NeuroCampus – Inside Out:

Per Borghammer

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Borghammer's lab investigates the existence of different Parkinson's disease subtypes using multiple different approaches and methods.

Per Borghammer. Photo: Karoline Klitgaard

Can you describe your research in a nutshell?
In my lab, we work to understand the underlying nature of Parkinson's disease. We have a very diverse group and use many different methods and approaches. My primary focus is clinical patient studies using various types of imaging, since I am a nuclear medicine specialist, but we do collect all sorts of other data from the patients.

All our work centers around the hypothesis that there are multiple subtypes of Parkinson's disease. We are currently focusing on two: a brain-first type, where the pathology starts in the brain and then spreads to the rest of the body and a body-first type, where the pathology starts in the gut and spreads via the vagus nerve to the rest of the body and brain. In this regard, it is crucial to be able the measure which parts of the nervous system that has been damaged and in which order e.g. the dopamine system or the PNS. The first step in this process is to figure out whether these subtypes in fact exist, the next is then to figure out why they exist. To answer these questions we also use animal models, in which we model the subtypes by injecting pathological substances into either the brain or gut of rodents and observe how it spreads to other parts of the body. In addition, we examine blood samples and tissues from human patients e.g. using some of the many Parkinson's brains from the Danish brain collection using microscopy, immunohistochemistry and more.

What translational impact may your research have for people?
Discovering different Parkinson's subtypes and the causes behind them will be a great step in the direction of personalized medicine that could, on one hand, treat the symptoms of the individual patient much more effectively and on the other hand, potentially bring us closer to actually curing the disease, rather than only treating the symptoms as we do today. The crucial point is that different disease subtypes may require different curative strategies.

How did you end up where you are today?
When I did my degree as a medical doctor, I originally wanted to become a neurologist. I find working with the brain and neurodegenerative diseases very fascinating, as the study of these diseases require a lot of creativity and new methodology, since we cannot for instance take biopsies from the brain. Instead, we have to rely on more indirect measures such as brain imaging. For my PhD, I became affiliated with the PET center. During this period, I became very interested in research, Parkinson's disease and the world of neuroimaging, which led me to become a nuclear medicine specialist rather than a neurologist.
Many scientists working in the area of brain diseases come from a very brain-focused background, and I believe that my background in nuclear medicine, which involves scanning of all parts of the body, has helped me to think outside "the brain box", e.g. when it comes to origins of Parkinson's disease.

What does a (local) strong neuroscience research network mean for you and your research?
The work in the lab is fundamentally multidisciplinary, and I believe that having contact with other scientists with different skills and ideas is critical for not getting stuck in just your own way of thinking.
It is important seek new knowledge abroad, but I think it is equally important to collaborate locally, as it builds local strength and in many ways is a lot more efficient, especially when you can connect a lot of different people working together to solve the same problems.
From my experience with multidisciplinary research, I think the most important thing is to not be scared off by your own limited expertise. If I, for instance, get an idea about how a certain mechanism may function in Parkinson's pathology in the gut, it is essential, that I do not just abandon the idea because it is outside my field of expertise. Instead, I have to trust that my idea is good enough and so find the right people to "play with", who know something about that specific area, e.g. pathologists and gastroenterologists. With time you may not only have investigated that specific idea, but may also have developed a new sort of expertise in collaborating with these areas of research, broadening your horizon even more for your next idea or research project. And importantly, I find such multidisciplinary teamwork immensely rewarding - and fun.

If you had unlimited resources to conduct a big, multidisciplinary neuroscience project, what would you like to do?
Parkinson's is a very heterogeneous disease, and I believe that, in order to really understand it, we need to know much more about every individual patients at a more granular level.
I would like to gather information about symptoms, imaging data, blood samples, genetic information, metabolomic data etc. from a hundreds of patients at various points of their disease course, and then decipher the underlying patterns in this information. We are, in fact, already collecting a lot of these data points, but it would require a lot more resources and funding to conduct the actually analyses, including strong bioinformatics skills and probably the use of artificial intelligence to get

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