KINESIOLOGY

Examination Questions

I. (a) Define kinesiology and give its general relationships to certain other sciences.

(b) List at least three of its contributions to the betterment of teaching physical education.

II. (a) Where, in the human body, is the location of motion?

(b) Where, the source of bodily motion?

III. (a) Name the three general classes of joints to which all articulations of the body belong.

(b) Name and give one example each of the six types of freely movable joints.

IV. Answer these questions yes or no:

(1) A muscle can only pull; it never pushes.

(2) Whenever there is nervous stimulation the muscles relax.

(3) Every muscle has its two ends attached to different bones.

(4) All muscles are arranged in antagonistic pairs or groups.

(5) The smaller muscles are located where the greatest force is needed.

(6) The human machine has a high degree of efficiency.

(7) The primary factors in the physiological condition are fatigue, source of food substance, and removal of waste substances from the tissue.

(8) The muscles of the body are of three types, smooth, cardiac, and skeletal.

(9) The cardiac is the type directly responsible for motor activity.

(10) Muscle activity takes place through the regular processes of metabolism.

(11) Inertia is a property of all objects.

(12) The human body is stable when in a standing position.

(13) Gravity is a constant force acting on all bodies.

(14) The two articulating bones of the hip joint are the scapula and the humerus.

(15) The elbow joint is a ball and socket joint.

(16) The gliding type of joint is best exemplified by the articular processes of the vertebrae.

(17) The ball and socket joint is perfectly described by its name.

(18) The saddle type of joint is a special arrangement found only in the thumb.

(19) Adduction is a lateral movement away from the central plane of the body.

(20) Abduction is a movement inward toward the central plane of the body.

V. (a) What do we mean by equilibrium? Give your most complete definition.

(b) Since it is impossible to understand the physical principles of total body action without understanding certain governing laws of motion, please give in detail the Newtonian laws: (1) the laws of inertia; (2) the laws of acceleration; (3) the law of reaction.

(c) The levers of the body frequently move in complete unison and with perfect timing in respect to their involved neighbors. For instance, when one climbs the stairs, one's weight is lifted by extension at three articulations simultaneously. Name the articulations and state generally what takes place in such activity at these articulations.

VI. (a) List four of the fundamental manipulative skills.

(b) Explain briefly the three principal types to which all manipulative skills belong.

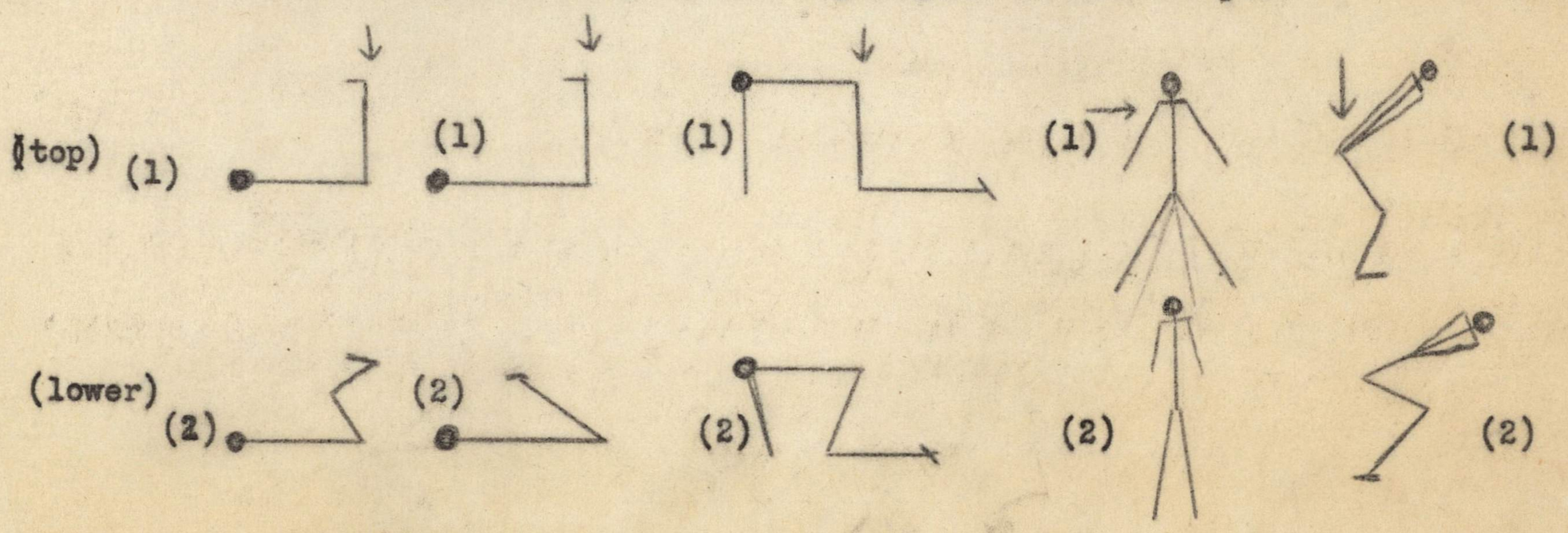
VII. In the field of selected sports state briefly the types of fundamental manipulative skills to which each of these sports belong, and give at least three general musts, either muscular or mechanical, for the successful performer of each sport. (If you prefer, substitute other sports with which you may be more familiar.)

(a) Archery

(b) Badminton

(c) Tug o' War

VIII. Each figure below represents the base for some couple balancing stunt. The arrow represents the weight line of the top performer. Why is the weight supported more easily by the top figure in each couple?



