Epillet
C.T.P.

Excellent
C.T.P.

M U S C U L A T U R E

O F T H E

H O M O --- S A P I E N

A summary of the more tangible facts concerning the superficial muscles and the properties and functions of all the muscles.

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U N I V E R S I T Y P R E S S
Dubuque

DEDICATION

I want to dedicate this paper to a philosophy rather than to a person---a philosophy as exemplified by the poem written as the PREFACE. It was given to me by one of my very closest friends during my thirty-eight months in the service, W. Fletcher Smith of Conway, Arkansas. It accentuates one of the finest possible traits that any person could acquire in the struggle for good christian living.

PERSERVERENCE

Somebody said that it couldn't be done
But he with a chuckle replied
That maybe it couldn't, but he wouldn't be one
To say so until he'd tried.
So he buckled right in with a trace of a grin
On his face and if he worried he hid it;
He started to sing as he tackled the thing
That couldn't be done and HE DID IT!

Somebody said, "Oh, you'll never do that,
At least no one ever has done it".
But he took off his coat and he took off his hat
And the first thing we knew he'd begun it
With a lift of his chin and a bit of a grin
Without any doubting or quiddit;
He started to sing as he tackled the thing
That couldn't be done and HE DID IT!

There are thousands to tell you it cannot be done
There are thousands to prophecy failure
There are thousands to point out to you one by one
The dangers that wait to assail you.
But just buckle right in with a bit of a grin
Just take off your coat and go to it-
Just start to sing as you tackle the thing
That cannot be done and YOU'LL DO IT!

YYYYY

¶ ¶ ¶ ¶ ¶ Myology is a study of the muscular system. The terms muscular and muscular system, in this term paper refer only to the type of muscle known as the Striated, Voluntary or Skeletal muscle. VOLUNTARY muscle is so called because it is under the control of the will, or it is said to be under the influence of the central nervous system. It is called SKELETAL because of its association with the bone structure of the body, by which means its various body movements are executed. It is referred to as STRIATED as a result of the appearance of striations within it, when properly stained and looked at through a microscope.

The skeletal musculature of the human body may be classified according to the (1) embryological origin, (2) Anatomical position, (3) physiological action, and (4) a combination if these.

It is not my plan todevelop the muscular system in its entirety. I only mean to give the foundation for muscle function and after that to go over the most prominent muscle groups and tell a little about them. In this way I willgain a great deal and anyone reading this paper will receive an insight tobetter muscle vigor and health, without being slapped in the face by a bunch of "two-dollar" words which impress no-one.

I can see no asset to myself by going into each and every detail concerning the musculature, at this time. If I attempted to cite to memory all the scientific names of all the muscles, that would be pure folly. What I am going to do is develop the system in such a way that I can keep illustrations of most of the types, positions and functions in my mind. In that way I will have a working knowledge which will be invaluable to me in the coming years of coaching.

For the most part, I will use the muscles of the system that are obvious through "inspection" and leave the deeper groups for a future course in Kinesiology.

PART ONE.

About muscles.....

PART ONE

¥ ¥ ¥ ¥ ¥ In beginning this conglomeration of facts about the muscular system, it seems to me that foundation should be set down, so that the reader will become familiar with the basis of all muscular movement.

STRUCTURE

The smallest functioning unit of the musculature is the MUSCLE FIBRE. It is a string-like piece of tissue which varies in length from one inch to one and one half inches and is 1/250 to 1/500 inches in diameter; it isroughly cylindrical and is covered with a thin, tough coat of connective tissue, commonly known as the SARCOLEMMA. See Fig. 1.

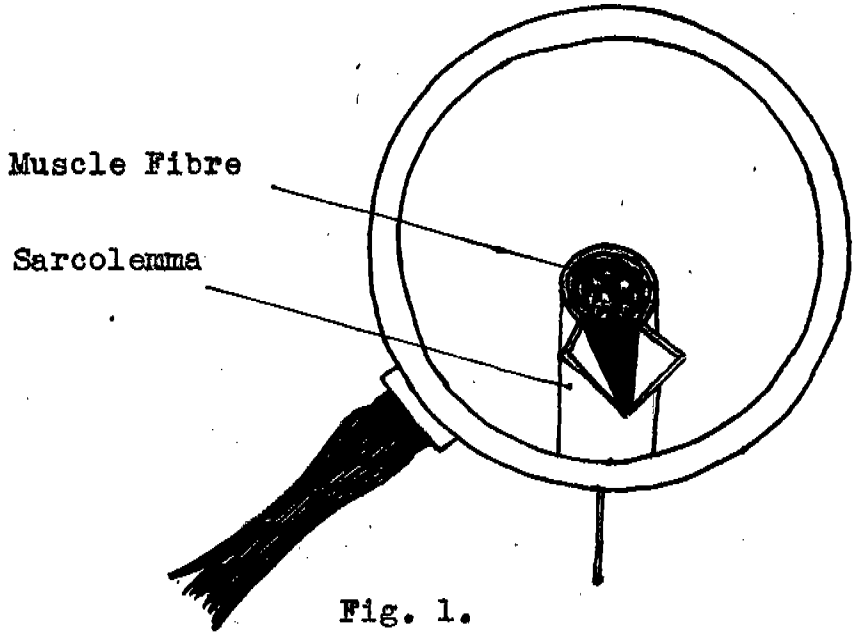


Fig. 1.

