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Inventing His Own Career Path

Freek Beekman Talks with Johannes Czernin and Christine Mona About Success in Academia and Industry

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Johannes Czernin, MD, editor-in-chief of *The Journal of Nuclear Medicine* (*JNM*) and a professor at the David Geffen School of Medicine at UCLA, and Christine Mona, PhD, an assistant professor in Molecular and Medical Pharmacology at UCLA, spoke with Frederik (Freek) J. Beekman, PhD, a distinguished inventor, entrepreneur, and professor of Applied Physics at the Technische Universiteit Delft (TU Delft; The Netherlands), about his career in academia and industry. Dr. Beekman, who leads the Biomedical Imaging Division at TU Delft, is widely known for his innovations in advancing molecular imaging. He studied experimental physics at Radboud University Nijmegen (The Netherlands) and in 1995 received his doctorate from Utrecht University (The Netherlands), graduating in 1995 with a thesis entitled, "Fully 3D Reconstruction of SPECT Using Object Shape–Dependent Scatter Models." From 1995 to 2008, he was a faculty member at the Image Sciences Institute and Department of Nuclear Medicine at University Medical Centre Utrecht (UMC Utrecht). In 2007, he went to TU Delft to head the radiation detection and medical imaging section.

In 2006, Dr. Beekman founded MILabs BV, a molecular imaging spin-off from UMC Utrecht, focusing on his inventions in high-resolution PET and SPECT and the design of multimodal and stand-alone scanners for preclinical and clinical applications. MILabs was sold to the Rigaku Corp. in 2021. In 2023 Beekman launched the Molecular Imaging Foundation and Free Bee International BV, a company that currently focuses on novel γ-imaging devices for clinical use.

Dr. Beekman's work has advanced technologies in detectors, collimators, reconstruction algorithms, and artificial intelligence for various imaging modalities, including PET, SPECT, CT, and optical tomography. He has published more than 170 peer-reviewed articles and holds more than 20 patent families. Recognitions for his achievements have included the Physics Valorisation Prize from the Dutch Science Foundation, multiple SNMMI and IEEE awards, and two times the Innovation of the Year Award from the World Molecular Imaging Society. Many of the cutting-edge imaging systems pioneered by Dr. Beekman and his teams are deployed across biomedical research institutions worldwide, driving a broad range of discoveries and facilitating the development of novel tracers and pharmaceuticals.

Dr. Czernin: *You have the reputation of having been a difficult child and difficult student. How did you make it through high school? What was your career path when you converted to being a regular boring human being?*

Freek Beekman, PhD

Dr. Beekman: I hope I didn't become too boring! My parents divorced when I was young, and I had to move between my mother and father. That was difficult. And I was very short-sighted so couldn't read well at school. School was a mess. I also was not very good at sitting still and learning things; I was too active. Other things in my village were so much more interesting—like we had a big dirt-bike racing track. Every year there was a Motocross Grand Prix—that was something I liked. I got a moped, which I hid at a farm, when I was 13 y old. I bought it for $10 and repaired it. A year later I mounted the back part of a scooter to the back of a soapbox car to create a makeshift car, which I crashed during the first test drive. After that I got more serious motorbikes. I think that building, tuning, repairing, etc., improves problem-solving skills and brings unique perspectives.

Dr. Czernin: *How did you finish high school?*

Dr. Beekman: I didn't. I dropped out. Then I went to school to become an electrician but didn't do well there either, because I barely attended. However, I somehow finished that school. I still wanted to be a dirt-bike racer, but they wouldn't let me through because of my poor vision. Then I played in a rock band, where the members influenced me very positively. Some of them went to university, and I got interested in studying other things. I then went to a higher-level school to train to become a technician. After I was done with this school, I went into the chip industry. I joined Philips, where I invented something to improve etching of chips. I stayed there only a short time, because I then met Frans H.M. Corstens, MD, PhD, a nuclear medicine physician from Nijmegen. I was interested in medical technology, and I joined his group at Radboud University.

Dr. Czernin: *Where did this interest in medical technology come from?*

Dr. Beekman: My father was a vet. I always went with him to farms to treat animals. He performed surgery on all kinds of animals. When I was 7 y old, I assisted my father with a cesarean section on a cow, which probably ignited my fascination for technology to improve health care. Later, learning about the development of the CT scanner and its ability to replace invasive procedures further fueled that interest.

