. “When I started university, I was split between studying science and history, and it was not possible in Denmark to combine these fields in a dual university degree,” he says. “So I started studying physics and mathematics in 1970 and in the second year I branched into physical chemistry, still having a hidden agenda of later studying the history of science.” He quickly became involved in undergraduate research within statistical thermodynamics and computer simulation of nuclear spin systems. “This was so captivating that I basically got stuck with science,” he jokes.

He earned his master’s degree in physics and chemistry in 1976, his PhD in physical chemistry in 1979, and finally his DSc in computer simulation techniques applied to phase transitions in 1984. For several years he worked on statistical mechanical modeling of phase transitions and critical phenomena, with focus on magnetic systems, solids, surfaces, and monomolecular overlayers.

In 1980, Mouritsen began a postdoctoral fellowship with *Myer Bloom* at the University of British Columbia, where he was introduced to biophysics. “My background in statistical mechanics and phase transitions turned out to be useful to study cooperative phenomena in lipid bilayers as models

of biological membranes,” he says. “I found it first very challenging to work in biophysics, in particular identifying problems that were both very ambitious but also could be tackled and lead to novel results using the techniques and methodologies I knew from basic physics. I learned very quickly that a fundamental understanding of physics and physical chemistry, combined with mastering computational techniques, could open up new inroads to the understanding of the structure and function of biological membranes.”

Since his postdoctoral appointments at Kings College London and University of British Columbia, Mouritsen has held positions as a senior researcher at the University of Aarhus, a research professor in materials science at the Technical University of Denmark, and later a professor of physics chemistry at the same institution. Since 2001, he has been a professor of molecular biophysics at University of Southern Denmark and has served as center director for the MEMPHYS-Center for Biomembrane Physics. Beginning in 2014, he has also served as the center director of the National Danish Center for Taste. As of May 2017, he will assume a new professorship in gas trophysics at the University of Copenhagen.

One of the biggest challenges of his career has been “to successfully make transitions between different research areas and to work on massively interdisciplinary problems,” he says. “I faced it by using generic modeling and the powerful concepts of analogies and principles of universality from the physical sciences.”

Mouritsen’s current research projects involve active membranes and lipid protein interactions; sterol effects on membranes; liposomes as drug-delivery systems; lateral domain structure of membranes; physical chemistry of seaweed materials; the science of taste; and gas trophysics of taste and mouthfeel. “In recent years I have become interested in the biophysics of food and taste, and together with colleagues and students I am trying

to promote and define a new field we have coined gastrophysics,” he shares. “I hope to be able to contribute to this field, for example in relation to clarifying relationships between structure, texture, mouthfeel, and flavor of foodstuff. In this work I am often collaborating with innovative chefs and, being the president of the Danish Gastronomical Academy, I have a very keen interest in gastro-nomic innovation.”

*Martin Zuckermann*, Simon Fraser University, met Mouritsen in 1980. Both were interested in lipid research at the time and decided to keep in contact in hopes of collaborating in the future. Since then, the two have coauthored — along with members of their research groups and other colleagues — 44 publications. “Ole is an excellent collaborator, who never fails to acknowledge the contributions made by other members of the team. His broad knowledge of physics in general and biophysics in particular and his scientific intuition have helped to stimulate the creativity of those with whom he interacts,” Zuckermann says. “His recent forays into the world of food science have further expanded the role of the physical sciences in this field.”

“Ole is curious and pushes boundaries, which creates an inspiring scientific environment. This is evident from his discoveries of fundamental physical properties and phase behavior of sterol-lipid membrane systems,” shares *Amy Rowat*, who completed her graduate studies in Mouritsen’s lab. “Equally inspiring is the way he asks questions about foods — from sushi to seaweed — and writes books on these topics.”

Mouritsen’s books examining food through a gastrophysics lens include *Sushi: Food for the Eye, the Body & the Soul*; *Seaweeds: Edible, Available & Sustainable*; and *Umami: Unlocking the Secrets of the Fifth Taste*. He has also organized symposia on related topics. “I happened to be in Copenhagen for one day of a workshop he hosted on seaweed and was blown away to meet seaweed harvesters from British Columbia, a researcher from Japan,

and a doctor who has written a recipe book about seaweed from Ireland — all of whom were in awe that Ole had put together this workshop unlike anything they had ever attended before,” Rowat says.

Another avenue through which Mouritsen shares his passion is teaching. Not only has he trained 43 PhD students in his lab, he has also worked to expose students from different disciplines to molecular biophysics. “For 17 years I was the director — and co-founder — of the Danish National PhD School of Molecular Biophysics, running one of Denmark’s most successful interdisciplinary and cross-institutional PhD courses,” he explains. “The special feature of this course is that during the term it takes place one day at a time at different universities across the whole of Denmark.



Mouritsen (right) discussing gastrophysics with chef Klavs Styrbaek.



Mouritsen demonstrates gelation processes for children.

In this way the students get exposed to many different research groups and traditions as well as many different techniques. This is extremely valuable for being able to work in the diverse field of molecular biophysics.”

To those who are just starting out their careers in biophysics, Mouritsen offers the following: “Be curious, keep an open mind, and maintain a broad interest while you dig deep down in your narrow specialization. Learn several techniques and methods, be aware of the power of combining the three pillars of scientific work and thinking — theory, experiment, and modeling/simulation, look out for the unexpected, and when bogged down in details and loads of data, don’t forget to look at the big picture.”

### Profilee-at-a-Glance

#### Institution

University of Southern Denmark

#### Area of Research

Molecular biophysics, gastrophysics