The fibre itself is composed of SARCOPLASM which is a mass of interfibrillar cells; scattered throughout the Sarcoplasm are still smaller fibrillae referred to as SARCOSTYLES. They are made up of alternate black and white disks and are thought to be the agencies responsible for the muscle contraction.

Of course, one fibre by itself can do only a minute amount of work, so that it becomes necessary to congregate a vast number of the fibres, and in this way, working together, a greater force can be exerted. This is done by taking a bunch of fibres and wrapping connective tissue, known as the internal perimysium, around the lot, a FASCICULI is created. See Fig. 2.

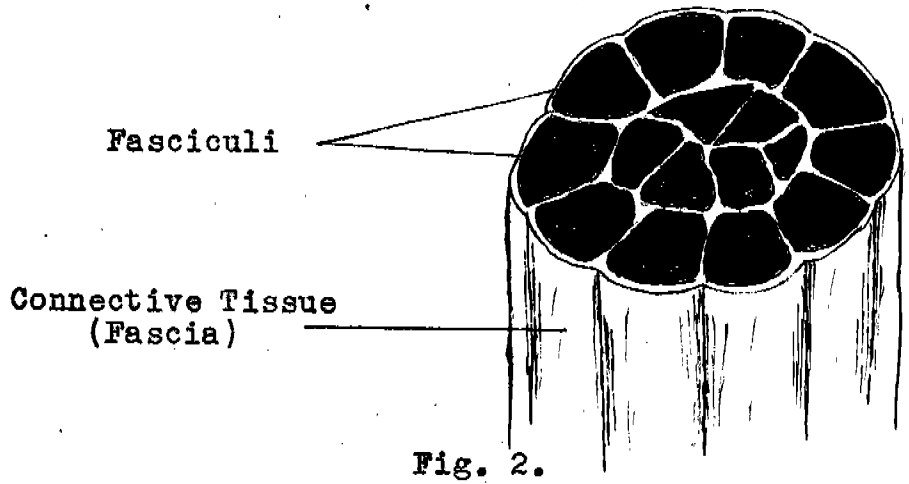


Fig. 2.

Although the Fasciculi makes a pretty sturdy structure, it still isn't strong enough to carry the work of the body. By bonding together a group of Fasciculi, the muscle itself is created. A connective envelope known as the muscle sheath, surrounds the muscle.

PROPERTIES

In order that the muscle will serve its' given purpose it has to be capable of doing various things; it must have the power of:

Contractility

The elongated fibre must have the power to shorten itself without sacrificing any of its volume.

Elasticity

It must be able to contract and stretch itself and return immediately, when the pressure is released, to its original shape and size.

Extensibility

Sometimes it becomes necessary for a section of muscle to become stretched without returning to their original state until a long time after the lengthening process has begun. The best example that I can think of is that of the Uterine muscles. From the beginning of the foetal growth until the day of delivery, the muscular walls of the uterus are called upon to "extend" themselves with no relief in sight for several months. After the child is born the muscles return again, slowly, to their original tone.

Tonus

Even when our muscles appear relaxed, some fibres are in a state of contraction, called TONE. Tone is for the purpose of allowing a muscle to respond immediately upon stimulus. Fatigue lessens tone; exercise increases it.

Irritability

Susceptibility to stimuli. Our muscles can be stimulated by several methods: 1) Palpation, 2) Heat, 3) Chemically, and 4) Electrically.

FUNCTIONS

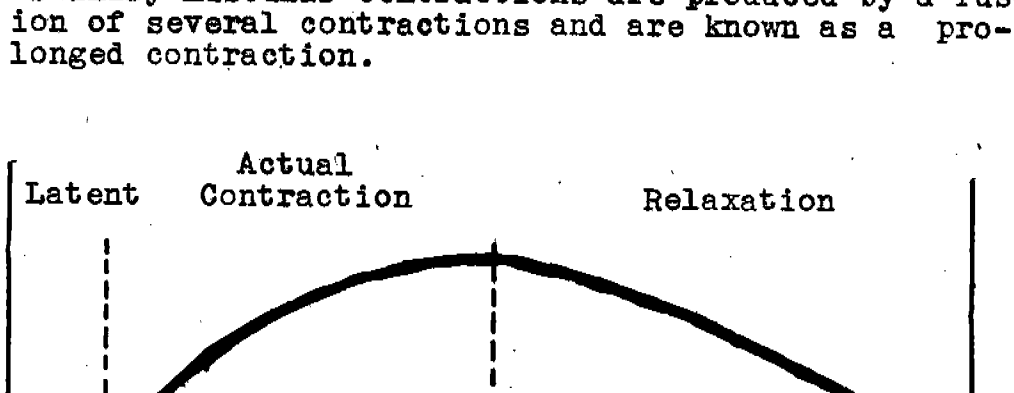
Generally speaking, our muscles have five functions: 1) They provide locomotion, 2) They give shape and form to the body, 3) They produce heat and energy, 4) They promote better circulation and overall body function, and 5) They store our fuel.

