A & P I
MUSCULAR SYSTEM

1. The tough connective tissue covering, which surrounds muscle is called:
   a. The belly of the muscle
   b. A tendon
   c. Fascia
   d. A sarcomere

2. T/F The less movable attachment sight of a muscle is the insertion site.

3. T/F When a muscle flexes, the entire muscle must flex. It is not possible to have a partial contraction.

4. The prime mover in flexion of the forearm is __________. Which muscle would be considered synergists of this action? Antagonists? Fixators?

5. T/F Push-ups are a form of isometric exercise.

6. Which of the following is in correct order from largest to smallest?
   a. Fasciculus, muscle, myofibril, muscle fiber
   b. Muscle, fasciculus, myofibril, muscle fiber
   c. Muscle, fasciculus, muscle fiber, myofibril
   d. Muscle, Muscle fiber, fasciculus, myofibril

7. _______________ is the connective tissue covering surrounding a fasciculus.

8. The plasma membrane of the muscle fiber is called the:
   a. Syncytium
   b. Sarcomere
   c. Troponin
   d. Sarcolemma
   e. Motor unit

9. T/F The connective tissue covering which encases a muscle fiber is called the epimysium.
10. The thin myofilament of the sarcomere is composed of the protein ____________________.

11. **T/F** Muscle fibers display the characteristic of syncytium. In other words, each cell has only one nucleus.

12. In the space provided below, sketch a sarcomere. Label all muscle filaments, bands, zones, and lines.

13. Which area contains only actin filaments (from #12 above)?

14. Which area contains only myosin filaments?

15. Which area contains both?

16. During muscle contraction which area(s) shrink(s)?

17. ______________________ filaments have club-like heads capable of swinging towards the middle of the sarcomere with force.

18. **T/F** Myosin filaments are capable of bonding to the thin filaments, pulling them towards the center of the sarcomere.

19. This small thread-like molecule is capable of preventing the myosin heads from attaching to actin by blocking the bonding sites of the actin molecule:
   a. Tropomyosin
   b. Troponin
   c. Trypsin
   d. Thyroxin
   e. Thrombin

20. This molecule is capable of binding with **Ca++**, pulling the small thread-like molecule (answer to #19) away from actin, opening the binding sites on actin. The name of this molecule is:
   a. Tropomyosin
   b. Troponin
   c. Trypsin
   d. Thyroxin
   e. Thrombin

21. The ______________________ is a series of tubes and channels that run throughout the cytoplasm of the muscle.
22. The tube-like invaginations of the sarcolemma responsible for conducted impulses into the muscle fiber are called:
   a. Motor end plates
   b. Synaptic vesicles
   c. Transverse clefts
   d. T-tubules
   e. Synaptic knobs

23. In the space below, draw and label the parts of a typical neuromuscular junction:

24. **T/F** The nerve ending (synaptic knob), which innervates the muscle, comes into direct contact with the sarcolemma.

25. **T/F** To break a rigor complex, one ATP must be spent.

26. **T/F** During glycolysis, the sugar glucose is broken in half.

27. Aerobic respiration requires:
   a. Carbon dioxide
   b. Oxygen
   c. ATP
   d. Lactic acid
   e. Myoglobin

28. Which process produces more energy, aerobic or anaerobic respiration?

29. **T/F** Myoglobin is commonly carried in the blood stream.