Dr. Mona: *Your path is quite diverse and somewhat nonlinear and chaotic. Do you think that a more conventional path would*

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have led to this creativity and given you the resources to bounce from one idea to another?

Dr. Beekman: It's difficult to determine. Although some individuals with conventional paths are also creative, many don't necessarily innovate after completing higher education. On the other hand, some people who just quit the educational system become the greatest innovators in the world. Take Mark Zuckerberg or Steve Jobs.

Dr. Mona: *Could you expand on this?*

Dr. Beekman: Creative people are attracted by problems and then work to find the information they need to educate themselves to solve the problem. In school, students learn material and then forget it. I always want to learn things that I can use immediately. Maybe students should be challenged very often by problems that they want to solve at that moment. But that's, of course, difficult. You cannot have a curriculum in medical school, for example, composed solely of case studies. I think education is moving more toward problem solving. My 12-y-old son gets a much more interesting education than I had. Mathematics are immediately applied to real-world problems, and that is, of course, good. He's a little bit like me, so I don't know where this is going. And, he's likely to say, "Yeah, Daddy, I read your interview, and you didn't do so well at school either."

Dr. Mona: *Do you see a role for yourself in education in The Netherlands?*

Dr. Beekman: I try to get students to play with ideas. I want them to tell me that my idea is not the best one, that they can think of something better—because there's always something better. A mix of practical and theoretic education is important. You have to have a real feel for the process, for example, of building a machine. You need hands-on experience, and these kinds of skills aren't necessarily learned at university.

Dr. Czernin: *Dr. Mona referred to your "chaotic" educational path. How did that affect your ability to work in a company or structured environment? How did you manage to adapt to real-life challenges?*

Dr. Beekman: I think I never really adapted, which is perhaps both a problem and an advantage. I started MILabs, where I could do more or less what I wanted because I didn't have a supervisory board. Only at the end, when we had venture capital, we had a board, which made it more difficult, because there were too many nonproductive ideas that they thought I should follow up on. It's very important to listen but still go your own way. Sometimes this is a little bit like school—it can be a waste of time. That's maybe the same thing that has always been difficult for me.

Dr. Czernin: *Was the freedom to make decisions one motivation for you to leave academia and go into the business world, or did you have decision freedom in the hierarchy of your university as well?*

Dr. Beekman: I actually managed to have a reasonable amount of freedom within academia. So, founding MILabs in 2006 wasn't primarily about seeking more freedom. At the university we had built U-SPECT-I, which resulted in the 2004 SNM Annual Image of the Year and the 2005 *JNM* Best Basic Science Paper, demonstrating the potential for commercialization. People asked me then whether I wanted to start a business. What attracted me was the idea of transforming an idea into a product. And I thought, "Let's get the valorisation grants and create a device that all the researchers can use." But business developers then wanted a big stake in the start-up. That's when my lawyer said, "Drop them. Be CEO yourself, and get rid of them. You can always take on another CEO later if you'd like." So, the company started, and I was the CEO.

Dr. Mona: *When I listen to you, it's clear how much you value the freedom to operate. It's getting harder and harder to have this type of freedom. How much stability and how much freedom to operate should we have in research?*

Dr. Beekman: Freedom is good, but you should also persist. Both persistence and freedom are important. You can still write the grant proposals you want, can't you? Of course, they often have to fit into the needs and interests of the department in which you are working. But don't you join a department where there's synergy with your own plans?

Dr. Mona: *With innovation, one is always taking risks. I cannot see innovation without freedom, without risk. Following paths that are already explored rarely leads to innovation.*

Dr. Beekman: Freedom is essential. You have to have space for crazy good ideas. But writing a grant proposal on those ideas too quickly can be too crazy for the National Institutes of Health, for example. Getting grants can take a long time.

Dr. Mona: *So how do you navigate this balance between safety and innovation/freedom?*

Dr. Beekman: The mix of having a company and an academic appointment is ideal for me. At the university I can work on a new image reconstruction algorithm, which can take a long time because it involves deep and difficult research. But in the company I can have an idea for a new product that can be delivered in 3 months. It's very challenging at a university to organize and produce a fast adaptation to a machine or a new tool. In your own company, you can simply ask, "Can we make this happen by next week?"

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Dr. Mona: *Would you be in favor of a hybrid system, where faculty have their research labs and also spin off companies where they can take risks?*

Dr. Beekman: Yes, that is nice. In a company you can do the really crazy things very quickly. That's why many of the big innovations come from companies.

