Interview with Gorm Danscher

Emeritus Professor Gorm Danscher was interviewed by Judie Cross. November 30, 2016.

Gorm Danscher has been Professor Emeritus of Neurobiology at Aarhus University since 2008 and CEO of Berlock ApS since 2002. He was awarded his Doctor of Veterinary Medicine (DVM) in 1967 from the Faculty of Life Sciences at the University of Copenhagen and Doctor of Medical Science (DMSc) in 1976 by the Faculty of Health Sciences at Aarhus University. He became an Associate Professor in 1967 and full Professor in 1988. The details of Autometallography (AMG) can be read by accessing the journal, *Progress in Histochemistry and Cytochemistry*, 41 (2006) 57–139, while some of his other numerous publications can be viewed here.

How did you become a university professor – was it a conscious choice on your part? And, in your experience, how has the role of university professor 'evolved' over recent years?

In science what matters most is freedom and opportunities. An important element is, therefore, to obtain a position that supports these goals and that is a chair. In the sixties the number of such chair-professorships were few in Denmark. But one sunny morning I found myself qualified enough to apply for two professorships in neuroanatomy that had become vacant. One was at the medical faculty at Aarhus University and one in the same faculty at Copenhagen University. The expert assessment committee in Aarhus came first with their decision and I chose to accept this appointment and withdrew my Copenhagen application.

In those days a chair professor was a public office, appointed by the Queen, making it all a little more ceremonious. Today the title 'full professor' is a 'personal' thing and the

appointment is on a group contract basis.. This ‘American’ way of handling expertise, creativity and scientific penetration have greatly diminished the prestige of the professor title in Denmark; also the chairs are gone. This goes hand in hand with profound changes in the way government research money is distributed. Overall, the Danish system has been muddled within a very short period of time. Although the system, from a teaching point of view might have its good points, the science part has to be radically transformed again otherwise Denmark will lag behind within a few years. One major calamity is hidden in the fact that the academic culture in western countries can’t adjust so fast, leaving universities all over the globe in a permanent crisis, in addition to financial concerns.

While still an associate professor I became involved at different levels of university management. At different times I was head of the Institute of Anatomy, Deputy Dean (acting Dean in the Senates Executive Committee) and later Dean of the Medical Faculty. In parallel with these jobs, I was member of the Board of Studies, the Faculty board, the University Senate and its Executive Committee.

In 1944 Aarhus University was given an extensive donation including a chemical factory, Cheminova, by its founder the magnificent Danish entrepreneur, Gunnar Andreasen. This substantial economic infusion made it possible for Aarhus University to stimulate science via awarding a large number of scholarships, providing project support and an enlargement/ renovation of science infra-structure. For many years I was elected board member of the Cheminova Foundation.

Who have been some of the important influences on you, in your work and career?

That the localization/function/toxicology of heavy metals in the mammalian brain became my lifelong passion arose from pure luck. I had started in a position as an Assistant Professor in

the Department of Biochemistry and the significant head of the Department, Professor Schønheyder, a great scientist and human being, for some unknown reasons believed in me – and tried to make vitamin E my destiny in science. However, since I had been a lad, I had wanted to study the brain and so this topic really could not become my passion. Nonetheless, because Prof. Schønheyder had the qualities he had, I made a shift and became Assistant Professor in Neuroanatomy. The professor there, Theodor W. Blackstad, was also a famous scientist in his field, the hippocampus. This part of the brain is well known for its central role in memory and spatial orientation. A guest scientist from Oslo, Professor Fin-Mogens Haug, was 'forced' to train me in his field, 'zinc in CNS'. He was unique and quality at all levels and he was the true igniter of the flame in my scientific life.

My interest in metallic gold was inspired by looking at a TV program. In that program it was shown that placing small pieces of gold in acupuncture points released pain and reduced swelling of rheumatic joints. They called it 'permanent acupuncture'. Knowing that little science supported the acupuncture technique, despite the impressive results the approach seems to have had, I came up with the idea that the effect (if not entirely based on psychological factors) could be that the gold pieces released gold ions; i.e. that it was the same phenomenon observed after systemic injections of gold compounds just played out locally; i.e. around the gold piece.

Can you walk us through the technical processes behind the possibilities gold dust offers?