MUSCULAR CONTRACTIONS

The simplest contraction of the muscles is a TWITCH, in which a single stimulus is the only stimulus. As in any other action, time is an element. A contraction occurs in three phases:

1) Latent-The period between the application of the stimuli and the actual response (about 1/100 sec.)
2) Active Contraction-The time in which the muscle becomes taut and carries out its function (about 4/100 sec.)
3) Relaxation-A rest period during which no stimuli are accepted by the muscle fibre (about 5/100 sec.)

Ordinary muscular contractions are produced by a fusion of several contractions and are known as a prolonged contraction.



EFFICIENCY

It has been proved by experiment that the system functions at top efficiency over a longer length of time if a medium load is born. Both light and heavy burdens cause the muscle to be less efficient and energy is wasted.

FATIGUE

When the muscles use dextrose over a considerable period of time or at a maximum effort and lactic acid is produced faster than the excretory faculties can remove the waste, the condition of fatigue results. The excess acidity causes the nerve endings in the immediate area to be stimulated giving us the "tired" feeling. It can be a general body sensation, too, and very often is.

STIMULATION

Without attempting to give a long-winded dissertation about the nervous system, let it suffice to say that each and every muscle fibre has a nerve running to it. It is like a private telephone wire and when the certain fibre is needed for a given action, "cehtral" just calls in and things begin to happen, in an orderly way, of course. A muscle may be stimulated in one of four ways, (1) Chemically, (2) By heat, (3) by touch, or (4) By electricity.

ANTAGONISTIC MUSCLES

Muscles are divided into pairs or teams; one set tends to undo the work of the other and in that way maintain an equilibrium. For instance: In their actions on joints, FLEXORS produce movement around the transverse axis in such a way as to reduce the angle of the anterioraspect, EXTENSORS return the members to their original position.

MUSCULAR MOVEMENT

Motion, a very important activity of the body is made possible by special development of the contractile property of the muscles. Motion not only includes locomotion of the body from place to place, or parts of the body, but also those of breathing, the cardiac movements, paristaltic movements of the alimentary canal, erection of the hair in an effort to regulate body temperature, constriction and dilation of blood vessels and many others. No matter what physiological activity we choose to discuss, you may be certain that it is linked directly or indirectly with muscles somehow. A gland could not manufacture nor excrete its secretion if the raw materials were not brought to it by muscle movement; neither could the temperature of the body be maintained if it were not for the work done by the muscles in their oxydative processes.

MUSCULAR TISSUE

Muscle tissue has its' origin in the mesoderm and constitutes from 40-50 percent of the mass of the body. Each skeletal muscle is a unit organ in itself. It may vary in size from 1 millimeter to 24 inches in length and is diverse in form. In the trunk of the body they are flat and broad and form the cavities which they enclose. In the limbs they are more or less elongated and spindle-shaped.

ORIGIN AND INSERTION

Skeletal muscles, generally, pass over joints, some of which are moveable and others that are not. If the joint is moveable it is proper to speak of the ORIGIN and INSERTION of its muscle family. The origin is the end attached to a stationary member while the insertion is the attachment to the bone moving during ordinary body activity. That is why the contraction of the muscle can cause movement-being fast at one end to an immoveable member, as it shortens it causes a lever action which will be described later on.

TENDONS AND APONEUROSES

As we get nearer the end of a muscle the connective tissue network of the muscle extends past the end in a white cord (tendon) or as a flattened tendon (aponeuroses). The tendons are very strong, not extensible, and yet very flexible. It is important to see the correlation between connective tissues of the body-tendons; fascae and ligaments blend with periosteum in some cases and altogether they rely on each other to share someof their duties.

PHYSIOLOGY OF A CONTRACTION

Tone is a remarkable property of a muscle whereby a steady, partial contraction, varying in degree, is maintained. Themechanism whereby tone is produced is not fully under stood, but physiologically it would have to be nerve impulses. By means of tone body posture is maintained, for long periods of time without evidence of fatigue. There is data to indicate that fibers of a certain muscle will contract in relays, therefore staving off fatigue. During sleep tone is at a minimum. Normal blood pressure is dependent upon the tone of the muscles of the arteries; digestion depends in part on the tonus of both the visceral muscles and also the paristaltic groups.

