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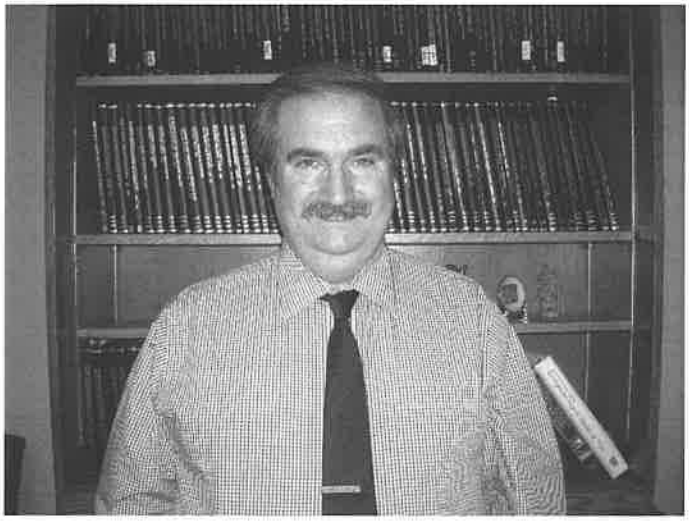
PRESIDENT OF THE TENNESSEE ACADEMY OF SCIENCE FOR 2011

I am pleased and humbled to serve as the 2011 President of the Tennessee Academy of Science. As past presidents of the Academy have done on many occasions, I'll take this opportunity to introduce myself with a summary of my career and my thoughts on the importance of science and science education in Tennessee.

I was born in Cookeville, Tennessee, while my father was in his sophomore year at Tennessee Polytechnic Institute. The better part of my youth was spent growing up in Tullahoma, Tennessee. I was active in band, science clubs, and theater for several years. I learned later that scientists are often artistic, and had I known this earlier in life, it may have further solidified my confidence to enter the field of Science. Being a youth during the Apollo years of NASA, I was drawn to the space program. I believe it was the unknowns of space and the exploratory nature of space travel that intrigued me the most. At one point, I spent more time building rockets made of paper and glue in class than paying attention to the teacher. This no doubt affected my grades in a negative way, and my parents were brought in to view my models. My parents had a talk with me about the importance of being focused on my studies, and as an example of dedication and planning, organized my study time with a wall chart. I didn't always listen, as my mind would often wander to the wonders of the unknown. I often found myself asking questions such as "why?" or "could it be?" but did not yet have the tools necessary to address the questions. A combination of chemistry sets and a high school chemistry teacher named Jane Weaver solidified my interest in Chemistry. Being also drawn to Biology, my path eventually led to Biochemistry, the chosen professional area of my career.

Mrs. Weaver made science fun. During her planning hour or after school, she would often take some of us into the lab and do demonstrations too violent for the classroom. Someone asked me once if I ever accidentally blew anything up. My reply was, "not accidently." The youth today do not have the same experiences growing up as I did, and in the information age are exposed to so much information that some of it may drive them away from Science (like all those adults arguing about origins and evolution, the cause of global warming, or worse yet, the push towards position in the community and monetary gain versus career passion). I think that is a shame, and many of the pressures that rob youth of passion could potentially be one of the reasons we have fewer and fewer middle school students entering high school with the goal of being a scientist, mathematician, or engineer. Mrs. Weaver passed away last year. I wish I had one last opportunity to thank her for the role she played in shaping my life. She always told us to ask "Why?" and never fall into the trap of misusing the scientific methodological terms, such as hypothesis, theory, and fact. She was passionate about science and passed that on to many of her students over the years. Maybe our naivety helped keep us passionate about science.

When the time came to consider college, I was drawn to Tennessee Technological University. I had heard from others that professors were tough on students at Tech, and as a young



Dr. Jeffrey O. Boles.

man of 18, I believed I could handle it. After I visited the campus and the department of Chemistry with my mother, my decision was finalized. Both my father and Mrs. Weaver were graduated from Tech, and I'm sure this contributed to my decision. In the fall of 1980, I returned to my birthplace as an ACS Chemistry major. We loaded up the blue Oldsmobile station wagon with its simulated wood side-panels with my luggage and the entire family, including my three younger brothers, and headed to Cookeville. It was a tough first year—and only got worse during the second year. As I struggled with my studies, my thoughts returned to things I had been taught growing up about dedication, time management, etc., and once again to Mrs. Weaver and her passion concerning Chemistry as the central science. My Dad told me to set short-term, mid-term, and long-term goals and to work towards them one at a time. Through perseverance and a great deal of hard work, I did reach my goal of obtaining a B.S. degree in Chemistry from TTU. During my senior year as an undergraduate student, I was exposed to research. It was here that my passion was solidified. I was no longer a kid in the backyard with his chemistry set making stink bombs, but instead a young scientist trying to make a difference for humanity. I turned down a full-time job offer at a Cookeville ink company to enter graduate school instead and to work towards a master's degree in Chemistry. I chose to work under Scott Northup in Computational Biophysical Chemistry. I had studied many computer languages as an undergraduate, and my dual interest in Chemistry and Biology prepared me well for this course of research. My time for the next two years was divided between courting my future wife, Tammy Hatfield, and writing computer code on a terminal to carry out molecular dynamics simulations. By the time my M.S. degree was completed, I was prepared to work on a doctoral degree. My thoughts ran between, "But where?" and "What would I study?" As you might imagine, I eventually let my passion dictate the path.

