It all happens at the interface

The best Dutch nanotechnologists work at MESA+. One of them is Jeroen Cornelissen. At his fortieth he belongs to the new batch of young professors at the institute. A chat about giving lectures, heading a department, and the cell as an overcrowded fish bowl.

Jeroen Cornelissen has just returned from giving a lecture on organic chemistry. He teaches first-year students the molecular and chemical basis of life. Cornelissen: “Giving lectures costs physical energy, but it perks me up mentally. It’s fantastic if you see that during the series of lectures the whole group becomes enthusiastic and that they understand how it works. And then you have the real fanatics who want to know more and ask intelligent questions after the lecture; that really is terrific.”

IBM uses organic chemistry

Jeroen Cornelissen (1972) graduated from Nijmegen as a chemist. After that he obtained his doctorate cum laude at Nijmegen in the field of organic chemistry and polymer chemistry. He then went to San José in California to do research into organic materials at IBM.
What’s IBM’s link with organic chemistry? Cornelissen, still in his ‘teaching mode’, picks up a wooden ice lolly stick and a plastic coffee stirrer and explains: “Look, imagine that this wooden stick is a conductor and this plastic stirrer too. You want to place two conductors on a chip as close together as possible. But the one may not influence the other. So you have to insulate them. You can do that with the help of organic materials. We used a trick to get air bubbles into glass and that gave us a good insulator. Later on we used that same principle to make sensors from porous glass. And as it happens, IBM is now focusing on sensors.

The flattest possible group

After his postgraduate period with IBM Cornelissen was a lecturer at Nijmegen between 2002 and 2009. Since 2009 he holds a professorship at MESA+. He runs the Biomolecular Nanotechnology group. “I try to keep the group structure as flat as possible. There are three members of staff and some 15 trainee research assistants and postgraduates. Each member of staff has his own field of interest, but we attempt to interweave our projects with one another in a natural fashion.”

NAME: Jeroen Cornelissen (1972)
POSITION: Professor of Biomolecular Nanotechnology
PREVIOUSLY: Studied chemistry at Nijmegen and obtained his doctorate cum laude there in 2001. He was a postgraduate at IBM. He does a great deal by virtue of grants for individual researchers: Veni (2002), Vidi (2005), EURYI (2007)
MESA+... "facilitates excellent research. Not only with the best equipment, but also with intellectual infrastructure"

Cornelissen does not believe in applying artificial structures. But he does try to lay down the law on molecules.

Cornelissen, specialised in the surface of virus particles and is working jointly on a project with staff member Nathalie Katsonis who knows a great deal about the structure of liquid crystals. In this joint project they are attempting to keep Cornelissen's virus particles in their place by means of a material with Katsonis' spiral staircase structure.
Cornelissen: "We combine chemistry with biology and physics and work closely together with Juriaan Huskens' Molecular Nanofabrication group. We share laboratory space and technicians. I am convinced that the majority of scientific discoveries arise at the interface of disciplines."

Nature inspires
As the leader of a research group Cornelissen does not believe in applying artificial structures. But he does try to lay down the law on molecules. Cornelissen: "We want to use biological principles to design materials that assemble themselves. For instance we make protein cages, and thus form nanoreactors. These cages can also serve to protect a medicine and ensure that it's delivered to the right place in the body."

That sounds futuristic: protein cages. How does it work? Cornelissen: "We used to work a lot with viruses. Now the shell of a virus resembles a sort of miniature football. We recently discovered that bacteria also make protein cages for their own use. The reason why is not yet clear but we think that it has to do with the fact that a bacterial cell is not so empty and structured as they say in most biology books. The cell is more like a sort of overcrowded fish bowl where there is scarcely room to swim. Such a cage probably serves to allow certain reactions take place in a protected environment. Maybe because they are toxic for the environment or because the environment is toxic for the reaction. It's also possible that the reaction has to take place very precisely, that it takes place very slowly and may not be disturbed. We are trying to understand the concepts and apply them to make our own materials."