IX. (a) Since the spine is the keystone for the development of an upright posture, name four of its specific functions in this service to the human body.

(b) There are some 14 or 15 commonly recommended exercises for posture training. Name at least five such exercises and discuss briefly <u>why</u> each is effective.

X. List at least 5 home or occupational activities.

I A. Define kinesiology and give its general relationships to certain other sciences

B. List at least three of its contributions to the betterment of teaching physical education

II. A. Where, in the human body is the location of motion.?

B. Where, the source of bodily motion.?

III A. Name the three general classes of joints to which all articulations of the body belong.

B. Name and give one example each of the six types of freely movable joints. (Diarthrodial)

IV. Answer these questions yes or no.

1. A muscle can only pull. It never pushes.
2. Whenever there is nervous stimulation the muscles relax.
3. Every muscle has its two ends attached to different bones.
4. All muscles are arranged in antagoinstic pairs or groups.
5. The smaller muscles are located where the greatest force is needed.
6. The human machine has a high degree of efficiency.
7. The primary factors in the physiological condition are fatigue, source of food substance and removal of waste substances from the tissues.
8. The muscles of the body are of three types, smoothe, cardiac and skeletal.
9. The cardiac is the type directly responsible for motor activity.
10. Muscle activity takes place through the regular processes of metabolism.

Read all of Part I to Page 86.

Analysis of Human Motion

Equilibrium — a state of balance between opposing forces or actions. Hence a state of balance or even adjustment, between opposing forces, — influences, — interests.

Equipoise

Against — Not forming an angle. Without angles

Viscosity. Resistance offered by a fluid to the relating motion of its particles — Internal friction

Causes of mechanical inefficiency — metabolic process accompanying contraction

Loss in heat, lactic acid produced — Combustion and waste production.

The viscosity or internal resistance of muscle fiber

Still greater restraint of ~~skin~~ fascia and skin surrounding muscle

The tension of antagonistic muscles, the inertia of the part, the pull of gravity, and sometimes friction.

KINESIOLOGY - ANSWERS

pp. 5,7,8, Chap. I

I.

I. (a) Kinesiology is the science which investigates and analyzes human motion. The sciences of physics, physiology and anatomy contribute basically to kinesiology. Kinesiology is a composite of these sciences.

(b) 1. Kinesiology attempts to integrate all the contributing fields of information through direct application to the problems of the teacher of swimming, of dance, of correctives, of sports, and of all other physical education activities.

2. Kinesiology makes an analysis and evaluation of activities.

3. Kinesiology, by analyzing and evaluating activities, makes for better and easier teaching. This analytical ability makes creative, individualized and effective teaching of motor skills possible.

4. A knowledge of kinesiology has its social and physhological benefits, in that through an understanding of the problems of efficiency and economy of movement a new sensitivity to and confidence in poise and grace result. Too, a better understanding of problems of physiological cost, energy budgeting and muscular timing result.

5. Kinesiology should give a better appreciation of posture, for the basic principles which determine the standards for sitting, standing, walking, and body carriage in general are found in this stury.

6. The analysis of movement and understanding of standards should make the teacher more aware of irregularand unusual performance, and of abnormal structure.

(At least 3 of above 6)

p. 12, Chap. II

II.

(a) The location of motion is in the articulations of the body.

p. 35, Chap. III

(b) The source of all bodily movement is in the muscles of the body.

III.

P. 13, Chap. II

(a) diarthrodial, or freely movable
Amphiarthrodial, slightly movable.
Synarthrodial, immovable

pp. 13-15, Chap. II

(b) (1) arthrodial, gliding joints. Ex: articular processes of the vertebrae
(2) condyloid, joint formed by a convex prominence gliding over an adjacent surface. Ex: articulations between the carpals and the first segment of the fingers.
(3) enarthrodial, ball and socket joint. Ex: shoulder joint.
(4) ginglymus, hinge joint. Ex: elbow joint.
(5) reciprocal reception, saddle joint. Ex: found only in the thumb joint.
(6) trochoid, pivot joint. Ex: This type of joint is found in the head of the radius - where rotation is permitted.

IV.

(1) Yes
(2) No
(3) Yes
(4) Yes
(5) No
(6) No
(7) Yes
(8) Yes
(9) No
(10) Yes
(11) Yes
(12) No
(13) Yes
(14) No
(15) No
(16) Yes
(17) Yes
(18) Yes
(19) No
(20) No

V.

p. 115, Chap. VII

(~~f~~a) Equilibrium, in all activities, is an active muscular process to control the center of gravity of the body and of its parts with respect to the base of support.

(b) Newtonian Laws:

1. The laws of inertia:
   1. A resting body remains at rest if no external force operates upon it.
   2. A body moving with uniform motion retains this uniform motion so long as no external force operates upon it.
2. The laws of acceleration:
   1. Acceleration is directly proportional to the force producing it.
   2. Acceleration is inversely proportional to the mass of the body.
   3. Acceleration is in the same direction as the force producing it.
3. The law of reaction: Every force which meets resistance has an equal and opposite counterforce.

p. 134, Chap. VIII

(c) Hip, knee and ankle. One's weight is lifted by extension at all three articulations. Extension cannot naturally take place at any one of these articulations without also occurring at the other two.

N.B. For class uses an exact description of this process would be advisable. See p. 134.

VI.

pp. ~~188-198~~
188-198, Chap. XIII.

(a) Pushing, pulling, throwing, striking, (or others, such as kicking, etc.)

