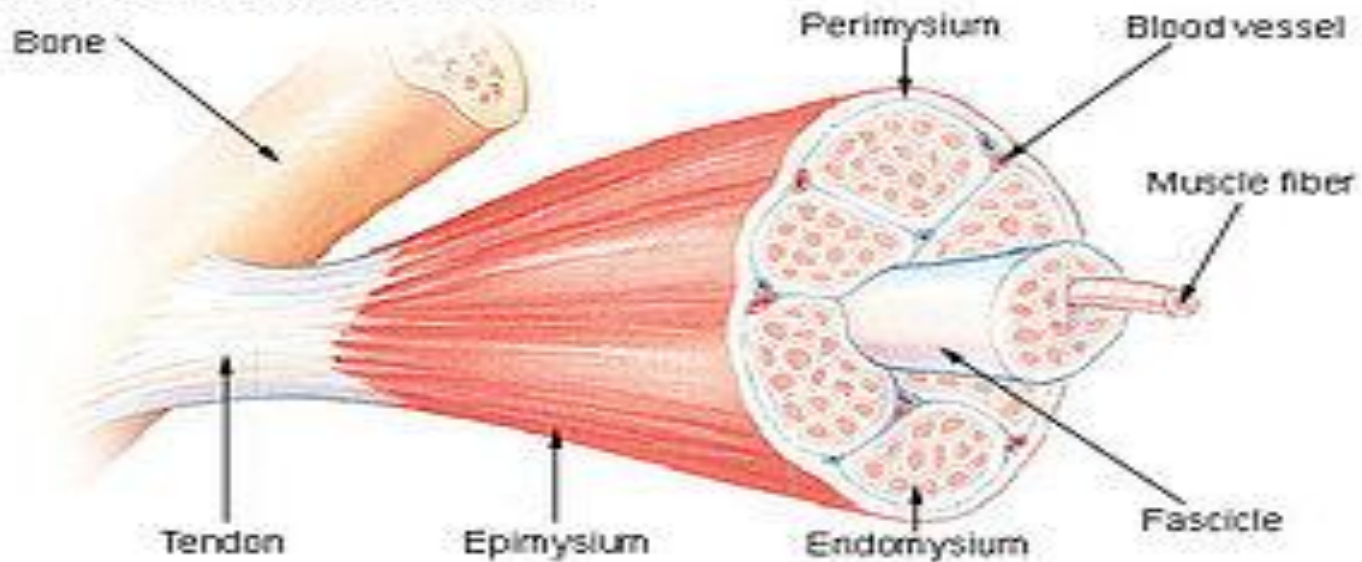


MYOFIBRILLAR PROTEIN AND ITS FUNCTIONAL PROPERTIES

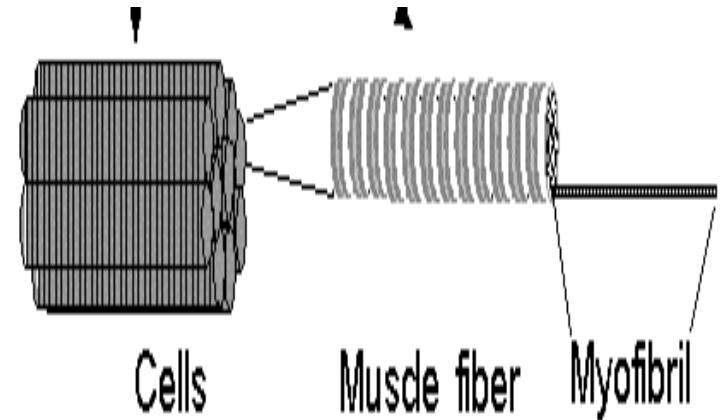
Structure of a Skeletal Muscle



Hauzoukim

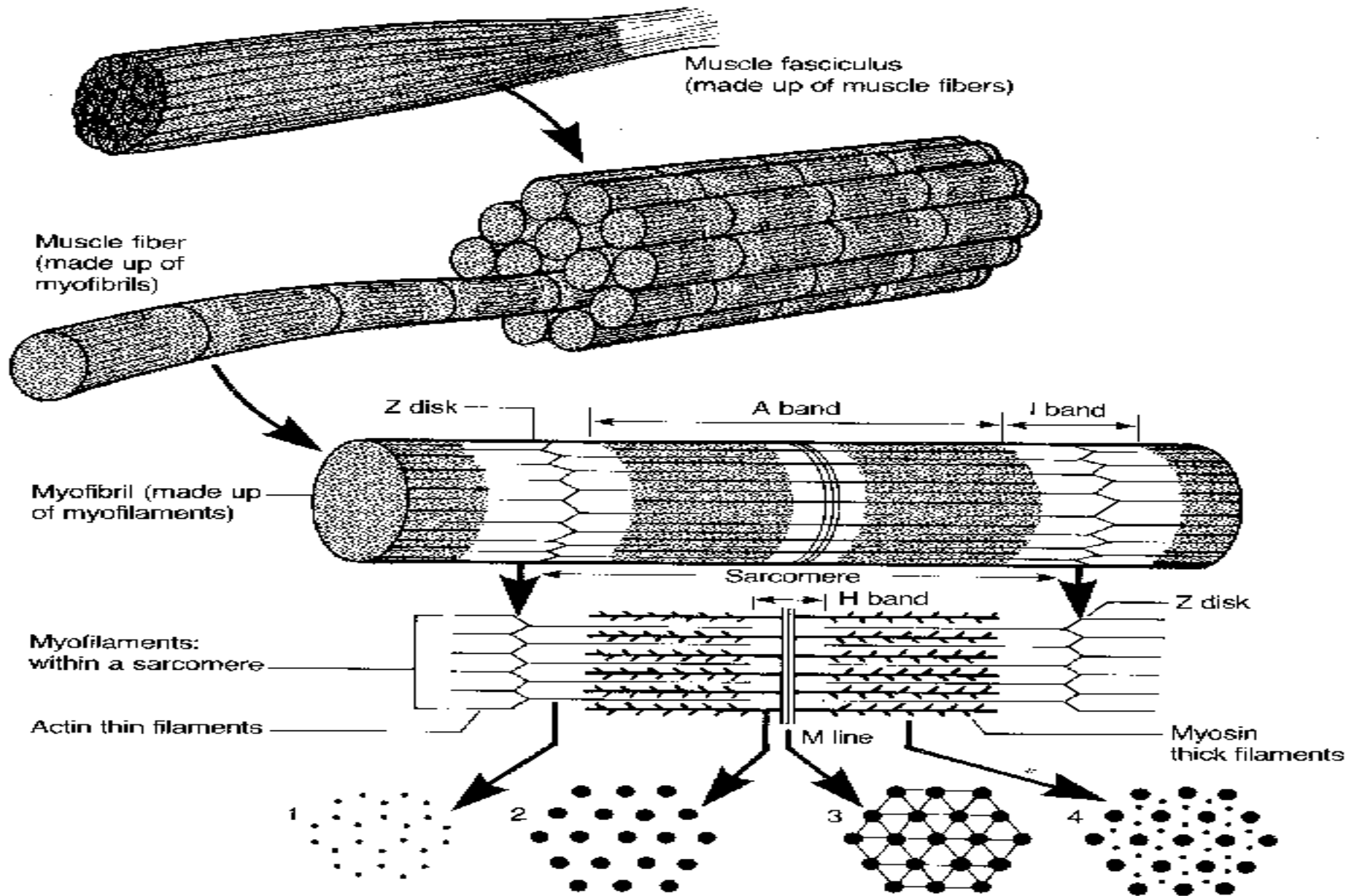
INTRODUCTION

- A myofibril is leasic rod like
- unit of a muscle.
- During myogenesis – muscle
- cell are composed of myocytes/
- muscle fibres & muscle fibre contain many chain of myofibrils .
- Myofibrils – thick & thin filaments.
- Actinomyosin motors are important in muscle conyraction.



