

Under the Microscope



with Scintica:

Anand Narayanan , PhD

NASA Space Biology Postdoctoral Fellow, Florida State University



Scintica had the opportunity to sit with Dr. Anand Narayanan, also known as Sunny, to discuss his research on investigating biomedical questions in regard to space exploration. Sunny is a cardiovascular physiologist and is currently with NASA as a Biology Postdoctoral Fellow at Florida State University. With the support of NASA, he is studying important revelations that will help take humanity to the next level of space exploration! Please read through the transcript of his interview, conducted by Scintica's own Gabriel Escalante, to learn more about Sunny and his passion for building the bridge between the biomedical field and space exploration.

Gabriel: Hey, I'm going to be interviewing Dr. Anand Narayanan, a NASA Space Biology Postdoctoral Fellow from the Florida State University. First of all, welcome Sunny and thank you for joining us today.

Sunny/Dr. Anand Narayanan: Thank you for having me!

Gabriel: What made you decide to get into this career path? What was the moment you knew you wanted a career in the sciences and what drew you to this field?

Sunny/Dr. Anand Narayanan: Well, I've always had a very strong affinity and connection with academics, and so I'm still in academia! I'm really blessed and fortunate to be – I enjoy learning very much! My interdisciplinary, continued experiences, and history are suggestive of that at least. That's what I've always been, even as a kid, I was always very interested in main topics, and many areas of study. I enjoyed experiencing and learning about all subjects.

Though, I have an affinity to NASA, to the exploration of space, and in particular humanity's exploration of space. That just fascinated me as a kid: our human space exploration efforts and our international effort. The collaboration by US leadership, but also a partnership with Canada and European Space Agency and countries from Asia, South America, Africa, Australia, every continent

really, to work together and discover, engineer, and invent; to push progress towards increasing our knowledge in many areas.

My inspiration as a scientist, I had been interested in various subjects, and I had always an affinity towards noticing differences and that shaped my educational training pathway. I have an affinity towards engineering and sciences because I learned early on, that's what general individuals on NASA were doing; but also, I had an aptitude for the sciences, technology, and engineering mathematics, so that supported my interests. Though, I also had an interest in medicine and in biology. So before going too far along into my education training as an undergraduate student, I'd always been thinking, NASA, from my experiences and knowledge at the time, was primarily in building rockets and space stations, and go to the moon, or Mars or other places across the solar system...Medicine probably did not have much of a tie with what NASA had ongoing.

Then, through educational programs and opportunities, I did learn of a connection – the bridge between medicine and space. And that's what led to my next steps to Texas A&M and that's what's led to my next step here at Florida State, bridging between different disciplines and combining them.

Gabriel: So, you definitely have a lot of experience in your field. We're curious to know, how did you get your job? What jobs and experiences have led you to the present position that you are right now?

Sunny/Dr. Anand Narayanan: Yeah, thank you for that question. And in terms of my career progression, what helped shape my career pathway was being very enthusiastic, being very open to learning, and also being interested in pursuing challenges. The combination of those factors connected and supported my interests in science, in the STEM field in general, and encouraged me to constantly look out for opportunities and programs that I could participate in, develop, support, lead, and, in turn enrich my academic and career experiences.

Gabriel: Based on the research that you're doing for space; would you be able to expand a little bit more in what are the real-world applications that are implied in your research? What is your desired outcome?

Sunny/Dr Anand Narayanan: Thank you very much for that question. That is one of my favorite questions to think about and respond to. Also thank you for highlighting your passion for the space field. There are still many things I am

unaware of with regards to space program, and there's so much to learn. One thing I enjoy about the space community is there's a really rich history and there's so much one can learn; there's so much one can identify ways to get involved.

With regards to the field of space medicine and spaceflight sciences, is the unique direction in the human space exploration projects that I think has more of a tangible application compared with any other space related activity. Though, I'm biased to saying that being in the field, but let me explain why.

In the context of space applications and technologies there's really a lot. You highlighted ISS and there's rockets, there's rovers, but fundamentally all of these technologies and engineering systems are for us to learn more about the universe, and also in particular support our progress into space. Whether traveling to the moon, as we have done before, or spending time in space through habitats like the International Space Station and learning about the environment and how we respond to the environment, we can address very unique and different challenges that we can't really experience here on Earth.

We learn about biology and maths in a way that provides a different perspective that biomedical research here on Earth studies and discovers. We can use our knowledge and approaches and what we learn from the space projects to learn more about medical questions here on Earth. For example, from my own experiences, we were working together on a space related project and studying how certain organ systems were adapting to the factor of microgravity in space and made a discovery of how the organs adapt to that unique space factor; but then discovered that those concepts and questions had not been thought about in medical conditions of those organs.

Gabriel: What was the most challenging part of your research and simultaneously what was the most enjoyable part of your research?

Sunny/Dr. Anand Narayanan: Certainly, there are many challenges and many elements of research that I enjoy so this is a really tough question. But in terms of challenges for myself – the two are somewhat connected in a way. Space projects are challenging in the context that they're very different from projects here on Earth from many perspectives. From resources available, from what can be studied, from the frequency, and from the kind of hypotheses that can be really tested and investigated.

