**CHAPTER 6 : MUSCLE PHYSIOLOGY**

**Terminologies:**

**Muscle:** a contractile tissue, which has the property of excitability, extensibility and elasticity

**Myocyte:** Muscle tissue is made of large number of individual units called muscle cells/ myocyte or muscle fibers

**Endomysium:** Connective tissue layer which covers individual muscle fiber

**Perimysium:** Connective tissue layer which covers muscle fasciculus

**Epimysium:** Connective tissue sheath which covers whole muscle

**Sarcolemma:** Plasma membrane of muscle fiber

**Fasciculus:** Bundles of muscle fibers

**Sarcoplasm:** Fluid present inside each muscle fiber, similar in composition to that of intracellular fluid

**Sarcoplasmic reticulum:** Endoplasmic reticulum of muscle cell

**Triad:** A pair of cisternae with a T tubule in between

**L tubules:** Longitudinal tubules, present parallel to myofibrils

**Terminal cisternae:** Bulbous structures at the ends of L tubule. They are storage place for calcium

**T tubules:** Short tubule system runs perpendicular to myofibrils and contain extracellular fluid

**Sarcomere:** Distance between two Z lines.Basic contractile unit of muscle

**Rigor mortis:** Contracture after death

**Motor unit:** All the muscle fibers in a muscle that are innervated by a single motor neuron

**Latent period:** Period between application of stimulus and beginning of contraction

**Refractory period:** It is the brief period during which muscle undergo contraction for first stimulus is unable to respond to second stimulus

**Tetanisation:** Fusion of successive twitches when frequency of stimuli is given at a rapid rate

**Fatigue:** Decrease in the working capacity of muscle when it is continuously stimulated

**Neuromuscular junction:** Junction between terminal branches of motor neuron, which invaginates onto the midpoint of sarcolemma

**Myofibril:** organelle of muscle cell that shows special function- contraction

**Intercalated disks:** intercellular junctions at the end of cardiac muscle fibers

**Frank starling law:** Energy of contraction of muscle is directly proportional to initial length of fiber

**All or none law:** When a muscle fiber is stimulated, by minimal or maximal effective stimuli, the whole fiber contracts to maximum or will not contract at all

**Synaptic cleft:** Space between nerve terminal and the plasma membrane of muscle

**Electromyogram:** Recording of electrical activities of muscle cell

**Refresher points**

**PM contraction:** Rigor mortis

**PM cooling:** Algor mortis

**PM staining:** Livor mortis

**Creatine phosphate** in muscle is referred to as ATP sparer or energy buffer

About 5-6 hours after death, all muscles of body assume a state of contracture – **Rigor mortis**

The efficiency of muscle contraction is **45%**

Muscle contraction without shortening of length: **Isometric contraction**

Whole cardiac muscle obeys all or none law because of **Synctium**

**Myasthenia gravis** is a neurotransmitter disorder in which auto antibodies are produced against Ach receptors

**Difference of skeletal, cardiac and smooth muscles:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Characteristics** | **Skeletal muscle** | **Cardiac muscle** | **Smooth muscle** |
| **Location** | Attached to bones | Found only in heart | Found in walls of blood vessels and in organs of digestive, respiratory, urinary and reproductive tracts |
| **Function** | Movement of the body | Pumping of blood | Control of blood vessel diameter, movement of contents in hollow organs |
| **Anatomical description** | Cylindrical, multinucleated cells arranged in parallel bundles | Short cells with blunt branched ends. Cells joined to others by intercalated discs and gap junctions | Small, spindle shaped cells joined to each other by gap junctions |
| **Voluntary** |  Yes |  No |  No |
| **Gap junctions** |  No |  Yes |  Yes |
| **Cross striations** |  yes |  yes |  No |
| **Nucleus** |  More than one |  One |  One  |
| **Troponin** |  Present  |  Present  |  Calmodulin |
| **T tubule** |  Present  |  Present |  Caveolae |
| **Fatigue** |  Yes |  No |  No |
| **Action** |  Voluntary |  Involuntary |  Involuntary |
| **Nerve supply** | Somatic nerve | Autonomic nerve | Autonomic nerve |
| **Speed of contraction**  |  Fast |  Intermediate  |  Slow  |
|  **RMP** |  -95mv |  -90mv |  -50mv |