STRUCTURE

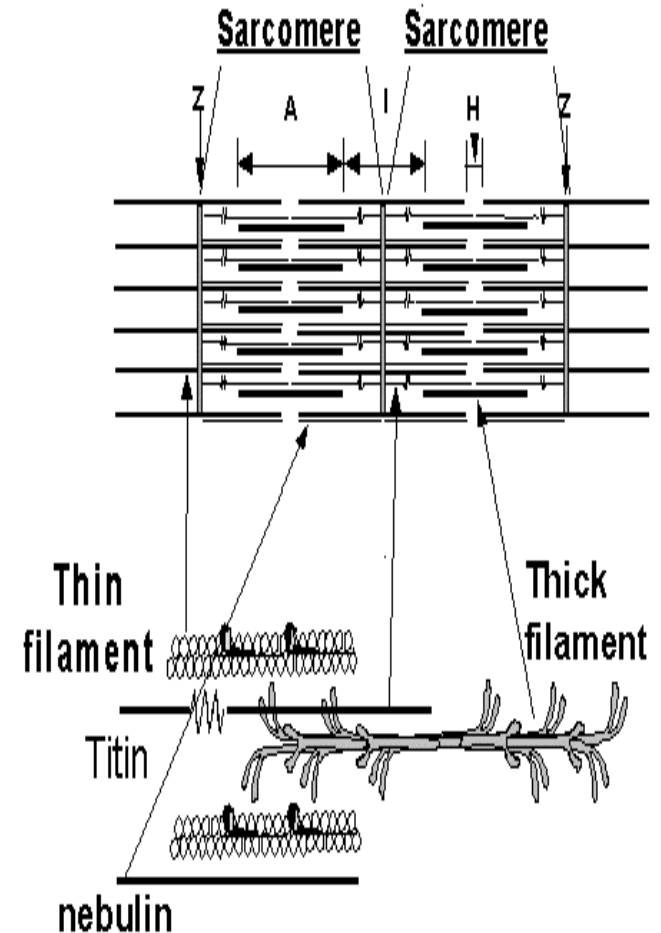
- Filament of myofibrils: myofilament consist of thin filament & thick filament.
- Thin filaments: protein actin , coiled with nebulin filament.
- Thick filaments: protein myosin , held in place by titin filament .
- Myosin is responsible for force generation.
- Thick filaments : globular head with both actin & ATP binding sites
: long tail involved i its polymerizaton into myosin filament.



- Young myofibers contain 7:1 ratio of thin to thick filaments.

FORMATION AND APPEARANCE

- Each sarcomere is delimited by two very dark coloured band: – Z -discs / Z- lines.
- Z-lines do not easily allow the passage of light.
- A sarcomere is divided into –I-bands & A-bands.



- I-bands: lighter colour bands present at either ends & contain only thin actin filament.
- A-bands : darker grayish bands in middle & contain both actin & myosin filaments ,mostly myosin filament.
- H-zone : bright central region & no actin & myosin filament overlap (muscle in relax state)
- H-zone is bisected by dark central line called M-line

ACTION

- The myosin head form a cross bridge with actin myofilament (rowing action).
- Actin is associated with troponin + tropomyosin complex
- Relax condition:
 - :- myosin head has ADP & phosphate bound to it.



- During contraction:

:- actin is pulled along myosin towards the centre of sarcomere until the actin & myosin completely overlapped.

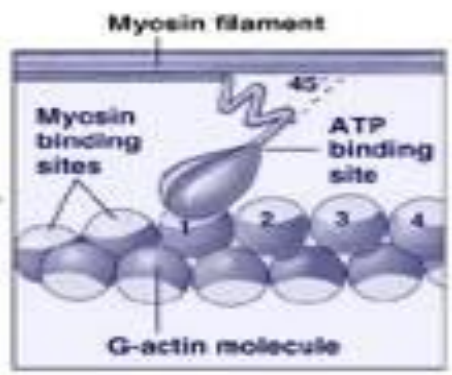
:- H-zone becomes smaller due to increasing overlap & muscle shorten.

- Fully contracted :- H- zone is not visible.

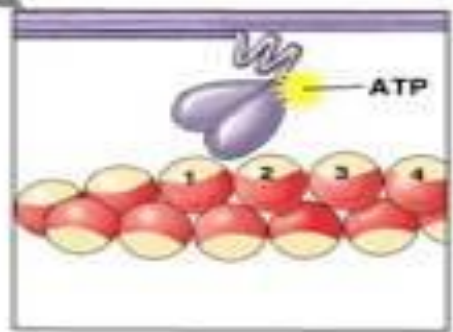
Steps of muscle contraction

- Rigor state: the cross bridge is at 45° relative to filament.
- When a nerve impulse arrive Ca^{2+} ions cause troponin to change shape.
- Moves the troponin + tropomyosin complex away leaving myosin binding site open.
- The myosin head now bind to actin myofilament.

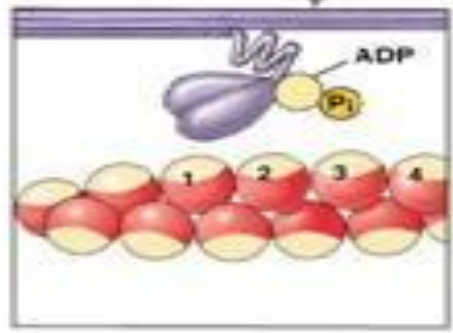
1 Tight binding in the rigor state. The crossbridge is at a 45° angle relative to the filaments.



