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After completing a doctorate I pursued a 21-year career as a Research Chemist specializing in Analytical Chemistry and working on problems and opportunities in three different application areas (for details see underlined text later in this narrative). My first job was 2-1/2-years as a 'Research Officer' in the Inorganic division of the Bath University Department of Chemistry in England, which I then followed with a 2-1/2-year National Research Council Post-Doc in the Center for Bio/Molecular Science and Engineering at the Naval Research Lab in Washington, D.C. I then worked 4-1/2 years as a Research Chemist in the Quality Assessment Research Unit of the USDA Agricultural Research Service in Athens, Georgia, followed by 11-1/2 years as a Faculty Research Associate in Agronomy in the Crop and Soil Sciences Department at The Pennsylvania State University. In the 7 years since then, I have been a stay-at-home father and husband, while my wife, Gretchen Kuldau, continues to work as a tenured professor at Penn State. She and I met in Georgia and after we moved to Pennsylvania we adopted two children, now ages 14 and 10. Some of the activities I enjoy are gardening, ukulele, cooking, reading, travel, building/repairing, tennis and recreation with family in Seal Rock, Oregon and Peterborough, New Hampshire. I'm aiming to get back into research once our children are older and more independent.

To provide the traditional metrics of a research career I reviewed my c.v. It lists 55 research publications, including a few in top-tier journals, some that can definitely be counted as achieving a notable technical first, and at least one wild-card that ended up being surprisingly well-cited. My technical contributions were included in at least 95 scientific meeting presentations, 7 of which garnered awards by me or my student collaborators. I also served on 21 graduate student committees in various fields of study, mostly agriculture students while at Penn State, and was usually both a technical mentor and technical contributor in my area to the student's thesis project. In a few cases I was the advisor or co-advisor of the student. Beyond the aforementioned peer-reviewed journal publications, my significant technical contributions appear in 14 publication-style thesis chapters of 9 graduate-student collaborators. My annually-renewable fixed-term faculty position in the College of Ag at Penn State was structured in a way that compelled me to collaborate with tenure-track faculty members. Even so, while at Penn State I authored 9 internally-funded competitive grants, which was critical for improving the capacity for Analytical Chemistry in my lab in the Crop and Soil Sciences Department. As a side note, I also enhanced lab capabilities by building and refurbishing equipment and creating software and algorithms. I was co-investigator on 6 significant externally-funded competitive grants, from such sources as USDA, Pennsylvania Department of Agriculture and The US Department of Energy.

My initial grad work focused on development of vibrational spectroscopic instrumentation and techniques to widen the capabilities of the techniques (FTIR, Raman, NIR, and SERS) and to facilitate the use of these techniques outside of the laboratory environment. One initiative was improving the ability to utilize Raman when interfering fluorescence is normally a limitation, and another created fiber-optic sampling configurations for industrial process monitoring, industrial materials management, and field-site environmental sensors. A lot of this work also involved development of Chemometrics for processing the digitized spectral data to get the desired information out of large collections of complicated vibrational spectra, or to train an instrument to work like a sensor for the amount of a component or value of a material property. I took a deep-dive into this kind of work again when I joined the Agricultural Research Service after two post-docs in a different research area. Problems in agriculture had driven the development of computer-driven NIR analysis decades before, and I worked with a group to expand on these successes by utilizing different types of analytical instrumentation, different training algorithms and exploring new applications. For example, we trained an instrument to use reflectance of the shorter wavelength NIR range to determine several parameters the nutritional content of a wide-variety of intact cereal food products.

In the midst of my grad work in spectroscopic instrumentation, my grad advisor left for an industry job, which is also where my research to date was pointing me. I did want to enter industry, but only after getting more basic science experience with vibrational spectroscopy and its applications, and so began to redirect my Raman research toward biomimetic materials synthesis and characterization. My new advisor was Paul Yager, a UW Bioengineering professor with expertise in Raman spectroscopy of lipids, and under his direction I studied the potential of self-assembled fiber-like lipid microstructures as materials. Yager had discovered an important class of these and shown that they could act as templates for synthesis of metal microtubules that had some materials applications. After characterizing some properties of that phospholipid system with Raman, I thoroughly studied the fiber-forming abilities of biologically derived sphingolipids, both at UW and The University of Bath, where there was expertise in biomineralization processes that could potentially coat or encapsulate the self-assembled fibers for technological purposes. We did achieve iron oxyhydroxide mineralization of the lipid fibers, but it was far from a technological success. My initial work on silicate coatings was promising, but my supervisor discouraged this and it was also nearing time to make my Bath exit. Part of the technical challenge in this area was control of the nucleation and growth of minerals at

interfaces, so I did some studies of this aspect of the problem while at the Naval Research Lab. Biomimetic material science is a highly multidisciplinary area of work, and in my work I made extensive use of microscopy (optical, electron, AFM), but also diffraction (XRD, electron) and molecular modeling. By the end of my second post-doc it was apparent that the technological promise of this line of research was still quite far off in the future, and furthermore, that my research strengths were on the characterization side of the problem.

It was primarily my knowledge and skills in Chemometrics that got me into my third area of chemical research: characterization of agricultural materials in the service of agriculture. I started out at USDA-ARS knowing very little about agricultural research issues and working on some narrow research questions in spectroscopic determination of agricultural product quality, but this widened to include a broad range of analytical techniques and agricultural research problems while in the College of Ag at Penn State. There are way too many areas to describe fully, but the following keyword list can give a sense of the type of research work: soil carbon, soil colloids, biodiesel, beef and dairy fat quality, mycotoxins, cellulose, dietary fiber, feed and forage quality. While I had the requisite fundamental knowledge of characterization, the work necessitated gaining a lot of new hands-on expertise: many chemical/gravimetric methods, laboratory automation/robotics, field sampling equipment and chromatography (HPLC, GC-MS, LC-MS).

In 2000 I had chosen to leave the Agricultural Research Service in Georgia for the PSU College of Ag in central Pennsylvania so that my then-new wife could pursue a tenure-track position at Penn State University. I had received performance awards at ARS and was hitting my stride, so it was a difficult choice to give up that job. In the College of Ag, my eyes were fully opened to the rich and diverse types of analytical problems presented by modern agricultural systems. However, it was also an era of a shrinking funding pie for agricultural research, especially at colleges, and I never obtained a large share of a rich source of funding. Moreover, a lot of effort was wasted on fruitless pursuit of low-success-rate funding sources and other kinds of research resources. When the resource pie shrinks, the lower-status positions, non-core areas and riskier initiatives suffer more from the cuts. The final straw for my fixed-term position was the state budget cuts precipitated by the Great Recession of 2009. The family was also feeling the pressure of childcare at this time. In hindsight I had made a terrible career mistake by choosing to leave ARS for the College of Ag. Funding of a scientist position at ARS was not lavish, but it was automatic, easily more than twice what I had in the College of Ag, and also came with the benefit of working within a structured multidisciplinary team of specialists. If your main goal is to apply your specialized knowledge to accomplish research in significant agricultural problems and opportunities, this is a good place to be. By contrast, being a Research Chemist as a fixed-term faculty member in the Agronomy program in a College of Ag, was, in a word, frustrating. Fortunately, on the whole it did work out fine for my family as a unit, and I was able to make valuable contributions to the research area and to the training of students. Indeed, for some of the agriculture students, the hands-on experience with analytical techniques is what helped them obtain their first job after graduation.