CHEMISTRY OF A CONTRACTION

It must be understood that the original product used for energy in a muscular contraction is obtained by the digesting of carbohydrates. Of course, that envolves enzymatic action, so let's do the basic digestion of the material here. In the mouth, two enzymes are present: PTYALIN and MALTASE; the Ptyalin changes starches to maltose and the Maltase changes t he maltose to dextrose. The intestinal juice itself contains SUCRASE which

changes Sucrose to Dextrose, LACTASE which changes Lactose to Dextrose, and MALTASE which changes Maltose to Dextrose. In the Pancreatic juice we have AMYLOPSIN which changes starch to Maltose, and MALTASE, again that changes Maltose to Dextrose. In all the cases the end product is DEXTROSE and that is the "coal" for a muscle movement. It is stored primarily in the liver as Glycogen, although the muscles are the biggest storehouse for it. The Chemical reaction of Phospho-creatine is not really a complex thing; in fact, it is quite simple. However, in order for the contractions to be continuous, an equilibrium reaction must be envolved, in which the Phosphoric acid and Creatine go back to Phospho-creatine and that is where the carbohydrates come in.

PHOSPHO-CREATINE
is touched offby an electrical spark (nerve impulse) and forms

⇓

PHOSPHORIC AC. & CREATINE
and the heat and energy envolved gives us the

⇓

E N E R G Y
for a muscular contraction.
(Now it stands to reason that the body can't store enough Phospho-creatine to go on endlessly so another chemical reaction is envolved.

STARCHES & CARBOHYDRATES
are eaten and digested and assimilated by the villi of the small intestine and stored in the liver and muscles as

⇓

G L Y C O G E N
when ready for use a molecule of water causes hydrolysis and it is returned to

⇓

D E X T R O S E
which is burned in the muscles and forms

⇓

LACTIC ACID*
and carbon dioxide and water. This reaction envolves heat and

E N E R G Y
and this energy is used to reunite Phosphoric acid and Creatine to Phospho-Creatine for future muscle contractions.

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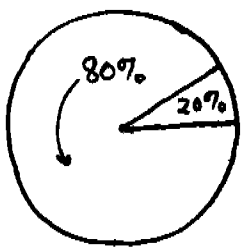
* Of course, it is also true that the normal income of Dextrose is insufficient for body needs, so that a chemical equilibrium again comes to the rescue. 20 % of the lactic acid unites with oxygen from the blood stream and forms carbon dioxide, water and ENERGY. Now, this energy is utilized in changing the other 80 % of the lactic acid back to Glycogen for future use..."and so on, far into the night..."



RESPONSE TO STIMULI

Experiments have shown that if a stimulus is applied to a single muscle fiber and it is strong enough to cause a contraction, that the response will be maximal irregardless of the strength of the stimuli. That has been tagged the ALL-OR-NONE law. This does not mean that the physiology of the fiber will not vary; it means that the vigor of the fiber is due strictly to it's nutritional history and that stimulation is merely a means to an end. That irritibility is increased with successive contractions may be seen by stimulating a muscle at a given frequency and noting the graph of the contraction strength. A staircase affect will be noticed. This is due to the accumulation of waste products formed over the forst few contractions. If the contractions persist the irritability shows a decrease due toexcess lactic acid which begins to indicate fatigue. See Fig. 3.

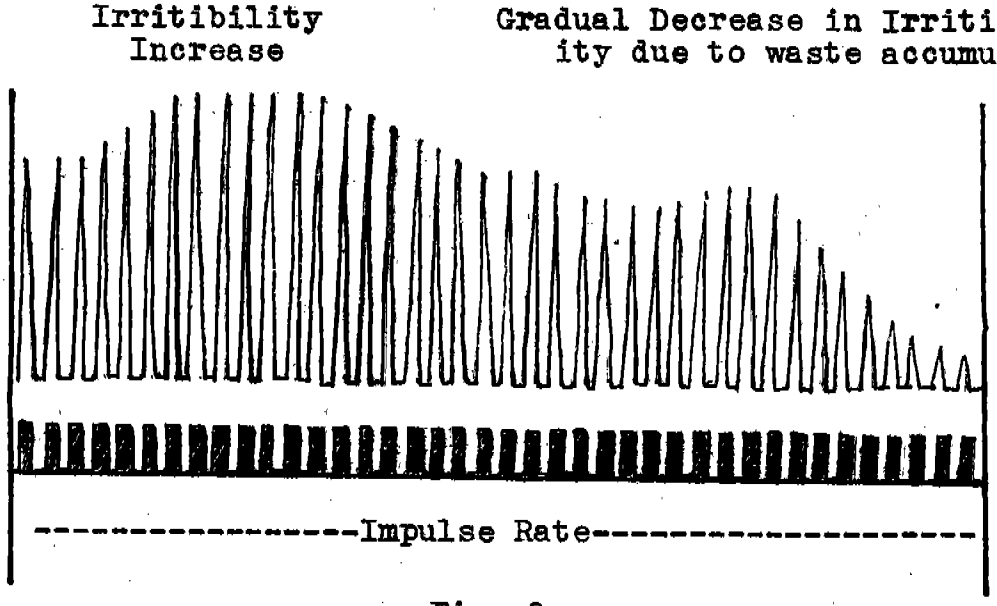


Fig. 3.