Gabriel: What is the defining moment in your research that you were like: "Wow, this is amazing! This is a great discovery, or advancement!"

Sunny/Dr. Anand Narayanan: Thanks for that question. So, from my perspective, there may be a few different ways to think about that question. In terms of defining moments, one significant moment from a career perspective was the discovery that there is an interest in the human condition and how people adapt to space – that was incredibly defining for myself. A defining moment in my research experience to date is recognizing that research allows for failure and how research hypotheses can, based off of the experimental results, can match or go against the research hypotheses. But then in turn, the data is the data, and it provides us new knowledge with regards to the area study. That's very much a topic I enjoy very much to think about in the context of space research, as the environment is very, very novel, and in turn provides a unique way to approach previous knowledge or our understanding of physiology in unique ways, where that may not necessarily fit with what previous studies have shown because of how unique the environment of space is.

So, for example, as a doctoral student there was a little bit of knowledge of the digestive system in the context of space, and I learned more about it in the context of medical conditions. There hadn't been a lot of investigation in the context of space research and that was curious to me, as there were some studies from a nutritional perspective in the context of the digestive system, but nothing very comprehensive. And in turn, when thinking about this and researching this question more, and also, I was being supported by Texas A&M that provided an opportunity to not only think and research about this question, but actually conduct experiments in collaboration and being involved with various studies to really look closely at this question, this led to in an investigation and exploration of a new adaptation to spaceflight environment factor, microgravity, that hadn't really explored before. That moment really shaped my direction as a doctoral student. It ultimately led to my dissertation project, so specifically it was a very defining moment for my doctoral degree, but also it was really the opportunity to think about a question that hadn't really investigated before and studying it and testing it and failing and really confirming it was the unique finding it turned out to be. It was a really great experience in terms of how to think about research and how to think about

experimental design, and how space really provides a unique perspective to think about biological adaptations.

Gabriel: You mentioned a lot of about your findings and your passion. Would you say that when you mentioned about the adaptability in space, would this be one of the most surprising scientific findings you've encountered or probably the most important?

Sunny/Dr. Anand Narayanan: Great question. So, in the context of most surprising – it was! It was contrary to what I was reading about and literature and contrary to the space literature. And it was important to me as it was related to my own graduate work. NASA also found it an interesting question and inquiry of study. I was really blessed to be supported by NASA and to present at their Biomedical Research Conferences and share the results. Part of that work actually also continued as part of my study as a postdoctoral fellow while being supported by NASA to closer investigate this finding in a different space related context.

And yes, much of our knowledge and most of our studies will still have been specific to studies of space of us being on International Space Station. It's great that you mentioned Mars where that has been a long-term target, and we're actively thinking more about Mars and in particular we are thinking about how factors on a mission to Mars are different than what a crew such as Chris Hadfield and many others experience on the International Space Station or what they may experience on the way to the moon. A big one is radiation: the type of radiation that a crew to Mars may experience is very different. That's another area of inquiry that is important in terms of studying what those effects are and how they may have an effect on crew health.

Gabriel: Thank you so much Sunny. Having this in mind, let's move on forward to your ultimate goal of your research. What do you want to achieve with your research?

Sunny/Dr. Anand Narayanan: Thank you for that question. In terms of achievements, I've been very blessed, and I've really enjoyed being so actively involved with NASA and our human space exploration efforts. I've had a lot of personal professional satisfaction already and appreciative of the many opportunities I've had to support human space exploration projects. I would of course very much enjoy continuing this forward lead and increase our

knowledge of biology in the context of space, and also how that may help us identify new ways to think about medical conditions here on Earth and even treatments. Though a large motivation for my academic interests is also to encourage and inspire the next generation of esteemed scientists and engineers and really all disciplines to become involved in space. There's really so much more to be discovered and so many ways to get involved. That for me would be my greatest achievement in terms of career; to have many more individuals become involved in answering of the endless number of questions and topics that we particularly know very little about in the context of saying "Mission to Mars" or even going back to the moon.

Gabriel: Thank you so much, Sunny. Definitely your passion inspires other people. Trust me, you're inspiring me to know more about space right now. Let's continue with your research. What is the coolest thing about your work and research? Do you get to meet with astronauts, or do you spend a lot of time in the lab? I know there are a lot of factors involved that are a lot of fun, but also, I know it's a lot of work.

Sunny/Dr. Anand Narayanan: Certainly, my most favorite element of research are really the many different people I get to interact with. I've had interactions with astronauts, NASA scientists, engineers, professors, postdocs, grad students, undergraduate students, and really interesting individuals like yourselves – the Scintica team! And really that's the coolest part of what I get to do is get to really interact with so many different people from all over the world through conversation and start thinking about space and are eager to learn more. So that's from my perspective my favorite part and the coolest part of what I get to do.

Gabriel: Would you be able to elaborate more about the type of equipment that you use and if it differentiates from other labs that you've visited or labs that, you know just in general, because I know every research is very specific to the researcher needs and what you're trying to find.

