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 the neighboring tissues, such as endodermis and the vasculature.

Why is the pericycle deeply embedded within the plant? Newly developed lateral roots have to emerge through the overlaying tissues, which in monocots can be numerous layers of cortex. Since the pericycle is so crucial for the overall root architecture, these overlaying layers possibly act as a protective coat and/or as a signaling buffer mediating interactions with the rhizosphere.

Can we regard pericycle cells as stem cells? Lateral root initiation occurs in a few pericycle cells at the xylem pole, designated as 'founder cells', which retain the capacity to undergo (asymmetric) cell division higher up in the root when other cells have differentiated. A tight control of cell cycle progression in the xylem pole-associated pericycle cells is required for lateral root initiation, and this cell cycle state is not synchronized with the other pericycle cells at the phloem pole. The peculiar characteristic of maintaining cell division competence in this tissue has led to the concept of an 'extended meristem' and is regarded as the basis for the high flexibility of plant roots to respond to an ever-changing environment in the soil. The competence of the pericycle to undergo lateral root initiation is to some extent limited, and one of the key regulators of this mitotic competence is ALF4. Another peculiar observation is that the formation of a callus from multiple organs resembles the formation of a lateral root meristem from pericycle cells. Taken together, pericycle cells can be considered as true stem cells.

Can we profile the pericycle? To obtain a deeper understanding of the role of the pericycle, we need to profile the cells in this tissue specifically on the level of transcripts and proteins. Several studies have already given us some insight, using fluorescence activated cell sorting in combination with fluorescent, tissue-specific markers and using laser capture microdissection.

What are some important future questions in this field? The fact that in roots some pericycle cells, surrounded by differentiated cells, can still become programmed to begin to proliferate, thus leading to the initiation of a new organ, is intriguing, but the underlying mechanisms of this are far from understood, and is the subject of active research. We also know little about how internal and environmental cues are perceived by these cells to shape the final architecture of the root systems of plants. Finally, we know hardly anything about the appearance of the pericycle during plant evolution, and a potential evolutionary correlation with the formation of lateral roots.

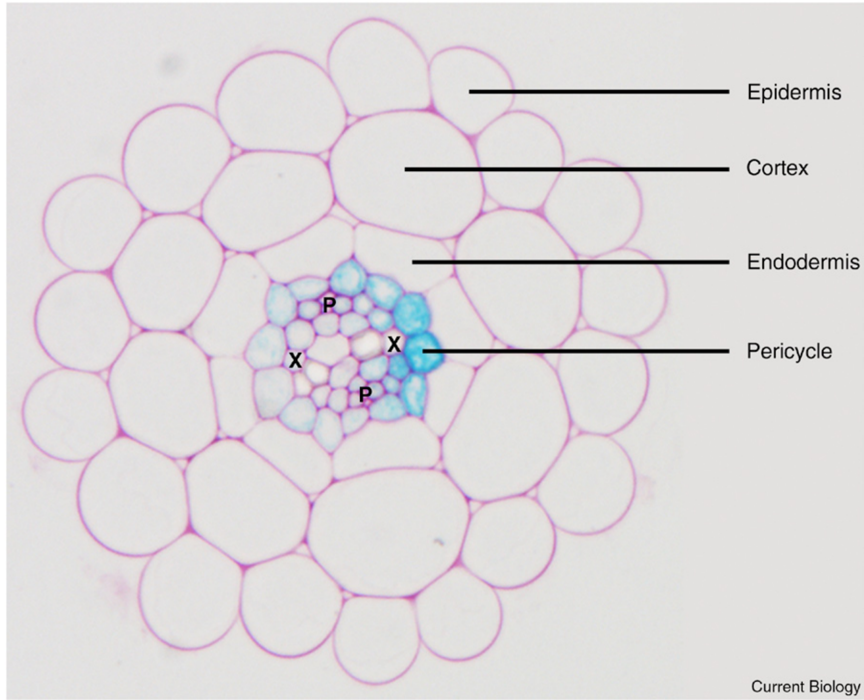

Figure 1. The pericycle.
Transverse section of an *Arabidopsis* root. X, xylem pole; P, phloem pole; blue, *pGATA23::GUS* expression, a marker-gene construct indicating the lateral root initiation competence of pericycle cells.

Where can I find out more?

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