30. What is the function of myoglobin?
31. Red muscle is:
   a. Rich in myoglobin and resistant to fatigue
   b. Rich in myoglobin and susceptible to fatigue
   c. Low in myoglobin and resistant to fatigue
   d. Low in myoglobin and susceptible to fatigue

32. Which muscles in the human body are red muscle?

33. Which of the following factors can contribute to fatigue?
   a. ATP consumption faster than ATP production
   b. The muscle begins to run out of acetylcholine
   c. Lactic acid builds up
   d. Being infected with a virus or bacteria which causes illness
   e. Low glucose levels
   f. All of the above

34. Which of the following displays the All or None response?
   a. The muscle
   b. The fasciculus
   c. The muscle fiber
   d. Actin filament

35. Which of the following is capable of a graded response?
   a. The muscle
   b. The muscle fiber
   c. A motor unit
   d. The sarcomere

36. What is threshold stimulus? What happens to a motor unit once threshold has been reached?

37. Asynchronous motor unit contraction would be associated with:
   a. A smooth, controlled muscle movement
   b. Tetanus
   c. Harsh jerky movements
   d. Total muscle relaxation
   e. B & C

38. **T/F** In wave summation, the effects of stimuli are added up until the muscle reaches complete tetanus.
39. Noncontractile elements of the muscle include:
   a. Perimysium
   b. Reticular fibers
   c. Myosin
   d. Collagen
   e. All but A
   f. All but C
   g. All of the above

40. **T/F** All muscles are in a state of readiness, with some motor units in tetanus while you are conscious. This is called muscle tone or muscle tonus.

41. **T/F** A muscle is an organ.

42. **T/F** Cramps result from a lack of ATP.

43. Creatine phosphate can:
   a. Act as an energy reserve
   b. Stimulate the production of cholinesterase
   c. Transfer its phosphate to ADP to form ATP
   d. Refill myoglobin with O₂
   e. A & C
   f. B & D

44. Which organ is capable of converting lactic acid back into pyruvic acid?

45. When a working muscle experiences a shortage in oxygen, it switches from aerobic respiration to______________.

46. How many ATP are created per molecule of glucose in aerobic respiration?

47. **T/F** After the myosin head has bound to actin and pulled it inward, the myosin head must be recharged. This requires the expenditure of an ATP molecule.

48. A motor unit:
   a. Is a single motor neuron and all of the muscle fibers it controls
   b. Exhibits asynchronous summation
   c. Will contract only after a threshold stimulus has been reached
   d. A & B
   e. A & C
   f. B & C
49. At a neuromuscular junction, an impulse traveling down a motor neuron would cause the release of ________________ from the synaptic knobs.

50. Receptors, specialized for receiving neurotransmitters, are found in this portion of the sarcolemma:
   a. The T-tubule
   b. The synaptic cleft
   c. The synaptic vesicle
   d. The motor end plate
   e. The motor unit

51. An impulse carried along the sarcolemma would travel down the T-tubules, causing the release of CA++ ions from:
   a. The lateral sacs
   b. The myofibril
   c. The sarcomere
   d. The myofilaments
   e. B & C

52. CA++ ions bind to _________________. This causes _________________ to shift, hence opening the binding sights on actin.

53. For a muscle to relax:
   a. Cholinesterase must break down acetylcholine
   b. CA++ ions must be actively pumped back into the lateral sacs
   c. The rigor complex must be broken
   d. All of the above
   e. None of the above
ESSAYS

1. Describe in detail a muscle contraction from the initial stimulus of the motor neuron to relaxation of the muscle.

2. Describe in detail what happens during oxygen debt. Be sure to include all components, types of respiration, and organs involved.
Use a piece of paper to cover up half the page and practice identifying origin, insertion, and action. They switch and cover the other half and identify the muscle.

TEMPORALIS
O = TEMPORAL FOSSA
I = CORONOID PROCESS, RAMUS OF MANDIBLE
A = RAISES THE MANDIBLE

MASSETER
O = ZYGOMATIC ARCH
I = ANGLE, RAMUS OF MANDIBLE
A = RAISES MANDIBLE

PTERYGOIDS
A = SIDE TO SIDE MOVEMENTS OF MANDIBLE

STERNOCLEIDOMASTOID
O = 2 HEADS
   MANUBRIUM OF STERNUM
   MEDIAL PORTION OF CLAVICLE
I = MASTOID PROCESS
A = ROTATE HEAD (SINGLY)
   FLEX CERVICAL VERTEBRAE (TOGETHER)

