**Highlights**

* Chronic activation of mTORC1 in skeletal muscle modulates substrate oxidation
* Skeletal muscle mTORC1 activity is an important regulator of energy expenditure
* RNA-seq reveals multiple mTORC1-responsve genes in skeletal muscle
* mTORC1 activation increases thermogenesis via sarcolipin-driven uncoupling of SERCA in muscle
* Chronic skeletal muscle mTORC1 activation reduces longevity