



Peter Roepstorff, a brief biography

Peter Roepstorff is a Professor of Protein Chemistry at the University of Southern Denmark, Odense, Denmark. He is one of the early pioneers in protein and peptide mass spectrometry starting as early as in 1967, and has received a number of awards for his research including among others the Linderstøm Lang Gold Medal, the Novo Nordic Award and a HUPO Award. He is member of the Royal Danish Academy of Sciences and Letters and of the Danish Academy of Technical Sciences. He is Dr. *Honoris causa* at Uppsala University and he was knighted by Her Majesty the Queen of Denmark for his contributions to science.

Peter Roepstorff founded and until recently headed the Protein Research Group at the University of Southern Denmark where the main research focus is the development of methods for protein mass spectrometry and proteomics, including techniques for the determination of post-translational modifications. Numerous graduate students and post docs from all over the world have received education in the Protein Research Group and many of them are now heading proteomics laboratories in different countries. He has published more than 400 scientific articles and book chapters, one of the most cited being a paper suggesting the nomenclature for mass spectrometric peptide fragmentation. He is a member of the editorial boards of many scientific journals in the fields of mass spectrometry and proteomics. In 2005 he transferred the responsibility for the Protein Research Group to the next generation in order to get more time for research. This has allowed him this year to participate in a major Danish Marine Biology Expedition, Galathea 3, where he was scuba diving in tropical coral reefs in the search for new fluorescent proteins.

About Peter

Throughout his career Peter has been searching for new challenges in protein chemistry and mass spectrometry. The early work in the late 1960's and early 1970's led to methods for peptide sequencing and for the determination of novel post-translational modifications, including the discovery of gamma-carboxyglutamic acid. His interest in protein sequencing by mass spectrometry led him in 1974 to take on a position of assistant professor at the newly established Odense University, now University of Southern Denmark, where he quickly installed the

first mass spectrometer. The laboratory expanded in the late 1970's and 1980's and by 1988 there was an additional associate professor (Peter Højrup), several outstanding technicians (Lene Skou, Kate Rafn, Inger Christiansen) and 6–7 graduate students working with Peter. I (ONJ) joined the laboratory in 1988 as I was looking to find a project advisor that would take on a M.Sc. student in cell biology and computer science. Other potential supervisors were rather confused when they heard about the combination of cell biology and computer science, but not Peter. He saw an opportunity to develop software for the analysis of LC chromatograms, a project that eventually led to the development of a method for characterization of mutant human hemoglobins by HPLC, PDMS and computational data analysis, and me being infected by the 'protein mass spec' bug. During the 1990's several new mass spectrometers were installed (MALDI MS, ESI MS) and the laboratory expanded further by employment of Finn Kirpekar and myself (ONJ) as associate professors, our indispensable secretary Helle M. Mortensen, more technicians (Andrea Lorentzen, Søren Andersen) and numerous students and postdocs. As the Protein Research Group entered the new millennium, also Thomas J.D. Jørgensen and Martin R. Larsen were employed to help expand the ever-growing fields of protein chemistry, biological mass spectrometry and proteomics. Today, the Protein Research Group encompasses approximately 60 researchers, students and technicians and is active in most branches of biological mass spectrometry, protein chemistry and proteomics. Throughout this expansion process and the growth of protein mass spectrometry and proteomics at a global scale, Peter was never afraid to grant responsibility and projects to younger colleagues, allowing them to become independent scientists and develop new research programs in Odense or abroad.

Peter is an outstanding mentor. His scientific knowledge and analytical mindset combined with a great sense of humor and empathy has provided him with many devoted and loyal students and colleagues all over the world. Peter has always promoted education and training and the laboratory in Odense hosts numerous visitors and collaborators. Peter strongly believes that the best science is achieved in an open and friendly atmosphere, with a mix of Danish and foreign students and postdocs. The high scientific level, the non-hierarchical organization, and the international ambience of the laboratory is a big inspiration for all students and colleagues and has made the laboratory known

all over the world as an excellent training site. Peter's visions and ideas for running a research laboratory is now propagated by the next generation, including Peter Højrup, Finn Kirpekar, Martin R. Larsen, Thomas Jørgensen and myself, with Peter as an active and interested participant.

From early on, Peter initiated research projects with biotech and pharma companies in Denmark and abroad. In fact, the first plasma desorption mass spectrometer that was installed in Odense in the mid-eighties was co-financed by the Novo and Nordisk Gentofte companies (now Novo-Nordisk A/S). The openness towards academic-industrial collaborations continues today and includes Danish and international pharma and biotech companies and mass spectrometer manufacturers. This not only ensures access to new technology and funding for interesting research projects in the Protein Research Group but also provides employment opportunities for graduates and postdocs.

Peter is not only rightly considered a founder of what started as mass spectrometry of proteins and then became proteomics; he remains one of the most eminent developers and experts. It was both his vision and his relentless efforts which brought the field to the success we all now take almost for granted.