**Skeletal muscle fiber types:**

|  |  |  |
| --- | --- | --- |
| **Red fibers / type I** |  **Type II A** |  **Type II B** |
| Slow twitch oxidative | Fast oxidative | Fast glycolytic |
| Red colour | Red colour | White colour |
| Slow contraction speed | Fast contraction speed | Fast contraction speed |
| Myosin ATPase activity is slow | Myosin ATPase activity is fast | Myosin ATPase activity is fast |
| Mitochondria and myoglobin content are more | Mitochondria and myoglobin content are more | Mitochondria and myoglobin content are less |
| Metabolism is aerobic | Metabolism is aerobic | Metabolism is anaerobic |
| Slow rate of fatigue | Moderate rate of fatigue | Susceptible to fatigue |

**Muscle contraction types:**

|  |  |
| --- | --- |
|  **Isometric contraction** |  **Isotonic contraction** |
| Contraction between two fixed points | Contraction between one fixed and the other moveable joints |
| No sliding movements no shortening in length | Shows sliding movements shortening in length |
| No work performance | Work is performed |
| Less energy release, low fenn effect | More energy release, high fenn effect |

 **Subject Name: Veterinary physiology**

 **Chapter Name: Muscle Physiology**

 **Chapter: 6th**

 **VPY (IIPER1699624056)**

**1**. How much percent of the whole-body mass is due to skeletal muscle

a. 30b. 40

c. 50 d. 60

**2**.Following is the property of skeletal muscle

a. Striated and unbranched

b. Cylindrical, multinucleate cells

c. Innervated by somatic nerve

d. All the above

**3**. In case of smooth muscles, T tubules are replaced by

a. Calmodulin b. Dense bodies

c. Caveolae d. None of the above

**4**. Following is the property of smooth muscle

a. Non-striated and unbranched

b. Spindle shaped and have single centrally placed nucleus

c. Contain calmodulin instead of troponin-tropomyosin complex

d. All the above

**5**. In skeletal muscle, striated appearance is due to

a. T tubules b. Arrangement of myofilaments

c. Cocked position of head of thick filaments d. Sarcolemma

**6**. Which of the following muscle type is more susceptible to fatigue

a. Skeletal muscle b. Smooth muscle

c. Cardiac muscle d. All the above

**7**. Which among the following is not the property of cardiac muscle

a. Long refractory period b. Physiological syncytium

c. Obey all or none rule d. Can be summated temporarily

**8**. Following is the property of muscle

a. Excitability b. Extensibility

c. Elasticity d. All the above

**9**. Obturator nerve paralysis in cow is due to

a. Lack of adduction in hind limb b. Lack of abduction in hindlimb

c. Lack of Extensors c. None of the above

**10**.Type I muscle fibers are characterized by

a. Red, oxidative, slow twitching b. Red, glycolytic, slow witching

c. White, glycolytic, slow twitching d. White, oxidative, slow twitching

**11**. Limb movement away from the median plane is

a. Adduction b. Abduction

c. Flexion d. None of the above

**12**. White fibers are characterized by

a. Abundant sarcoplasmic reticulum b. Fast glycolytic fibers

c. Few mitochondria d. All the above

**13**. Whole muscle is wrapped in a connective tissue sheath called

a. Endomysium b. Perimysium

c. Epimysium d. Sarcolemma

**14**. The muscle fascicle is surrounded by a connective tissue sheath called

a. Endomysium b. Perimysium

c. Epimysium d. Sarcomere

**15**. Muscle cell plasma membrane is known as

a. Sarcolemma b. Sarcoplasm

c. Sarcomere d. Sarcoplasmic reticulum

**16**. Following statement about sarcomere is true

a. A contractile unit between two Z discs

b. Myofibril is divided into repetitive units called sarcomeres

c. Sarcomere contains protein myofilaments

d. All the above

**17**. Two principle contractile proteins present in skeletal muscle are

a. Actin and troponin b. Actin and myosin

c. Troponin and tropomyosin d. Actin and tropomyosin

