

Zebrafish, which any of you who are fish fans here, keep in the fish tank, can get to be about two inches long. It's got a little heart with just two chambers, one atrium and one ventricle, and that pumps blood throughout the whole body, past the gills, which are the equivalent of a lung in a fish. The heart is very muscular just like our heart. Inside there are very thick muscular walls that allow the heart to effectively pump throughout this very complex series of veins. Now let's see what happens if we cut off the tip of the heart. ouch, ow. Don't worry! The fish is OK. It's ok. The fish immediately closes up that wound within seconds the clotting process starts up. Now in our heart what would happen is there would be a big clot and eventually that clot would eventually heal over but nothing more would happen. But Ken Poss and his coworkers recently noted that aside from the fact that there are cells within the zebrafish myocardium in the red muscle that can actually activate like satellite cells and start to divide to make new muscle. There's also this slowly proliferating engulfing layer of single cells on the outside of the heart called the epicardium, which is really a magic layer of cells because it engulfs the whole scar area, and then in a really remarkable series of events that recapitulate developmental biology of the heart, a series of growth factors, in this case a growth factor called fibroblast growth factor is produced by the heart as it's regenerating, and this fibroblast growth factor (FGF) docks into epicardial cells set on the edge of the heart, and those epicardial cells with this signal, know to march into the myocardium, so there they are marching in. Now, the next thing they do, obviously now we're in a macroscopic picture is a very important, absolutely fundamental part of making new muscle, which is to vascularize it. So with the new veins in there the fish ends up with a brand new heart with new muscle, and not only with new muscle but all of the appropriate coronary vasculature innervated, and the fish can actually survive and swim away.