DIGASTRIC
O = Anterior belly-INNER SURFACE OF MANDIBLE
   Posterior belly-MASTOID PROCESS
I = HYOID BONE
A = RAISES HYOID, ASSISTS IN SWALLOWING

MYLOHYOID
O = INNER SURFACE OF MANDIBLE
I = HYOID BONE
A = ELEVATES FLOOR OF MOUTH

STERNOHYOID
O = MANUBRIUM, MEDIAL END OF CLAVICLE
I = HYOID BONE
A = PULLS HYOID INFERIORLY

STERNOTHYROID
O = MANUBRIUM
I = THYROID CARTILAGE
A = PULLS LARYNX INFERIORLY

THYROHYOID
O = THYROID CARTILAGE
I = HYOID BONE
A = PULLS HYOID INFERIORLY
   RAISES LARYNX

SACROSPINALIS
COMPOSED OF 3 GROUPS OF MUSCLES OF EITHER SIDE OF VERTEBRAL COLUMN FROM TO BACK OF HEAD
A = ERECTS SPINE

Splenius
O = SPINOUS PROCESSES OF UPPER THORACIC AND 7TH CERVICAL AND LIGAMENTUM NUCHAE
I = UPPER CERVICAL VERTEBRAE
A = EXTENDS THE HEAD
<table>
<thead>
<tr>
<th>Muscle</th>
<th>O</th>
<th>I</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTERTRANSVERSARII</td>
<td>O = TRANSVERSE PROCESS OF ALL VERTEBRAE</td>
<td>I = TRANSVERSE PROCESS OF VERTEBRA ABOVE ORIGIN</td>
<td>A = ABDUCTS VERTEBRAL COLUMN</td>
</tr>
<tr>
<td>SCALENES</td>
<td>O = TRANSVERSE PROCESS OF CERVICAL</td>
<td>I = 1ST TWO RIBS</td>
<td>A = FLEX, ROTATE NECK Assist in inspiration</td>
</tr>
<tr>
<td>INTERSPINAES</td>
<td>O = SUPERIOR SURFACE OF ALL SPINOUS PROCESSES</td>
<td>I = INFERIOR SURFACE OF SPINOUS PROCESS ABOVE ORIGIN</td>
<td>A = EXTEND VERTEBRAL COLUMN</td>
</tr>
<tr>
<td>ROTATORES</td>
<td>O = ALL TRANSVERSE PROCESSES</td>
<td>I = BASE OF SPINOUS PROCESS ABOVE ORIGIN (short)</td>
<td>BASE OF SPINOUS PROCESS TWO VERTEBRAE ABOVE ORIGIN (long)</td>
</tr>
<tr>
<td>SEMISPINALIS</td>
<td>O = TRANSVERSE PROCESS OF THORACIC AND 7TH CERVICAL</td>
<td>I = SPINOUS PROCESS OF CERVICAL AND UPPER THORACIC</td>
<td>A = EXTEND HEAD, POSTURE MUSCLE</td>
</tr>
<tr>
<td>DIAPHRAGM</td>
<td>A = MOST IMPORTANT MUSCLE FOR BREATHING</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXTERNAL INTERCOSTALS</td>
<td>O = INFERIOR BORDER OF RIBS</td>
<td>I = SUPERIOR BORDER OF RIB BELOW</td>
<td>A = ASSIST IN INSPIRATION</td>
</tr>
<tr>
<td>INTERNAL INTERCOSTALS</td>
<td>O = INNER SURFACE OF RIBS</td>
<td>I = SUPERIOR BORDER OF RIB BELOW</td>
<td>A = ASSIST IN INSPIRATION</td>
</tr>
<tr>
<td>RECTUS ABDOMINUS</td>
<td>O = PUBIC CREST</td>
<td>I = XIPHOID PROCESS</td>
<td>A = COMPRESS ABDOMINAL CAVITY FLEXES VERTEBRAE COLUMN</td>
</tr>
<tr>
<td>QUADRATUS LUMBO RUM</td>
<td>O = POSTERIOR PORTION ILIAC CRE ST</td>
<td>I = 12TH RIB, TRANSVERSE PROCESSES OF LUMBAR VERTEBRAE</td>