**18**. Actin: Myosin ratio in the skeletal muscle is

a. 2: 1 b. 15: 1

c. 20: 1 d. 50: 1

**19**. Actin: Myosin ratio in the smooth muscle is

a. 2: 1 b. 15: 1

c. 20: 1 d. 50: 1

**20**. Anisotropic band contains which protein myofilaments

a. Actin b. Myosin

c. Both a and b d. None of the above

**21**. Main storage site of calcium in skeletal muscle cell

a. Sarcolemma b. Sarcoplasmic reticulum

c. Mitochondria d. ECF

**22**. Source of calcium in cardiac muscle cell is

a. Sarcoplasmic reticulum b. Extracellular fluid

c. Both a and b d. None of the above

**23**. In skeletal muscle triad consists of

a. T tubule + 2 (terminal cisternae) b. T tubule + terminal cisternae

c. 2 (T tubules) + terminal cisternae d. 2 (T tubules) + 2 (Terminal cisternae)

**24**. Motor neuron and all the muscle fibers that it innervates is known as

a. Triad b. Motor unit

c. Synapse d. None of the above

**25**.The axon terminal of each nerve cell makes contact with individual skeletal muscle fiber at

a. Neuromuscular junction b. Synapses

c. Motor unit d. Action potential

**26**.The gap present between the axon terminal and the sarcolemma of skeletal muscle cell is

a. Neuromuscular junction b. Synaptic cleft

c. Motor unit d. Cross bridge

**27**.Following neurotransmitter brings depolarization of skeletal muscle fiber

a. Acetylcholine b. Dopamine

c. Glutamine d. GABA

**28**. Milk fever/ parturient paresis in cow occurs due to

a. Hypocalcemia b. Hypercalcemia

c. Hypokalemia d. Hyperkalemia

**29**. Following statement is true about depolarizing muscle relaxants

a. Not hydrolyzed by Ach esterase b. Non-competitive muscle relaxants

c. Cause flaccid paralysis d. All the above

**30**. Conduction of action potential from surface of muscle fiber to inner aspect occurs by

a. Neuromuscular junction b. Sarcotubular system

c. Endomysium d. None of the above

**31**. Action potential in skeletal muscle is propagated by

a. Opening and closing of Na2+ and Ca2+ ion channel b. Closing of K+ ion channel

c. Opening of Mg2+ ion channel d. Closing of Mg2+ ion channel

**32**. Which of the following protein covers the binding site on actin during relaxation

a. Troponin b. Tropomyosin

c. Myosin d. None of the above

**33**. During skeletal muscle contraction, Myosin cross bridges attach to active sites on

a. Actin b. Myosin

c. H - zone d. Z disc

**34**. The major components of actin filament are

a. Actin b. Troponin

c. Tropomyosin d. All the above

**35**. The ATPase activity is present in the

a. Actin b. Myosin head

c. Myosin tail d. Tropomyosin

**36**. During skeletal muscle contraction, each myosin molecule hydrolyses

a. 1-3 ATP/sec b. 3-5 ATP/sec

c. 5-10 ATP/sec d. 10-15 ATP/sec

**37**.During skeletal muscle contraction, troponin C binds with

a. 1 calcium ion b. 2 calcium ions

c. 3 calcium ions d. 4 calcium ions

**38**. Immediate source of energy for skeletal muscle contraction is

a. ATP b. Creatine phosphate

c. Fatty acid d. All the above

**39**. Which of the following source of energy for skeletal muscle is about five-times more abundant than ATP

a. Fatty acid b. Creatine phosphate

c. Glucose d. Lactic acid

**40**. Which of the following is the primary fuel for skeletal muscle during prolonged endurance exercise

a. Fatty acid b. ATP

c. Creatine phosphate d. Glucose

**41**.Following statement is true about rigor mortis

a. Contracture after death b. Due to lack of ATP

c. Muscle remains in contraction d. All the above

**42**. Large number of motor units causing a strong contraction is

a. Wave summation b. Motor unit summation

c. Tetany d. Treppe

**43**. When the frequency of contraction is increased, the strength of contraction increases by

a. Wave summation b. Motor unit summation

c. Treppe d. Tetany

**44**. Individual muscle twitches when become fused into single prolonged contraction, then the strength is maximum at a point known as

