BY CHRIS TACHIBANA

Bengt Långström

Mr. PET in Uppsala

PROFESSOR BENGT LÅNGSTRÖM has been interested in chemistry and "science in general" since he was a basketball-playing high school student in a small Swedish town above the 65th parallel. He first heard about using radiochemically labeled biological molecules for research as a PhD student, when his advisor moved from Umeå University to Uppsala University and discussed the methods with another faculty member. "PET [positron emission tomography] was not even a concept yet," he says. "They were just talking about using ^{11}C-isotopes for some applications."

PET is a non-invasive imaging method that follows a tracer molecule through specific interactions in a living organism. The tracer can be any biological molecule - a neurotransmitter to a nutrient, labeled with a short-lived radionuclide for location by the PET scanner. The interactions can be as diverse as degradation or receptor binding. The most common clinical tracer is a fluorodeoxyglucose, a modified sugar that indicates areas of active metabolism. Used alone or with other imaging techniques like computed tomography or magnetic resonance imaging, PET gives a real-time three-dimensional look at internal structures, systems, and biological functions. One limitation is that the radionuclides of some tracers are so short-lived, they must be generated very close to where they are used, so PET centers are often near cyclotrons. In fact, this was the key to building the Uppsala University PET Centre under Långström's direction.

PHOTO: STAFFAN CLAESSON.

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The Uppsala University Hospital PET Centre

As part of his PhD project, he went to Lawrence Berkeley National Laboratory in California from 1975 through 1976. "During that time I started to grasp that PET was more than just labeling interesting compounds and had many different potentials," he says. "When I went back, I was determined what to do. I saw the need for a dedicated cyclotron, and fortunately, we had a great head of the university at the time who gave us support to apply for a cyclotron at the university." Through a joint effort of several departments, the cyclotron was built, and Långström made the Uppsala University Hospital PET Centre a reality. The Centre, which in 2002 had 35 employees and about 10 graduate students, was a publically and privately funded contract research organization and research center for several decades. In 2010, it reverted to a university and hospital venture.

Likes to be back in the lab

Långström is still on the Faculty of Science and Technology at Uppsala University, in an emeritus position, and holds faculty positions at the Imperial College of London, and the University of Southern Denmark. His last PhD student finished in 2010, so he is enjoying being "the senior guy who can have a lot of opinions and give guidance in different directions and likes to be back in the lab." One direction he is urging young scientists to go is expanding PET uses. PET is used extensively in cancer research to detect tumors and determine if they are becoming less metabolically active and shrinking in response to treatment. Under Långström's direction, the Uppsala University PET Centre conducted groundbreaking studies using PET to identify characteristics of brain disorders such as Alzheimer's disease. Radiolabels can be attached to any biological molecule with minor influence on its properties, so PET is popular for drug development, testing uptake and stability in model animals and humans. But Långström says PET is also an excellent basic research tool. The short half-life of PET radionuclides means the same subjects can be used as the control group in one round of images, and as the study group in a later round. A labeled drug and a placebo can be followed at different times in the same individual, or in animal studies, in the same individual before and after disease induction. "These repetitive studies can give insights into biological processes that other techniques cannot," says Långström. PET limitations named by Långström include limited resolution ("although sometimes even a lousy picture can give you unique information"), and the radioactivity requirement. However, Långström asserts that PET is so sensitive that low amounts are needed, the radioactivity is short-lived, and in fact, allows the chemicals to be easily monitored. He says PET sensitivity and versatility are advantages in areas such as "material science, nanotechnology, plant physiology, genomics, proteomics and other 'omics", as well as measuring physiological differences between people with different genotypes at specific polymorphisms.

An innovative thinker

This kind of creative thinking is what made Långström "Mr. PET in Uppsala", says Professor Poul Flemming Høilund-Carlsen, Clinical Physiology and Nuclear Medicine Odense University Hospital and University of Southern Denmark. He has collaborated with Långström for five or six years, and calls him "one of the top three radiochemists in the world. He is broad-minded, and broadly interested, an innovative thinker, and he can do and invent things other people wouldn't even have thought of." Långström has been successful in both clinical and academic work because "he understands how physicians and physicists think," says Høilund-Carlsen.

A suspenders guy

Photos of Långström show him with a big smile and eye-catching suspenders, and the personality and sartorial statement are confirmed by Høilund-Carlsen, who says, "he is absolutely unique and a rare person." He also thinks Långström's work deserves a Nobel Prize. As for the suspenders, he says, "He used to have some with Mickey Mouse. Now he has some black ones with flames." Långström himself says, "I'm a suspenders guy. I'm comfortable in them."

Långström travels often to London and Odense, and in 2010, went to the United States to receive the prestigious Georg Charles de Hevesy Nuclear Pioneer Award from the Society for Nuclear Medicine. He is based in Uppsala, though, and although he wears many hats with his three academic positions, what he looks forward to on returning to Sweden is putting on his flashiest suspenders and spending the day with family, friends, and especially the grandchildren.

BENGT ROLAND LÅNGSTRÖM

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Career highlights: Professor in Chemistry, Uppsala University 1989-2010
CSO at Imanet (Amersham Health), GEHC 2002-2009
Head of R&D of Uppsala Imanet, 2002-2006
Managing Director of Uppsala Research Imaging Solutions (URIS) AB 2002
Director of Uppsala University PET Centre 1990-2002
Director of the "Subfemtomole Biorecognition Project", RDC of Japan 1993-98
Publications: 350 papers in chemistry journals; 470 papers in life science and medicine
Family: Wife, two children and proud grandfather of two.