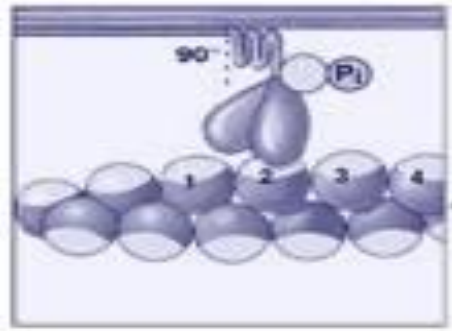
2 ATP binds to its binding site on the myosin. Myosin then dissociates from actin.



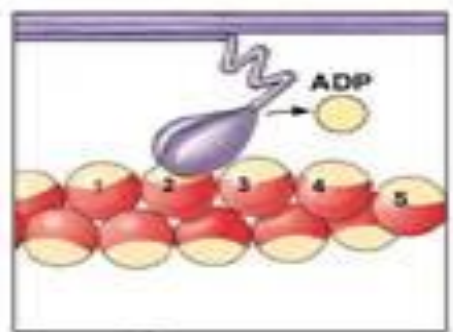
3 The ATPase activity of myosin hydrolyzes the ATP. ADP and P_i remain bound to myosin.



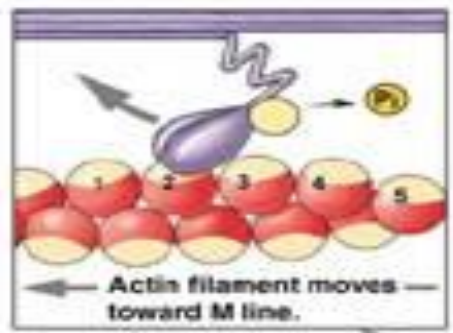
4 The myosin head swings over and binds weakly to a new actin molecule. The crossbridge is now at 90° relative to the filaments.



5 At the end of the power stroke, the myosin head releases ADP and resumes the tightly bound rigor state.



5 Release of P_i initiates the power stroke. The myosin head rotates on its hinge, pushing the actin filament past it.



- Energy in head of myosin filament moves the head which slide the actin past.
- ATP bind to the binding site on myosin.
- Myosin disconnect from actin to grab ATP.
- ATP ase activity of myosin hydrolyses ATP :ADP & Pi(presence of Ca^{2+} ions activate myosin ATPase).

- The myosin head swing over & bind weakly to a new actin chain molecule.
- The cross bridge is at 90° relative to filament.
- Release of P_i initiates the power stroke
- Myosin head rotates on its hinge & pushing actin filament past it.
- At the end of power stroke the myosin head release ADP & resume the rigor state.

FUNCTIONAL PROPERTIES

- Protein in fish muscle divided:-

- I. Structural protein:

:- actin , myosin , tropomyosin & actinomyosin which constitute 79-80% of tot. P cntent compare with 40% in mammals.

:-soluble in natural salt soln. with high ionic strength(0.5 M).

2. Sarcoplasmic protein:

:-component of extra cellular fluid & sarcoplasm.

:-comprise about 20-35% of tot. Muscle protein .

:-commonly called myogens.


:-extracted by homogenizing the muscle tissue with water / soln. of neutral salt of ionic strength below 0.15M.


3. Connective tissue protein:

:- represent 3% of tot. fish muscle protein .

:-cannot be extracted by water,acid, alkaline soln. & neutral salt soln. Of 0.01- 0.1 M conc.

:-components: collagen, elastin(very resistant to moist heating & cooking)/ both.

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- Structural protein make up the contractile apparatus responsible for muscle movement.
 - The amino acid composition is roughly similar to corresponding protein in mammalian muscle(slightly differ in physical properties).
 - When protein is denatured under controlled cond. , their properties may be used for technological purposes.

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- Eg: Production of surimi based products in which gel forming ability of myofibrillar protein is used.
 - After salt & stabilizer are added to a washed & minced preparation of muscle protein & after controlled heating & cooling procedures the protein may form a strong gel.

CONCLUSION

- Myofibrillar protein :Major protein in fish muscle.
- These protein account for 65-75 % of tot. Muscle compared with 52-56% in mammals.