Passive membrane properties

Key term
1. Passive membrane properties
2. Membrane resistance
3. Membrane capacitance
4. Time constant
5. Motor unit
6. Size principle
7. Length constant
8. Axonal conduction velocity
9. Spatial summation
10. Temporal summation

Question and explanation
1. How does the time constant affect temporal summation?
2. Describe two methods to measure the time constant.
3. How does the length constant affect axonal conduction velocity?
4. How does the size principle work in the muscle fiber recruitment?
5. Describe two neuronal strategies to achieve high conduction speed.

Action of membrane proteins in cell function

Key Term
1. Sensory transducer
2. Chemoreceptor
3. Mechanoreceptor
4. Enteroreceptor
5. Exteroreceptor
6. Stimulus
7. Response
8. $K_{ATP}$ channel
9. Kinocilium
10. Stereocilia
11. Tip link
12. Nociceptors
13. Capsaicin

Question
1. Explain the molecular basis for baroreception in aortic bodies.
2. What is the hair bundle in the cochlea, and how does it work in sound wave detection?
3. How does the $K_{ATP}$ channel work in glucose regulation?
4. What is the hot channel, how does it work in nociception?
5. Describe the molecular basis for temperature sensing?
6. Explain how various TRP channels work jointly in temperature sensation?

Cell Functional regulation

Key Term
1. Allosteric Modulation
2. Covalent Modulation
3. Phosphorylation
4. Dephosphorylation
5. Kinase
6. Phosphatase
7. Effector protein
8. Kinase cascades
9. Receptor tyrosine kinase
10. CaM kinase II
11. CREB

**Question**
1. How many major families of protein kinases can be classified? Give their names.
2. Describe potential sources for a rise in cytosolic Ca\(^{++}\) level?
3. How can metabolic substrates and products be involved in the regulation of cell functions?
4. Explain PKA-mediated signal transduction.
5. How does PKC work in signal transduction?
6. Describe the structural properties of receptor tyrosine kinases.
7. Describe an example in which receptor tyrosine kinases regulate each of cytosolic and nucleus signal transductions.
8. Explain how phosphorylation and dephosphorylation affect cell function.

**Excitation-contraction coupling**

**Key term**
1. Excitation-contraction coupling
2. Endplate
3. Acetylcholinesterase
4. T tubules
5. Ryanodine receptor
6. RyR1
7. RyR2
8. Calsequestrin
9. Dihydropyridine receptor
10. SERCA

**Question**
1. Describe events for excitation-contraction coupling in skeletal muscles.
2. How does the T tubule system work in E-C coupling?
3. What are the functions of dihydropyridine receptor in skeletal muscles?
4. What is the ryanodine receptor, and how can it be activated?
5. Describe the mechanisms for removal of Ca\(^{++}\) from cytosol after excitation.

**Molecular motors and muscle contraction**

**Key Term**
1. N-Kinesin
2. C-Kinesin
3. Dynein
4. Microtubule
5. Beta tubulin
6. Melanosome
7. Myosin II, V and VI
8. Actin
Question

1. How do microtubule polymerization and depolymerization produce mechanical movement?
2. Describe structural properties of kinesins?
3. How many types of kinesins are there, and what are their differences?
4. How far does each step of kinesin movement go, and how much force does each step produce?
5. What is the mechanism underlying axonal anterograde transport?
6. What molecular motors contribute to retrograde transport in axon?
7. Describe the sequence of events for filament sliding in striated muscles.

Mechanics of muscle contraction

Key Term

1. Series elastic force
2. Parallel elastic force
3. Isometric contraction
4. Isotonic contraction
5. Preload
6. Afterload
7. Slow-oxidative fiber
8. Fast-glycolytic fiber
9. Fast-oxidative fibers
10. Aerobic exercise
11. Anaerobic exercise

Question

1. Describe the length-tension relationship in skeletal muscles.
2. What preparation do you use to study the length-tension relationship? Why?
3. How does norepinephrine affect the length-tension relationship in the heart?
4. What is the force-velocity relationship in skeletal muscles, and what information does it provide?
5. What preparation do you use to get the force-velocity relationship?
6. How many types of fibers are in skeletal muscles, and what is the difference among them?
7. How do the skeletal muscle fiber types affect muscle fatigue?
8. What types of skeletal muscle fibers do you use when you play soccer? Why?
10. Myosin light-chain phosphatase

Question
1. What is the ionic basis underlying the five phases of cardiac action potentials in fast response fibers?
2. What ion channels are involved in slow response fibers?
3. What is the pacemaker channel, and how does it work in regulating heart rate?
4. How does the M current regulate the heart rate?
   1. What is the Ca^{++}-induced Ca^{++} release, and how does it work?
   2. How does Ca^{++} regulate smooth muscle contraction?
   3. Describe protein phosphorylations in the regulation of smooth muscle contraction.