

**Interview FOM expres - December 2015**  
**Section 'Women in Physics' - English version**

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**Knowing how life works**

*University of Twente professor Mireille Claessens talks about her research into proteins*

**FOM workgroup leader and member of the FOM advisory committee Physics of Life Processes professor Mireille Claessens works at the boundary between physics, molecular sciences and biology with her research into proteins. 'I have always been fascinated by life: how it works and how it has evolved.'**

Although in her work as a professor at the University of Twente she mainly focuses on the physical problems, Mireille Claessens did not start as a physicist. 'I studied Molecular Sciences at Wageningen University. During an information day there, I immediately knew "this is it". I was attracted by the combination of subjects, the type of students and the research-focused mentality. Most of the 20 students from my year are still active in research.' During her degree, she quickly became interested in the physical subjects, she says. 'Those required the most brain work, and that is what I enjoy most. During my postdoc in Munich, I briefly thought that I should have studied physics. Nevertheless, I am still happy with my choice. Due to my interdisciplinary training, it is easier for me to make the link to biology and to see what the interesting problems are in that field. That gives me many advantages.'

Biophysics is a well-developed discipline in the Netherlands, Claessens states. This was also one of the reasons why she returned to the Netherlands eight years ago. 'For me personally, the attraction comes from the fact it concerns problems related to life. And it is a really challenging discipline. Cells are complex systems. It is a challenge to do quantitative and predictive research with simplified models, and to subsequently translate the outcomes into behaviour that you should be able to see in living cells.' The biophysics community plays an important role, she says. 'We all know each other. Each autumn, we have a large biophysics meeting, 'Dutch Biophysics' in Veldhoven. Everybody attends it. And the FOM advisory committee Physics of life processes is paving the way for interdisciplinary projects.'

**Protein with many faces**

Her research focuses on the relationship between physical properties and the behaviour of biomolecules. 'My primary interest is alpha-synuclein, a protein present in large quantities in cells, which can form amyloid fibrils. The protein can assume different functions due to interactions with the environment and it apparently contains switches that determine for which function it must be made suitable.' Claessens wants to know how these switches work. Which material properties determine which function the protein is assigned to? And can the switches be influenced from outside the cell?

Furthermore, the protein plays a role in various illnesses, such as Parkinson's disease and a specific form of dementia. For example, the protein could accumulate in the brain where it

could then form amyloid plaques. These plaques are visible in the brains of Parkinson's patients. 'It was widely believed that the cell regulated the coagulation of this protein. However, we have demonstrated that this coagulation is not a process regulated by the cell, but is instead the result of a spontaneous self-ordering of the protein.'

Amyloid structures are not always harmful; they also have various useful functions. Bacteria, for example, use these to remain attached to surfaces. In human cells, these structures play a role in hormone storage. Recently, Claessens' group discovered – more or less by chance – that negatively charged, nanometre-sized pieces spontaneously organise into well-defined shapes with micrometre dimensions. Now they are trying to elucidate exactly how the self-organisation works. 'If we can understand that, we might be able to control the interactions between the protein strands and use them to form networks. That could in turn lead to applications. For example, we are working together with a tissues group to examine whether such a network could be used as a substrate for cells to grow on.'

One of the things that Claessens enjoys most about her work at the university is her contact with students. 'Especially with the PhD students, whom you see grow so much in a period of four years!' These days, she hardly comes into the lab herself, but she has few regrets about that. 'Now I can determine the broad lines of the research and focus more on the long-term plans.' However, in the periods when she has no teaching commitments and there is slightly more space in her diary, she still often enjoys puzzling with data. 'Because nothing beats trying to understand what happens in such a protein.' (SK)

### **Photo caption**

Professor Mireille Claessens (1975) is Head of the Nanobiophysics Group of the MESA+ institute and the MIRA institute of the University of Twente. A short film about her research at the University of Twente is available via the weblink below. She received a Vidi grant in 2009 and won the Dutch National Science Quiz in 2012 – and with that a trip to CERN!

> <https://vimeo.com/118594417>