TYPES OF CONTRACTIONS

When a skeletal muscle contracts to lift a weight, the trunk of the muscle becomes shorter and thicker, but the tonus varies not at all. Since the tone doesn't change, this type of contraction is known as an ISOTONIC contraction. There is another condition where the tone shows an increase and the length and diameter of the muscle remains the same. Such a condition would exist if the muscle were contracted in order to lift a weight that is far too heavy for it to raise. This one is known as an ISOMETRIC contraction. Skeletal muscles are usually isotonic, although the co-ordination of the two types is used frequently.

CONTRACTION IN SKELETAL MUSCLES

The force of a contraction of thestriated muscles varies with the magnitude of the stimulus. Do not construe this to be a contradiction of the "all-or-none" law. It will be remembered that each muscle fiber is a separate unit and has its' own motor nerve connection. Unlike the cardiac muscles which contract as a unit when stimulated in any way, the skeletal muscles divide the strength of the stimuli equally between as many fibers as are required to perform the operation in question. Of course, the remaining fibers are at a state of tone or rest.

FATIGUE AND EXERCISE

As was developed previously, the initial response of a muscle to exercise, is the increase in irritability due to carbon dioxide and lactic acid. If a muscle is continuously stimulated, however, the contractions become progressively lower in amplitude until finally no more stimuli will be excepted by the muscle and no contraction will occur. That is why a rest period after exercise is important-the body must have time to carry away the excess products of waste which have accumulated. If fatugue is carried on the point of complete exhaustion the cells do not recover. The protein units of the fibers coagulate and the condition of RIGOR MORTIS is evident. This may occur from ten minutes to seven hours after death. Fatugue should never be associated with t he muscles only. Probably the first thing to show tired symptoms are the junctions between nerves and muscles (the myo-neural junctions). Then, too, fatigue is not only a physiological thing-it may be precipitated by such mental states as monotony, lack of interest, lack of will power, laziness, etc. Exercise stimulates circulation and in that way brings on a complete change in the cell conditions all over the body, as well as an alteration of environment for all the lymph cells. Tone is also increased by exercise.

LEVERS

Direct muscular contraction and intermediate bony levers are the essentials for locomotion. In our bodies the muscles and bones cooperate to form levers. A simple lever is a rigid pole or rod free to move about some fixed point or axis, known as a fulcrum. In considering the torque affect the levers are acted on at two different points, (1) the resistance and weight which has to be overcome, and (2) the force which is exerted to overcome the resistance. Our bones vary in shape and size according totheir functions as prescribed by evolution. The resistance may be a part of the body to by moved, some weight to be lifted or, a combination of both. Rather than give you a course in Physics about levers, let the following illustrations suffice in our analogy of anatomical leverage. See Fig. 4.

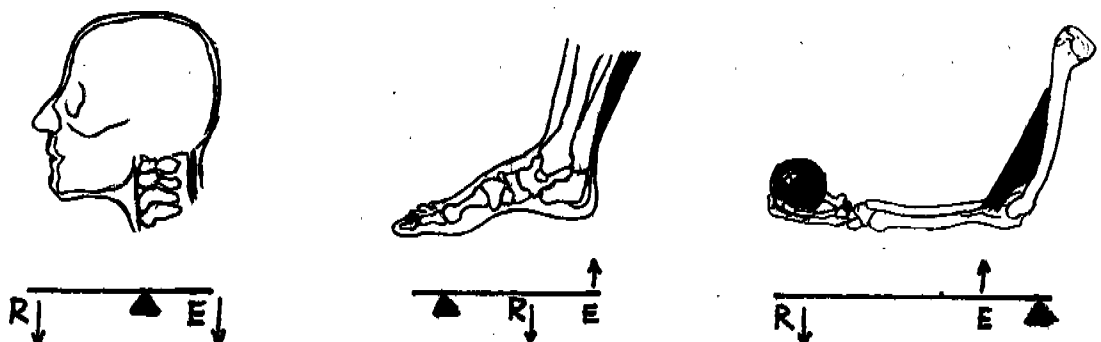


Fig. 4.