A few years before I published the Gold AMG Technique, a Canadian scientist, Professor Faulk, had developed a technique that made it possible to visualise the location of antibodies bound to antigens at ultrastructural level. What he did was to replace the fluorescent molecules used in light microscopy with 40 nm gold particles. In this way the antibody-antigen connection could be traced by an electron microscope. The

only problem was the technique made it impossible to view the particles at light-optical magnifications and it therefore was difficult to choose the right places to study using the electron-microscope. The gold AMG method solved this problem by encapsulating the gold particles in silver whereby they grew to sizes that could be observed both by light-optical microscopes and electro-microscopes; i.e. it became easy to study the exact localization of the same molecules (antibodies/enzymes) in tissues at all magnification levels

The TV program prompted me to get hold of a number of the gold pieces used by physicians and veterinarians to perform 'permanent acupuncture' and placed these in several different places (including the brain) in animals designated for experimental purposes. Several weeks later, I subjected these animals to euthanasia, took out tissue samples that contained the gold pieces, embedded the tissue in plastic , AMG enhanced, and looked for a possible release of gold ions from the gold pieces.

Before this study it was firmly believed that metallic gold was inert; i.e. it could not be dissolved in an organism. Gilding of implants, stents and the like was, and still is, widely used in surgery. But the above studies showed that metallic gold is slowly dissolved when placed in a living organism.

At ultrastructural levels I could see that the gold pieces were attacked by macrophages that started to release gold ions from the surface of the gold implants. The bio-released gold ions diffused out from the surface and were taken up by the macrophages themselves and, in particular, mastcells – these cells are mainly responsible for the oedema/swelling that is so characteristic of rheumatic joints. As a rough simplification, one could say that because macrophages are key cells in the inflammatory cascade and mastcells central for swelling; pollution with the bio-released gold ions orchestrate the observed suppression of the local

inflammation, remove the swelling and clear away the pain in animals and patients.

I also proved the obvious, that the bigger the surface; i.e. the more gold surfaces accessible to macrophages, the greater the release of gold ions. The two products BI and BMI are developed keeping this in mind.

You began your own company in 2002. I'm curious about the motivations behind your decision to combine business with academic life. Also I wonder whether such a change was in any way related to challenges facing university environments today?

My scientific life has revolved around 'biological effects of heavy metals, in particular the vital importance of the metal, zinc (Zn). This metal is fascinating, being essential for hundreds of enzymes and indispensable for DNA and RNA reproduction, but what bewitched me and became dominant in my research was a peculiar pool of zinc that is located in synaptic vesicles of important populations of neurons in the brain and spinal cord.

In order to finance these studies, I had to broaden my activities to exploring toxic metals like mercury, bismuth, lead and silver. In this way, and with the support of six assistants and associated professors, a skilful and rather numerous technical staff, and a varying number of guest-professors, PhD students and post- doctoral students from many countries, I became part of a high spirited and productive group that included local medical students, and young medical doctors aiming to be awarded their PhD or DMSc degrees. In 1981 I developed the 'Gold-Autometallography' (Au-AMG) mentioned above. It was based on the discovery that UV light can transform chemically bound gold ions to metallic gold nanoparticles.

For many years, rheumatism has been treated with a gold

compound called Aurothiomalate (Myocrisin®). The drug is injected in a muscle and the gold ions (Au+++) are distributed to all parts of the body, apart from the brain. The treatment is known to be beneficial for about 60 per cent of patients; i.e. it reduces swelling and pain in the joints, but is very toxic. Therefore, new anti-rheumatic drugs have been developed, but when they don't help, Myocrisin is still used at some hospitals. Our research has shown that metallic gold, on the other hand, is safe – supporting the notion that although used for thousands upon thousands of year in the Far East and India no harm has been associated with its use. Only when used as a gold compound, i.e. Myocrisin, is it dangerous and has to be used with great medical care. In a multitude of papers, we have supported this 'safe' notion.

In 2002, I started a little company, Berlock ApS, based on financial support from the Danish export promotion agency and after having obtained permission from Aarhus University to exploit this discovery. Today, Berlock ApS has patents in Europe, USA, China and Canada and produces two gold products for treating sterile inflammation, BerlockImplants(BI) and BerlockMicroImplants (BMI). Research on animals is accumulating and applications for further research on animals and patients have been sent to the NIH and private funds here and abroad. The products have not yet been approved by FDA in USA or the Health Authorities in Europe.

Being a child of my time, doomed destiny, the rather drastic changes in academic life have definitely been instrumental to my 'going commercial'. On the other hand, my hereditary nosiness, longing for freedom and fun were decisive. Now, being emeritus I am kind of totally 'free' – just have to be as pleasant a person as my genome allows me to be and escape illness.

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