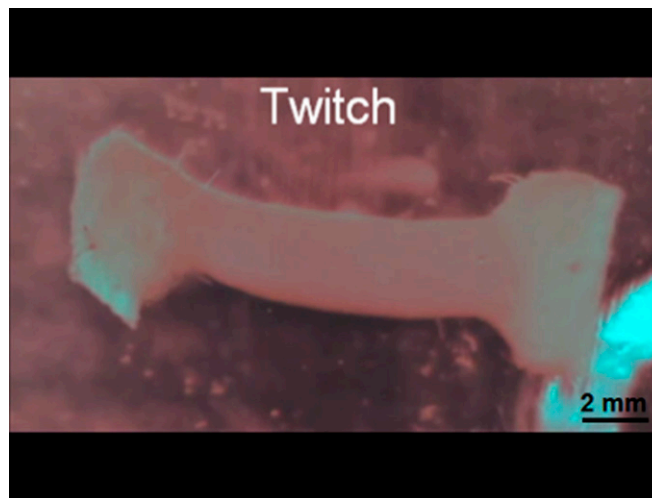# Supporting Information

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**Movie S1.**   Engineered muscle contractions. Representative twitch and tetanus contractions of an unloaded, 2-wk-old engineered muscle bundle electrically stimulated by a single pulse (10-ms duration, 3 V/mm) or a 40-Hz pulse train, respectively. During culture, ends of the engineered muscle were attached to rectangular Velcro felts.

[Movie S1](#)
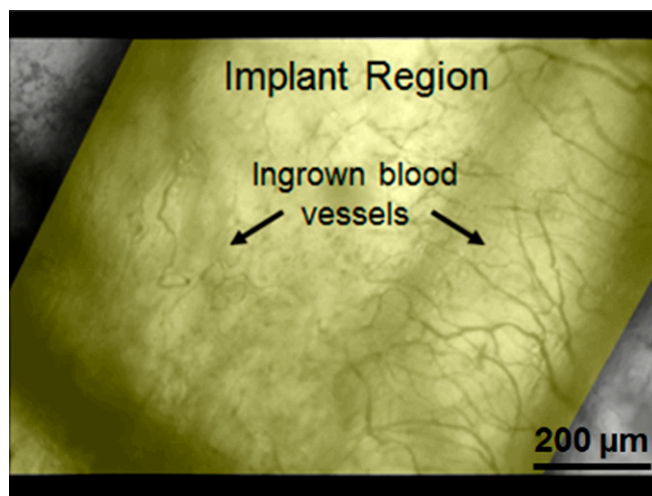


**Movie S2.**   Ingrown neovasculature within implanted engineered muscle. Representative intravital recordings of ingrown neovasculature within the implanted engineered muscle (yellow pseudocolor region) at 7 and 14 d postimplantation. Red blood cell flow through the ingrown vessels and spontaneous contractions of engineered muscle are readily observed.

[Movie S2](#)

**Movie S3.**   Spontaneous tetanic contraction of implanted engineered muscle. Representative intravital recording of spontaneous tetanic contractions in the implanted engineered muscle (yellow pseudocolor regions) at 14 d postimplantation. Note that, during tetanic contraction, blood flow in the ingrown capillaries seems to be transiently interrupted.

[Movie S3](#)



**Movie S4.**   In vivo recordings of $Ca^{2+}$ transients. Representative intravital recordings of GCaMP3-reported spontaneous $Ca^{2+}$ transients in the implanted predifferentiated (PreD) and undifferentiated (UnD) engineered muscle bundles (yellow pseudocolor regions) at 14 d postimplantation. Note asynchronous firing of spontaneous $Ca^{2+}$ transients (GCaMP3 flashes) in different myofibers within the implants. Stronger flashes are followed by more forceful contractions.

[Movie S4](#)

**Movie S5.** Ex vivo recordings of Ca$^{2+}$ transients. Representative recordings of GCaMP3-reported, electrically induced Ca$^{2+}$ transients in the PreD and UnD engineered muscles explanted 14 d postimplantation. Single electrical pulse (10-ms duration, 3 V/mm) induces synchronized, spatially uniform firing of Ca$^{2+}$ transient (GCaMP3 flash) rapidly followed by strong twitch contraction.

[Movie S5](Movie S5)