Q & A

Anu Suomalainen

Anu Suomalainen (Wartiovaara) completed her MD degree in 1991, and in 1993 defended her PhD thesis on mitochondrial DNA mutations in diseases, at the University of Helsinki, Finland. She relocated to McGill University in 1998, and returned to Finland in 2001. Her research group has been established in Biomedicum-Helsinki since 2001, and belongs to the FinMIT Centre of Excellence of the Academy of Finland on mitochondrial biogenesis and disease. From 2007 she has been Sigrid Jusélius Professor of Clinical Molecular Medicine. Her work has been recognized with international awards, including Anders Jahre and Europe et Medicin prizes, and she is an EMBO member. Since the 1990s she has been a pioneer in the field of nuclear control of mtDNA maintenance, and the genetics of mitochondrial disorders. The major focus of her research group is to discover molecular mechanisms underlying primary and secondary mitochondrial dysfunction in disease, develop models for these disorders and to utilize physiological knowledge from the models to develop therapies for the currently incurable mitochondrial disorders.

Why did you end up in science, having a medical background? I had been determined to become a practising clinician, and I did work during and right after my MD studies in general health care, acute medicine, internal medicine and neurology clinics. However, I was attracted to research, and I encountered important teachers, who added fuel to the emerging flames. Early in my PhD project, in 1990, my mentors Hannu Somer and Matti Haltia urged me to travel to NYC, Columbia Presbyterian Medical Center, to work with Billi DiMauro and Eric Schon, who taught me the essentials of mitochondrial disorders and genetics, knowledge that was just beginning to be established. This NYC period established a tight scientific friendship and collaboration network with colleagues around the world, which still is important for my work. After NYC, I returned to Finland to the lab of Leena Peltonen, who provided me with state-of-the-art resources and guidance on molecular genetics, and inspired me with her enthusiasm, drive and passion to science, which was unique. I stayed in her lab until 1998, after which I went to do a second postdoc in Canada, in Eric Shoubridge's group. Eric is a leader in our field; exceptional in his ability to notice an important detail, his precision and technical perfection, and his fearless tackling of any biological question. Leena's and Eric's surroundings had a big impact on getting me completely hooked on the molecular basis of disease. Also, I soon noticed that it was not realistic to lead a competitive research group, do simultaneous clinical work, and be a mother of three and therefore I left the clinics.

What advice would you offer someone wondering whether to start a career in biology? First: if you have an interest in science, do not worry too much about a specific topic. Get yourself involved in an active scientific environment and good group: search for a mentor and supervisor who stimulates your mind. Do your PubMed homework of the potential mentor, interview group members in addition to the group leader, but also follow your gut feeling. I only hire people that I like, and similarly, you should only choose a mentor that you like. Second: science is not a nine-to-five job. It is like being an artist, it does not count hours and it is driven by curiosity. Often you fail, sometimes you are stuck with no inspiration, and sometimes the result is a masterpiece. It requires hard work and persistence, and a bit of luck. It is not easy — even if you are in a good lab, no-one else but yourself can do a science career for you. Third: if you have the sparkle, just do it!

If you knew what you know earlier on, would you still pursue the same career path? Yes. Definitely. I got my first actual researcher salary only after completing my PhD. I still remember the feeling: privileged and amazed for getting paid for my best hobby. I really like the fact that I do not currently know what is the hottest stuff that we will be working with in 6 months' time. This work is never routine.

What is your favorite conference? It is hard to single out a specific conference. I sometimes am invited to congresses that are not exactly on

my own field. The most stimulating new ideas often come from such conferences. The latest conference of that kind was the World Congress of Neurology in Vienna, and its session of neurological consequences of malnutrition.

Do you have a 'scientific hero' — if so, who and why? Leena Peltonen, my supervisor and mentor, who passed away at much too early an age in 2010, was a great role model for a scientist. Her drive, vision and intuition in science were impressive. She diligently promoted and emphasized excellence in science, and used her charisma and influence in science politics to benefit the scientific community. She showed her students the importance of popularizing science, educating laypeople, and was very good at it: still, in Finland, if people on the street have to mention a Finnish scientist by name, they will name her.

How do you feel scientific research differs in Finland compared with other countries? I think that for a small country, our biomedical research is at an excellent level and the resources are good. We still have quite transparent funding systems, aiming to fund scientific excellence.

If you could change one thing about research in Finland, what would it be? With the economic crisis, and reducing levels of funding, we really should focus on our strengths in science, and not try to maintain

everything. Political guidance of research funding is increasing, and more and more targeted funding calls are directed to restricted subjects and applied sciences. The strength of basic research should be maintained, and not endangered in search of fast commercial applications.