Sometime during 1987, I saw an article in *Chemical & Engineering News* entitled "Selenocysteine, the 21st amino acid." I had spent the previous two years studying the molecular level of life, chemical transformations by enzymes, and the difficulty of determining the three-dimensional structure of proteins. The 21st amino acid intrigued me. Selenium. It's heavier than the atoms typically found in proteins and nucleic acids. "Could this unnatural or unusual amino acid be exploited to solve the three-dimensional structure of proteins?" "Could other amino acids accommodate selenium?" "Could proteins somehow be tricked to utilize selenocystein, or selenomethionine, instead of their wild-type counterpart?" When I was younger and asked "Why?", I did not have the tools to answer those questions, but now, as a young man about to earn his master's degree in Chemistry, the tool belt was beginning to provide the tools needed to satisfy, scientific curiosity. I started searching for a Doctoral program where I could potentially study such questions and found one at The University of South Carolina (USC).

In the Spring of 1988, just before Tammy and I married, I accepted an invitation to visit USC. I was 26, and it was the first time I flew on an airplane. While on that visit, I met Dr. Bruce Dunlap and Dr. Jerry Odom. These professors led doctoral students in what was called the Selenium-Tellurium Research Group. I spoke to them about my research interests with selenium, and they were very interested as my goals fit well within their plans (at the time, they were synthesizing coenzymes which contained Se or Te for nuclear magnetic resonance structural studies). Everything was going well until I entered the lab that fall and was told by fellow graduate students that my idea was crazy, in that *you can't fool Mother Nature*. I must admit, the prevailing scientific thought at that time was that you can't, but I simply wasn't going to let a prevailing hypothesis stop me from trying. They told me nature won't allow you to replace a natural amino acid for an unnatural one throughout an organism. At first I was concerned by the sea of negativity, but in the end, through collaboration with a professor at Columbia University with a similar pursuit, passion and perseverance prevailed. I was one of the first researchers to completely replace all of the methionines in *E. Coli* with selenomethionines and to completely characterize an unnatural selenoprotein. The final data, demonstrating that these transformations could not only be accomplished but could be accomplished without altering the structure of the protein itself, were revealed in an electron density map of both structures superimposed on one another. There were 14 perfect spheres of additional electron density surrounding the 14 methionine sulfur atoms. We immediately published the paper in *Biochemistry*, and that technique is now the most widely used technique for solving 3-D structures worldwide. Passion and persistence ruled once again. With the guidance of a Post-Doc named Louis A. "Pete" Silks, I also synthesized a new amino acid, L-Telluromethionine (TeMet) and was the first to incorporate it biosynthetically into protein. TeMet has proven much more difficult to bio-incorporate but has shown some success worldwide for the solution of 3-D structures as well.

In the winter of 1992, while at a scientific meeting in Houston, I met a University of Alabama, Birmingham, professor named Magnus Hook. He was about to move his lab to The Texas A&M Institute of Biosciences and Technology in Houston. This Institute was an arm of the Biochemistry and Biophysics Department at Texas A&M, 60 miles down the road in College Station, Texas. Magnus Hook had an army of molecular biologists and needed to hire some biochemistry Post-Docs to study the many proteins he was isolating and over-expressing. He needed someone to set up a new biochemistry lab, someone who was interested in studying the structure and function of his cell surface adhesion proteins. As it turns out, he was looking for someone like me, and I joined him in Houston in the fall of 1992 following graduation with my Ph.D. from USC. Setting up a new lab and collaborating with the biologists solidified further my decision to enter academics as a profession. However, my close proximity to NASA and my desire to work in space led me in that direction as well. I was torn, but after a few failed attempts to enter the astronaut corps as a Mission Specialist, I began to seek academic positions and somehow get my foot in NASA's door by some other route.

My search for an academic position led me back to Tennessee Tech, believe it or not. I was about to come full circle. I was born in Cookeville, spent my BS/MS years in Cookeville and was now back in Cookeville as a tenure-track assistant professor. I was the first TTU chemistry graduate hired since the middle of the last century. When I first saw the advertisement, I was not even going to apply for the position, but I heard they were looking for someone with my background. I was excited to come back to a University that provided as much attention to undergraduates as they did graduate students. The TTU model was the model for my search for an academic position, so I was not that surprised to find myself back at TTU.

Once in Cookeville, I immediately touched base with Gerry Bunick, an X-ray crystallographer at Oak Ridge National Laboratory. Gerry had offered me a job as a Post-Doc following my graduation from USC, but I turned it down to work for Texas A&M. I told Gerry I was interested in producing selenoproteins of the nucleosome core particle—a major focus of his structural studies at Oak Ridge. We began a fruitful collaboration over the next few years that led to my involvement in a project where we prepared and sent proteins to the Russian MIR space station via a NASA Space Shuttle for crystallography studies. I didn't get to go myself, but I guess it was the "next best thing to being there." Gerry gave me one of the crystallography chambers used on MIR to study our proteins. It is a prized possession and a testament to a passion first fueled in my youth.

Over the last decade, my research interests have broadened somewhat, but I still work with unnatural amino acids. I now apply new technologies, such as Proteomics, to the expansion of the genetic code. My passion for the environment has led me into the fields of Environmental Proteomics, chemical fingerprinting, and alternative energy (cellulosic ethanol). My passion for students and serving others led me to the Chair's office of the Department of Chemistry— something I never sought as a goal. Passion is a wonderful thing if it's allowed to flourish. We in the scientific community, whether educators or ambassadors, need to fertilize the passion of youth and actively seek ways to remove barriers that divert potential young scientists from our profession. Next year is the 100-year anniversary of the Tennessee Academy of Science. Over the years, the academy has seen many challenges. The challenge of attracting more students to our art, and retaining those young artists, may be our greatest challenge yet.