

HUMAN ANATOMY AND PHYSIOLOGY-1(BP101T)

UNIT: 2 SKELETAL SYSTEM

CLASS: 7

TOPIC- PHYSIOLOGY OF MUSCLE CONTRACTION:

THE SLIDING FILAMENT MECHANISM:

- Muscle contraction occurs because myosin heads attach to and “walk” along the thin filaments at both ends of a sarcomere, progressively pulling the thin filaments toward the M line.
- As a result, the thin filaments slide inward and meet at the centre of a sarcomere.
- They may even move so far inward that their ends overlap. As the thin filaments slide inward, the I band and H zone narrow and eventually disappear altogether when the muscle is maximally contracted.
- However, the width of the A band and the individual lengths of the thick and thin filaments remain unchanged.

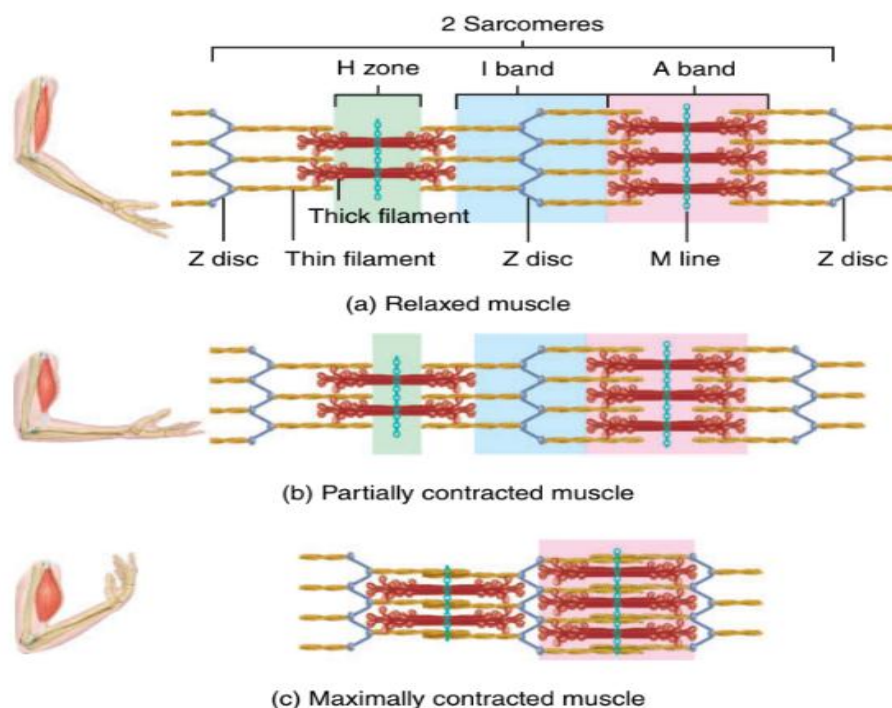
- The thin filaments on each side of the sarcomere are attached to Z discs, when the thin filaments slide inward, the Z discs come closer together, and the sarcomere shortens. Shortening of the sarcomeres causes shortening of the whole muscle fiber, which in turn leads to shortening of the entire muscle.

THE CONTRACTION CYCLE: Sarcomeres exert force and shorten through repeated cycles during which the myosin heads attach to actin (forming cross-bridges), rotate, and detach. During the power stroke of contraction, cross-bridges rotate and move the thin filaments past the thick filaments toward the center of the sarcomere.

1.ATP hydrolysis: Hydrolyzes ATP into ADP (adenosine diphosphate) in the presence of ATPase—enzyme and a phosphate group—are still attached to the myosin head. The energy generated from this hydrolysis reaction is stored in the myosin head for later use during the contraction cycle.

2. Attachment of myosin to actin: When a myosin head attaches to actin during the contraction cycle, the myosin head is referred to as a cross-bridge.

