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Microbes, Medicine, and Astronauts: Reflections on a Collaborative Project

I have often joked that if my long-time goal of becoming a surgeon falls through, my backup plan is to become an astronaut. While I have never worried about finding fulfillment in a medical career, I have also always had an interest in what I call "space stuff" —astrophysics, cosmology, and human space exploration. Over the years, I have pursued this in various ways—minoring in Astrophysics, for one, and visiting NASA facilities in my free time—but it has always been ancillary to my pursuit of medicine. Advancement in a career as specialized as surgery can make it difficult to justify unrelated academic side interests, but even so, I have never quite been able to leave my passion for space behind.

I therefore chose my medical school largely because of its unique partnership with NASA and the opportunity to complete the "Space Medicine" elective pathway. The requirements included working with a research mentor on a project related to space medicine. When preparing for this elective, we brainstormed ideas blending our differing research experiences and interests. We settled on a broad question: could microorganisms be useful in protecting astronauts from harmful space radiation?

This was a daunting project to begin. Although I had worked on several different infectious disease-related research projects in multiple microbiology labs, I knew little about radiation and its implications for space travel. While my mentor was invaluable, I did most of my learning on my own, starting from scratch. I read papers and formulated questions to develop my knowledge of radiation, its impact on the body, and our current strategies to protect against it. Only once I had bolstered my understanding could I begin broadening my perspective of this problem by collaborating with various experts.

Speaking with these researchers–who spanned the country and included radiation oncologists, microbiologists, physicists, and more–was by far the most exciting part of the project. I would start by asking them to explain the state of their field, their own research, and how they thought it might impact human health in space. Our conversations would gradually segue into more speculative territory: What potential solutions do you see to the problem of astronaut radiation exposure? What kind of scientific collaborations would you like to see? What "crazy" or "fringe-science" ideas would you like to pursue?

I noticed two themes in their answers. First, these researchers' ideas always surprised me. Regardless of the myriad theories on our central question I had already encountered or considered, each person I spoke with offered a novel thought that never would have occurred to me, certainly shaped by their expertise and diverse personal perspectives. It was fascinating—and of course informative—to hear the breadth of possibilities from each individual, especially on such an unconventional topic.

Second, everyone I spoke with stressed the importance of multidisciplinary collaboration for advancing astronaut health. There is no "singular expert" in astronaut radioprotection. The problem of protecting astronauts from potentially deadly space radiation is complex and multifactorial, so viable solutions will

demand input from many fields. Whether that solution is based on microorganisms, like I was investigating, or on other strategies entirely, the researchers I spoke with each affirmed and echoed that the answers I was looking for would have to draw upon the wisdom of many.

These researchers all had expertise that was deep within their individual fields, but narrow within the overall challenge of astronaut health. Synthesizing this expertise allowed me to assemble a meaningful understanding of an incredibly broad topic and write a paper proposing potential solutions. The ideas we put forth will require even more multidisciplinary work to develop and apply, but I hope some of them will eventually improve our ability to protect our astronauts.

As I interviewed for residency, I was frequently asked about this project and how it relates to a career in surgery. It sometimes feels like the rapid advancement of medicine silos researchers and clinicians into their own fields, but my diverse interests within and outside of medicine have more often contributed to, rather than detracted from, my success. Clearly this project will not enhance my suturing skills or my ability to diagnose appendicitis, but I strongly believe that it will make me a better physician overall. It has given me a greater willingness to look for answers outside the box, synthesize many perspectives, and pursue a holistic understanding of new problems. Surgery, and medicine as a whole, are constantly advancing fields, and the best doctors are those who can accept and employ new techniques and technologies in their daily practice. I am confident that this, among other multidisciplinary experiences, will make me the type of surgeon who both embraces and contributes to the progress in my field. And maybe, one day, it can even get me to Mars.