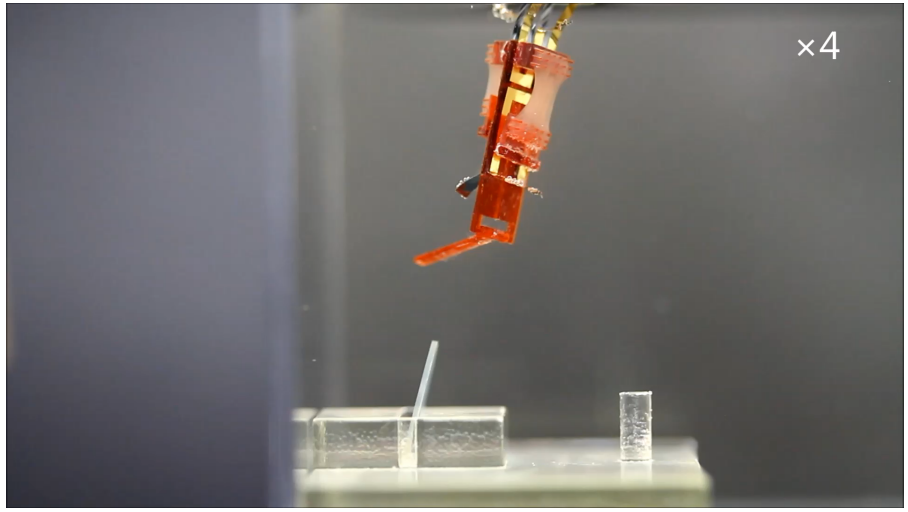
Bioactuator project

Skeletal muscle as Bioactuators

Y. Morimoto, *Science Robotics* ,2018

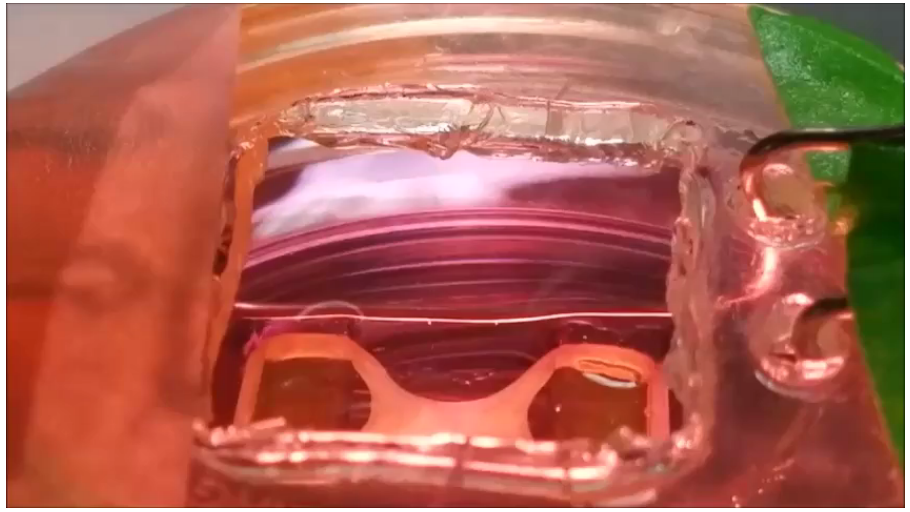


- Derived from myoblasts isolated from rat babies

- Expensive
- Limited growth

- High power

G.J.Pagan-Diaz, *Adv Mater,*2018



- Derived from C2C12…cancer cell line of myoblasts

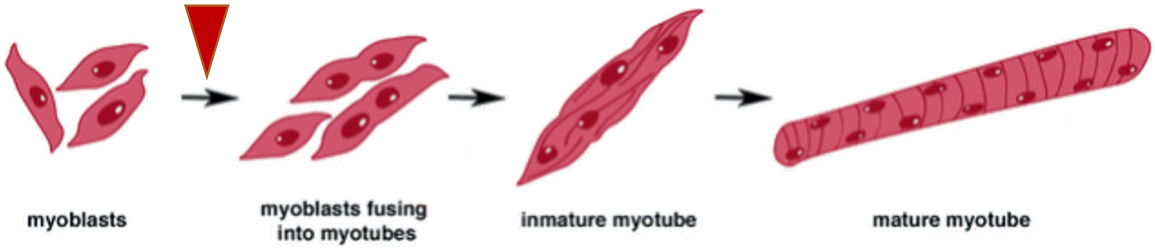
- Inexpensive
- Unlimited growth

- Low power

How to make skeletal muscle actuator

Making tissue-engineered skeletal muscle

Start differentiation