And what lessons could other countries learn from Finland? A major difference, when compared, for example, to central and southern Europe, is gender equality. For decades, Finnish women have had their jobs outside home, and this has been supported by the state: we have an excellent and affordable communal day-care system and equal high-quality basic education systems. Being a woman has not hindered my scientific career. However, I notice the difference, when I travel south. A concrete example: I was interviewed for the Centre of Excellence call when 8 months pregnant. A German colleague said that she would never have passed the interview in her country, looking so pregnant. It did not even occur to me that my physical appearance or life situation would somehow affect the outcome of my interview. It did not. We were selected for Centre of Excellence of the Academy of Finland.

How do you balance basic research with translational research in your lab? Me being an MD is reflected by the fact that all our research starts from questions concerning disease mechanisms — even if we often find ourselves deep in basic molecular biology. Therefore, all our research has a translational twist. Application of our results to patient care is straightforward for genetic diagnosis and biomarkers — I also serve as a Chief Physician in charge of mitochondrial disease diagnostics at Helsinki University Central Hospital. To truly develop new treatments for patients, strong basic academic research and well-developed interactions with pharma companies are required.

Do you have any strong views on journals and the peer review system? During the last five years, impact factor has become increasingly important for journals, which affects the editorial work: science that makes headlines is promoted. This trend worries me. I also think that too much lobbying is allowed and going on. I have been told that I am naive, but I strongly think that the data should speak for themselves.

I very much welcome openness in the review process. By this, I do not mean that anonymity of reviewers should be removed, because that would endanger objectivity — the scientists' sandbox is small. However, some journals have opened the reviewer statements and revision process to be publicly available after acceptance of the article, which I warmly support. I also like the system, used by some editors, in which a conflicting review statement is forwarded to other reviewers for them to comment. This reduces the likelihood of unjustified paper-trashing by a hastily done review by 'the third reviewer'.

What is your greatest ambition in research? To understand the molecular physiology of energy metabolic disorders, the interdependence and regulation of different metabolic pathways in detail, and to be able to apply this knowledge to develop therapies for the currently incurable disorders. We are not quite there, but closer to the goal than ever before.

What do you think are the big questions to be answered next in your field? The mitochondrial field has — for obvious reasons — been focusing a lot on the organelle. However, it has become increasingly evident that interaction and signaling between different organelles play a major role in disease. Therefore, in fact it is hard to define an organelle as an isolated system, as lysosomes guide mitochondrial biogenesis, mitochondria tune nuclear transcription, endoplasmic reticulum defines sites of mitochondrial division, etc. Furthermore, single cells and tissues may modify the metabolism of distant organs in the whole organism through various different levels of metabolite and cytokine signaling. The metabolic network is dynamic and acts locally, distally, in space and in time. Input from multiple disciplines is required to clarify how such cell- and tissue-specific signaling patterns fine-tune physiology to meet environmental demands and how they contribute to disease.

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Quick guide

Pericycle

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What is it? The pericycle is a unique layer of cells in plants, named after its position, encircling the vascular tissue in stems and roots. In roots, it is surrounded by the inner cortical layer, namely the endodermis (Figure 1).

Can it be regarded as a separate plant tissue? The pericycle is a heterogeneous, non-vascular tissue in plants that is divided into two populations — one at the xylem pole and one at the phloem pole. Pericycle cells at these poles are marked by differences in size, by ultrastructural features and by specific proteins and gene expression. Transcriptional evidence suggests that pericycle cells are intimately associated with their underlying vascular tissue instead of being a separate concentric uniform clonal layer. Moreover, distinct functions have been attributed to xylem pole versus phloem pole pericycle cells, countering the idea of a delineated plant tissue.

What is the pericycle required for? Several different functions have been attributed to the pericycle both in roots and shoots. In the root, it is required for xylem loading (for example, BOR1, an efflux-type boron transporter for xylem loading, is specifically expressed in the pericycle). In angiosperm roots, it is essential for lateral root initiation and later on becomes involved in secondary growth.

What about pericycle and lateral root initiation? In most plants, including the model species *Arabidopsis thaliana*, lateral root initiation occurs at the xylem poles (Figure 1). In monocots like maize that have multiple xylem strands, initiation takes place at the phloem poles. Nevertheless, it appears that the same or similar key molecules are involved in regulating the process of lateral root initiation in both cases, with positional information coming from