(b) 1. Those in which performer keeps contact with the object. Ex: pushing, pulling.
2. Those in which momentum is developed in an object and then released. Ex: All types of throwing.
3. Those skills in which momentum of a body part, or of a tool, is imparted to either a stationary or moving object and it is either moved or accelerated in movement thereby. Ex: serving a tennis ball, or a place kick in football, or striking a baseball, etc.

VII.

p. 203, Chap. XIV.

(a) In archery the momentum is developed in object and then released, as in throwing. Archery calls for precision of movement. Its successful achievement depends largely upon the kinesthetic perception of position and ability always to reproduce this desired position. While it belongs to the same class of skills as throwing, it involves the projection of the arrow by a mechanical device rather than by muscular force. This game demands static rather than dynamic precision.

pp. 207-209, Chap. XIV.

(b) In badminton, we have a type of the fundamental skill of striking, i.e., the type wherein the momentum of a tool or body part is imparted to either a stationary or a moving object by an external force, and the object is moved thereby.

Badminton involves many striking techniques. While the game is similar in some respects to tennis, is differs definitely. The equipment is largely responsible for this. The lighter racquet is largely responsible for this and thus lacks the potential force of the tennis racquet. The compensation for this lack of force must be made in the greater speed of the stroke and in a different timing. From the standpoint of mechanics these drives are classified as either underhand or overhand.

pp. 189-190, Chap. XIII

(c) In Tug o' War the performer keepp contact with the object, as in the fundamental skills of pushing or pulling.

In this sport, if the resistance is light ~~in~~ arm action alone will suffice. When the resistance is greater, the force can be increased by leaning away from it. Leg extension and the back extensors may be brought into play. In moving backward, the back extensors fix or set the trunk.

VIII.

In these couple balancing stunts the top couples in each case are maintaining the more correct positions because they conform more closely to the principles which govern balancing. First, the area of support is broader in the top figures. There must always be a center of support and the top performer should be placed so as to keep the weight line near this center. All balancing must be performed with respect to the center of gravity of the persons doing the balancing. As long as the center of gravity falls inside or behind the arc of the base of support upon which the balancing is being done the balancing will be stable. But the center of gravity of the one being balanced must not pass beyond that edge. In all balance events, the performers must have a thorough understanding of the rules of stability, dealing principally with the size of the base and the location of the center of the gravity with respect to the base. There is, however, the factor of rotary momentum to be considered. Rotary momentum is usually necessary to assume balancing positions. Therefore, in the drawings the weight is more easily supported by the top figures because weight is easier to hold if the legs of the base are in a vertical position, unless the base figure is standing, then the legs may be widened to spread the area of support.

IX-A.

p. 332, Chap. XIX.

(1) It is a support for the weight of the trunk.

(2) It is the solid point of attachment for most of the muscles anchoring and controlling the pectoral girdle, as well as the lattisimus dorsi which moves shoulder joint.

(3) It encloses and protects the spinal cord and the nerves which lead to and from it. This requires a firm, carefully articulated, and not too flexible column.

(4) It absorbs jolts and jars which come to the body even from such commonplace activities as walking, running and jumping.

IX-B.

P. 339, Chap. XIX.

(1) Wand lowering between shoulders. This exercise is good for round shoulders, kyphosis, and forward head.

p. 340

(2) Hanging from the horizontal bars. Passive hanging from the bar is economical of muscular effort but is not good for round shoulders; but in active hanging, the muscles contract to hold the weight and thus transform an activity which is ppor for round shoulders into one which is beneficial.

p. 343.

(3) Standing with feet together, lift inner border of each foot but keep heels and toes on the floor, weight on outer borders of the feet. The main value of this exercise is in strengthening these muscles which support the arch along its medial border.

p. 339. Chap. XIX.

(4) Prone lying, arms extended sideward, palms down - raising of head, shoulders, and arms from floor. This exercise when done properly is localized hypertension of the thoracic region, with a little hyperextension of the cervical region. Care must be taken to localize the action in the thoracic regions, with no extreme tension in the lumbar region.

p. 338, Chap. XIX.

(5) "breaking chains". Elbows flexed, arms horizontal, backward movement of arms

in transverse plane. This exercise is also excellent for round shoulders. It is also facilitated by an extension of the thoracic spine; and, by directly encouraging an erect position is good for kyphosis.

X.

pp. 323-327, Chap. XVIII

1. Stair climbing
2. Reaching
3. Wringing or twisting movements
4. Hammering and chopping
5. Shoveling and sweeping.

Physiological Cross Section
Length of fibers are known } — Possible to compute amount of work of which muscle is capable.

$$\text{Work, ft pounds} = \frac{\text{Cross section in sq. inches} \times \text{lbs of force possible per sq inches} \times \text{1/2 length of fibers in inches}}{12}$$

Where W = work in foot pounds
85 = pounds of force possible per sq inch.
Division by 12 reduces inches to feet.

or

$$\text{Work Kilo. m} = \frac{\text{Cross section in sq cm} \times \text{Kilos of force possible per sq c. m.} \times \text{1/2 length of fibers in c m}}{100}$$

Where W = Work in kilogram-meters
6 = Kilograms of force possible per sq. centimeter
division by 100 reduces centimeters to meters

Units of the metric system are often not very meaningful. If the muscular measurements are in the metric system, but it seems desirable to express work in units of the English system, that may done by the following formula —

6 kilograms = 13.2 pounds
30.5 centimeters = 1 foot.

