

Drug delivery research

The field of drug delivery is highly interdisciplinary, covering aspects from biophysics to cellular biology, and so collaborations have often had a key role in success. This month, we feature two people who have long been involved in this varied area of research.



Sven Frøkjær, Ph.D.

Head of Faculty, Faculty of Pharmaceutical Sciences, University of Copenhagen, Denmark.

Twenty-five years ago, when particulate drug delivery systems were just beginning to emerge, Sven Frøkjær moved to Novo (now Novo Nordisk). His job: to set up a basic research unit focusing on the potential use of nanoparticles for drug targeting and on the potential of liposomes as oral delivery systems for proteins and insulin. “We were among the first industrial groups addressing drug targeting from a pharmaceutical perspective,” Frøkjær says.

Frøkjær had previously obtained an M.Sc. in pharmaceutics and a Ph.D. in physical chemistry from the Royal Danish School of Pharmacy, and then spent a year as a postdoc. “The shift from academia to industry allowed me and my colleagues to address fundamental questions within drug delivery with better access to resources,” he says. Importantly, however, he also realized the power of academic

collaborations, which included teaming up with the world-leading group in cellular processing at the Institute of Cellular and Molecular Pathology, Louvain Medical School, Brussels, headed by the Nobel laureate Professor Christian De Duve for their biological studies. “One of the reasons [we collaborated] was that we were allowed to take an interdisciplinary approach to drug delivery and drug targeting, covering basic aspects from biophysics to cellular biology — an approach that broadened my perspective on research,” he says.

He feels that these academic partnerships were highly inspiring and instrumental for his career in industry, during which he changed focus to protein drug delivery and took on more managerial responsibilities, becoming Vice President of Nutritional R&D. Although very happy with his position at Novo Nordisk, the close contact he maintained with academia through joint research projects, as well as teaching as an external lecturer, led to him accepting an appointment as full professor at the Royal Danish School of Pharmacy in 1993. “I decided to go back to academia to have better possibilities to choose and direct my research towards the more fundamental challenges I find of scientific interest in drug delivery and



formulation of biomacromolecules — a jump I have never regretted,” he explains.

Now, as Dean of the Faculty of Pharmaceutical Sciences at the University of Copenhagen, Denmark, as well as professor of pharmaceutics, his experience in industry has equipped him with the skills and contacts needed for this position. “I think the most important lesson in my career has been to go from industry back to academia,” he says. “This shift has given me a thorough understanding of differences in culture and research objectives between the two types of organizations and has enabled me to facilitate collaborations between industry and academia to the benefit of both parties.” Frøkjær now aims to develop the faculty as one of the most highly recognized pharmaceutical academic institutions in Europe.

With his extensive experience in both an academic and industrial setting, Frøkjær has these words of advice to those thinking of embarking on a career in drug delivery: “Keep focused on your core expertise and interest but at the same time be open to collaboration across borders and to potential synergistic input from other scientific disciplines — drug delivery is a highly interdisciplinary field.”



John S. Patton, Ph.D.

Founder and President, Dance Pharmaceuticals, San Francisco, California, USA.

After more than a decade studying marine biology in academia — focusing on how lipids are digested and absorbed — a telephone call from Genentech in 1985 was the starting point for John Patton’s move into drug delivery. “I was always thinking of how to be more practical with my research and somehow help people more directly,” he says. “And Genentech asked if I could help them find a way to get proteins into the body without injections, which was appealing in this respect.”

At the time, Patton was associate professor of microbiology and marine science at the University of Georgia, USA, a position he reached following a Ph.D. from the Scripps Institution of Oceanography, USA, and postdoctoral training at the University of Lund, Sweden, and Harvard Medical School, USA. His involvement with Genentech led him to take a leave of absence

from his academic post, and he joined Genentech full-time later in 1985, becoming the leader of their drug delivery group.

After 5 years at Genentech, during which time he showed that proteins could be delivered through the lung, Patton left to co-found Inhale (now Nektar), a company focused on drug delivery technologies, and he has played a key part in building the company over the past two decades. As Chief Research Fellow, his role involved generating new drug delivery product ideas and building up a case for why significant amounts of money should be spent on them, and how they are going to affect medicine.

In this capacity, Patton most enjoyed being at the cutting-edge of drug delivery, and in particular “working with great people, building technical and business consensus step by step until the project takes on a life of its own and I can go back to finding another opportunity.” He is also keen on helping new companies to get started, mentoring and telling drug-delivery stories at universities. Here, he highlights some of the challenges that entrepreneurs are likely to face. “Drug development is always nerve wracking — there is never enough time or money,” he says. “It can be difficult to get

multiple innovative ideas developed and realized in a small company, but then partnering with large pharma can also have drawbacks,” he says. “In this respect, I should have started several new companies — been a serial entrepreneur.”

And now, Patton has done just that, going on to found another new company: Dance Pharmaceuticals.

For those considering a career in drug delivery, Patton offers the following advice: “Go deep into basic chemistry and biology, write lots of papers and submit to the highest level journals, speak as often as possible at conferences, and ask tonnes of questions,” he says. “Also, find out if you like the science more than the idea of a new product — if so, drug delivery might not be the ideal area for you. And, in general, it is very important to understand that you need to be a team builder in order to succeed. Clever ideas are a dime a dozen; the right people to execute and make them a reality are hard to assemble, lead and keep.”

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Career snapshots: http://www.nature.com/naturejobs/magazine/career_snaps.html