Global Trends

Scientific Horizons:

A Conversation with Professor Flemming Besenbacher, Chairman-Elect, The Carlsberg Foundation

September 2011

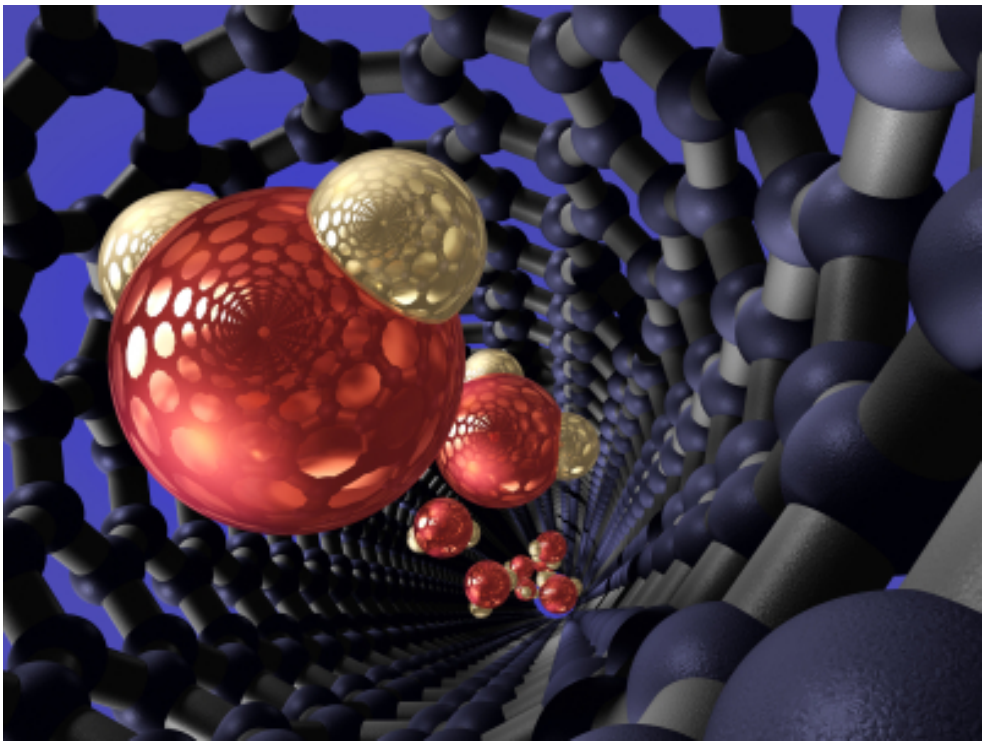

Photo: A model of molecules of water being channelled through a single-walled carbon nanotube. Nanotubes can be wide enough to permit molecules such as water to pass whilst being narrow enough to prevent even small particles of pollutant from getting through.

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The Carlsberg Foundation (Danish: Carlsbergfondet) was founded by J. C. Jacobsen in 1876 and owns 30% of Carlsberg Group. According to the charter the Foundation must ensure that the Basic Capital always exceeds 25% of the share capital of Carlsberg A/S with an entitlement to at least 51% of the votes in Carlsberg A/S. Presently the Foundations controls approximately 74% of the votes.The Foundation's aim is to manage the Carlsberg Laboratory and to support Danish scientific research within the fields of natural sciences, mathematics, philosophy, the humanities and social sciences. It is run by five Trustees elected by and from the Royal Danish Academy of Sciences and Letters. Unusually for an organization that owns a publicly traded company, the Carlsberg Foundation aims to share its scientific advances within its industry and more broadly within Denmark and worldwide.

Global Trends recently had the chance to speak with Professor Flemming Besenbacher, who will be Chairman of the Carlsberg Foundation from the start of 2012, about the Foundation's work and the importance of science in addressing the opportunities and challenges presented by global trends.

GT: What is the focus of the Carlsberg Foundation in terms of supporting the advance of science?

The mandate we have is a broad one although clearly focused on the areas of supporting science, humanities and social sciences, which specifically excludes technical sciences and clinical sciences. What we do within our scope of activity is defined by the Board, with our current area of focus being to take the best Ph.D. students and send them abroad to the US, Europe, Asia – MIT, Harvard and more – to gain their post-doctoral experience with the very best groups of scientists for two or three years. We then bring these students back to post-doctoral positions in Denmark, essentially feeding back into Danish society very talented young people, with a global perspective. This is where the Carlsberg Foundation is putting much of its efforts and funding today.

GT: The Carlsberg Foundation contributes to advancing areas of science that contribute to addressing some of today's pressing global issues, from food to agriculture. How do you see the role of science in pushing forward our horizons on these challenges?

Part of the Foundation's money contributes to scientific work in the Carlsberg Laboratories but more goes towards furthering basic fundamental science. Here we are most interested in finding the best individuals to whom we give grants to further work in the fields of energy, food or other areas. Of course, in the business world we talk a lot about corporate social responsibility – but I believe there is another critical dimension, scientific social responsibility, on which I have recently authored an article[1]. This is where I really believe the sciences should step up and take the responsibility to address some of the world's grand challenges. It also means bringing scientific breakthroughs out into society and collaborating with industrial partners to see how science and business can work together to address the challenges.

[1] Krogsgaard-Larsen, P., Thostrup, P. and Besenbacher, F. (2011), Scientific Social Responsibility: A Call to Arms. Angewandte Chemie International Edition. doi: 10.1002/anie.201105641

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GT: What you are talking about is unusual – a business organization saying we must partner with other organizations, whether governments, other scientists or industry partners, to tackle some of these global issues early. What are the implications of this approach?