<td></td>
</tr>
<tr>
<td>EXTERNAL ABDOMINAL OBlique</td>
<td>KNOW ARRANGEMENT AND FIBER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INTERNAL ABDOMINAL OBlique</td>
<td>DIRECTION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRANSVERSE ABDOMINUS</td>
<td>A = COMPRESS ABDOMINOPELVIC CAVITY</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Muscle</strong></td>
<td><strong>Origin</strong></td>
<td><strong>Insertion</strong></td>
<td><strong>Action</strong></td>
</tr>
<tr>
<td>------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Levator Ani</td>
<td>A = KEEP THINGS FROM FALLING OUT OF THE PELVIC CAVITY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coccygeus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trapezius</td>
<td>O = OCCIPITAL BONE, LIGAMENTUM NUCHAE, SPINOUS PROCESSES 7TH CERVICAL AND THORACIC</td>
<td>I = LATERAL CLAVICLE, ACROMION PROCESS, SPINE OF SCAPULA</td>
<td>A = ELEVATES, DEPRESSES, ROTATES ADDUCTS, STABILIZES SCAPULA</td>
</tr>
<tr>
<td>Rhomboideus</td>
<td>O = 7TH CERVICAL TO 5TH THORACIC</td>
<td>I = VERTEBRAL BORDER OF SCAPULA</td>
<td>A = ADDUCT, STABILIZES, AND ROTATES DOWNWARD</td>
</tr>
<tr>
<td>Levator Scapulae</td>
<td>O = TRANSVERSE PROCESSES C1-C4</td>
<td>I = SUPERIOR ANGLE OF SCAPULA</td>
<td>A = ELEVATES SCAPULA</td>
</tr>
<tr>
<td>Pectoralis Minor</td>
<td>O = 3RD THROUGH 5TH RIBS</td>
<td>I = CORACOID PROCESS OF SCAPULA</td>
<td>A = DEPRESSES SCAPULA, PULLS SCAPULA ANTERIORLY</td>
</tr>
<tr>
<td>Serratus Anterior</td>
<td>O = 1ST 8 OR 9 RIBS</td>
<td>I = VERTEBRAL BORDER OF SCAPULA</td>
<td>A = STABILIZES, ADDUCTS, AND ROTATES SCAPULA UPWARD</td>
</tr>
<tr>
<td>Pectoralis Major</td>
<td>O = MEDIAL CLAVICLE, STERNUM, COSTAL CARTILAGE OF 1ST 6 RIBS</td>
<td>I = GREATER TUBERCLE, INTERTUBICULAR GROOVE</td>
<td>A = FLEXES, ADDUCT, AND MEDIALLY ROTATES HUMERUS</td>
</tr>
<tr>
<td>Latissimus Dorsi</td>
<td>O = SPINOUS PROCESS OF LOWER 6 THORACIC, LUMBAR VERTEBRAE SACRUM, POSTERIOR ILIAC CREST ALL VIA LUMBODORSAL FASCIA</td>
<td>I = GREATER TUBERCAL, INTERTUBICULAR GROOVE</td>
<td>A = EXTENDS, ADDUCT, MEDIALLY ROTATES HUMERUS</td>
</tr>
<tr>
<td>Deltoide</td>
<td>O = LATERAL CLAVICLE, ACROMION PROCESS, SPINE OF SCAPULA</td>
<td>I = DELTOID TUBEROSITY</td>
<td>A = ABDUCTS HUMERUS, ANTERIOR FIBERS FLEX, POSTERIOR FIBERS EXTEND</td>
</tr>
</tbody>
</table>
SUPRASPINATUS
O = SUPRASPINOUS FOSSA
I = GREATER TUBERCLE
A = INITIATES ABDUCTION OF HUMERUS

