The Effects of Scaling on Muscle Force Production in Biological Machines

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Bio-bots are biohybrid machines powered by bioactuators composed of tissue-engineered mammalian cells. These systems which exceed the standard limitations of programmed machines promise appealing potential applications in bioengineering fields, such as in non-invasive drug delivery and self-healing technologies. However, bio-bots are currently limited by their minute size. A lack of investigation into the effects of bio-bot size on force production makes it difficult for researchers implementing more complex geometries to choose a size that would reap the most benefits in efficiency and effectiveness for their experiments. This gap in knowledge is addressed by designing, printing, and stimulating a single bio-bot design at four different sizes to determine the impact scaling size has on muscle deflection, and therefore force production. This study demonstrates a positive correlation between bio-bot size and force production and the trend produced from this data could serve as a reference curve for future researchers to use when they are looking to alter the size of their own designs.