Thus

$$W = \frac{\text{Cross section in sq. cm.} \times 13.2 \times \text{1/2 length of fibers in c m}}{30.5}$$

KINESIOLOGY

1. Define the following:
   (a) Anatomy
   (b) Physiology
   (c) Kinesiology
   (d) Syndesmology
   (e) Osteology
   (f) Neurology
   (g) Myology
   (h) Histology

   any part of the body with a special function.

2. What is a cell? What is the difference between a cell, an organ, and a system? a methodic arrangements of parts - The animal economy - Digestive sys.

3. Discuss what is meant by an exciting cause and a predisposing cause and give an example illustrating each. Any agent that arouses or augments organic activity - The exciting liquid in a voltaic cell (Inclining to - disease

4. What is meant by abduction and adduction in physical education? What is the difference between rotation and circumduction?

5. What is a "charley horse"? Explain the kinesiological relationship between extension and flexion, and a "charley horse."

6. List and describe three types of muscle tissue. Give examples of each.

7. Draw a diagram of a muscle cell and label sarcalemma, sarcaplasm, sarcomeres, sarcostyles and myo-neural junction.

8. A typical skeletal muscle consists of:
   (a)_____
   (b)_____
   (c)_____
   (d)_____

9. What is the approximate chemical composition of a muscle? What is a "property?" Give the properties of muscle tissue.

10. Name a muscle or ligament that derives its name from:
    (a) Location
    (b) Points of attachment
    (c) Shape
    (d) Structure
    (e) Direction
    (f) Function

11. Explain the difference between: Give examples of each.
    (a) prime movers
    (b) antagonists
    (c) fixation muscles

12. Draw a diagram of a motor neurone and label dendrites, nerve call, nucleus, axis cylinder, neurilemma, medullary sheath, and terminal branch.

13. Give the function of
    (a) nerve cell and its nucleus
    (b) axix cylinder
    (c) Neurilemma
    (d) dendrites

14. What is a lever? What is the relationship between levers and kinesiology?

15. What is a synovitis? What is a symphesis? Joints are classified as:
    (a)_____
    (b)_____
    (c)_____

16. What is the difference between cranial and spinal nerves? Name the 12 pairs of cranial nerves. Name the 31 pairs of spinal nerves. Name the sympathetic nerves.

17. What muscles are called the hamstrings, and why are they important?

18. In punting a football
    (a) What muscles of the limb are employed?
    (b) How do these muscles act on the pelvis?

19. What muscles effect flexion and extension of the knee?

20. What is the work of the following muscles in relation to the movement of the ankle joint:
    (a) tibialis anterior
    (b) Plantaris
    (c) gastrocnemius

21. Give three (3) ways in which the tensor facia lata affects movement.

22. Describe the general movements of the shoulder girdle; the kind of joint; and the ligaments involved in the shoulder joint.

23. What muscles of elbow joint produce supination and extension? What is the difference between supination and pronation? Name the pronators and flexors.

24. What nerves are involved in the reflex arc.

25. The instructor tells the student in their minds eye to lick their tonge over a lemon. What action takes place over the nervous system?

5/27/41 Name Ed Swanger

7

1. Diagram each of the three orders of levers. 2. Define: "power arm"; "weight arm".
3. Give the formula and work the problems: (a) Power arm 15 inches--Weight arm 33 inches--Power 120 pounds. Find the weight. (b) Power arm 4 feet--Weight arm $2\frac{1}{2}$ feet--Weight 200 pounds. Find power. 4. What is the importance of the pH or acid-base balance of the blood. Explain how proper base-balance is maintained in the body. 5. Define: second wind. Mention at least six changes which take place within the body immediately previous to or at the outset of second wind. 6. Define: "buffer" "Steady State". 7. Explain the term "Oxygen debt" and the significance of the phenomenon. 8. What is mean by: (a) "absolute power" and (b) "Optimum load".

$A = \frac{P.A.}{W.A.} \times P.W.$

2 joints

5/27/41 Name _____ 7

1. Diagram each of the three orders of levers. 2. Define: "power arm"; "weight arm".
3. Give the formula and work the problem: (a) Power arm 16 inches--Weight arm 33 inches--Power 120 pounds. Find the weight. (b) Power arm 4 feet--Weight arm 2½ feet--Weight 300 pounds. Find power. 4. What is the importance of the pH or acid-base balance of the blood. Explain how proper balance is maintained in the body. 5. Define: second wind. Mention at least six changes which take place within the body immediately previous to or at the onset of second wind. 6. Define "brief" "steady state". 7. Explain the term "Oxygen debt" and the significance of the phenomenon. 8. What is meant by: (a) "absolute power" and (b) "Optimum load".

REFERENCE BOOKS

1. Bowen and McKenzie, Applied Anatomy and Kines
2. McCurdy and McKenzie, Physiology of Exercise.
3. Gould and Dye, Exercise and its Physiology
4. Steiddler, Body Mechanics
5. Schneider, Physiology of Muscular Activity.
6. Grays or Cunningham's Anatomy.
7. McCurdy and Larson, Physiology of Exercise
8. Edwards, Anatomy for Physical Education
9. Carlson and Johnson, Machinery of Body
10. Zoethout, Physiology .

Kinesiology is a science of body mechanics (Bowen & McKenzie).
is a science which treats of movements of the human body (Webster's) ;
science of human motion.

Physicology -- science which treats with the functions.

Anatomy -- science which treats with structure

Histology -- science of microscopic anatomy

Osteology -- Science of the anatomy, structure, and function of bones.