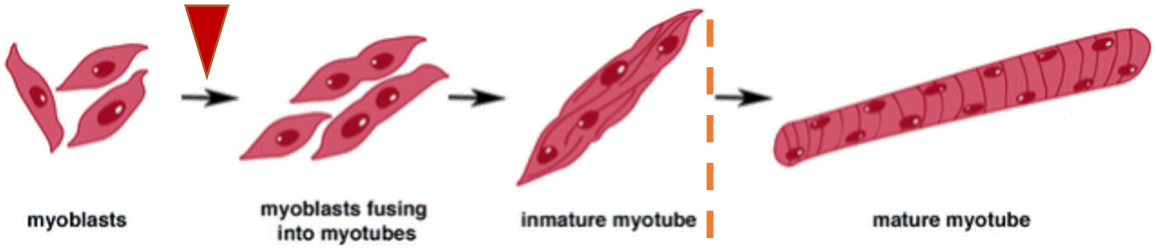


How to make skeletal muscle actuator

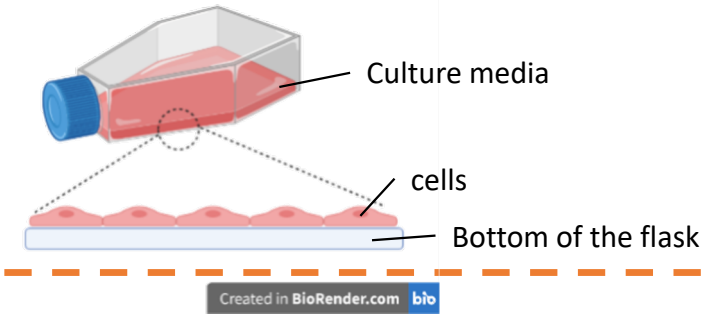
Making tissue-engineered skeletal muscle

Easy process

Start differentiation



Can be done in normal/2D cell culture

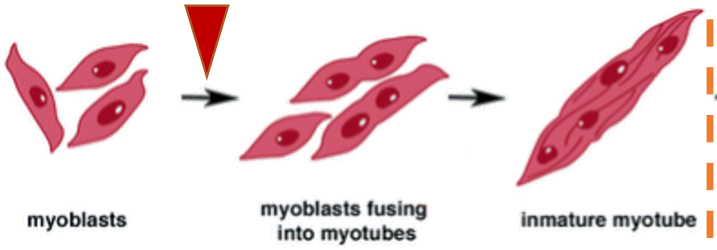


How to make skeletal muscle actuator

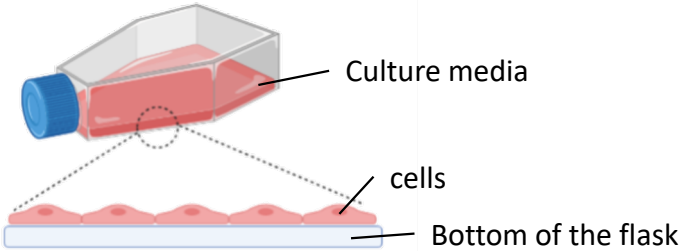
Making tissue-engineered skeletal muscle

Easy process

Start differentiation



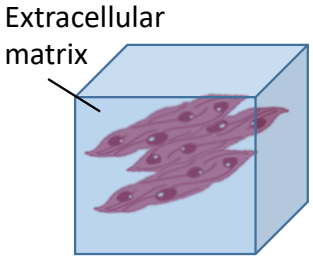
Can be done in normal/2D cell culture



Created in BioRender.com bio

Challenging!