NOMINCLATURE OF THE MUSCLES

Many muscles bear two names, one Latin and the other English, e.g., OBLIQUUS EXTERNUS OBDOMINUS and EXTERNAL ABDOMINAL OBLIQUE. Sometimes more than one Latin name is tacked on to a muscle, e.g., PSAOS MAGNUS and PSAOS MAJOR, VASTUS INTERMEDUIS and VASTUS CRUREUS. Sometimes no well known English name is associated with a muscle, e.g., LEVATORES COSTARUM; sometimes the English name is the best that is known, e.g., DELTOID instead of DELTOIDEUS. Anatomists are recommending the B.N.A. * names in Anglicized form more and more.

CLASSIFICATION OF MUSCLE ACTION

A classification of muscle action must of necessity be artificial and arbitrary. Some movements transgress on the premises of others, but still some sort of differentiation must exist. FLEXION indicates the making of an angle; the bending forward at the hips, bending of limb segments and a variety of others. EXTENSION means straightening and is the opposite of flexion. ABDUCTION indicates a lateral bending of the trunk away from the median line, or of the digits, from the axial line of the limb. Abduction of the trunk may be either right or left and ADDUCTION is then the return to the median line. In the arms it becomes necessary to define radial or ulnar abduction according to direction; adduction, of course, is return from either side to the axial line, again. CIRCUMDUCTION is the movement in which the member executes a conical

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* B.N.A. is the title given to a list of some 4500 anatomical terms excepted at Basle in 1895, by the International Society. This list is at present undergoing revision in an effort to decrease its size and simplify it.

motion. It is in sequence, actually, flexion, abduction, extension and adduction, altogether. ROTATION is movement around the longitudinal axis. So much for that. A few classic examples are given in Fig. 5.