Myology -- The science of the nature, function, structure and disease of muscles.

Syndesmology -- The science of the ligaments.

Angiology -- The science of the blood-vessels and lymphatics.

Splanchnology -- Science of the nature and functions of the viscera.

Neurology -- Science of nervous structure, funntion, and pathology.

Embryology -- Science of embryonic evolution.

LIST OF DEFINITIONS

Abduction	1. Movement away from the middle line. 2. A position resulting from such movement. a. of the foot, rotation of the foot outward around its own axis.
Adduction	To or across the median plane
Apposition	1. The putting in contact of two substances 2. Contact of two surfaces.
Atonic	A want of tone; debility, Want of tone or power.
Circumduction	Continuous circular movement of a limb.
Contraction	Decrease of volume; shortening
Contracture	A state of permanent rigidity
Elevation	The action of a muscle lifting a part
Extension	1. Traction upon a fractured or dislocated limb. 2. The straightening of a flexed limb or part.
Flexion	The process of bending
Ossa	Bones
Pronation	The downward turning of the palm
Relaxation	Diminution of tension; languor
Rotation	Turning on the axis
Supination	A turning of the palm upward. 2. The attitude of lying upon the back.
Muscle tonus	A state of involuntary partial contraction that is always present in living state
Spastic	Pertaining to spasm; rigid

I. Muscle

A. Striated - usually skeletal muscles, except for tongue and eye muscles which are also striated--the voluntary muscles

B. Smooth or involuntary muscle tissue--lines the walls of the viscera, blood vessels, ducts of glands

C. Cardiac--walls of the heart striated with intercal ted disks

II. Skeletal Muscles - about 45 % of body weight. About 700 muscles to move approximately 206 bones.

A. Structure

1. Muscle cell or fiver is about one inch to one and one half inches long, and about 10-110 microns in diameter, (reduce to millimeter micron is 1/1000 of M or 1/2500 of inch.

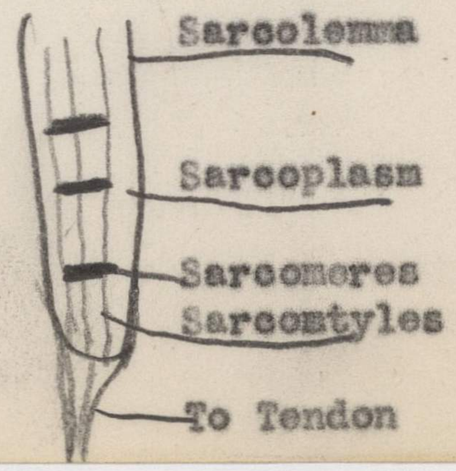
2. Sarcolemma covers muscle cell. The tendon fiber extends from the end of the cell to the tendon. The sarcolemma tends to fuse with these tendon fibers to the tendon.

3. Nuclei are along the edge of the muscle between the sarcolemma.

4. Scarcostyles or fibriles are rodlike parts of the muscle. These are made up of separate compartments or segments called Sarcomeres. In these sarcomeres are light bands called the I bands (disk) and dark colored bands called the A. bands. The light colored bands contain certain potassium salts and is the fluid part. When the muscle contracts, the I bands become dark and the Q bands become lighter. The effect is like the opening and closing of a shutter. The I and A bands do not extend across the entire muscle cell. The two disks which extend across entire cell hold sarcomeres in place.

The myo-neuro-junction is the place where the nerve fiber joins the muscle cell; also called motor end plate.

Muscle cell



A. Typical skeletal muscle consists of--

1. Fasciculi or muscle bundles
2. Fascia is a fibrous tissue sheath enveloping the fasciculi.
3. Perimysium externum is the areolar tissue surrounding and bounding each fasciculus to its neighbor.
4. Perimysium internum --areolar tissue which holds the elongated muscle fibres of the fasciculus together. The perimysium internum is connected on one hand to the sarcolemma, and on the other to the perimysium externum, by which it is brought in connection with part of a tendon.

III. Chemistry of Muscle

A. Water -- 75%
B. Fats -- 2%
C. Salts -- 1%
D. Carbohydrates -- 0.5%
The glycogen eventually forms lactic acid. Then lactic acid and energy for resynthesis into phosphocreatine.
1. Glucose
2. Glycogen
These give rise to:
E. Lactose -- 0.15%
F. Creatine-- 0.4%
G. Phosphocreatine -- .4%
or
phospogen
The phosphocreatine is broken down into phosporic acid and creatine and energy for muscle contraction. 1/5 of Lactic acid and $O_2 = CO^2 + H^2O$ plus energy in order to resynthesize 4/5 of lactic acid in glycogen.

Lack of Oxygen is the real cause of muscle fatigue since the lactic acid cannot act to be changed back into glycogen.

Properties of Muscles

(property is a distinguishing characteristic)

1. Elasticity

2. Irritability

Muscle Nomenclature

Muscle names may be derived from their

1. Situation: pectoralis or tibialis

2. Points of attachment: stemomastoid

3. Shape: trapezius

4. Structure: triceps, digastic

5. Direction: rectus, oblique

6. Function: flexon, ~~adjucto~~ abductor

Muscle Action

No muscle acts as a single unit, but in a combination of muscles in even the simplest movement. Movement is essentially not absolute, but general in relation to musculature.

When muscle contracts its insertion is generally approximated to origin where both attachments are movable, frequently the ~~insertion~~ origin may for time become relatively more fixed than insertion.