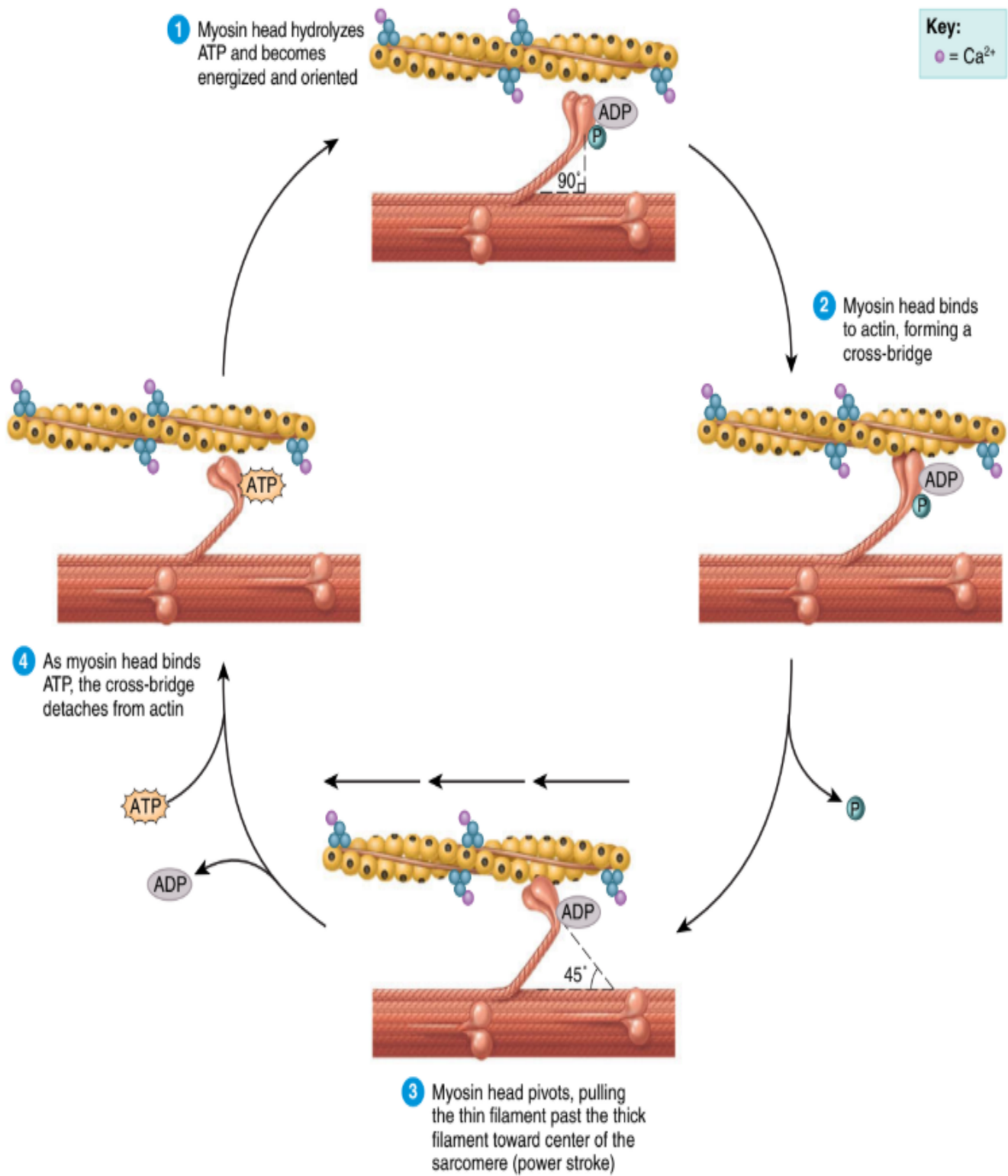
3. Power stroke: After a cross-bridge forms, the myosin head pivots, changing its position from a 90° angle to a 45° angle relative to the thick and thin filaments. As the myosin head changes to its



new position, it pulls the thin filament past the thick filament toward the center of the sarcomere, generating tension (force) in the process. This event is known as the **power stroke**.

4. Detachment of myosin from actin: As ATP binds to the ATP- binding site on the myosin head, the myosin head detaches from actin.

RRCP



- The contraction cycle repeats as the myosin ATPase hydrolyzes the newly bound molecule of ATP, and continues as long as ATP is available and the Ca^{2+} level near the thin filament is sufficiently high.

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