**Lessons learned in tissue regeneration: materials, processes, and animals**

Biomaterials save lives and improve health of millions of people. We can derive biomaterials from a natural source or make them by chemical synthesis. We use the formal for cardiac and nerve repair and the latter for vascular regeneration and protein delivery. Humans don’t regenerate heart or central nerve, but many other species do. My lab studies the effectiveness of using the extracellular matrix (ECM) from regenerative species to repair mammalian hearts and central nerve. We found that matrix from zebrafish was more potent at regenerating cardiac tissues than rodent-derived in a mouse model. The cardiac and nerve functions are preserved better in the regenerative ECM treated animals than controls. However, in our pursuit of a more suitable source of regenerative ECM, we learned closely related species is not necessarily ‘close enough’. On the opposite end of the spectrum, I designed porous grafts made of a synthetic elastomer. We replace a segment of artery in the rat with the graft. The grafts degrade completely and transform into neo-arteries that mimic native arteries mechanically, biochemically, and structurally. This in situ regeneration occurs both in the aorta and the carotid artery. We had encouraging outcomes in rats. However, we learned that sheep model presents its own set of challenges beyond size. I will end with our future direction considering the lessons we learned.