The different ways in which individual muscles may function in any given movement are as follows:

1. Prime movers--those which by their active contractions are resopnsible for the actual movements of parts which occurr.

2. Antagonists--capable by their contraction of producing the reverse movement, and by their relaxation enable the movement to be effected. Have a reciprocal action with the prime movers.

3. Fixation muscles--to provide a stable or fixed basis from which muscle may act to give precision in the performance of any desired movement or effective action against resistace.

Ex. fixation of upper limb, in any desired position, by action of muscles at shoulder and elbow joints to enable movements of hands and fingers

4. "Synergic" muscles--special type of fixation action--the flexon carpi ulnaris and extension carpi ulmaris, which are adductions apwrist, act together as synergists to permit simple abduction of the thumb.

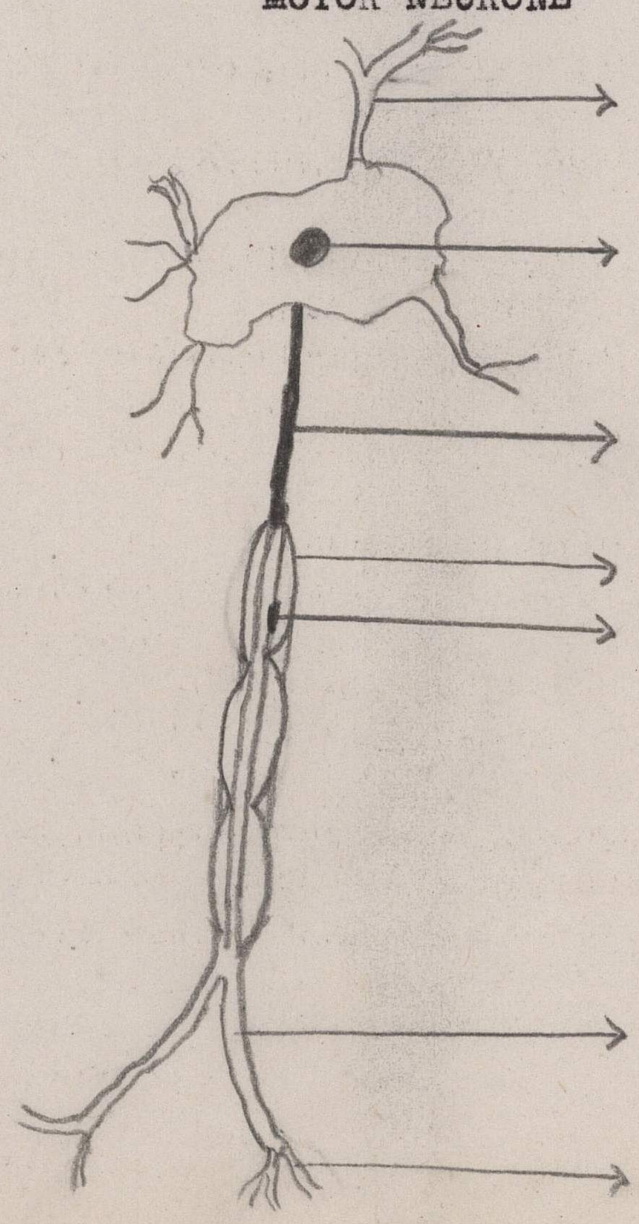
Nerve supply to muscle

1. Three of the nerve fibres to a muscle believed to be motor

2. 2/5 sensory

3. Some sympathetic nerve fibres--function not determined

MOTOR NEURONE



1. Nerve Cell & Neucleus: reservoir of food material aids nutrition and growth of entire neurone--less than 1/10 mm in diameter (fiber sometimes 1 meter long)

2. Axis cylinder--central thread of nerve material in fiber on which implulse travels--impulse travels about 100 feet per second.

3. Neurilemma--protects axis cylinder most of its length

4. Medullary sheath--white fatty sheath within neurilemma insulates central thread and prevents impulses from spreading to other fibers.

5. Dendrites--paths of impulses to cell.

6. Axones--path of impulse passing from cell.

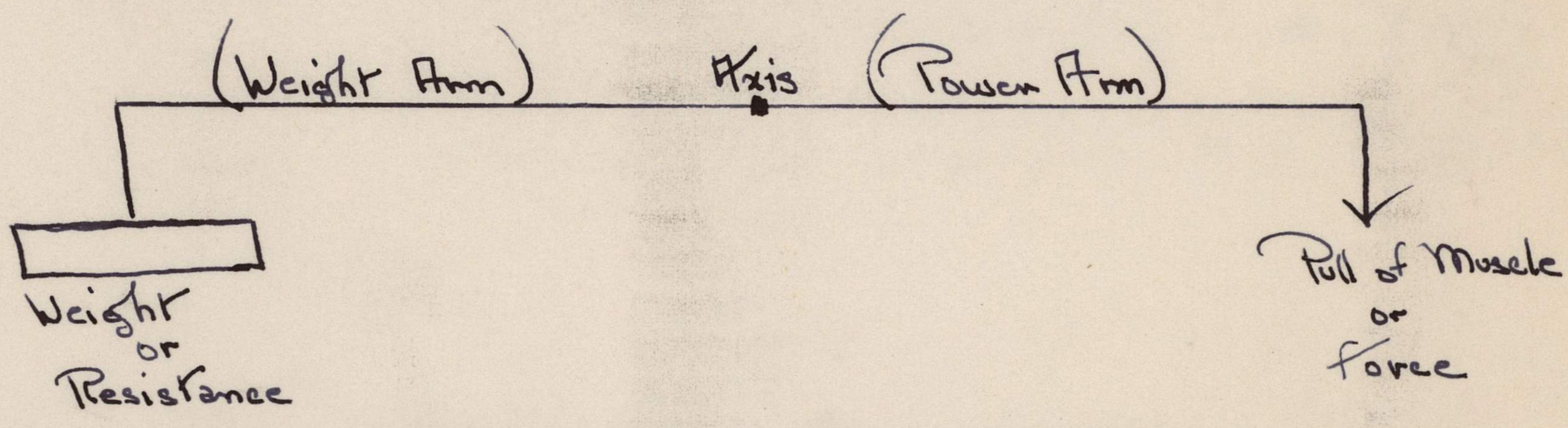
BONE LEVERS:

