INTERVIEW

“I am an unabashed optimist about the long-term future of science.”

Illustration by Shonagh Rae

Neil Shubin, the new president of the National Academy of Sciences, talks about learning to see as a scientist, leading the Academy during a challenging time, and communicating science in a noisy information landscape.

Renowned evolutionary biologist and new National Academy of Sciences president Neil Shubin is the author of the critically acclaimed book *Your Inner Fish*. His book combines insights on human anatomy and molecular biology with the story of the expedition he led that made the breakthrough discovery of *Tiktaalik*—a fossil representing an intermediate body plan between fish and amphibian. Previously, Shubin was the Robert R. Bensley Distinguished Service Professor of Organismal Biology and Anatomy and vice dean for academic advancement at the University of Chicago, where he led a dynamic multidisciplinary research laboratory that has integrated breakthroughs in paleontology with an understanding of the molecular biology of development.

Shubin takes the helm as NAS president this July. His role includes chairing the National Research Council, the operational and research arm of the National Academies of Sciences, Engineering, and Medicine. We sat down with him to discuss how he plans to lead the institution during a turbulent time for science, his thoughts on how the research enterprise could be reimagined, and how he sees science evolving in the (very) long term.

You are known for discovering an awesome and revelatory giant fish fossil. When you were a kid, was that what you imagined doing?

Shubin: I knew I wanted to be a scientist. I liked science broadly. I loved astronomy. My parents bought me a small telescope when I was a child and I'd make drawings of the moon. I was one of those kids who would walk around with a Golden Guide to minerals or dinosaurs. But as a kid, I wasn't quite sure about the fossil thing—it was really more natural history, math, and science that interested me. It wasn't until later in my career that I discovered a passion for evolution and fossils.

And you're very well known for seeing fossils. How did you learn to see as a scientist?

Shubin: So much of that is a process—it's lifelong learning. You're always learning to see in new ways. And there's seeing in terms of the physical act, the optics, and the neurobiology of actually seeing. But there's also seeing conceptually.

Learning to find fossils means experiencing a whole lot of failure. To find a fossil in the field really takes a lot of trial and error, and it's mostly error to begin with. So the first thing you learn is to be accepting of your errors, because that's a big piece of it. But learning to see also means learning the concepts of a field, learning the history, the background of the science—and that's learning to see in a whole different way.

So much of being a paleontologist or evolutionary biologist means learning to see the fossils in the rocks but also learning to see what they mean and what they tell us about the history of life and our planet.

Given what you have already accomplished in your career, why did you want to take on this new role as president of the National Academy of Sciences?

Shubin: The moment we're in is a very consequential one for science in America and across the world. And I think leading the Academy is a very important opportunity for me to contribute in a meaningful way to the quality of science, to the way science can impact society, to the career trajectory of scientists, and much more. The NAS represents so many of the values, the principles, and the things I care about.

I see the National Academy of Sciences as this sort of hidden jewel, although it is known very well to scientists and policymakers. But what most people don't realize is that the Academies have played an important role in our growth as a nation and our emergence as a scientific powerhouse. To be part of that is an honor and a privilege. Being president is also going to have lots of challenges, but all of this appeals to me.

You're coming into this job at a really challenging time for science, with a lot of turmoil in the policy and funding arenas. What do you see as the role of the NAS and the National Academies at this moment?

Shubin: We have to double down on what we do well. We need to recognize the best science and the scientists who've done that work through our various membership activities, awards, and so forth, but we also need to recognize the best science as it applies to the work we do to advise the government, private foundations, and other sponsors.

When we look at what the National Academies can do, they have produced, over decades, thousands of reports for the government and other entities, which follow a process which is truly a gold standard. It tries to remove conflicts of interest and biases to provide nonpartisan, evidence-based advice grounded in the best science.

There is an enormous opportunity for outreach because the Academies have all this important content. We have thousands of reports and publish thousands of papers in our journals each year. Our job is to push this knowledge out in ways that matter to the general public, so people can see "Why does science matter in my life?"

