[MUSIC PLAYING]

RICHARD WEINSHILBOUM: We have drugs for breast cancer, and yet 40,000 women die of breast cancer every year in the United States. And an equal number of men die of prostate cancer. We have drugs for both of them, and we need to find better ways to individualize them.

If we go back to what I call the Neolithic era when I was starting to do this kind of research, and we see the changes that have already occurred, it is mind-boggling. The way we've been used to doing things seemingly forever, but at least for the past 50 years, is going to change. And it's going to change very rapidly.

GIANRICO FARRUGIA: We realized early on that this was a really important opportunity for Mayo to be able to offer to its patients-- the ability to reduce side effects, to choose the right drug, and deliver it at the right time. Dr. Weinshilboum is probably the person that is most responsible for starting this field in the entire world.

LIEWEI WANG: He is the founding father of pharmacogenomics, that particular area, which we look at the genetic and the genetic contribution to drug response.

RICHARD WEINSHILBOUM: At least 30 years ago, we had the idea that it might be possible that who your mom and dad are-- that is, your genes-- might have some effect on the way you respond to the drugs that doctors prescribe for you. When I was in medical school at the University of Kansas, if we saw a child with acute lymphoblastic leukemia of childhood, the number one cancer of kids, tragically that child would be dead in one year. There was really nothing we could do for them. Today, 90% of the children with leukemia of childhood are cured today by the use of drugs. Not radiation, not surgery-- by the use of drugs.

Now, we can test for that genomically, we can predict it's going to happen, and we don't have to expose the child to the danger of having an adverse response to the drug, potentially a life-threatening adverse response. Why does it surprise us that who your mom and dad are and the genes you get from your mother and father play important roles in how you're going to respond to drugs?

GIANRICO FARRUGIA: Most people who receive Plavix as [INAUDIBLE] therapy do well, but 20% of us do not metabolize the drug, and therefore it doesn't work. The question we need to answer, is it a good thing to know the genotype and then choose whether or not to give Plavix, or is it better to just give a different drug, or to do nothing at all.

[MUSIC PLAYING]

Mayo about six years ago started a center that was called the Center for Individualized Medicine that was only focused on research. And then two years ago, we realized it was time to advance. It was time to make sure that we started putting it into practice. And to do so, we created this new center for individualized medicine that focuses not only on the research, but also on the translation, and more importantly making sure that what we translate gets into the hands of our patients as quickly as possible.

MATTHEW FERBER: Mayo Clinic has a longstanding expertise in the diagnostic laboratories, but the technology is only half of the solution when we start talking about exome and genome sequencing. The real diagnostic value is pulling information out of that genome.

[MUSIC PLAYING]

RICHARD WEINSHILBOUM: In cancer, we're doing it in a slightly different way because, in cancer, we have both all that variation in the way your body responds to the drug and handles the drug, and we've got all the mutations in the cancer. So we have to actually determine what the sequence of that tumor is to know what the right target is and how that patient is going to respond. What we're seeing is that each of the tumors has its own set of molecular markers, and you treat them very, very differently.

[MUSIC PLAYING]

GIANRICO FARRUGIA: What I think we will see is that what we originally think about it as specialty care when it comes to genomic medicine becomes much more integrated into the daily life of our patients and our providers. We start seeing that newborns gets their whole genome sequenced, and that genome is stored and then used as needed.

RICHARD WEINSHILBOUM: We'll know the genotypes for-- that is, the DNA sequence variations-- for all of the genes that encode proteins that either metabolize drugs, transport drugs, or are targets for drugs so that, if a doctor writes a prescription for codeine in the future, which codeine is still a fine drug for some people, then immediately the electronic medical record will recognize that this patient already-- we already know in the electronic medical record that this patient has multiple copies of CYP2B6, the gene that makes codeine into morphine, and will send an alert to the physician, your patient might be at risk. Do you want to use this drug, do you want to select an alternative drug, or do you want to change the dose of the drug.

GIANRICO FARRUGIA: What motivates me is the fact that it has to be done fast because, unfortunately, a lot of patients benefit, but some don't. Every day, there are patients who, if we had come up with what we've come up today, would have been helped a year ago. And conversely, there are patients today that will be helped a year from now. We can't keep that year always being a year. We've got to make it months. We've got to make it days.

RICHARD WEINSHILBOUM: It's going to be amazing, but it's going to be disruptive. And wonderfully so, because we need to prevent disease, not treat it.

[MUSIC PLAYING]

SPEAKER: Mayo Clinic's pharmacogenomic research team is currently conducting numerous clinical trials in its fight against breast cancer, prostate cancer, and coronary artery disease. The teams consist of pathologists, scientists, bioethicists, genomic counselors, bioinformatics specialists, operations staff, and medical professionals. The past, present, and future success of these trials has been and will continue to be a direct result of the support provided by the Pharmacogenomic Research Network.

[MUSIC PLAYING]