a. Rigor mortis b. Treppe

c. Tetany d. Contracture

**45**. Each successive muscle twitch has slightly more strength than previous one, it is called

a. Tetany b. Treppe

c. Staircase phenomenon d. Both b and c

**46**. True regarding single-unit smooth muscle cell

a. Contain large mass of muscle fibers b. Gap junctions present

c. Contract simultaneously d. All the above

**47**. Multiunit smooth muscle fibers are found in

a. Iris b. Ciliary body

c. Arrector pili muscle d. All the above

**48**. Following structures in smooth muscle fiber are the points of attachment for actin thin filaments

a. Dense bodies b. Calmodulin

c. Sarcomere d. Caveolae

**49**. The contractile unit of skeletal muscle is

a. Dense bodies b. Sarcomere

c. Z disc d. T tubule

**50**. The contractile unit of smooth muscle cell is

a. Dense bodies b. Sarcomere

c. Calmodulin d. Caveolae

**51**. Contraction in smooth muscle fiber is

a. Rapid b. Prolonged and often tonic

c. Short and jerky d. Prolonged

**52**. Following statement is true about smooth muscle fiber contraction

a. Sarcoplasmic reticulum is rudimentary b. Cross bridge heads have less ATPase activity

c. Slow attachment of myosin heads to actin d. All the above

**53**. Following structure does not occur in smooth muscle

a. Dense bodies b. Calmodulin

c. Neuromuscular junction d. Caveolae

**54**. Which of the following structures release neurotransmitters affecting numerous single unit smooth muscle cells

a. Varicosities b. Dense bodies

c. T tubules d. Calmodulin

**55**. Smooth muscle fibers contract simultaneously because of

a. Presence of gap junctions b. Absence of gap junctions

c. Presence of sarcoplasmic reticulum d. All the above

**56**. Dark dense bands at the end of cardiac muscle fiber is

a. Dense bodies b. Intercalated disc

c. Synctium d. Sarcomere

**57**. Mitochondria make up about how much percent of the cytoplasmic volume in skeletal muscle

a. 2 % b. 5 %

c. 10 % d. 15 %

**58**. Mitochondria make up about how much percent of the cytoplasmic volume in cardiac muscle

a. 1 % b. 20 %

c. 30 % d. 40 %

**59**. Predominant source of energy for cardiac muscle cell in aerobic metabolism is

a. ATP b. Creatine phosphate

c. Fatty acids d. Glucose

**60**. Cardiac muscle fibers are electrically connected because of presence of

a. Gap junctions b. Intercalated discs

c. Both a and b d. Caveolae

**61**. The coordinated simultaneous contraction of all the cardiac muscle fibers is due to

a. Formation of functional syncytium b. Formation of morphological syncytium

c. T tubules d. None of the above

**62**. Most adaptive tissue in the animal body is

a. Connective tissue b. Muscular tissue

c. Nervous tissue d. Epithelial tissue

**63**. Satellite fibers are responsible for regeneration of

a. Skeletal muscle fiber b. Smooth muscle fiber

c. Cardiac muscle fiber d. All the above

**64**. Sweeny/ shoulder slipoccurs due to damage to

a. Medial palmar nerve b. Lateral palmar nerve

c. Supra scapular nerve d. Ulnar nerve

**65**. Following inhibitory neurotransmitter is not releasedin tetanus

a. Glycine b. GABA

c. Serotonin d. Al the above

**66**. Following statement is not true about Azoturia in horses

a. Also known as tying up or Monday morning sickness

 b. Occurs in starved horses

c. Coffee colored urine

d. High levels of creatine kinase and myoglobin in blood

**67**. Acute exertional rhabdomyolysis occurs in following dog breed

a. Racing greyhound b. Working dogs

c. Idle dogs d. Both a and b

**68**.Nutritional myopathy occurs due to deficiency of

a. Vitamin E b. Selenium

c. Both a and b d. Calcium

**69**. Eclampsia in bitch;

a. Due to hypocalcemia

 b. Small breeds with large litters are more susceptible

c. Mild tremors, muscle spasm, twitching and ataxia occur

 d. All the above

**70**. Dark beef cutters result due to

a. Pre-harvest stress on live animals before slaughter b. Muscle glycogen depletion