INFRASPINATUS
O = INFRASPINOUS FOSSA
I = LESSER TUBERCLE
A = ROTATES HUMERUS LATERALLY

SUBSCAPULARIS
O = SUBSCAPULAR FOSSA
I = LESSER TUBERCLE
A = ROTATES HUMERUS MEDIANLY

TERES MAJOR
O = INFERIOR ANGLE OF SCAPULA
I = UNDER AXILLA TO LESSER TUBERCLE
A = ADDUCTS, EXTENDS, AND MEDIANLY ROTATES HUMERUS

TERES MINOR
O = MIDWAY UP AXILLARY BORDER
I = WRAPS AROUND OUTSIDE OF HUMERUS TO GREATER TUBERCLE
A = ROTATES HUMERUS LATERALLY, WEAKLY ADDUCTS AND EXTENDS

BICEPS BRACHII
O = LONG HEAD-SUPRAGLENOID TUBERCLE
SHORT HEAD-CORACOID PROCESS
I = RADIAL TUBerosity
A = FLEXES, SUPINATES FOREARM

BRACHIALIS
O = LOWER 1/2 HUMERUS, ANTERIOR SIDE
I = CORONOID PROCESS OF ULNA
A = FLEXES 4-ARM, ESPECIALLY IN THE PRONATED POSITION

TRICEPS BRACHII
O = LONG HEAD-INFRAGLENOID TUBERCLE
LATERAL HEAD-POSTERIOR SURFACE OF HUMERUS
MEDIAL HEAD-POSTERIOR HUMERUS BELOW RADIAL GROOVE
I = OLECRANON PROCESS OF ULNA
A = EXTENDS THE FOREARM

BRACHIOADIALIS
O = DISTAL PORTION OF HUMERUS
I = STYLOID PROCESS OF RADIUS
A = FLEXES THE FOREARM

ILIOPSOAS
O = LUMBAR VERTEBRAE, ILIAC CREST
I = LESSER TROCHANTER
A = MOST POWERFUL FLEXOR OF FEMUR

GLUTEUS MAXIMUS
O = POSTERIOR ILIUM AND SACRUM
I = POSTERIOR FEMUR, ILIOTIBIAL BAND
A = PRIMARY EXTENSOR OF FEMUR
GLUTEUS MEDUAS
O = LATERAL ILIAC CREST
I = GREATER TROCHANTER
A = ABDUCTS, MEDIANLY ROTATES THIGH

GLUTEUS MINIMUS
O = LATERAL ILIUM
I = GREATER TROCHANTER
A = ABDUCTS, MEDIANLY ROTATES THIGH

TENSOR FASCIAE LATAE
O = ANTERIOR PORTION OF ILIAC CREST
I = LATERAL TIBIA, FIBULA BY WAY OF ILIO-TIBIAL BAND
A = STABILIZES KNEE WHILE WALKING

ADDUCTOR MAGNUS
O = PUBIS, ISCHIAL TUBerosity
I = LINEA ASPERA
A = ABDUCTS, LATERALLY ROTATES THIGH

ADDUCTOR LONGUS
O = CREST AND SYMPHYSIS OF PUBIS
I = LINEA ASPERA
A = ABDUCTS, LATERALLY ROTATES THIGH

ADDUCTOR BREVIS
O = INFERIOR RAMUS OF PUBIS
I = LINEA ASPERA
A = ABDUCTS, LATERALLY ROTATES THIGH

GRACILIS
O = SYMPHYSIS PUBIS, PUBIC ARCH
I = PROXIMAL MEDIAL TIBIA(Passes behind knee joint)
A = ADDUCTS THIGH, FLEXES LEG