Advanced 3D culture is necessary



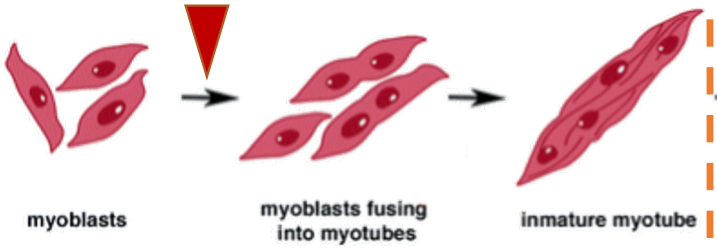
The force of engineered tissue is largely depends on maturation degree of myotube

How to make skeletal muscle actuator

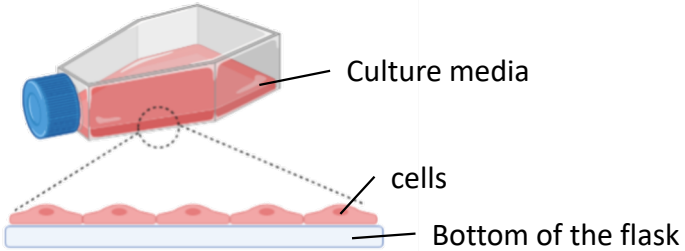
Making tissue-engineered skeletal muscle

Easy process

Start differentiation



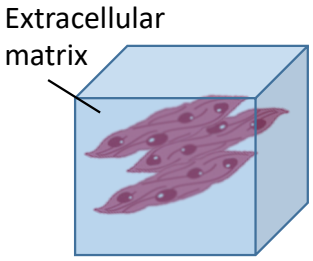
Can be done in normal/2D cell culture



Created in BioRender.com

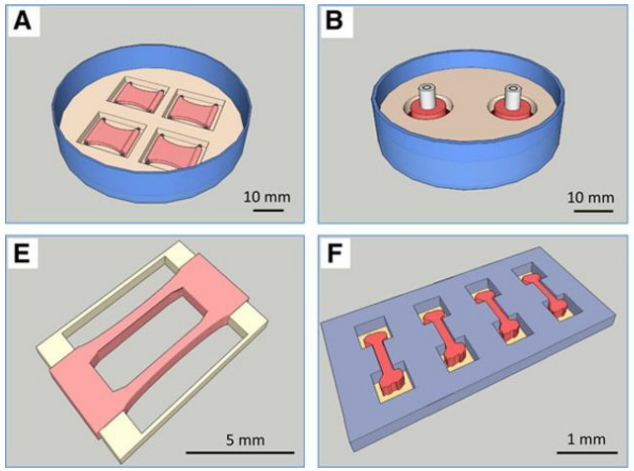
Challenging!