c. Acute food poisoning d. Both a and b

**71**. Which among the following is composed of myosin protein

a. Thin filaments b. Thick filament

c. All myofilaments d. All the above

**72**. Arrange the following skeletal muscle structures from largest to smallest; 1. Fascicle 2. Myofilament 3. Muscle fiber 4. Myofibril 5. Sarcomere

a. 1, 3, 4, 5, 2 b. 2, 5, 4, 3, 1

c. 1, 4, 3, 2, 5 d. 3, 2, 5, 4, 1

**73**. Following statement is not true about neuro-muscular transmission

a. It shows fatigue due to depletion of acetylcholine vesicles

b. It is one way conduction; from nerve to muscle

c. It is stimulated by succinyl choline

d. It is blocked by botulinum toxin

**74**. To initiate contraction in skeletal muscle, which protein binds with calcium

a. Troponin T b. Troponin C

c. Troponin I d. Tropomyosin

**75**. During skeletal muscle contraction, function of calcium is

a. Expose myosin binding sites to actin b. Cause ATP binding to actin

c. Release the inhibition on Z discs d. All the above

**76**. Which of the following neurotransmitter increases permeability of skeletal muscle sarcolemma to Na2+ ion during depolarization

a. Succinyl choline b. Acetylcholine

c. Serotonin d. GABA

**77**. Events occurring during excitation-contraction coupling

a. Release of Ca2+ ion from sarcoplasmic reticulum

b. Cross bridge formation between actin and myosin

c. Hydrolysis of ATP to ADP

d. All the above

**78**. Mechanical force of contraction is generated by

a. Shortening of thick filaments b. Sliding of thin filament past thick ones

c. Bocking action of tropomyosin d. All the above

**79**.Which of the following pathways is fastest to regenerate ATP during muscle activity

a. Anaerobic glycolysis b. Lactic acid formation

c. Both a and b d. Aerobic respiration

**80**. Single-unit smooth muscle is found in

a. GI tract b. Urogenital system

c. Both a and b d. Iris

**81**. Cardiac muscle cells stop contraction after how many seconds of oxygen deprivation

a. 30 b. 40

c. 50 d. 60

**82**. Fatigue in skeletal muscle is due to

a. Less number of mitochondria

 b. A total lack of ATP

c. Insufficient intracellular quantity of ATP due to excess consumption

d. All the above

**83**. Muscle fatigue is due to

a. Depletion of energy

b. Failure of neuro muscular transmission

c. Failure of transmission in motor nerve

d. Inability of action potential to spread over muscle

**84**. Which of the following muscle type is involuntary in action

a. Skeletal muscle b. Cardiac muscle

c. Smooth muscle d. Both b and c

**85**.Number of heme groups in myoglobin molecule is

a. 1 b. 2

c. 3 d. 4

**86**. The primary contributor of lactate during muscle fatigue is

a. Stored glycogen b. Gl

c. Creatine phosphate d. Fatty acids

**87**. Structural and functional unit of skeletal muscle fiber is

a. Myofibril b. Sarcomere

c. Myofilament d. Muscle fascicle

**88**. Myosin protein contains

a. 2 light and 2 heavy chains b. 2 light and 4 heavy chains

c. 4 light and 2 heavy chains d. 1 light and 1 heavy chain

**89**. Autoimmune disease caused due to destruction of acetyl choline receptors in post synaptic membrane is

a. Myasthenia gravis b. Hashimoto’s disease

c. Rheumatoid arthritis d. Systemic lupus erythematous

**90**. During cross bridge formation, myosin binds with

a. Globular actin b. Fibrous actin

c. Troponin d. Tropomyosin

**91**. In skeletal muscle, most of the intracellular calcium is bound to

a. Troponin b. Calmodulin

c. Calsequestrin d. Calbindin

**92**. During isotonic contraction

a. Tension remains same b. Muscle length varies

c. Both a and b d. Tension varies

**93**. Enzyme that cleaves myosin protein at hinge region

a. Papain b. Protease

c. Collagenase d. Trypsin

**94**. RMP in the cardiac muscle is

a. -70 mv b. -90 mv

c. -65 mv d. -55 mv

**95**. RMP in the smooth muscle is

a. -50 mv b. -70mv

c. -90mv d. -95 mv

**96**. If cardiac muscle fibers die, they are replaced with

a. Scar tissue b. Satellite fibers

c. Both a and b d. Purkinje fibers

**97**. Enlarged areas of sarcoplasmic reticulum along the side of transverse tubules is known as

a. Longitudinal tubules b. Transverse tubules

c. Terminal cistern d. Caveolae

**98**. Light band/ isotropic band contains

a. Actin b. Myosin

c. Troponin d. Both a and b

**99**. The dark line present in the middle of H-zone is

a. Z disc b. M line

c. K line d. L line

**100**. Phosphorylation of light chain of myosin in smooth muscle is caused by

a. Creatine kinase b. Creatine phosphatase

c. Myosin light chain kinase d. Myosin light chain phosphatase

**101**. The least and the most moveable end of skeletal muscle are respectively called

and

**102**. Generally, the length and diameter of skeletal muscle fiber is respectively

and

**103**. The tubules which encircle myofibrils and are arranged parallel to them are called

**104**.Large motor unit is found in

**105**. For cranial and spinal motor neuron action potential, NM junction functions as

**106**. A communication link between sarcolemma and Myofibril is provided by

**107**. The depolarization signal in the following skeletal muscle cell structures is transferred in the manner; 1. Sarcolemma 2. SR 3. T tubules 4. Sarcomere 5. Myofibril

