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Don’t Get it Scrambled: Growing Muscle Goes 3D

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The relationship between blood vessels and muscle fiber generation can be described with the well-known metaphor about the chicken and egg; the question being, what comes first? Does the regeneration of blood vessels cause the growth of muscle fibers; or does the regeneration of muscle inherently induce the growth of vasculature? The answer to this question is one of the aims and motivations for the engineering of an in vitro 3D model of skeletal muscle. Utilizing primary mouse cell culture and tissue engineering, this 3D model serves as a real-life example of cellular self-organization and muscle regeneration. Compared to previously studied methods, our 3D tissue culture using primary cells differs as it contains all of the cell types that are present within muscle, consequently portraying a more realistic model of functional muscle. We ultimately hope to gain a better understanding of the effect of vasculature on muscle fiber development in this in vitro “mini muscle”, which is theoretically translatable to applications in human skeletal muscle in vivo. To accomplish this, we have derived fabrication methods to engineer a plate with the ability to sustain muscle growth. This plate is made by laying a plastic base with a dog-bone shaped indentation, which is where muscle development occurs. After harvesting, isolating, and seeding cells from the tibialis anterior muscle into the plate we supply the culture with different proliferation and differentiation media. During the two weeks of allotted time for regeneration, we utilize time lapse microscopy to determine how this growth is affected respective to these different media. Continuing with this project, our next goals include determination of the best growth conditions for muscle fiber and vascular regeneration, optimizing the cell isolation protocol to maximize yield of even rare cell populations, and establishing functionality of the regenerated “mini muscle”.