Scientists must be elected by their peers to be members of National Academy of Sciences. It is a high-level membership organization, but at the same time, it is charged with providing advice to Congress. Do you think there are tensions between those two functions?

Shubin: The biggest tension to me is that a lot of NAS members don't know what we do on the [advising] side. A lot of people, when they're elected, it's a big deal. Their department throws them a big party, they pop some champagne, they put the National Academy of Sciences on their curriculum vitae—and that might be the last we hear from some of them.

The membership piece is extremely important because recognizing the best science is what we do and it's what we've done since the days of Abraham Lincoln in 1863. But our biggest impact on society has come from our advisory work. I don't see it as a tension per se, but sometimes [membership and advising] spin too far apart, and I'd like to pull them together more.

Part of that requires working with Congress and this administration. What are your plans for doing that?

Shubin: What sets the Academies apart—the superpower of this organization—is our ability to take on almost any subject and leverage the highest-caliber science and technology experts to reduce policymakers' uncertainty, limit risk, and identify opportunities. When Congress or any administration asks for advice, we're here.

The White House Office of Science and Technology Policy has signaled its intention to pursue a new paradigm for federal funding of research, moving away from the model that the United States has had since World War II. What role could the National Academies play in informing those efforts?

Shubin: What the National Academies can do almost uniquely is to call for a broad, multisector conversation involving academia, industry, private foundations, and government partners to ask the question: What is the best ecosystem for promoting science discovery and innovation and what does that involve—all the way down to STEM pathways and all the way up to funding and publication? Our role here is not to provide a policy. Our job is to provide what the science says and what the data show in terms of how to promote the best science.

Do you have your own ideas about what a reimagined innovation ecosystem might look like?

Shubin: I come at this, obviously, like anybody who has lots of ideas on how best to promote discovery and innovation. But those ideas have to be tested against reality.

I would not be talking about the fish that my team discovered if we didn't have long-term funding that allowed me to fail and learn from failures. The only way I was able to learn from failures was to have long-horizon funding, when I wasn't being measured from year to year, because there were about five of those six years where the team and I were not successful. Long-horizon funding allowed me to try, fail, and learn from those mistakes. What I'd love to see is for that kind of strategy to be deployed more widely.

At the same time, there are some other areas that we really have to reconsider. For example, scientific publication itself—that world is changing. Right now, career trajectories in science often depend on publication metrics or grant metrics. We have to ask, do those metrics really measure what we want—which is impact, scientific impact? And that can be challenging to measure in real time.

Will universities continue to be a driving force for US research?

Shubin: Universities are certainly going to be a major part of the equation. They are a robust engine for science, often the long horizon, discovery-based science that applications depend on. There are certain branches of science which are very university-driven and that's not going to change. I wouldn't have survived in industry looking for a 385-million-year-old fossil fish. Or at least not a profitable one.

But how that all fits together is in flux at the moment. The university model may have to change. We have a demographic cliff of fewer students entering college, so that's going to shake things out. Research and development are much more supported through industry than public sources and universities today, so there's that part of the equation too. In some fields like quantum computing or nuclear fusion, partnerships between industry, universities, and the public sector, properly done, could be the best of all worlds—bringing technological advances to the country and jobs to local communities.

Do you think the next generation of scientists is going to be able to have a career like yours?

Shubin: Mine wasn't always perfect. The future could be better in a lot of ways. I just want to make sure it's a lot better. One of the things I really want to explore when we reimagine the ecosystem for discovery and innovation is, what are the career pathways? How is AI changing that? How are new models of publication changing that? How will new models of funding change that?

These are all ongoing questions—they're not one and done, where a committee makes a recommendation and we move on. They really need continual attention because we live in such a fast-changing world. That's also why I think we need a multisector conversation—not just academics or government or nonprofits or industry alone, but together.