Sunny/Dr. Anand Narayanan: Yes, thanks for the question. Yes, I enjoy very much with the field in science how equipment tools are really critical as part of the scientific project in terms of what kind of hypotheses that could be actually tested, the type of kind of observations that can be made, and the kind of results that can be determined. So, in terms of equipment, I'm a cardiovascular physiologist, though outside this interdisciplinary background I do have

experience with various types of equipment and tools, and that has really expanded my scope of the kind of scientific questions I think about and can plan for. As a cardiovascular physiologist, the specific tools and equipment that I specialize in can be like the Myography in terms of testing the function of elements of the cardiovascular system; and the Doppler Ultrasound in the context of non-invasively quantifying cardiovascular function. And then to learn the function and understand how the mechanism varies in the biochemical approaches and how various elements of the cardiovascular system adapt intrinsically and then explain those observations that are seen from physiological level is done with techniques such as Western Blot, or Histology, or to look beneath the surface; so to speak of it at the micro level and then coupled to our more big picture. In that way we study science from a, in my opinion, a very holistic and comprehensive approach, and also translational. As a basic scientist, I very much appreciate the discovery scientists and discovery science, but also having an engineering mindset, I think about how these findings may also connect with what patients are seeing for a medical condition, but also with the space research, what kind of adaptations astronauts may experience when they travel into space and predict or think about some of their health adaptations. And the tools available to say those scientific questions are critical.

Gabriel: Thank you for the answer. So, let's move on to a new direction. What advice would you give to young people or the next generation coming up that are interested in a similar career as yourself?

Sunny/Dr. Anand Narayanan: So, my favorite question! From my perspective being open minded, enthusiastic, curious, hardworking, and looking for challenges are some of the elements that have been critical to my career pathway – and enjoying the journey as well. Going back to my earlier comment with regards to failure, enjoying the moments of failure as those are the moments that really profoundly launched my career development. So, I actively look for failure and look for ways to figure out how to learn from those failures, and that's what has led to learning a lot.

My approach has been investigating and learning about different fields; so being open minded about having an engineering background but going over to a community of biologists and asking silly questions and not worrying so much about the failure of the answer but learning from the answer.

I learned more about biology by approaching the science questions I have in mind with that kind of perspective, and in turn, thinking about engineering projects in a different way. And similarly, from a biological perspective, going over as a cardiovascular physiologist, and having conversation with individuals outside my field and asking silly questions and even basic ones, like how does a skeletal muscle work, because it works very differently from vascular smooth muscle cells, and that's a difference. And that difference may have a unique biological context in my area study and that's silly question may lead into a really innovative new research project even though it may have failed to have an answer at the beginning. That's my general advice and encouragement that has been really key to my career progression as a scientist.

Gabriel: Thank you Sunny for those empowering and inspirational words. Yeah, you got to adapt for failure. It's a good way for someone to learn and just adapt to the new situation – really fascinating! Thank you for providing those words. And let's move on to the final question. So, back to your research. What is the future direction of your research? What comes next and what are the next steps?

Sunny/Dr. Anand Narayanan: Thank you, that's a question I'll have trouble to think about and respond and I'll use the excuse of my research experience being very interdisciplinary and having very many interests. So, in terms of future next steps, certainly developing into more independent research scientists and research lab and focusing on specific research questions. Though also in particular, supporting the next generation of esteemed individuals. So generally speaking, I am looking forward to very much these next steps and thinking about how to study and explore the many space biomedical research questions that exist and have yet to exist.

Gabriel: Thank you Sunny, just out of curiosity this is just one additional question. Do you have any role models that inspired you to become the multiple titles that you have? For me, it's Steve Irvin and it definitely helped me out because it helped me shape the person I am and how I care for animals and passion for what I'm doing. So, I'm just curious to see if you have a similar figure or someone that you look up to in your research in your area, of course, or just in general, to be honest.

Sunny/Dr. Anand Narayanan: Yes. Thank you for that question. In terms of role model, I have a few from a career perspective. One includes Neil Armstrong in terms of him being a pioneer. I also admired Carl Sagan. Growing up as a

scientist his broad appreciation of space and his manner of communicating science is something I've admired and appreciated very much. And then also Katherine Johnson, a more recent famous figure, so to speak. We have a close connection where she grew up in the same place I grew up, and the first NASA center that I was involved with now has been renamed after her. So, it's also a personal professional connection there, as well as her long history in supporting our human space exploration projects. So those are a few.

Gabriel: Thank you so much Sunny. We have reached the end of our video. And thank you to everyone for joining us. But most importantly, thank you Sunny for joining us today and answering all the questions that we had. It's always a pleasure to see you and I hope that we get to see each other again through the Scintica team and discuss more about your research because that's what we love doing. Thank you so much Sunny!

Sunny/Dr. Anand Narayanan: Of course, my pleasure. It was great seeing you all and thanks again for having me. I look forward to also staying in touch and thank you. I really appreciate it.