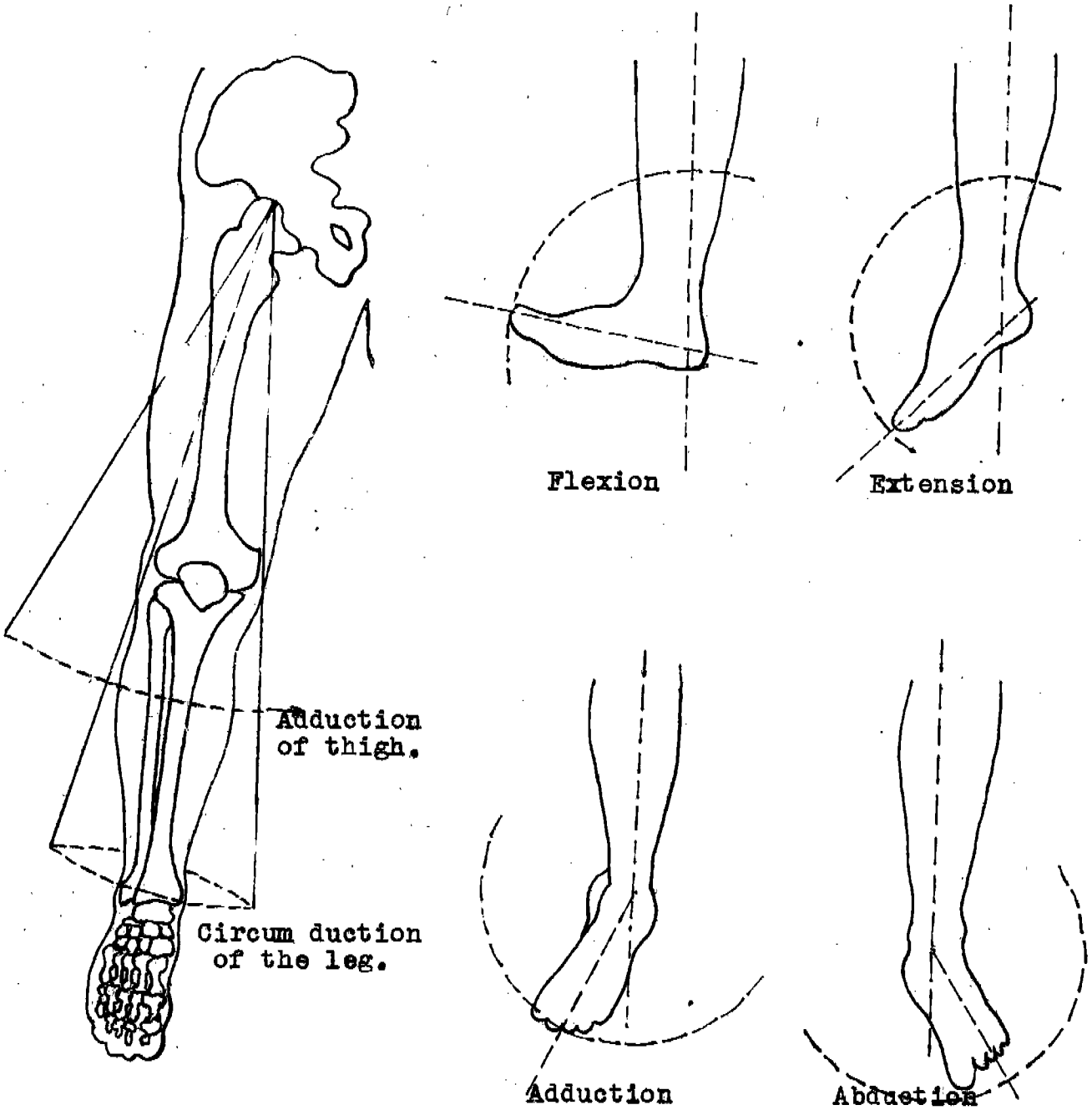


Fig. 5.

STRUCTURES SUBSIDIARY TO MUSCLES

Without too much adieu it would be a good thing to discuss briefly, the nerves that activate the muscles and the vascular system that irrigates the muscles.

To each muscle of the body is meted out a nerve containing both sensory and motor fibers; about 2/5 of the fibers are sensory and 3/5 are motor. The cranial muscles have nerves whose origin is in the brain, while the lower neck, back, thorax, and abdominal nerves are energized at the spinal column. Co-ordination of muscles is the result of the simultaneous stimulation of many muscle fibers by reactions of nerve cells in the gray matter of the spinal cord.

Muscles are generously supplied with blood vessels. Usually the large blood vessels go right along with the larger nerves. Arteries empty into arterioles and the arteriole ramifications, the capillaries, communicate through the lymph medium to nourish the cells, both with oxygen and nutritional products. Veins form the return of the blood that has been contaminated with the oxydative by-products, and by means of valves (to prohibit back wash) and muscle vigor, they carry the blood back to the heart to be relieved of waste products and be re-charged with nutrients.

MUSCLE STATISTICS

Muscle composes slightly more than 2/5 of the body's mass. The B.N.A. (Pasel Nomina Anatomica) recognizes 327 paired and 2 unpaired skeletal muscles and 47 paired and 2 unpaired belonging tothe visceral systems. Here is a rough grouping of the skeletal system:

	Paired	Unpaired
Head	25	1
Neck	16	
Back	112	
Thorax	52	1
Abdomin and Pelvis	8	
Upper Extrem.	52	
Lower Extrem.	62	
	327	2

PART TWO

Disorders of Muscles.....

PART TWO

Most muscle disorders occur because of an abnormal position, strain, or because the individual who has the disorder is not used to the environment into which he has precipitated himself at the time of the affliction. Let's look at the more general abnormalities.

Bruise---A contusion or bruise is usually the result of a direct blow upon a muscle. The effect is similar to that found in a piece of meat after it has been placed on a block and hit with some hard object. There is an accumulation of fibrin in the muscle, which on palpation feels like pieces of shot. There is usually extravasation of blood intothe tissues, with blue or purple marks visible on the surface. Sometimes the discolorations are somewhat removed from the site of injury because the blood has traveled down a muscle sheath to a more distant part. If the periosteum has been injured, new-bone formation may be laid down in the blood clot.

Treatment: Hot applications, alternating with cold applications, warm baths and rest are most impoetant. DO NOT MASSAGE UNTIL THE BLOOD CLOT AND FIBRIN ARE ELIMINATED!

Stone Bruise---This is an injury to the subcutaneous tissue with the skin remaining intact. The injury may include the periosteum ofthe bone as well as the muscle and other subcutaneous tissues. The most common site is on the heel or sole of the foot where it is caused by running or jumping on some hard object. There is usually tenderness and pain on use of the part. It may be discolored and swollen; and a loss of function may result.

Treatment: Theinjury is treated by rest, application of heat, massage and removal of pressure.

Traumatic Myositis Ossificans---This condition is frequently met in athletes following a bruise. It is caused by a tearing of the periosteum of a bone in the region of the injury and the formation of bone-like tissue in the muscle. There is a history of a bruise. On palpation the examiner feels a bony deposit in the soft tissue; it may be checked by x-ray.

Treatment: Physician.

Muscle Strain---This condition is characterized by injury to the muscular tissue or the fibrous structures surrounding the muscles. It results from subjecting these fibers to a strain out of proportion to their strength. They are suddenly overstretched or contracted. The condition varies in extent. It may be mild consis-

ting of only micorscopic tears in the muscle fibers. In severe cases there is extensive injury to the fibers and the muscle may be torn from its attachment to the periosteum or tendon. Stiffness and sorenessdevelop several hours after the accident, or perhaps on the following day. If severe there is pain at the time of injury. Later there is stiffness, soreness and tenderness. The part may become swollen. There is usually some limitation of action.

Treatment: Rest and application of heat. Massage after the acute stage and appropriate to the condition is of much value. It should not be too vigorous.

