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Benita Albert concludes her story on the life of Chris Bunick, Oak Ridge schools graduate who has excelled in both science and medicine.

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Chris Bunick (ORHS Class of 1996) enrolled in Vanderbilt University in the fall of 1996. He stayed there over the next twelve years, taking advantage of a course of studies via an innovative path to his future career of physician-scientist. He earned an undergraduate degree with majors in Mathematics and Molecular Biology, a PhD in Biochemistry from the Vanderbilt School of Medicine, followed by an MD degree. Chris was attracted to Yale University's reputation in the field of dermatology, specifically the renowned faculty and training program. Chris said his PhD research touched on dermatological diseases, but his MD program experience conflicted his future planning as he found the field of dermatology could also be, as he put it, "gross."

However, a vagary of experiences along with a passionate advisor swayed his thinking. Chris wrote, "I overheard medical interns complaining about their job—one saying, 'I should have chosen dermatology,' and the other saying, 'I should have chosen radiology.' I said to myself at that time, I need to make sure I correctly choose from the git-go, and after a lot of reflecting on who I was and what I wanted, I realized that I am a visual learner and doer. My research in crystallography involved 'seeing' the molecular structures of proteins and understanding how they worked. I thought a visual specialty like dermatology or radiology might suit me, so I did a rotation of both for one month. I realized I could not sit in a darkroom for my life, and I was fortunate to have a passionate dermatology teacher on my rotation, Dr. John Zic, from Vanderbilt who really inspired me to pursue dermatology more. I applied to dermatology and matched at Yale. Also contributing to my choice was the fact that I liked the breadth of the specialty—you really get to do it all—the routine skincare, complex internal medicine cases, surgery (I cure cancers every day!), cosmetics, and histology. I thought the breadth of specialty was really attractive because of the life-long intellectual curiosity it would fulfill in me."

Now Chris finds that his life has come full circle. I asked Chris about the teaching side of his career at Yale: "I have a few small teaching responsibilities. First, I teach the current Yale dermatology residents a few lectures per year. Second, one month per year, I am the consult at Yale New Haven Hospital, and this involves teaching residents as well. Lastly, I am a research mentor to medical students, graduate students, and post-docs in my research laboratory. I really enjoy teaching, and I always try to instill clarity and fun in my teaching, just like my early, ORHS teachers."

In his undergraduate program, Chris sought a research experience, an academic extra he was able to incorporate into a busy, four-year program of studies due to the almost full year of college credits earned via AP coursework at ORHS. He performed research investigations in a structural biology lab with a mentor, George Stubbs, who would prove to be an important advocate in his later pursuit of a combined MD and PhD program.

Chris wrote, "In my senior year of college I realized that I wanted to be a physician-scientist, but since I did not have an MCAT (Medical College Admission Test score result), I was in a pickle trying to get into the Vanderbilt Medical Student Training Program." However, he gained acceptance based on strong recommendations from his undergraduate professors and his research. He subsequently completed his PhD research on DNA repair mechanisms associated with xeroderma pigmentosa, a rare skin disorder which further inspired his interest in dermatology.

In 2008 Chris moved to Yale, and in his first year as an intern practicing internal medicine at the Yale New Haven Hospital, he garnered "The Intern of the Year Award." He served his residency in dermatology in 2009-2012 and pursued a post-doctoral fellowship (2011-2013) in the lab of 2009 Nobel Laureate, Thomas Steitz who won the Nobel Prize in chemistry for his ribosome research. Subsequently, Chris continued his work at Yale with an instructor's position in the Department of Dermatology where he now serves as an Associate Professor and where he inhabits the lab research space vacated by Steitz. Chris is now well established and advancing his physician-scientist career in an atmosphere he claims is the best place possible for his work.

Asking about his patient practice, Chris replied, "I see patients approximately two days per week, with the rest of my time dedicated to biomedical research. The math of life really adds up to doing research 100% of the time, plus 40% clinic. I see about 4,000 patients per year. I find the research/clinic balance very rewarding. I enjoy taking care of patients, and at

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the same time, the connection with clinic helps me ask better questions on the research side. I do general dermatology as well as dermatology surgery."

In 2017, Chris was awarded "The Young Investigator Award" by the American Academy of Dermatology. Seeking further insight into the research side of his life, I asked Chris to explain. He answered with a chronology of his life experiences as follows.

"At its core, my research lab is a structural biology lab, using x-ray crystallography and cryo-electron microscopy to determine structure of proteins and nucleic acids and their complexes. My first exposure to crystallography was listening to my dad talk at the dinner table about his research, as well as being excited that his experiments were going up into space! My first hands-on experiments with protein crystal growth were part of the JJHS science fair, and then after that, I spent two summers during my undergraduate career working as an intern in my dad's ORNL lab. This translated into my undergraduate research on potato virus X in Gerald Stubbs' lab, and then my PhD work studying calcium-building proteins and DNA repair mechanisms. Today I use crystallography as the primary method to determine protein structures relevant to skin function and skin disease pathogenesis. To the best of my knowledge, I am the only board-certified dermatologist in the U.S. who runs a structural biology-focused lab."

