

[MUSIC PLAYING]

**VADIM  
FEDOROV:**

At the Ohio State University we developed a special program, when we collect an alive human heart. It's directly taken from the chest of the patient-- diseased heart. Then the patient will receive a new donor heart.

So we put the heart in the special ice solution, wash out from the blood. As such, the heart could be preserved for about 24 hours in this solution. Put these tubes inside of their main coronary arteries, which go in from aorta.

As such, the heart could be perfused under 50, 60 millimeters of mercury. It's pressure, the same pressure which will be in our heart.

Then the heart warms up and starts beating back. Again, it can be in a different rate, because most of the hearts, they have different kinds of disease.

After the heart is [INAUDIBLE], we put in all our electrodes-- clinical electrodes. Plus, we focus on our optical apparatus, different cameras. Then, we can inject special fluorescent dye, which can sense electricity.

After we inject this dye, and they put in a red light. We excite this fluorescent probe, and we can see how an electrical wave propagates across the heart. Where is the origin of our electrical heartbeat, how it propagates, and where is the problem? So we can see these arrhythmias from the optical cameras. Actually, simultaneously, we can see 60,000 recordings across the whole heart and visualize whole electrical activity in our human heart in 3D.

And after this, we see, where is the source of this arrhythmia. We put in a clinical catheter exactly on this spot, make this local ablation, which destroys only 3 by 3 millimeters. But it has to be also in the depths to transmit the ablation.

And if we put this on the right spot, we completely eliminate this small [INAUDIBLE] reentry, micro-reentry activity. However, our discovery, specific for the human heart, we call this "micro-reentry," micro-anatomic reentry because we found they always have special connective tissue, fibrotic lesion. And the [INAUDIBLE] activity develops around this connective tissue.

But we can see in 3D, and we can see it's kind of a loop. Provides very fast source of electrical activity in our heart. If we define, where is this loop, we can put an electrode right there, ablate it, destroy it, patient will be free from arrhythmias.

From 50 to 20%, a patient only could we treated successfully long-term from these arrhythmias. So we're looking forward to significantly increase this percentage based on the mechanism which we uncover in the human heart. We should be studying these high-resolution optical imaging, and this imaging can significantly improve patient-specific atrial-fibrillation treatments.

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