Lever is a rigid bar revolving about a fixed point.(axis or fulcrum)

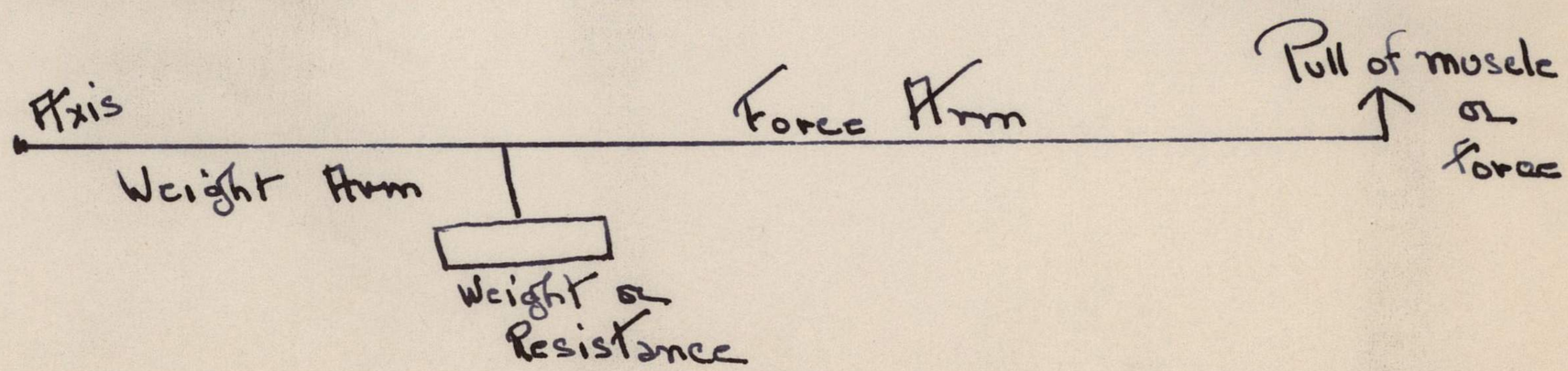
The action of bones as levers and the action of muscles to move these levers is fundamental to kinesiology, since all forms of physical movement occur thru the use of levers

There are 3 types of levers:

A. Lever of first class has axis between the other two points:- force and weight act in same direction. Ex. triceps muscle acting on elbow joint (axis) and weight is hand.

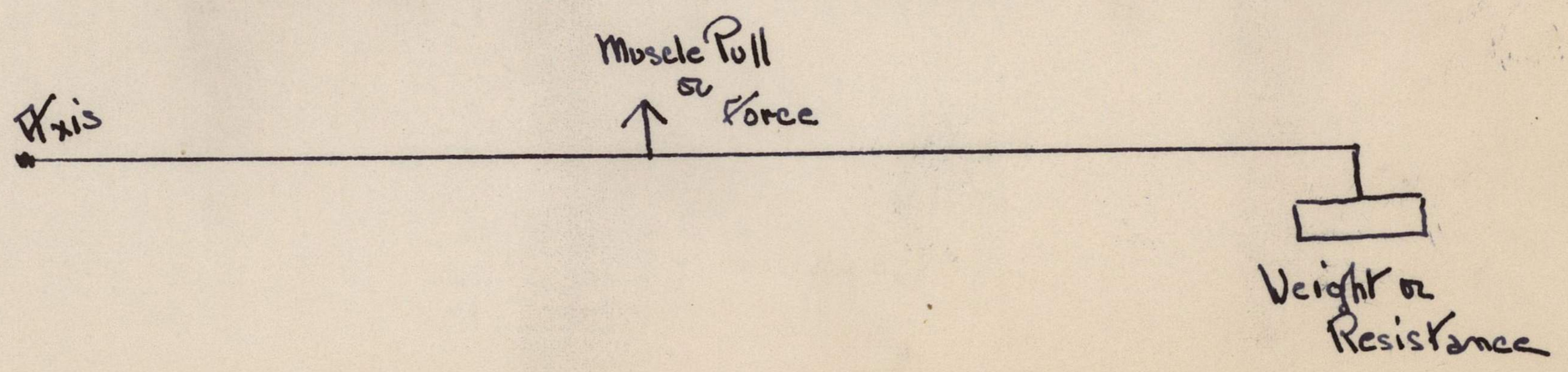


B. Lever of second class has the reistance on weight applied between the force or muscle pull and axis; force and resistance act in opposite directions and the force required is less than the weight or resistance. Very few (some say none) levers of second class in body.



C. Levers of third class--have force applied between the resistance and the axis; force and resistance work in opposite directions; force always greater than the resistance.

Ex. Biceps as force, elbow as axis and weight the hand.