I asked for one or two examples of particular research that Chris has found most rewarding. Chris responded: "First, my lab's project studying keratins has been intellectually rewarding. We determined the first crystal structures of the keratin 1/keratin 10 complex, the primary keratins forming the epidermal skin barrier. We actually discovered from these structures a novel mechanism by which all intermediate filaments, not just keratins, assemble. We are now studying this mechanism further and trying to understand its role in skin cancers and cancer pathogenesis. We are optimistic it might lead to new therapeutics."

"Second, my lab studied an acne vulgaris drug called sarecycline. We discovered a new mechanism by which this drug works compared to other tetracycline class drugs. This has been a big advance in the acne field, leading to a better understanding of how current drugs work and how to make better ones for the future."

Asking how the COVID pandemic has impacted his work, Chris said: "Living in Connecticut, so close to New York City, our state was in the very earliest wave of places hit with surging COVID-19. Our clinics and my research lab were shut down for three months, then clinics slowly reopened at 50% capacity and only in the past couple months have achieved pre-pandemic levels. The research, fortunately, has been progressing. The shutdown was a period to catch up on paper writing. There are in fact many skin findings that can occur in COVID infections, but perhaps the most common one I see is hair loss. There are a few types of hair loss that I have seen worsened by COVID infection, as well as in some cases, by COVID vaccines." Chris added that in observing this condition the good news has been that within three or four months most COVID hair loss corrects itself.

Chris reached for the future and a hopeful view in answering my question on what lessons could be learned from the COVID crisis. "I think scientifically there are a lot of positives that can come out of the pandemic experience. First, mRNA vaccine technologies. While companies like Moderna were already working in this technology, the pressing need for vaccines in the COVID era accelerated these vaccines by years. The mRNA technology is going to be repurposed for many other types of vaccines, including ongoing studies into cancer vaccines...and other diseases which will benefit all of mankind."

Continuing with three more examples, Chris wrote, "I think what may emerge from the COVID crisis is a 'scientific awakening.' For any student who thinks math, science, and writing skills are not important, it was exactly all of those factors that came together so quickly to try to find ways to end the pandemic. The importance of scientific research is never clearer. Third, the fact that COVID preferentially, although not absolutely, was more severe in sick and elderly people should renew the emphasis on personal health. Gym classes, sports, hobbies, etc. in school do matter for building a foundation of life-long health. Fourth, it is pretty clear that we are likely to have another pandemic in the next 100 years. We have to find ways to positively work together as nations to make sure this is handled better in the future. Nations need to think more carefully about the types of research they are doing with regards to potential release of deadly viruses."

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Chris added one more, as he called it, "bright spot" during the past year. He enthused about the efforts to reach space by Elon Musk, NASA, and others. "Seeing a new spacecraft built by advanced engineering with digital displays was truly amazing—maybe our generation's version of man walking on the moon. I believe within ten years we will likely have a base on the moon, and within twenty years, it is not far-fetched to think human travelers will be going to and from that base. As someone who grew up watching Star Trek with my dad, I do believe there is a lot of exploration and expansion into space yet to come."

I asked Chris he if would sign up for space travel, and he answered with an enthusiastic "Yes!" However, he would first need to get his family's approval. His wife, Lilia is a clinical therapist who is multilingual in five languages. His sons are Gerard (Gerry), named for his paternal grandfather, and Ian. Though Chris no longer plays soccer, he enjoys watching and coaching his sons in the sport.

Chris Bunick has won innumerable awards, is currently a Principal Investigator on three research grants, and serves as the Chair of the Dermatology Foundation for the State of Connecticut, to name only a few of his additional, professional leadership roles. Our interview allowed me to observe and to rejoice over his passion for science and medicine. Chris expressed a desire to return to his roots in Tennessee in the future, perhaps in retirement, while also saying that he feels he has the best of worlds in his current work and colleagues at Yale. One of Chris's answers, a reflection on his hometown origins, I knew should end this story. I consider it an answer which speaks to the pride this community should feel in their "former children" many of whom are in the broader world making important contributions to society and science.

Chris wrote, "With respect to the Oak Ridge School system, I cannot believe how incredibly lucky I was to have such a strong curriculum growing up. There is little doubt I could not be where I am today without the foundation the Oak Ridge Schools provided me. When I look back, all the programs, classes, AP course opportunities, and experiences with teachers positioned me for the very opportunities I needed to be successful at Vanderbilt and to end up as a physician-scientist. Growing up in a science-heavy and science-famous city was itself inspirational. I always like to joke with patients, when the subject comes up, that my high school had the atomic symbol on it. While some today may view it as a sign of death and destruction, I view it as a sign of an intellectual community coming together to try to achieve something new and unique that, in the long run, would make mankind better. This is the very inspiration that we all try to convey in our daily lives, hopefully."

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Thank you, Benita, for yet another exciting story of a graduate of Oak Ridge schools who is certainly impacting his world in a most positive way.

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Chris Bunick