Advanced 3D culture is necessary

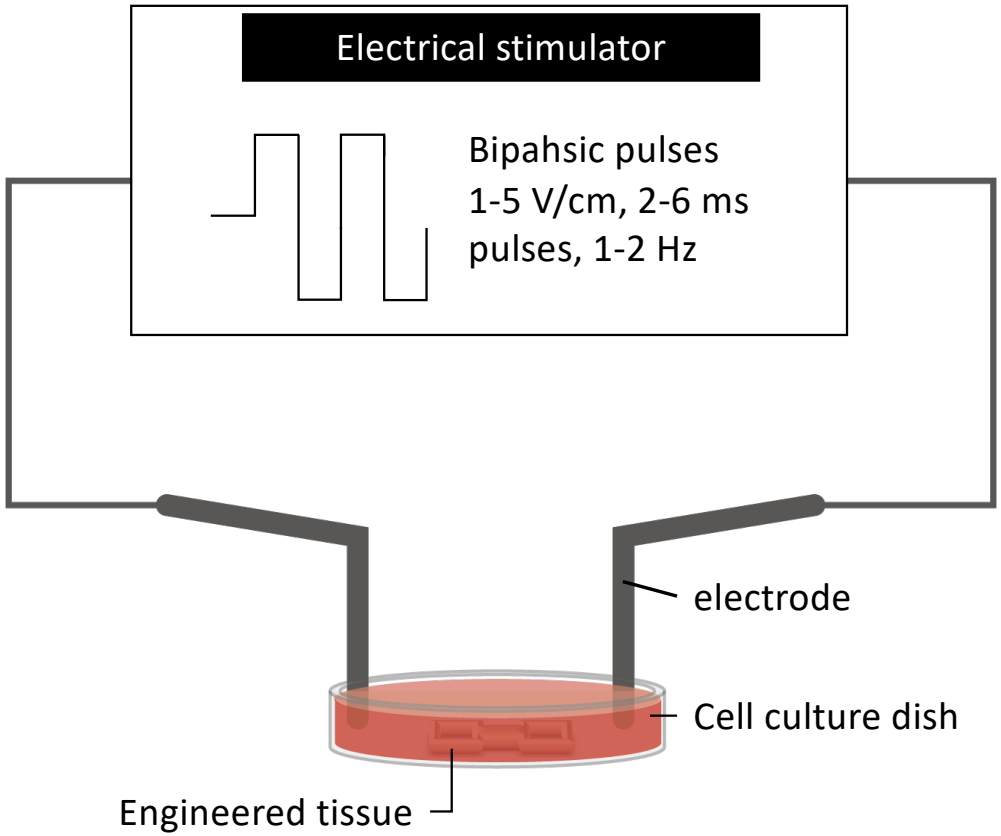


The force of engineered tissue is largely depends on maturation degree of myotube

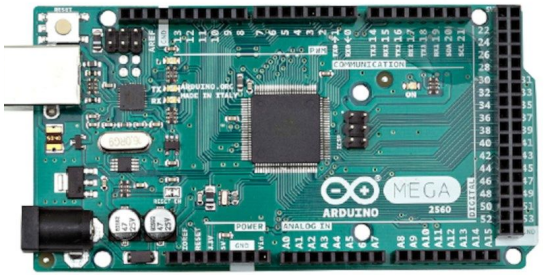
Use mold to make a shape



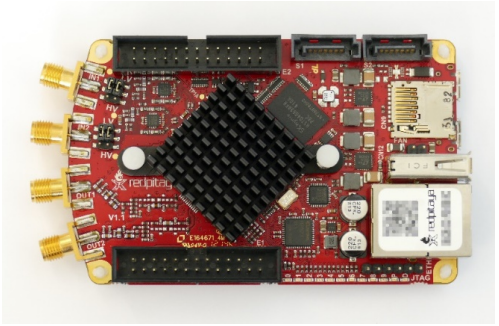
Electrical stimulation



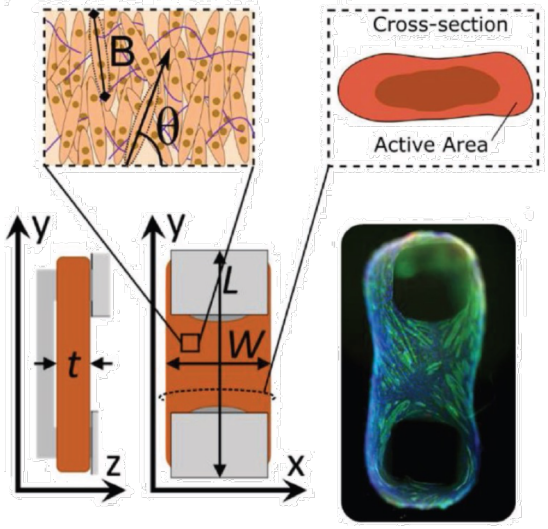
ARDUINO



redpitaya



A Contest of Force –who is the strongest?-



Factors affects the force of engineered muscle

1) The number and length of myotubes
2) Volume of the tissue (remember nutrient diffusion limitation < 200µm)
3) Alignment of myotubes
4) Individual force of myotubes (the degree of maturation)

Let's set initial value of 1) and 2) same and compete by

- structure (include alignment of myotubes)
- maturation degree of myotubes = force of individual myotubes