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Interview with Ron Mittler

Ron Mittler

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Ron Mittler was born in Israel to a non-scientific family. He studied botany as an undergraduate at The Hebrew University of Jerusalem (BSc 1989) and eventually returned there to start his own research group after obtaining his PhD and gaining postdoctoral experience at Rutgers, The State University of New Jersey. In 2001 he moved his laboratory to the USA and spent time at Iowa State University and The University of Nevada in Reno. Since 2010 he is based at the University of North Texas. Ron's research interests include reactive oxygen signaling, heat-stress responses in plants, abiotic stress combination, rapid systemic signaling, ultra-fast responses in plants, and the regulation of iron and reactive oxygen metabolism in the mitochondria of cancer cells. Ron serves on several editorial and scientific boards and was recently cited by Thompson Reuters as one of 2014's highly cited researchers, which in his opinion indicates that he is contaminating the minds of too many young scientists with his ideas.

What influenced your path into plant biology?

I started undergraduate school with the intention of becoming a veterinarian. To pay my way through college I started working as a lab assistant in one of the research labs on campus. Conducting research in the lab, for the first time in my life, was a real eye-opener and I caught the 'research bug'. Professor Elisha Tel-Or in whose lab I was working at the time has an immense passion for research on plants, and he proposed that I should work on desert plants and conduct physiological and biochemical assays to study how these plants adapt and acclimatize to stress in their environment. Not only was I hooked on plant research immediately but I was also introduced to the wonderful world of reactive oxygen species, a topic that has captivated me throughout my 'adult' research life. From these early studies I learned to think about the plant as a whole organism, about the interactions of plants with their environment in the field – hence my attraction to stress combination – and about plasticity, development, and population dynamics as key factors for plant survival in the field. I guess the desert is a wonderful place to start one's scientific career. Suffice it to say that I never went to veterinarian school and that I continued my way to an MA in plant biology in that lab, with the encouragement of my advisor to go to the USA for my PhD studies.

How did you decide on your current research topics?

I like to try to address questions that are very important for plant biology, but that had not been looked at much by others. For example, I chose to work on stress combination, because I believed from my early work on desert plants that it is a combination of different abiotic stresses that affects crops in the field more than a single stress condition. To my surprise, I found out that few people were looking into stress combination using molecular tools, and I therefore decided to focus on this topic. I have always been fascinated with reactive oxygen species and their multifaceted role in the life of all organisms on Earth. To me it is the ultimate conundrum of life or death, with the everlasting demand to keep balance or homeostasis as an answer. Recently, I have been interested in how reactive oxygen species mediate rapid responses in plants that are local or systemic. The decision to study rapid responses came from observations by my lab and others that these responses are important and from the fact that not too many people have addressed this important question. In choosing a subject to study I also attempt to find out first if it has an important function in plant survival and only if I find out that it has, I focus on it.

What would you be if you were not a plant biologist?

A veterinarian or an engineer.

Do you have a scientific hero?

My heroes are from the reactive oxygen field. They are people such as Kozi Asada, Irwin Fridovich, and Barry Halliwell. People that charted the way and made canonical contributions to the field in the form of discovering superoxide dismutase (SOD), ascorbate peroxidase (APX), and the Asada–Halliwell–Foyer pathway.

What paper has influenced you the most?

Sorry, but I do not think I have one particular paper that influenced me the most. I really liked many of the genetic papers describing work on the hypersensitive response and plant immunity by people such as Fred Ausubel, Jeff Dangl, and Brian Staskawicz. I found these papers to be very elegant, and they influenced my path in science by convincing me of the power of genetics in *Arabidopsis*.

What is the best advice you have been given?

Publish at least one good research paper a year, regardless of what is happening in your private life. This advice, given to me by Professor Ilan Chet, who at the time was the head of the Weizmann Institute, was and still is very true

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in my opinion, and has helped me maintain continuity in my career.

What advice would you give?

If you can, when you start your career in science, be smart about it. Do not choose a subject only because it is interesting to you. Choose a subject that is interesting to you, but can also bring you high-impact publications and funding. Work hard, there is no substitute for working hard. Be efficient and smart about your work and always include all possible controls (it will save you time in the long run). Try to follow only biologically important questions and think ahead. Always learn from others and take good care of your students and postdocs. They are, after all, one of the true testimonies to how good a scientist you were.

Are there any issues in science funding that you feel strongly about?

I think that funding agencies in the USA and Europe should give more money to individual investigators, as opposed to big collaborative grants, that I find to be sometimes a very big waste of money. Also, the decision by some funding agencies not to fund *Arabidopsis* research seems unwise to me. More money for plant research is a must in my opinion. We will be facing a food crisis very soon owing to the extremely dangerous combination of global climatic changes, decreased land for agriculture, limited water resources, and increased global population. I believe we need new funding initiatives, on top of what we already have, that will directly target these issues and enable us to develop sustainable and productive agriculture under these, not so far ahead, perilous future conditions.

What is the biggest hindrance to science?

The combination of a decrease in the level of basic education and the level of funding for science. Our children are our greatest asset. We need to invest much, much more in their basic and advanced education and in the values we instill in them.

In hindsight, what in your research career has given you the most pleasure?

The moment when all the data finally come together and you can formulate a solid working hypothesis. Nature is so beautiful, and understanding how it works is the ultimate challenge. It usually takes several years of hard work to gather all the information and data necessary to come up with a new idea or model to test, and having all the pieces fall in place together is in my view the ultimate reward for a scientist. Of course new questions immediately arise, but this is why science is so great.

What big questions interest you in the long term?

How plant cells communicate with each other and how plant-wide signals are generated, transmitted, and decoded in the different tissues. I also believe that the timescale we have been trained to think about when it comes to plant responses to their environment is not entirely accurate. I think that many responses occur within seconds and not minutes or even hours as people used to think.

What is your opinion on the second green revolution?

It is very much needed. As scientists we should promote almost any initiative that supports it, and try to raise our voices to warn the public about the need for it. We did it before (the first green revolution), but it will be much harder to do it again because the environmental, economic, and political conditions are not in our favor, and some of the public perception of plant science is damaging to say the least...

What are the future challenges in plant science?

Design a synthetic plant from scratch by putting together its genome the way we want to. Introduce genes for self-assembling nanoparticles into the plant genome to obtain needed phenotypes. Control developmental programs and use them for our purposes to design novel plants and/or plant features. Unravel the function of all the genes in the most important plants and crops. Unleash the full potential of plant secondary compounds for cancer therapy.