NeuroCampus – Inside Out:

Jørgen Kjems

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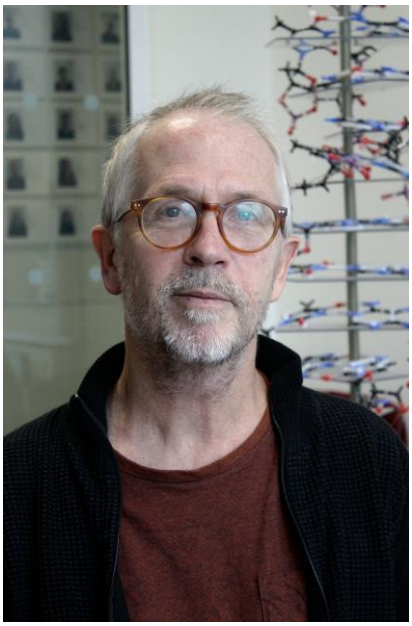
Kjems Lab investigate non-coding RNA and its versatile possibilities in both neurons and other cells with a particular focus on circular RNA. They use this knowledge in the development of drugs that target specific cells and genes.



Jørgen Kjems. Photo: Karoline Klitgaard

Can you describe your research in a nutshell?
In my lab, we conduct research in RNA. One branch of our research is basic and focus on understanding the role of non-coding RNAs in gene expression and its role in diseases. Another branch focuses on using this knowledge to develop RNA drugs, also called biologics.
By working at this molecular level we are able to create very precise drugs that target only specific cell types and even specific genes in these cells.

The work with the RNAs in drugs goes in two different directions: One way is a genetic drug via delivery to the diseased cells via targeted nano-particles. Here circular RNA is an interesting therapeutic agents due to its superior stability, its ability to regulate genes and work as messenger itself. Another is to use the RNA itself as an instrument to target diseased cells. RNA can fold into complex structures that, like antibodies, can recognize and block cellular functions. In this way we can use RNA to target malfunctioning cells and viruses and thereby diagnose and treat a wide range of diseases..

Using these principles we have developed drugs for treatment of e.g. cancer, inflammatory diseases, and infectious diseases. For instance, we have worked on developing different types of ligands that target receptors specific to a certain type of cancer cells and in that way target the drugs directly towards these.

What translational impact may your research have for people?
By using targeted RNA drugs we can make medicine that is both more effective and has less side effects than most of the medicine we currently use. The drugs can be personalized by examining e.g. what specific type cancer a patient suffers from. It is however still a complicated and challenging process to get this administration to proceed exactly as we intend.

How did you end up where you are today?
I am originally a chemist with a minor in physics, but I very quickly moved on to engage in more biological questions. From molecular biology, I ended up here in nanoscience, an interdisciplinary mix of all the others fields.

The study of RNA has been the common thread throughout my entire career: I started by studying RNA in thermophilic bacteria, and moved from there to RNA in humans, focusing on the HIV-virus, and finally I decided to focus on cellular RNAs, both micro- and circular RNA. RNA has also been the driving force for my engagement in neuroscience. RNA regulation plays a bigger role in neurons than in any other type of cells. The RNA in neurons are more diverse, and especially the circular RNA appear to be much more abundant and perhaps more functional in neurons than in any other cell. Today about 1/3 of the projects in our lab concerns neurons.

What does a (local) strong neuroscience research network mean for you and your research?
Here at iNANO all our projects are collaborative, and I believe that is essential to combine ideas from different people from different fields in order to make a big difference.
In our neuronal projects we always collaborate with other local neuroscience researchers. It is essential for us to work together with people who know more about neurons at a different level than we do and especially neural pathologies. By working together with other basic researchers, we can understand the appropriate context of the neuron, and by working together with the clinicians at the hospital, we can for instance gain access to valuable clinical samples from patients.
I think we have a special opportunity here at Aarhus University. We have a critical mass of qualified researchers from different areas of neuroscience, but at the same time we are still few enough that it allows easy collaboration and contact across different areas.

If you had unlimited resources to conduct a big, multidisciplinary neuroscience project, what would you like to do?
At this moment, we have arrived at a significant point in the study of neural diseases, where we as basic researchers have developed appreciable understanding of the development of brain diseases from a genetic, molecular level to a single cell level. Simultaneously the clinicians have achieved an understanding of the development of many diseases as it follows from the single cell to the whole brain. This means that we are now at a point where we can fully connect the knowledge all the ways from the genetic basis to the diseases' full development in the brain. I would like to gather an interdisciplinary team in order to connect all the information about brain pathologies and investigate for instance how a spectrum of a certain disease is connected with a spectrum of molecular changes.

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