released by the actin sliding, which triggers the execution of power stroke all at once. We further found that two steps of power stroke and a physiological ATP concentration are also important factors for synchronous force generations. Therefore, our findings reveal how molecular properties of skeletal myosin are designed for cooperative force generations towards efficient muscle contractions.

Reference

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02.06
The transmission of the proton motive force along I-Band segments of the mitochondrial reticulum

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In the mitochondrial reticulum of skeletal muscle, the I-Band segments (IBS) form a contiguous matrix with the mitochondrial segments at the periphery (PS) of the cell. An electrical coupling via the matrix between the PS and IBS has been demonstrated. Oxidative phosphorylation complexes that generate the proton motive force (PMF) are preferentially located in the PS, while Complex V, which utilizes the PMF, is primarily located along the IBS. It is hypothesized that PS can support the production of ATP in the IBS by maintaining the potential energy available to produce ATP deep in the muscle cell via conduction of the PMF down the IBS. This theoretical study was undertaken to better understand the physical mechanisms governing PMF transmission in the IBS. The IBS was modeled as a 300 nm diameter, water-filled tube, with an insulated wall. Two mechanisms were considered to drive ion transport along the IBS: the electrical potential and/or concentration gradients between the PS to the end of the IBS. The magnitude of the flux was estimated from the maximum ATP production rate for skeletal muscle. The major transport ions considered were H+, Na+ and K+ using diffusion coefficients from the literature. Simulations (COMSOL) suggest conduction along the IBS via H+ alone is unlikely requiring unreasonable gradients, while Na+ or K+ could carry the current with minor gradients in concentration or electrical potential along the IBS. Mobile H+ buffers (i.e. phosphate) were too scarce to support H+ transport. The majority of conduction down the IBS is likely dependent on Na+–K+ and some anion; however, this requires that H+ is recycled from the matrix of the IBS to the PS for active extrusion. We propose that the abundant cation–proton antiporter in skeletal muscle mitochondria operates in opposite directions in the IBS and PS to permit local recycling of H+ at each site driven by cooperative gradients in H+ and Na+/K+ which favor H+ entry in the PS and H+ efflux in the IBS.

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02.07
MSTN genotype variation affects skeletal muscle mitochondrial abundance and fibre composition in untrained Thoroughbred horses

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Multiple polymorphisms have been observed in the equine *myostatin* (*MSTN*) gene however two have become of considerable interest – a single nucleotide polymorphism (SNP) in the first intron (g.66493737C > T) and an SINE insertion polymorphism (Ins227bp) in the promoter region – due to associations with best race distance, body composition and skeletal muscle fibre composition. The aim of the study was to test the hypothesis that *MSTN* variation affects mitochondrial abundance and fibre composition. In a set of n = 143 horses the two *MSTN* polymorphisms were in complete concordance. *Gluteus medius* skeletal muscle biopsies were extracted from a subset of n = 82 (n = 37 CC/II, n = 34 CT/IN, n = 11 TT/NN) untrained Thoroughbred horses (21 ± 3 months). Mitochondrial abundance was determined by measuring citrate synthase activity spectrophotometrically in whole muscle biopsies and by measuring the ratio of mitochondrial to nuclear DNA by qPCR. Skeletal muscle fibre types were determined by qPCR gene expression levels of myosin heavy chain isoforms. Mitochondrial abundance was significantly ($P < 0.01$) decreased in the presence of the C-allele/insertion allele and skeletal muscle fibre type proportions were significantly ($P < 0.01$) different among the three *MSTN* genotypes. CC/II horses had a lower proportion of type I fibres along with a higher proportion of type IIX fibres compared to CT/IN and TT/NN animals. These data indicate that variation in *MSTN* genotype correlates with mitochondrial abundance and fibre composition in untrained Thoroughbred horses. As type I skeletal muscle fibres are more oxidative and contain more mitochondria than the glycolytic type IIX skeletal muscle fibres, the fibre composition data is in agreement with the mitochondrial abundance differences observed. These data are also consistent with previous reports that the presence of the insertion allele results in a decrease in type I fibres and an increase in type IIX fibres.

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02.08
Complex I assembly factor TMEM126B mutations result in muscle weakness and isolated complex I deficiency

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Mitochondrial complex I deficiency results in a plethora of often severe clinical phenotypes presenting already in early childhood. The genetic defect is often difficult to find due to the large number of genes