If the scientists don't take on these challenges, then what we see is the politicians coming in and saying, "Now we should have a program on food, on energy and so on." Often they make these programs so focused that they are a waste of money because the politicians are not aware of the latest scientific breakthroughs. Of course, you can also say that we should take the technologies we have today and make them 10% better, but that's not good enough for the future. We have to have breakthrough technologies. For example, nobody could have imagined that the world wide web which changed the world could have come out of a physics laboratory.

I truly believe that the most important thing universities can contribute to society is well educated young people. Universities should not do focused research on specific areas of application, rather this should be the focus area of businesses. So it is critical that we give these organizations well-educated people with a global mindset and that's what we at the Carlsberg Foundation are trying to help achieve by working with the young scientists as they develop their expertise.

GT: Your expertise is in nanotechnology, which is a key technology for the future. Can you tell us more about this work?

I am originally trained as a physicist, and have been working in catalysis, at the boundary between physics and chemistry. In 2003 Aarhus university decided to start a nanoscience centre, called inano, which would be a multidisciplinary centre. From the educational point of view, this was unique worldwide in 2003, as we were the first university to put together a curriculum in nanoscience – for the first time, people coming to Aarhus University could take a Bachelor's degree in nanoscience. This multidisciplinary approach is critical because many of the global challenges we face today are at the borderline between the traditional scientific disciplines, so scientists need to know something about physics, chemistry, biology, molecular biology as well as other disciplines. However, developing such a curriculum which integrates these disciplines was not trivial as it required breaking down the walls between the departments. However, we had the full commitment of the University's Rector and Dean, so we did it and it has been a great success. Today we have a graduate school with 165 Ph.D. students in the nanoscience centre.

GT: Where do you believe nanoscience is going to make the greatest difference in future, and contribute to the global challenges we face?

Sometimes people believe nanoscience is a revolution, but it's not a revolution, it's more an evolution. From the science perspective, we are getting better and better at making smaller and smaller things. Nanoscience is the technology which lets us run around with mobile phones, laptops, all our flash screens and so forth. It's all based on nanotechnology. So where's it going to take us? There is no doubt in my mind that the nanomaterials area is going to be extremely important in future. In electronics, the ongoing challenge will be how we make things even smaller than we do today. Nanotechnology will also contribute to addressing environmental issues, for example in helping us to design new and better catalysts from first principles. It will help us deal with energy issues where you can already see contributions to advances in solar panels, as well as new materials to improve windmills. In Denmark 30% of our energy comes from wind and windmills are getting larger and larger, so if you could make materials for the blades that have the same strength but half the weight that would be a fantastic contribution to efficiency. Then we could also think about distributed power as well as large wind farms. In addition, energy storage is an increasing challenge

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as we move towards renewable energy sources, because energy production from solar or wind is not constant, so you need to find a means of storing the energy. Here again nanotechnology can help in terms of developing advanced materials that can split water into hydrogen and store the hydrogen. Again, you can distribute this stored energy for example through fuel cells in rural areas.

GT: You also mentioned the water challenges the world faces. Is this something that nanoscience is actively working on?

Another key area of potential application for nanotechnology is water, as the world is running short of water. One area I am particularly interested in is a technology which could take sea water and convert it into tap water. Such a technology could be a big step towards solving some of our water problems, at least for areas with a coastline. We have a small program looking at this, but I would like to develop this further, first, to push forward on converting sea water to tap water and, second, to develop membranes to clean water and make it drinkable again. Polluted water is a significant issue for the world and nanoscience can make a huge contribution to the development of membranes and the filtration process to address this challenge.

GT: As a scientist, thinking about the vast opportunities around us, as well as the challenges, how can science have the greatest positive impact?

The world faces grand challenges. Sometimes I am very disappointed when I listen to the politicians because often they are not really addressing these questions today. We are talking about the financial crisis and so on, but these trends are going to have a huge impact on society in a few years and one thing is for sure, it is not the bankers or financial people who will solve these problems. It's science. Therefore, I would hope that politicians would be willing to invest more in science to address these problems. For example, China is increasing its R&D budget by 10% to 20% a year. I would hope that the US and Europe would do the same, because if you look at the leading technologies in the world today, much of it originates from the US and Europe. We have so many ideas here, so many brains, but I think we could, at least in Europe, significantly improve how we bring this fantastic science into business. From the EU point of view we have to find other ways to do this than we are doing today.

GT: You are obviously addressing these barriers here at the Carlsberg Foundation and bringing science into both business and society. What lessons would you share with business leaders?

We have to develop more partnerships between universities and industries – but one-to-one partnerships. For example, I participate in EU research programs where there may be twelve different business partners, so if I am the CEO of one of these companies, I have to share my ideas with potentially twelve different competitors. This does not work. We have to develop partnerships where, for example, a company develops a relationship with a university in Denmark or Holland and then they apply together for a grant from the EU. The way we are doing it now simply does not work in my opinion. So, build strong relationships where partners can challenge each other.

There are also benefits to businesses having scientists on their boards. You may say that such people do not have the business experience, but as smart people they can quickly get up to speed on issues. They then offer the significant benefits of being able to challenge the business thinking and bring in new ideas from different perspectives. In particular, because science is very future-oriented, it is invaluable in helping business take a longer-term perspective.

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