Dr. Czernin: *Universities want to benefit from intellectual property. They structure technology transfer agreements that can be complex and convoluted and require special expertise. In addition, the universities may want ownership.*

Dr. Beekman: This is an intriguing area. Whether universities should have a stake in companies depends on the circumstances, but in many cases, it seems reasonable. In my experience, if you develop intellectual property using university funds, the university typically asserts ownership and seeks shares in your company or royalties. I encountered this with MILabs, where both the technology transfer offices of UMC Utrecht and TU Delft (where I later moved) obtained significant stakes. When we sold MILabs, they each made millions. This arrangement was fair, considering the universities' investments in patents developed during academic work. They also took a risk investing in a very small company with this very poor guy with not much money in the bank.

Dr. Mona: *This brings us to the question of why you chose to sell MILabs. You had good university partners, good investors. Right now, there is a boom in nuclear medicine. Good imaging tools such as SPECT/CT and PET/CT are crucial to successful preclinical and clinical developments. So why did you sell?*

Dr. Beekman: The timing for the sale was opportune. Despite the challenges of the COVID-19 pandemic, MILabs experienced rapid growth, significantly boosting its value. Now I have newfound freedom, allowing me more time to spend with my children. Moreover, many innovators who sell their companies find themselves wanting to move on, as a result of corporate bureaucracy, for example. I remain active in the field and have already embarked on a new venture: Free Bee International, initially conceived as a lighthearted celebration of my newfound freedom and now focusing on molecular imaging.

Dr. Mona: *How do you continue to create cutting-edge innovation? How do you stay creative?*

Dr. Beekman: One always sees only a part of the world. My patent lawyer has known me for 20 years. He says that I am more creative now than ever, since I am no longer a CEO. I also have hobbies—it's important to do other things with your brain to get distracted. Then you can be more creative.

Dr. Mona: *You leave space for other interests to grow and to bring innovation to your primary field. It's a work/life balance in some ways.*

Dr. Czernin: *When we say work/life balance, what does that trigger in your mind?*

Dr. Beekman: One of my role models and friends, Ronald Jaszczak, PhD, once shared with me over a significant number of beers the mantra "Work hard, play hard." I believe his message was about finding enjoyment outside of work, which in turn makes work more enjoyable. I truly believe in that.

Dr. Czernin: *But your work/life balance means that you have a lot of fun at work, too?*

Dr. Beekman: Not many people work the way I do. I feel I have a great work/life balance, because the work can be a really fun part of life, so that I can do it for many hours. In the busy times at MILabs, I didn't often play guitar or paint. But it still felt great, because there were so many interesting things to do and I could create machines. That, for me, is like what going to art lessons may be for another person.

Dr. Mona: *What is your advice for young people who are just starting in this booming field? How do we face future challenges?*

Dr. Beekman: If you have good ideas, go for it! Believe in yourself. Leave people behind who you think are smart but don't encourage you. Just go and listen closely to what is needed to take your next step. If you do all of this, success will come.

Dr. Mona: *And what's next for you? You spoke a little bit about Free Bee—what is it?*

Dr. Beekman: Free Bee is dedicated to advancing γ-imaging technologies to address unmet needs in areas such as cancer research, diagnostics, and therapy. Although PET has seen rapid development, I believe there's untapped potential in SPECT, especially as radionuclide therapy grows. In addition, Free Bee is exploring breast-specific γ-imaging (BSGI) as a more accurate and painless alternative to x-rays for detecting breast cancer, particularly in women with dense breast tissue. In 20% of women, conventional x-ray imaging cannot visualize anything; an alternative is needed. The notion that BSGI can be dramatically improved is, for me, a no-brainer, and I believe it may even become the screening tool of choice: no pain, much more accuracy, and a dose similar to or lower than that from conventional x-ray imaging.

Dr. Mona: *Do you have any interest in α-emitter imaging for theranostics? There is a very important unmet need as α-emitter–based therapies come to the market.*

Dr. Beekman: This is very important. For preclinical use we have already developed special SPECT methods (described in several articles, including in this journal) suitable for imaging high γ-energies or low abundances, needed to image distributions of α- and β-emitters. At Free Bee International and TU Delft we are working on novel technologies to meet these needs, as well as for clinical applications.

Dr. Czernin: *Congratulations, Freek, for your great success, and thank you for spending this time with us and our readers.*