a. 1, 3, 2, 5, 4 b. 1, 2, 3, 4, 5

c. 1, 4, 3, 2, 5 d. 2, 3, 5, 4, 1

**108**. Hydrolysis of Ach into acetic acid and choline occurs by enzyme

**109**. What is true about D- Tubocurarine;

a. Muscle relaxant b. Active substance of curare

c. Blocks binding of Ach to Ach receptors d. All the above

**110**. Muscle shortening that occurs in absence of action potential is called

a. Contracture b. Muscle fatigue

c. Tetany d. Treppe

**111**. Enzyme required for relaxation of contracted smooth muscle is

a. Myosin kinase b. Myosin phosphatase

c. Creatine kinase d. Creatine phosphatase

**112**. Which of the following muscle type are innervated by autonomic nerves

a. Skeletal muscle b. Cardiac muscle

c. Smooth muscle d. Both b and c

**113**. Strength of cardiac muscle cell contraction is dependent on

a. Concentration of Na2+ in extracellular fluid

b. Concentration of K+ in intracellular fluid

c. Concentration of Ca2+ in extracellular fluid

d. Concentration of phosphate in intracellular fluid

**114**. During eclampsia in bitch;

a. Excitation – contraction coupling mechanism is blocked

b. Excitation – contraction coupling maintained at NM junction

c. Tetany due to repetitive firing of motor nerve

d. Both b and c

**115**. Length and diameter of cardiac muscle compared to skeletal muscle is

a. Smaller b. Greater

c. Equal d. None of the above

**116**. Ratio of motor nerve branches to total muscle fibers is called

a. Inertia ratio b. Innervation ratio

c. Motor unit d. Summation ratio

**117**. In the presence of ATP, G-actin forms

a. F-actin b. H-actin

c. Troponin d. M-actin

**118**. Amount of heat produced by muscle is proportional to work done and it is called

a. Thermophilic effect b. Fenn effect

c. Caloric effect d. Specific heat

**119**. Cardiac muscle cannot be summated temporarily because of

a. Prolonged action potential b. Fast action potential

c. Intercalated disc d. None of the above

**120**. Smooth muscle contraction is initiated by

a. Na2+ ion b. Ca2+- Troponin interaction

c. Ca2+ - calmodulin interaction d. Tropomyosin- troponin complex

**121**. Action potential is initiated independent of nerve stimulation in

a. Skeletal muscle cell b. Cardiac muscle cell

c. Smooth muscle cell d. All the above

**122**.Slow and prolonged action potential in cardiac muscle cell is due to

a. Voltage gated slow Na2+ channel b. Voltage activated slow Na2+-Ca2+ channel

c. Voltage gated fast Ca2+ channel d. None of the above

**123**.H band contains

a. Actin filaments b. Myosin filaments

c. Both actin and myosin filament d. No filament

**124**. The ATPase activity of myosin head portion is regulated by ions

a. Ca2+, Mg2+ b. Ca2+, Na+

c. Na2+, K+ d. K+, Mg2+

**125**. Isotropic band is bisected by a dark thin band called

a. H - zone b. M line

c. Z - line d. L – line

**126**. Troponin I binds with

a. Actin only b. Myosin only

c. Tropomyosin only d. Actin and tropomyosin

**127**. Electrical activity of skeletal muscle during contraction is measured by

a. Electromyography b. Electrocardiography

c. Electroencephalography d. None of the above

**128**. ATP sparer or energy buffer is

a. Growth hormone b. Glucose

c. Creatine phosphate d. Insulin

