

Muscle Contraction

- Skeletal muscles are made up of fibre bundles, which contain hundreds of **myofibrils**.
- Each fibre is a single multinucleate cell extending the length of the muscle.
- Myofibrils carry out the contraction.
- Myofibrils are composed of individual units called **sarcomeres**.
- Sarcomeres are surrounded by a **sarcoplasmic reticulum** (specialized E.R. of skeletal muscle)
- Mitochondria are found between the myofibrils.

Structure of Skeletal Muscle Fibre

- Sarcomeres are made up of **thin actin** filaments and **thick myosin** filaments
- These filaments overlap to give a distinct banding pattern when seen with an electron microscope. (called striated muscle)

Sliding Filament Model

- When the muscle contracts the actin and myosin filaments slide past one another, shortening the muscle.
- Myosin heads attach to binding sites on the actin filament This forms cross-bridges with the actin filament.
- The myosin head bends, pulling on the actin filaments causing them to slide toward the centre of the sarcomere. ATP is used for this "power stroke"
- ATP supplies the energy for the contraction. It is required for the sliding of filaments as well as the separation of the actin and myosin which relaxes the muscle.
- The cross-bridge cycle continues: grab → pull → release
- When the muscle relaxes, the heads detach and the actin filaments move back.

Role of Calcium Ions

- Muscle contraction is driven by ATP and triggered by the release of Ca^{2+} from the sarcoplasmic reticulum
- At rest, the protein **tropomyosin** winds around the actin, covering the myosin binding sites.
- When stimulated by a nerve impulse, acetylcholine is released causing calcium ion channels to open.
- Ca^{2+} ions are released from the sarcoplasmic reticulum.
- The Ca^{2+} binds to a second protein, **troponin**, which causes the tropomyosin to move to the side exposing the myosin binding sites
- If ATP is present, the cross-bridges will form and the muscle will contract.
- After contraction, the Ca^{2+} ions are actively pumped back into the sarcoplasmic reticulum

MUSCLE CONTRACTION

