Biophysicist Professor Cees Dekker had a notable start to the year. He was appointed as a Professor of the Royal Netherlands Academy of Arts and Sciences for his life’s work and received a major European research grant to develop artificial cell division. Dekker (56) is now focusing on the development of artificial life.

‘Life is something you create together’
At school, we taught that a cell is a bag of protoplasm with a nucleus. After spending fifteen years on biomolecular research, do you see the cell?

‘Half a century of molecular biology has left us highly impressed by the huge complexity of cells. You could use various metaphors to describe them. Imagine a sealed-off entity like a spaceship as big as a city, with defence systems and gates to the outside world. There are energy plants to maintain life and a library of information for emergencies. There is a system of frames for minimal functionality, as a way of gaining a horizon involving the use of a soap bubble to create a minimal living system.

As someone who is openly religious, do you not have issues with humans creating life?

‘It’s a bit early for that question. It is usually the last thing people ask, but I have no problem at all with it. The question is a purely scientific one: what is life and how do you piece it together from components? And if you ask me to interpret it religiously, then I would say I see it as my duty to explore nature and use it in the service of my fellow humans and in God’s honour.’

You do not believe that God has the sole entitlement to create life?

‘No, indeed I have already argued that it is our duty to explore and make use of nature. If that includes investigating how life forms from different components, I see that as very valuable knowledge that can also be put to other uses. We may be able to create a minimal structure for the photosynthetic conversion of energy or capture greenhouse gases. I recently wrote a column in a Christian newspaper about ‘creating life in the lab’. It was about this very question and I have received very little criticism. Admittedly, it was in the middle of the holidays.’

When do you think we can expect to see this kind of artificial living cell?

‘It depends on how you define life. If you look at the minimum characteristics, they are compartmentalisation, a sealed entity, metabolism, cell division and information used by the cell to define itself. That information needs to be sufficient-ly stable but also be able to adapt to enable evolu-tion. If you take that as your working definition, I estimate that it will take around ten years to build a minimal living system.’

You believe we will live to see it?

‘Yes. The point is that I believe that this metabo-lism is very difficult to achieve. Cell division is also complex but I can imagine it in around five to ten years. For my colleague Bert Poolman, the reverse applies. He sees cell division as being extremely complex but envisages possibilities for achieving metabolism with five components. That makes me optimistic and believe that a sort of science can produce a living synthet-ic cell within a decade.’

On a different matter, this spring, you received an award for your life’s work from the Royal Netherlands Academy of Arts & Science KNW and a major European research grant to develop artificial cell division. What is your reaction to these two events?

‘The KNW is a great honour that I am very pleased about. It is an acknowledgement of my scientific work. It is also accompanied by a million euros worth of research funding. The Euro-pean Research Council grant was acquired in a competition for research proposals. It will help me to continue my work. Five research grants expired last year, so I was ready for a new stage in my research. I am now madly recruiting and have dozens of applicants here.’

How do these people find you?

‘I have a website and this time I also placed an ad-vert on the Nature job website, because I have sev-eral posts to fill. I also receive two or three appli-cations by email every day, throughout the year. I just came back from leave to find 300 emails waiting for me. Half of them are spam, but still, two emails per day is 500 applicants every year, and I appoint five of them – that is quite a selecti-on threshold.’

So, how do you choose the one percent?

‘I reject between 80 and 90 percent after reading the emails. They receive a nice thank-you letter from me as a courtesy, but this is the final response. I then interview via Skype, which rules out half of them. Interviews in person rule out half after that. That leaves just a few, who are the people who conduct the research.’

What are your selection criteria?

‘They need to be exceptional in their field and I need to like them. I tend to rely on my intuition, because they need to be friendly and communi-cative people who can work well in a team. They also need to be driven and be able to discuss things quickly and openly.’

In around 2000, you switched from nano research to bionano research. Why was that?

‘At that time, I became a full-time professor with a 25 to 30 year career ahead of me. I did not want to work endlessly on those nanotubes that we had made such a success of. They had lost their shine and I wanted to pursue a different route. In the late 1990s, the physicists at Delft began to move towards biology. People like Alexander van Oudenaarde, now the director of the Hubrecht-lab, Sander Tans, group coordinator at the Amolf and professor at Delft en Tjerk Oosterkamp, a theoretical physicist who was working on cell division, now also at Delft, but then based in Amsterdam. With this group of people, we pioneered single-molecule biophysics in the Netherlands. We studied biology at the level of individual molecules.’

They simplified biology to interaction between molecules?

‘Yes, from the complex city that makes up the cell, we took a single molecule to explore mecha-nistically how it works. I found it fascinating to discover that there are molecular engines that carry out actions using energy sourced from combustion. It struck me as a fascinating field to which I wanted to contribute in order to discover and develop things. I also saw a relevant way in to the field, because we had already been deve-loping nanotech instruments that could be used with single biomolecules straight away. The technol-ogy served as a bridge. I knew little about bio-log and needed to learn about it, but that turned out well. From there, fifteen years of work have brought us to molecular interaction. At its heart, biology is all about the interaction of molecules that together form life. A single molecule is not alive, it is the interaction with the surrounding proteins that make it a living system.’

There is an obvious parallel with the staff in the lab. You also expect them to interact well.

‘You could put it like that: individually you are nothing, but only become alive when you are together.’

‘It is our duty to explore and make use of nature’

Moving from A to B, a waste collection service and energy recycling plants. For every function in such a city, I can cite a protein complex with similar functions in the cell. The DNA serves as a library in which all the information is stored. It encodes information for protein-making factories. The proteins are like robots that combine to enable the whole thing to function. This is what fifty years of molecular biology is like. That information needs to be sufficient-ly complex but envisages possibilities for achieving metabolism with five components. That makes me optimistic and believe that a sort of science can produce a living synthet-ic cell within a decade.’

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