



Fig. S1. Histological effects of IMAA extension. (a,b) Light micrographs of cross-sections of resting (a) and stretched (b) muscle stained with Toluidine Blue and accompanying two-tone tracings illustrating the drastic change in muscle fiber shape and cross-sectional area upon extension. (c–e) Light micrographs of moderately stretched muscle stained with iron gallein showing the distribution of elastin fibers (some denoted by arrows) at the insertion on the midline raphe (c), anterior border of the muscle belly (d), and in the middle of the muscle belly (e). At the insertion, the muscle fibers are staggered in this moderately stretched condition, suggesting that fibers are able to move independent of one another depending on the length and extensibility of tendon fibers. Fine elastin filaments radiate from the myotendinous junction into the intermyofibrillar pad. At the anterior portion of the muscle belly, a lamina of elastin (E_L) can be seen along the convoluted collagenous epimysium, and elastin filaments radiate inward and attach to the peri- and endomysia of adjacent fibers. Thick elastin fibers radiate from endo- and perimysia between adjacent fibers and anchor to similar locations. Scale bars = 8 μ m. (f) A two-dimensional model of whole muscle passive stretching. Initially, collagen (green) and elastin (black) are highly convoluted in regions that will ultimately be displaced away from the origin and insertion during an extension event, but are less convoluted in regions that are tightly anchored. At the point beyond which individual fibers are maximally extended ($\sim 210\%$ resting length), fibers begin to slip relative to one another as the intramuscular extracellular matrix begins to adjust relative to the plane of extension. At this point, collagen fibrils become taut and elastin becomes highly extended. Recovery from this state of extreme strain ($>287\%$ resting length) requires elastic recoil provided by the extended elastin.

Table S1. Summary of anatomical and ultrastructural data for resting, stretched, and recovered snake MIAA muscles.

	Resting	Stretched	Recovered
Total Muscle Length (mm)	2.6±0.061 (n=2)	7.0±0.41 (n=2)	2.7±0.14 (n=2)
Sarcomere Length (μm)	2.63±0.02 (n=189)	5.49±0.87 (n=119)	2.15±0.21 (n=63)
Z-line –A Band (μm)	0.55±0.04 (n=30)	1.92±0.33 (n=30)	0.32±0.07 (n=30)
Gap (μm)	0	0.82±0.15 (n=25)	0
Longitudinal Z-line _{fibril1} to Z-line _{fibril2} distance (μm)	0.13±0.11 (n=100)	0.46±0.37 (n=100)	0.09±0.12 (n=100)

All values are mean±s.d. For total muscle length, means represent measurements from both right and left sides of same individual.