The Personal Matter of Physics

Old Dominion physicists explain the appeal of a life's work to interviewer James Schultz.

Charles Hyde-Wright

Reality's Consequences

I was always interested in science and the human race's ability to understand the world in the most general sense. We can turn our ideas into technology, into practical applications. But I've always been more interested in ideas. I'm more of an abstract kind of person.

In Berkeley, California, where I grew up, I was strongly influenced by the fact that my father was a nuclear chemist ... I can remember watching PBS programs on particle physics and enjoying them. I like the power of mathematics. It has its own internal sense. On the one hand, mathematics exists by itself. On the other hand, physicists have shown that any branch of mathematics describes the world. There's a whole set of consequences within mathematics. There are also surprises: structures built upon structures built upon structures. I think physics is the pre-eminent discipline in which we tie equations to the real world. We look at a piece of reality and it has consequences.

Nobel laureate Leon Lederman has estimated that 30 percent of our gross domestic product is directly due to our theoretical understanding of quantum mechanics. Again and again our ability to construct a theoretical model of the world has consequences — technological consequences. Look at computers. They've gotten faster and faster and cheaper and cheaper. Our ability to do this is entirely due to our understanding of the physical properties happening inside the silicon from which we build microchips. That will change in 20 years as we go even smaller. When you go from microns to nanometers, the internal structure of a computer changes radically. And you have to understand how fundamentally it works — and, so, physics.

There's no lack of ideas in physics, no lack of new technology. In physics we're constantly finding new phenomena. The end is not in sight.

Leposava Vuskovic

One Step Deeper

I grew up in Belgrade, Yugoslavia, where I didn't know prejudice of any kind. I was shocked when I discovered the concept even existed. There was no pressure to be or not be something. I felt free to develop my mind. No one told me that physics wasn't right for a woman. It was not an unusual choice for a woman to make.

Math was intriguing to me, but only if it was employed in something like physics. I was most attracted to its applied side. Otherwise, I felt it would have been an exercise in futility.

What physics answers is how everything works, not why nature works. God will answer that. But if you understand nature you can apply your knowledge to making many useful things. Before you understand a thing you cannot make full use of it. In medicine, for example, there have been many ways physics has been applied, from medical lasers to diagnostics. All are based on physical principles.

Good physics research requires a lot of supporting activities — a good machine shop, secretarial service. Everybody has to do their job so I can do mine. Every good result gets you one step deeper. It brings you tremendous happiness. You understand something that you, or somebody else, has never understood before.

Physics often stays within its own community. That's not enough. Physics must be transferred in some way to the wider community. It's important to persuade the general public to support physics. We need to tell people that by helping physics to survive, prosper even, you help yourself to survive. A physicist won't necessarily invent or build a device herself, but someone could, someone who understands the physical processes that enable its conception. There are many, many applications that can be used to enhance existing technology and help everyone improve their lives. That's why it's important to support fundamental research in physics.

Desmond Cook

Why Rust Away?

I was born in Australia, in the town of Geelong, which is 45 miles southwest of Melbourne. It was a combination rural and industrial area and one of the main shipping ports in the south. Geelong is still famous for its textiles; but you travel 5 or 10 miles and you'll be in a sheep-farming and dairy area. Because I was an only child I had to amuse myself. So I read books: general science, medical-type things. Math was very interesting to me.

My father was a chemical engineer who was killed when I was quite small. My mother and I lived with my mother's parents. When I was 9 or 10 my mother bought me a chemistry set and Lego-like constructs made from steel. I was always into models, building things like small plastic cars, jets and the like. Playing with different kinds of instruments — electronics, mechanical things — always really fascinated me. I also loved to paint and do woodwork with my grandfather's tools. By the time I was in high school, I took a keen interest in physics. I think it was the experimenting and the hands-on learning. I don't know why, but there were about 10 of us who really wanted to go to university to study physics. We battled each other and it forced us to improve. In this country up to $400 billion is spent annually maintaining and replacing corroding materials. That's a significant amount of money, about $1,500 per person per year. I bring my background in physics to address what really is an engineering problem: I basically want to improve the quality of steels. My specialty is the field of corrosion — more particularly the process and the byproducts of corrosion. What exactly happens when a piece of steel rusts or corrodes? What products form? I delve into the microscopic interactions, which need to be studied at the atomic level.

I made up my mind years ago I would concentrate my research in areas of industrial interest and which were beneficial to society. My goal is to help make bridges and buildings last longer. The longer-term goal is to improve materials overall. That helps everyone.

Mark Havey

The Most Important Mysteries

I was part of a large family in rural Maine. There were six of us — three brothers, two sisters and myself. All of us worked toward our aspirations. My father was a nuts-and-bolts biologist. He would bring home whole fish and put them in the freezer. The whole house smelled of fish all the time ...

I went to an engineering school and majored in engineering physics. I did like literature, though. I was the only techie in the English department. I was also really interested in science fiction. When I graduated, I had an offer to go to work for General Electric making chips for the developing computer industry. It was tempting because they offered me $11,000 a year to start and I knew that I'd soon be a rich man. But poverty called. I started graduate school instead because I was interested in astrophysics. I discovered I was pretty good in physics in general, better than I had suspected ...

As it goes along, physics spawns new technologies. One of its main benefits is the treasures it dumps out along the sides as it goes along on its quest. In physics I was trying to look for understanding of the world in a deeper way. I'm content with what I've found: an intellectually challenging career, an explanation of the things going on in the world and an appreciation of randomness. But the most interesting, the most fulfilling thing has been teaching students how to do experiments.

You go where the experiment tells you to go. You see what your results are telling you. Sometimes the result is fairly ordinary. Other times you find mysteries. It's the mysteries — the things you don't understand — that are the most important. They lead to a deeper understanding of existing physics or entirely new directions in physics. What you hope to do is introduce a new idea or discover something that no one has ever seen before.