Actually, at the outset all of what is now mass spectrometry of biological macromolecules was more of a dream than a true vision. I (F.H.) met Peter for the first time at an Ion Formation from Organic Solids symposium (IFOS) in 1982. Even though we discovered the evening before the conference that neither of us had thought of bringing enough money along to buy us a decent dinner and were later that evening rescued by a group of American colleagues, Peter asked me right away, whether I believed that one would ever be able to record mass spectra of proteins. My answer was that I had not given up the dream, but found it hard to believe in. Not so Peter! As a protein biochemist he saw the necessity for new and better analytical methods and believed that "where there is a need, there is also a way". He was proven right only a day later, when at the symposium the Uppsala group headed by Bo Sundqvist presented, well not a real spectrum, but anyhow a signal of insulin obtained by Plasma Desorption, developed some eight years earlier by Ron Macfarlane. This was the beginning of my friendship with Peter, which has lasted 25 years and, hopefully, will continue for many years to come. Peter immediately jumped the band wagon, joined forces with the Uppsala group, taught them how to prepare protein samples on nitrocellulose and only three years later at the IFOS 1985 symposium the group presented a real protein spectrum, of trypsin (MW 23.463). Meanwhile we in Frankfurt, and since 1986 in Münster, worked on the improvement of laser desorption and finally in 1988 obtained our first protein spectra, setting a new record with a mass in excess of 100,000. Peter was first skeptical whether MALDI could successfully compete with PD-MS, but after a week's visit to Münster in 1989 he left convinced that MALDI would be the method of the future. Typical for Peter, he not only looked at what we could do at that time, he also suggested to compare spectra of myoglobin and cytochrome c to get a first understanding of the "softness" of the desorption process. We saw only the non-covalent apomyoglobin but the holoprotein of the covalently bound cytochrome c.

A few years later around 1993 the Odense group and the Münster group again got together to tackle yet another seemingly hopeless problem, the MALDI-MS of nucleic acids. Karsten Kristiansen and Finn Kirpekar joined us on the Odense side and Edi Nordhoff and Stephanie Hahner from Münster. We all have fond memories of our meetings in Odense (at Peter's estate) and Münster every half year, where we not only discussed the problems we had encountered, but equally important simply enjoyed the friendship atmosphere and a free exchange of new ideas, no matter how futuristic. The project, actually, was not successful enough to convince the EU bureaucracy to fund a second round, but the core ideas, developed then are now the basis for a commercial use by Sequenom Inc.

Although, seeing him perform at conferences, earlier on, I (AJRH) met Peter a few years after we had our first joint publication. It was at a very memorable NATO summer school in Morocco, where nearly all attendees became ill from food-poisoning, and/or got stuck in air-traffic on the way back home because of the 9–11 disaster. A few years earlier, when I was at Warwick University I started to become interested in analyses of non-covalent interactions by mass spectrometry. When Dudley Williams visited Warwick it became clear to me that the antibiotic vancomycin would be an ideal model system to see how far we could stretch the applicability of this emerging new mass spectrometry based tool. A year later, a phd-student from Peter's lab, Thomas Jørgensen, spent a period in Warwick, and we laid the foundation for several papers that we jointly published. The first paper on the measurement of K_d 's by mass spectrometry became a well-cited classic, but maybe even more rewarding we were able to convince Dudley Williams that he should reconsider the new emerging potentials of mass spectrometry. I know Peter as an ideal mentor of young people. Maybe not that young himself any more, he has been of great support to me when I started my own group in Utrecht, just as he has been for many other researchers across the globe. Taking the Protein Research Group in Odense as a template, he was for me an ideal role-model, to try to set up my own research. Peter is very driven and ambitious, but always with a big smile on his face, asking everyone the familiar question; "what is the fun of this experiment?" Following up on the joint retreats of the Münster-Odense groups we instigated the Utrecht-Odense retreats focused on all aspects of protein mass spectrometry. During the first retreat we informed the Odense group on our work on TiO_2 for phosphopeptide enrichment, and further exchange of ideas led to this rather revolutionary new method for phosphoproteomics. For the last decades Peter's focus has been on protein mass spectrometry, mastering all aspects of it, ranging from proteomics to post-translational modifications and structural biology. His broad interest is nowadays quite unique - more researchers should have this. He is a well-respected attendee of many meetings as he is always very open in giving his opinion and (un)asked advice. His advice in advisory boards, review panels and workshops has always been fair and very supportive for young people with independent and new ideas. Peter always teaches colleagues and students to go for the fun-experiment, which often brings you the most exciting results and new insights.

Modern mass spectrometry of biological macromolecules cannot even be imagined without the role of Peter in its development. His overwhelming enthusiasm and relentless encouragement in his uncountably many interactions and collaborations with colleagues and groups all over the world will forever remain part of this development.

This Special Issue of the *International Journal of Mass Spectrometry* contains a series of scientific articles contributed from Peter's friends, former students and postdocs, and colleagues. We (the guest editors) would like to thank all the contributors for their tremendous enthusiasm and support for this 'project' and for submitting articles on cutting-edge research in biological mass

spectrometry and proteomics. The contents of this Special Issue nicely reflects Peter Roepstorff's relations to researchers all over the globe and his wide range of scientific interests, from fundamentals of mass spectrometry to the study of proteins from a variety of living organisms (including 'strange creatures').

Happy 65th Birthday, Peter!

Ole N. Jensen
Albert J.R. Heck
Franz Hillenkamp