# VIEW FROM THE CUPOLA

By Anna-Sophia Boguraev | M.D.-Ph.D. Student at Harvard and MIT

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**In the summer of 2015, I was a 17-year-old high school student at a space conference, surrounded by astronauts, CEOs, and scientists. My only space experience was when I was four years old and built a cardboard rocket ship and then spent the afternoon crying because it wouldn't fly. Back then, I didn't know much about what it meant to be a scientist, but I did know that when I looked into the night sky, I felt something pulling me to dream bigger. I couldn't have imagined that one day I'd send a real experiment to the International Space Station (ISS).**

I watched rocket launches and spacewalks outside the ISS, all the while wondering what it would truly mean—and what it would take—for us to live, not just survive, in space. It was that excitement and curiosity that drove me to enter the first Genes in Space contest, an annual student research competition founded by Boeing and miniPCR and supported by the ISS National Lab and New England Biolabs. Since then, everything I learned from Genes in Space has shaped my current career. As an M.D.-Ph.D. student at Harvard Medical School, I'm learning to solve complex medical problems in low-resource environments, a skill I hope to apply both internationally and beyond the stratosphere one day. Before Genes in Space, I didn't even know this kind of science was possible, never mind something I could do.

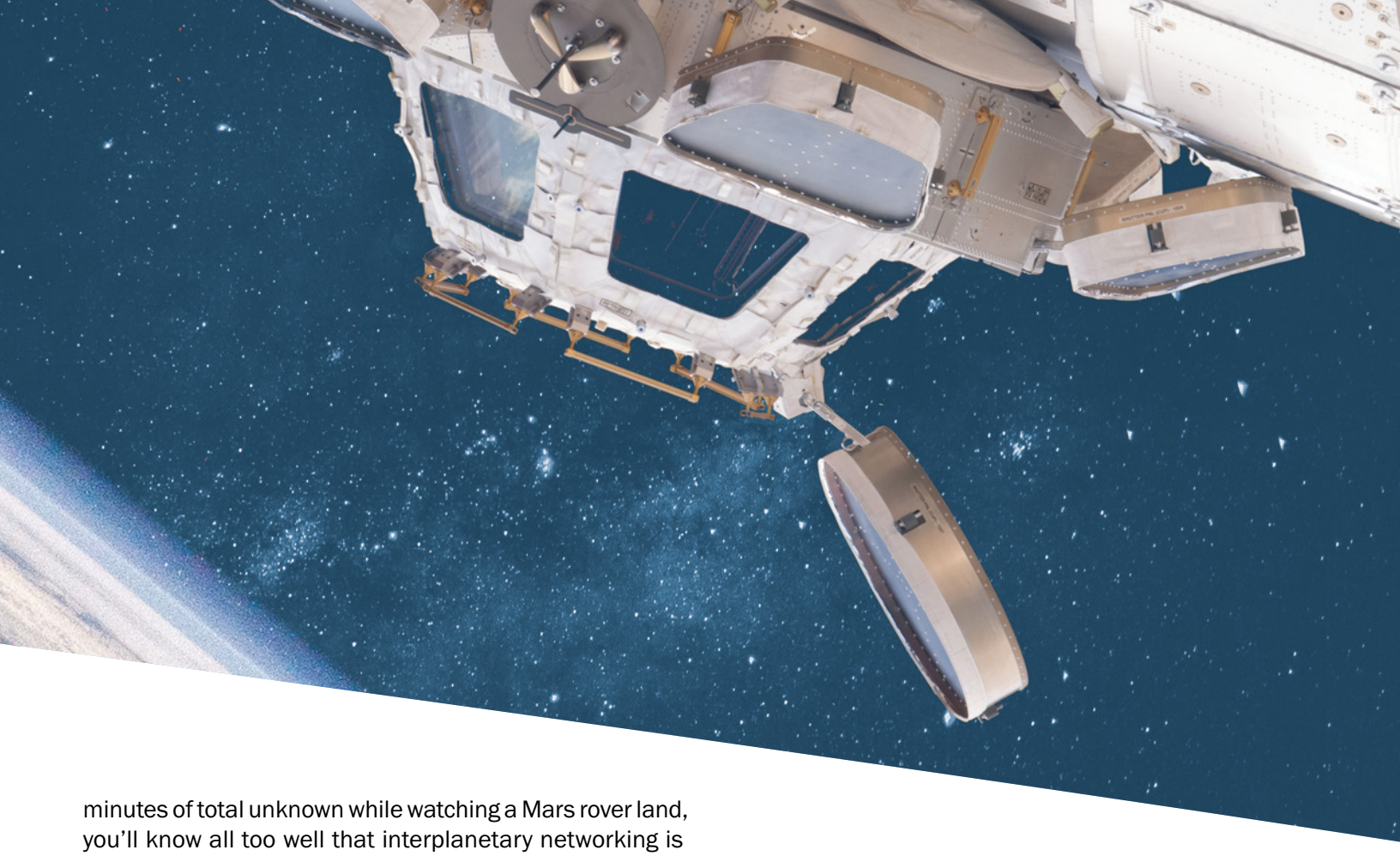
And I'm not the only student to learn how much is possible when we remove the variable of gravity. Over the last decade, I've had the good fortune of staying involved with programs like Genes in Space. I've seen how the opportunity for students to dream bigger, connect with a network of people solving problems in space and on Earth, and watch their own science launch to the ISS has shaped a generation of high schoolers. Many of these students have become my dear friends and colleagues, and all of them have been inspired by a curiosity that is no longer gravitationally tethered.