Based on what you're saying, is what it means to be a scientist going through an upheaval right now?

Shubin: It's not just about science—what it means to be *a human* is up for grabs at the moment in this age of artificial intelligence. Why should scientists be any different than all the other white-collar workers that are looking over their shoulder and marveling at what AI can do?

To me, what it means to be a scientist is to have an outlet for curiosity, creative problem-solving, and passion to understand the world we live in. That's not going to change. That's part of the human spirit, and we are an extension of the human spirit. Science is one of the great manifestations of human creativity and intellect. There's no computer program that's going to change that.

What may change is how we do science. It may change our career trajectories. It may change how we publish and consume scientific results. It will change our relationship with technology. But there are certain things that I remain ever optimistic about, and one is the transformative power of human curiosity, the creativity of asking new questions, and an ability to make sense of our world. AI models are trained on existing data. Scientists are at the frontier of knowledge, often understanding what experiments did not work, knowing observations that were not published, or appreciating the quality of data in a way an AI model does not. There's enormous value in that.

You're an accomplished science communicator. We've heard a lot over the years about how important it is for building public trust in science. Do you see gaps in the way that science is being communicated to different audiences, and do you have any ideas about how it should be improved?

Shubin: When you think about science communication broadly, we can't just think about one strategy. It has to be many strategies because people are different—their values are different and their life situations are different. Our job is to touch them in a diversity of ways that work for them and their situations.

For me, it really was the awe-and-wonder of the natural world that drew me into science. I'd sit there with my telescope and draw the craters on the moon thinking about *When did that asteroid hit?* and how the moon was pummeled over the years. It was just sublime the way it transported me to another world at a different time long ago. And that was when people were beginning to walk on the moon. Awe and wonder pulled me into this enterprise, and I know that matters to a lot of people.

But for other people, I think it's much more the practical side or the puzzle-solving side. One thing I think we really have to do is show people why the science that we do and the science that we've done really matters to their day-to-day lives.

We live in a very challenging age with regard to science communication. We're competing against social media, which tends to reinforce people's existing beliefs. We're competing against lots of information out there of varying quality. We're competing for relevance in a world where people are deeply influenced by the voices they hear more than the science itself. Communicating in that increasingly noisy information landscape is a challenge, but we have to do it.

AI is becoming ubiquitous in our lives and in science. Do you see AI changing the way the National Academies do their work and in the way they communicate?

Shubin: AI will certainly be able to help us improve, but it also creates challenges; it's a double-edged sword. It's important for us to be aware and vigilant, but also, we should be open to ways we can improve. If you think about what publication will look like in the future, if an AI model has been trained on multiple journals and scientific papers, it changes what a scientific paper means.

It also could change what we could do with the Academies' work. What if we trained AI on all the reports that we've done over the years and all our journal papers? We could develop resources that allow people to type in "What's the latest on water quality?" and then they can get access to our reports in a manner that's suitable for them—whatever level they are, whether a kid doing a term paper, a teacher writing a lesson, somebody in the general public, or a policymaker. It could change how we communicate with the outside world, with our sponsors, and beyond. It can also change how we do our work. It's a multiplier of what people can do.

Your work as an evolutionary biologist definitely takes the long view—a very long view. What is your long-term outlook for how science is going to evolve in the next century?

Shubin: I am an unabashed optimist when it comes to thinking about the long-term future of science. When you look at what science has been able to accomplish, increasingly so over the millennia, and then the speed it has moved recently, it's truly stunning and remarkable. Just think about the ways we're understanding the universe, life, the planet, social systems, and what that can mean for our lives.

Now short term, we have lots of challenges, enormous challenges. We have enormous challenges with the STEM workforce. We have enormous challenges with science funding. We have enormous challenges in accommodating AI. We're facing challenges and disruption in the short term, but it's hard not to be an optimist in the long term, when you look at what science is accomplishing now and what it can accomplish in the future. I see science as an expression of some of the greatest aspects of humanity.