**129**.Due to Fenn effect, efficiency of muscle contraction is only

a. 10 % b. 30 %

c. 45 % d. 100 %

**130**. **F**ollowing statements is true during skeletal muscle contraction

a. Length of I band decreases

b. Length of A band remains same

c. Z disc comes closer

d. All the above

**131**. Time period between point of stimulus and beginning of contraction is

a. Latent period b. Refractory period

c. Threshold period d. Contraction period

**132**. Wrinkled appearance of smooth muscle surface is due to

a. Varicosities b. Dense bodies

c. Calmodulin d. T tubules

**133**. One myosin molecule is surrounded by how many actin molecules

a. 3 b. 6

c. 9 d. 12

**134**. Approximate width of synaptic cleft is

a. 20-30 nm b. 30-40 nm

c. 70-80 nm d. 100-120 nm

**135**. Maximum strength of stimulus required to excite the tissue is

a. Impulse b. Action potential

c. Rheobase d. All the above

**136**. Which of the muscle type shows highest level of endurance

a. Skeletal muscle b. Cardiac muscle

c. Smooth muscle d. All the above

**137**. Cardiac muscle cells do not show fatigue due to

a. Short refractory period b. Long refractory period

c. Synctium d. Cross striations

**138**. The sources of energy required for muscle contraction are all except

a. Creatine phosphate b. ATP

c. Muscle glycogen d. Lactic acid

**139**. Which of the muscle type is un-branched

a. Skeletal muscle b. Smooth muscle

c. Cardiac muscle d. Both a and b

**140**. Following skeletal muscle type is highly susceptible to fatigue

a. Type I b. Type II A

c. Type II B d. All the above

 **ANSWERS**

**1.** b **29.** d **57.** a **85.** a **113.** c

**2.** d **30.** b **58.** d **86.** a **114.** d

**3.** c **31.** a **59.** c **87.** b **115.** a

**4.** d  **32.** b **60.** c  **88.** c **116.**  b

**5.** b **33.** a **61.** a **89.** a **117.** a

**6.**  a **34.** d **62.** b **90.** b **118.** b

**7.** d **35.** b **63.** a  **91.** c **119.** a

**8.** d **36.** c **64.** c  **92.** c **120.** c

**9.** a **37.** d **65.** **a**

 **93.** a  **121.** B

**10.** a **38.**  a **66.** b **94.** b  **122.** b

**11.** b **39.** b **67.** d **95.** a  **123.** b

**12. d 40.** a **68.** c  **96.** a **124.** a

**13.**  c **41.** d **69.** d **97.** c **125.** c

**14.** b  **42.** b **70.** d **98.** a **126.** d

**15.** a  **43.** a **71.** b **99.** b  **127.** a

**16.** d **44.** c  **72.** a **100.** c  **128.** c

**17.** b **45.** d **73. c 101.**  Origin and insertion **129. c**

**18.** a **46.** d **74.** b  **102.** 10-30cm and 5-100 µm **130. d**

**19.** b  **47.** d  **75.** a **103.** Sarcoplasmic reticulum **131. a**

**20.** c **48.** a **76.** b  **104.**  Limb and postural muscle **132. b**

**21.** b **49.** b  **77.** d **105.** Amplifier  **133.**  b

**22.** c **50.** a  **78.** b  **106.** T tubule **134.** a

**23.** a **51**. b **79.** c  **107.** a **135.** c

**24.** b **52.** d  **80.** c  **108.** Ach esterase **136.** b

**25.** a **53.** c **81.**  a **109.** d **137.** b

**26.** b **54.** a  **82.** c **110.** a **138.** d

**27.** a **55.** a **83.**  d **111.**  b **139.** d

**28.** a  **56.** b **84.** d  **112.** d **140.** c