My time with Genes in Space also led me to spend a summer at NASA Ames, where I worked with a phenomenal team of fellow college students, problem-solving and launching high-altitude balloons. It was there that I realized I wanted to be a doctor and a scientist—someone who, one day, stands with my feet on the ground and my eyes to the sky, bringing science done off the planet back to help patients still on it.

Educational programs like Genes in Space, which enable kids with big dreams and exciting ideas to consider space as an intellectual playground rather than a distant, unreachable place, are essential to developing the STEM workforce and space innovators of tomorrow. The eager students of today—who are in awe at space conferences, running around the expo, snagging astronaut keychains while learning about what we can do, and what we hope to accomplish, in low Earth orbit (LEO)—will be the astronauts, engineers, and scientists of tomorrow. They are the ones who will keep our future space stations and interplanetary outposts running and push the boundaries of what we think is possible.

In this issue of Upward, you'll hear about some of the scientists who are problem-solving for this spacefaring future and how Genes in Space has kept students involved and excited over the years.

The cover story highlights Spatiam Corporation and the technology it's developing to enable interplanetary Internet for communications and data transfer in LEO, on the Moon, and eventually on Mars. If you've ever endured the several



minutes of total unknown while watching a Mars rover land, you'll know all too well that interplanetary networking is challenging. The long distances data must travel results in delays, and planetary motion disrupts the connection. Spatiam utilized the ISS to successfully validate a commercial platform that enables networking in this challenging environment. In the future, technology like Spatiam's will be essential for maintaining connectivity across space stations and planets, ensuring seamless science and supporting the emotional well-being of astronauts as they expand human knowledge beyond Earth.

In the second feature, you'll learn about the past decade of Genes in Space and how the program has shaped the lives of many young scientists. From medical school to astrophysics Ph.D.s to tech startups, the alums of Genes in Space are thriving in their fields, and many are still chasing that passion for the stars that brought them to the contest as high schoolers. With the increasing commercial interest in space, we now, more than ever, need to support eager students (like me!) to build the space workforce of tomorrow.

Finally, you'll read about a brilliant biological innovation made possible by the microgravity environment of the space station—the same quirk of off-Earth science that made me so excited a decade ago. Encapsulate, a Connecticut-based startup, is using the ISS to culture 3D tumor models grown from cancer patient biopsy samples. These models enable a rapid and truly personalized evaluation of which chemotherapy drugs are most likely to treat the patient's cancer effectively. Not only is this platform revolutionary, but it also demonstrates the viability of space-based diagnostics as a tool for patients both on and off the planet. Not to spoil the story's ending, but so far, Encapsulate's microgravity-tested tumors have a predictive value of 100 percent for which chemotherapy drugs will work.

Together, these features tell the same story that drives me and much of the space research community. Science has always followed the path of the stars—from ancient math, observation, and navigation to current advancements and those of the future that today's students will make. The engineering that will take people off Earth, the biology that will keep them alive, and the discoveries we'll make outside our atmosphere will all be brought back to benefit people here on Earth.

Ten years ago, I was 17, realizing that if I could send my science to space, I could probably do pretty much anything I put my mind to. Today, I'm nearly (I hope) done with my Ph.D. and halfway to becoming a medical doctor. Ten years from now, I'll have a career where I'll consider problems of survival. Whether those problems are untreatable diseases on Earth or the details of human spaceflight, I'll know how to tackle them because I was introduced to the potential of space at a young age, which changed my perspective on what is possible. That's how you make a scientist: You take kids who are curious and make sure they know that the sky is quite literally no longer the limit.