SARTORIUS
O = ANTERIOR SUPERIOR ILIAC SPINE
I = PROXIMAL MEDIAL TIBIA
A = ASSISTS IN FLEXING THIGH AND LEG LATERALLY ROTATES THIGH

RECTUS FEMORIS
O = ANTERIOR INTERIOR ILIAC SPINE
I = TIBIAL TUBEROSITY
A = EXTEND LEG, ASSIST IN FLEXION OF THIGH

VASTUS LATERALIS
O = LINEA ASPERA
I = TIBIAL TUBEROSITY
A = EXTEND LEG, ASSIST IN FLEX THIGH

VASTUS MEDIALIS
O = LINEA ASPERA
I = TIBIAL TUBEROSITY
A = EXTEND LEG, ASSIST IN FLEX THIGH

VASTUS INTERMEDIUS
O = ANTERIOR SHAFT OF FEMUR
I = TIBIAL TUBEROSITY
A = EXTEND LEG, ASSIST IN FLEX THIGH

*VIA THE PATELLAR TENDON
BICEPS FEMORIS
O = LONG HEAD-ISCHIAL TUBerosITY
SHORT HEAD-LINEA ASPERa
I = LATERAL TIBIA AND FIBULA
A = FLEX LEG, LONG HEAD EXTEND THIGH

SEMITENDINOSUS
O = ISCHIAL TUBerosITY
I = PROXIMAL MEDIAL TIBIA
A = FLEXES LEG, EXTENDS THIGH

SEMINENBRANOSUS
O = ISCHIAL TUBerosITY
I = PROXIMAL MEDIAL TIBIA
A = FLEXES LEG, EXTENDS THIGH

TIBIALIS ANTERIOR
O = LATERAL 2/3'S OF TIBIA,
INTEROSSEOUS LIGAMENT
I = 1ST METATARSAL
A = DORSIFLEXES AND INVERTS FOOT

PERONEUS LONGUS
O = PROXIMAL 2/3'S OF LATERAL FIBULA
I = BOTTOM SURFACE OF 1ST METATARSAL
A = PLANTAR FLEXES, EVERTS FOOT

GASTROCNEMIUS
O = MEDIAL AND LATERAL EPICONDYLES
OF FEMUR
I = CALCANEUS VIA ACHILLES TENDON
A = FLEXES LEG, PLANTAR FLEXES FOOT

SOLEUS
O = POSTERIOR FIBULA AND TIBIA
I = CALCANEUS VIA ACHILLES TENDON
A = PLANTAR FLEXES THE FOOT
A & P I
MUSCULAR SYSTEM

1. C
2. F-origin
3. F-it is possible
4. biceps brachii; brachialis, brachioradialis; triceps brachii
5. F
6. C
7. Perimysium
8. D
9. F-epimysium encases entire muscle
10. actin
11. F-multinucleate
12. see your notes & text!
13. I-band
14. H-zone
15. A-band
16. I-band, H-zone, sarcomere
17. myosin
18. T
19. A
20. B
21. sarcoplasmic reticulum
22. D

23. See your notes & text! Label synaptic bulb, synaptic cleft, synaptic vesicles with neurotransmitters (like acetylcholine), motor endplate with receptors for acetylcholine, T-tubule, sarcolemma, muscle fiber

24. F-there is a synaptic cleft

25. T

26. T

27. B

28. aerobic (TCA cycle, electron transport chain)

29. F-carried in muscle

30. storage of extra oxygen

31. A

32. posture muscles, walking muscles

33. F

34. C

35. A

36. minimum stimulus required to cause contraction =threshold stimulus. What happens - it contracts!

37. A

38. T

39. F

40. T

41. T

42. T

43. E
44. liver (the "super" organ!)

45. anaerobic respiration

46. 36 ATPs

47. T

48. E

49. acetylcholine

50. D

51. A

52. troponin
tropomyosin

53. D

ESSAYS - See your notes, text, instructor!

{muscleap}