JOINTS--S.A.D.

I. Articulations

A. Synarthroses or immovable--sutures of skull

B. Amphiarthoses--slightly movable

1)Symphesis--present between vertebrae and pubic bones.

2) Syndesmoses--inferior tibio--fibular articulation.

C. Diarthroses--freely movable

1) Hinge joint--(Ginglymus)
Humerus and ulna joint

2) Pivot joint (Trachoid) radial head in ulnar notch

3) Condylord articulation

4) Ball and sochert joint--hip and (Enarthrosis) shoulder joints.

5) Gliding joint (arthrodia) joint between clavicle and acromium process of scapula; sleding limited by ligaments.

assignment of Joints + diagram

Knee Joint

A. Muscles

1. Popleteus

Origin: Outer side of lateral condyle of femur

Insertion: Above the oblique line on posterior surface of tibia

Structure: Thin flat triangular muscle which forms lower part of the floor of the popliteal space

Action: Flexion and inward rotation of knee

Innervation: Internal popliteal

2. Vastus externus

Origin: Anterior border great trochanter and linea aspera

Insertion: Tuberosity of the tibia

Structure:

Action: Extends the leg

Innervation: Anterior crural

3. Vastus internus

Origin: Inner lip of the linea aspera of the femur

Insertion: Tuberosity of the tibia

Structure:

Action: Extends the leg

Innervation: Anterior crural

3. Vastus intermedius

Origin: Inner lip of the linea aspera of the femur

Insertion: Tuberosity of the tibia

Structure:

Action: Extends the leg

Innervation: Anterior crural

Hip Joint

A. Muscles

1. Psoas

Origin: The sides of the bodies of the last dorsal and all the lumbar vertebrae.

Insertion: The small trochanter of the femur.

Structure: Muscle fibers arising directly from the bodies of the vertebrae and attaching obliquely into the tendon of insertion.

Action: Flexes and rotates the thigh outward, and flexes the trunk on the pelvis.

Innervation: Lumbar

2. Iliacus

Origin: The inner surface of the ilium and a part of the inner surface of the sacrum near the ilium.

Insertion: Lesser trochanter

Structure: Muscle fibers arising directly from the ilium and joining the tendon obliquely.

Action: Flexes and rotates the femur outward.

Innervation: Anterior crural.

3. Sartorius

Origin: The notch between the two anterior spines of the ilium.

Insertion: Lower front part of the inner tuberosity of the tibia.

Structure:

Action: Flexes and crosses legs.

Innervation: Anterior crural.

4. Rectus femoris

Origin: The antero-inferior spine of the ilium, between its tip and the hip-joint.

Insertion: The upper border of the patella.

Structure: The upper tendon passes down the middle of the muscle and the flattened lower tendon passes up beneath its deeper surface; the muscle fibers cross obliquely from one tendon to the other.

Action: Extends the leg

Innervation: Anterior crural

5. Pectineus

OriginIliopectineal line and pubis

Insertion: Femur below the lesser trochanter

Structure: Penniform, both ends of the muscle having muscular and tendinous fibers intermingled. It is twisted through 90 degrees as it passes from origin to insertion.

Action: Flexes the thigh and rotates it outward.

Innervation: Anterior Crural, obturator.

6. Tensor

Origin: A line about 1½ inches long just below the anterior extremity of the crest of the ilium.

Insertion: Fascia lata

Structure: The muscle lies between two layers of the fascia and the longitudinal muscle fibers are inserted into these two layers.

Action: Tensor of the fascia lata

Innervation: Superior gluteal

Flexors

I. Gluteus Maximus

Origin: Superior curved iliac line and crest, sacrum, and coccyx.

Insertion: Fascia,and femur below the great trochanter.

Structure: Muscular fibers arising directly from pelvis and making an oblique junction with tendon of insertion, which is a flat sheet extending up from the femur and along the posterior edge of the muscle.

Action: Extends, abducts, and rotates the thigh outward.

Innervation: Inferior gluteal and sacral plexus.

2. Biceps (femoris)

Origin: 1. Ischial tuberosity 2. Linea aspera

Insertion: Tuberosity of the radius, and deep fascia of forearm.

Structure: Tendon of origin is long and flat --forms septum between the biceps and the semitendinous; the lower tendon extends half-way up the thigh; the muscle fibers are short and pass obliquely downward from the upper tendon and the femur to join the lower tendon.

Action: Flexes and rotates the leg outward.

Innervation: Great sciatic and external popliteal.

3. Semitendinosus

Origin: The tuberosity of the ischium, by a common tendon with the biceps.

Insertion: The tuberosity of the ischium

Structure: Short muscle fibers pass diagonally downward from tendon of origin to join the tendon of insertion, bulk of muscle being in upper half of thigh.

Action: Flexes the leg on the thigh.

Innervation: Great sciatic

4. Semimembranosus

Origin: The tuberosity of the ischium

Insertion: Inner tuberosity of the tibia

Structure: Similar to the preceding muscle, but a longer upper tendon and a shorter lower one brings the muscular mass lower down.

Action: Flexes the leg and rotates it inward

Innervation: Great sciatic

Abductors

1. Gluteus Medius

Origin: Outer surface of ilium near its crest

Insertion: Back part of the top of the great trochanter.

Structure: Fibers arise directly from the ilium and converge to a penniform junction with the flat tendon of insertion.

Action: Superior gluteal (see innervation)

Innervation: See action Rotates, abducts and advances the thigh.

2. Gluteus Minimus