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Advancing your career in soil physics

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It is my pleasure to accept Dr. Yuki Kojima's invitation of writing an article for the Journal of Japanese Society of Soil Physics, focusing on encouraging young scientists to engage in soil physics and to advance their career. Although I read only a few papers (from Prof. Kosuke Noborio) of this journal, I have a high respect on it because to my knowledge, this is the only journal in the world specializing in the discipline of soil physics and it has already published 155 volumes in the 65-year history (four years older than me!). In the following I put together a few pieces of advice based on the experiences and challenges during my early time of soil physics research.

Actively integrate into the new community

For young scholars who have just embarked on the academic path, the first challenge is how to integrate into the new community, which may require an adjustment of the research direction. During the postgraduate studies, you defined the research topic and completed your studies by working together with your supervisor and committee members. You may need to make adjustment or even change the focus of your research to meet the requirements of the new institute. As a team member, it is important to actively communicate and negotiate with the program leader, and to decide your research topic that fits to the overall direction of the team without losing your own values and long-term goals. In this process, it is worthy to seek guidance from senior professors with rich experience and deep academic achievements. If your study area aligns with their interests in some way, it is good to seek their support and/or look for cooperative research work with them.

Follow the rhythm of scientific research

Like the evolution of living things, the process of scientific research has its own rhythm. For an early career researcher, you have a small group and your resource for doing research is very limited. At this stage, in addition to teaching, you are required to spend much of the time on writing proposals, recruiting students, equipping the laboratory, and looking for opportunities and roles that are beneficial to your career. This can lead to a huge amount of stress in the day-to-day life. In such case, it is advisable to keep the early research work on relatively narrow topics that demand less resources. With the growth of research team and buildup of laboratory facilities after a few years, you may consider extending the research program to more complicated field studies and combining theoretical work with applied issues. In my first 3 to 4 years at China Agricultural University, I had 1–2 graduate students, the laboratory was essentially empty, and the only support came from a program funded by the Natural Science Foundation of China (NSFC). Thus, I had to limit my research mainly on improving the thermo-TDR technology for measuring soil thermal properties, water content, electrical conductivity, and water flux (e.g., Ren et al., 2005; Gao et al., 2006; Lu et al., 2007; Ju et al., 2008), which was basically a continuation of my postdoc research at Iowa State University. A few years later, with the support of two national projects and another NSFC program, my group had been expanded to 6-8 students and the laboratory facilities were updated significantly. Then I was able to start long-term field studies in Northeast China and the North China Plain, where the thermo-TDR technology was applied to monitor in situ soil thermal and hydraulic properties and processes, e.g., soil bulk density, surface energy balance, dynamics of evaporation and transpiration, and thermal and hydraulic properties of frozen soils (Liu et al., 2008; Lu et al., 2008; Du et al. 2009; Du et al. 2010; Zhang et al. 2012; Du et al. 2013; Liu et al. 2014; Zhang et al., 2014; Peng et al. 2015; Tian et al. 2016; Peng et al., 2017; Wang et al., 2017). More recently, we have extended the application of thermo-TDR technology further to the real world, e.g., monitoring in situ soil water retention curves

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during welting/drying processes and quantification of soil structure and hydrothermal processes in the root zone (Zhang et al., 2018; Fu et al. 2020; Fu et al. 2021; Huang et al., 2021; Liu et al., 2023), which are rarely touched in traditional soil physics.

It is important to note that conduction of academic research is like running a marathon, one needs determination to reach the finish line. Young scholars are full of vigor, often interested in many topics of various fields, and are anxious to act immediately, but they are prone to make the mistake that treats all topics equally. While it is useful to broaden knowledge and build professional network, working on parallel topics simultaneously may degrade the figure of your academic integrity. You may consider broadening your research and working on different programs after you become more senior. In the past 20 years, I have led and participated in 13 national research programs in the fields of soil structure, field water balance, farming system, and soil-crop root interaction, the focus of my research, however, has primarily been on the quantification of soil hydrothermal properties and processes under either laboratory or field conditions.

Establish your own academic network and expand your visibility

For young scholars, it is of vital importance to build an academic network by participating in national and international conferences, organizing scientific workshops, communicating with peers, and providing social service (e.g., as society members, journal editors, and program coordinators). Academic network provides you the opportunity to present your research results and lets more people know you, which is essential for establish good cooperation links. Through academic networking, you can also follow what others are doing, obtain useful information, learn more about funding channels, and obtain the evaluation of your research work by others. In my early academic years, I served as the deputy director of the Chinese Society of Soil Physics for 8 years, organized several national soil physics meetings, and did my best to attend the ASA-CSSA-SSSA International Annual Meeting and the ISTRO Congress every year. I also served as editors and associate editors for the Soil Science Society of America Journal, Agronomy Journal, Canadian Journal of Soil Science, and Soil Use and Management, from which I learned a lot from others and met many new colleagues. In addition, I established long-term working relationships with Dr. Robert Horton of Iowa State University, Dr. Rainer Horn of the Kiel University, Dr. Joshua Heitman of North Carolina State University, Dr. Tyson Ochsner of Oklahoma State University, and Dr. Richard Walley of the Rothamsted Research through joint research programs, student training, exchange visit, and joint publication of scientific papers. which has been of great help in the academic growth of myself and my graduate students.

Leave time for thinking and reflection

Have you ever estimated your time distribution among daily issues (e.g., teaching, lab work, meeting, and short-term deadlines), reference reading, self-learning, and independent thinking? I must admit that much of my daily time is spent on preparing proposals, writing reports, reviewing manuscripts, filling all kinds of forms, and unexpected interruptions, and there is always a shortage of time for reading new references and thinking independently. In today's fierce competitive world of research, time management can make a big difference between progress and retreat. In my experience, the key issue is to free enough time for creative thinking and reflection independently. After a period of busy and intense work, make an appointment with yourself, get out of the pressure and exhaustion by thinking and reflection in silence, which is very useful for capturing new knowledge, generating inspiration, fine-tuning emotion, and recognizing your strengths and weaknesses more clearly.

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