>> Physics, if you look, has actually gone back centuries in terms of its applications within medicine, as medicine became more of a science. But, more recently, it has become more and more obvious, as medicine tries to become more precise, and as biomedical research tries to become more accurate and understand the processes, the real physical processes that are occurring at the molecular and submolecular level, that more physics and basic science is needed to understand those questions. So, that has driven the research agenda at the NCI, also. So, we, in fact, now have created programs at the NCI to better help fund and understand the questions raised at those various levels. One of the programs is a radiation research program within the NCI. The University of Maryland is one of the cancer centers of the NCI, and one of their avant-garde facilities is the proton treatment facility.

>> We are working on something called prompt gamma imaging for radiation therapy, in particular, proton therapy or light ion therapy. We are studying how the proton or ion beam interacts with the nucleus within the atoms of a tumor. When the proton beam interacts with these nuclei, it can excite it and cause the nuclei to give off secondary radiation, and in our case, we're interested in secondary gamma rays. These gamma rays can tell us information about the tumor environment, specifically, what type of elements make up this tumor. What is the concentration of oxygen within the tumor? What is the concentration of carbon? And, by measuring and imaging these different concentrations, we believe we could better understand how a tumor is responding to the radiation treatment that it's received.

>> One of the advantages of proton therapy is that the proton stops, which means that if it stops, it's not irradiating healthy tissue past that point. That is also a challenge in proton therapy, because we want to know exactly where it stops, and if that does change, then is it affecting any normal tissue past that point? And so, there are many techniques that are being examined or being studied to see how well we can monitor the range. Protoacoustics is another technique that we are looking at to see how well we can monitor this range in order to safely deliver proton therapy.

>> To expand medical physics, it's very important to do, expand in two areas. One is to connect better to the grass roots of physics and physical sciences on one hand. On the other hand is also to connect better to the medical sciences, not only through the professional involvement, but also on the research.

>> Computation [inaudible] biology helps the future of research in two ways. One is that we can do experiments on the computer that would be very complex to do in reality, or we can even simulate effects that we cannot test experimentally, and that creates a hypothesis to an experiment on a higher level. And, one example is the multicolor simulations. In multicolor, we are tracking single particles through a medium, so that medium in this case would be the patient, and we're looking at individual energy deposition events or nuclear interaction events, and from that we predict the dose that is delivered to the patient at every single point.

>> So, the question arises, how does one better build bridges between these basic physical sciences, particularly physics, and the medical needs for the science that they represent? The American Physical Society, which is the natural house of most basic physics within the United States, has the strength of the physics, but it doesn't have access to the medical questions that are relevant and the biomedical research that is needed. And, an organization like the American Association of Physicists in Medicine does have access to both those questions, and to those patient populations.

>> GMED came out of conversations with Robert and other people. We felt that the American Physical Society and its big March meeting really would benefit from stronger overlaps with the physicists in medicine field. And, there was very little representation at our big March meeting, and in the APS, actually, by physicists in medicine. So, we felt we needed to encourage that, and so we formed GMED to bring that into the American Physical Society in a complementary manner, not as a standalone thing, but as one where various physicists, high-energy [inaudible], all these areas that are represented in APS would now be able to hear what's going on in medicine and begin to make connections between their work and what physicists in medicine do.

>> In addition to that, would like to see how we can better communicate to the young physicists interested in this part of physics how they can find their home, how they can do research, how they can perhaps bring their personal experience, as well as interests, to then contribute to this exciting field of research.

>> I originally came from high-energy physics. I didn't really enjoy it, and I always was sort of interested in medicine, so I decided to look into other alternatives. I wound up going with medical physics. I enjoy working in medical physics because there's sort of an immediate application of what I'm doing. Now, you know, I can see the patients are being treated, and I know that what I'm doing is going to, you know, immediately impact their treatments and help them.

>> Having the strong partnerships, strong friends in the medical science is extremely important to move the field forward together.

>> We're trying to link these communities together in a way that hasn't been done before.

[ Music ]