Ruptured Muscle---If a muscle tears or divides it is called a rupture. The rupture is caused by a severe pull on the muscle or by a powerful contraction. The injury occurs suddenly and is accompanied by intense pain and loss of function. The subject is unable to move the part. There is swelling, weakness and tenderness. The two ends of the muscle separate, protrude and leave a depression between them. The muscles mostoften involved are the biceps, triceps, quadriceps and deltoid.

Treatment: Physician.

Cramps or Muscle Spasms---This is an involuntary and persistent contraction of the muscle. Strain, excessive fatigue andexposure to cold are important etiological factors. In a typical cramp the muscle shortens and its belly becomes thicker and firmer. The pain varies in extent; it may be very severe. There is temporary loss of function.

Treatment: Massage and heat.

Myalgia---This isa painful symptom in the muscles or their closely connected structures and is very common among young people. A number of factors may enter into its cause: hard work, too much exercise, or training, exposure to thecold, or direct injury to the muscle are all important. It isbelieved that infected tonsils, abscesses atthe roots of teeth, or other focal infections may be causes of the disease. Myalgia is usually local. An example is LUMBAGO.

Treatment: Rest for the affected part is of utmostimportance. Bandaging with a woolen bandage will help to keep thepart warm. Strapping with adhesive tape is sometimes quite necessary. Counterirritation should be used in the form of alternate hot and cold applications.

Stiffness---When muscles are subjected to an excessive amount of work lactic acid and other waste products are formed and it is the accumulation of these wastes that irritates the muscles andproduces the stiffness and soreness. Changes in the proteins may be the cause.

Treatment: Rest, heat and massage.

PART THREE

Selecting a suitable exercise program.....

PART THREE

The selection of the most suitable system of exercise naturally depends upon many factors. Age, physical condition, occupation, and sex are only the most obvious factors to be taken into consideration.

Below are some suggestions that may prove beneficial in formulating an exercise program:

1. Before definitely choosing a line of exercise, one should undergo a careful preliminary medical examination by a competent physician. This examination should reveal thestate of health of the individual and especially any possible defects in the heart, lungs or kidneys, that might make certain forms of exercise ill-advised.

2. Muscular exercise should be adapted to the needs of the individual. The factors already mentioned, age, occupation, and bodily condition, will have a bearing here. The adolescent, for instance, will be interested in organized games, such as baseball, football, and boxing. The male adult interests will center around fishing, hiking, camping, golf, and tennis. For the woman, tennis, golf, dancing, horseback riding, swimming, and walking will provide thechief forms of exercise.

3. Whatever exercise is selected, it should involve outdoor conditions as much as possible. Outdoor air tends to stimulate the bodily processes. Moreover, there is additional advantage of being exposed to sunlight, which is really a "vitamin" problem.

4. Exercise should be performed with regularity for one to get the full profit out of it. The man who takes a short vacation each summer and engages in desirable exercise only at that time cannot derive much benefit from it. Exercise should become a part of the daily habits of life. A few minutes of systematic exercise performed with regularity are much more valuable than spasmodic periods of more vigorous activity.

5. Gymnastic exercises are formal and artificial, but tend to develop muscles and movements. They lack in most cases the important elements of interest and enthusiasm which are found in outdoor gamesand exercises. For individuals who have had little or no previous training in exercise, gymnastics or calisthenics are useful atthebeginning. A combination of formal gymnastic training and outdoor activity is perhaps the best of all exercise.

6. Special exercises for the correction of special defects should be carried out under trained supervision, if at all possible.

7. That form of exercise is usually most beneficial which involves the action of large groups of muscles in different parts of the body. This tends to prevent overexercise of some muscles atthe expense of others, and promotes a better balance of organic activity. The great advantage of brisk walking lies in the fact tha it puts to use so many parts of the body.

8. Exercise, to be bendficial, should be vigorous so far as individual condition will permit. "Rest gym" is not especially conducive to rapidity of heart beat and increased breathing. There are excellent physiological reasons for perspiring, and so removing accumulated waste from the body.

9. Exercise should have theelement of enjoyment. Ifone gets pleasure from his exercise, he will repeat it and make it a habit. The importanceof regularity in exercise has already been emphacized.

10. One should never exercise to the point of depressing fatigue. This isespecilly aprecaution for adults of middle age or beyond. Activity and relaxation should alternate in the well-balanced exercise.

11. When one is beginning to exercise, activity should be kept gradual and increased as one becomes accustomed to it.

12. Some form of exercise should be planned throughout life, for there is no stage in the life process that is not benefited by properly adapted exercise.

13. Occupational therapy, or work of some kind for bedridden people, or others who cannot stand strenuous exertion, has been found useful for many. Such work usually consists of modelling, needle work, basket making, and other tasks of a similar nature.

PART FOUR

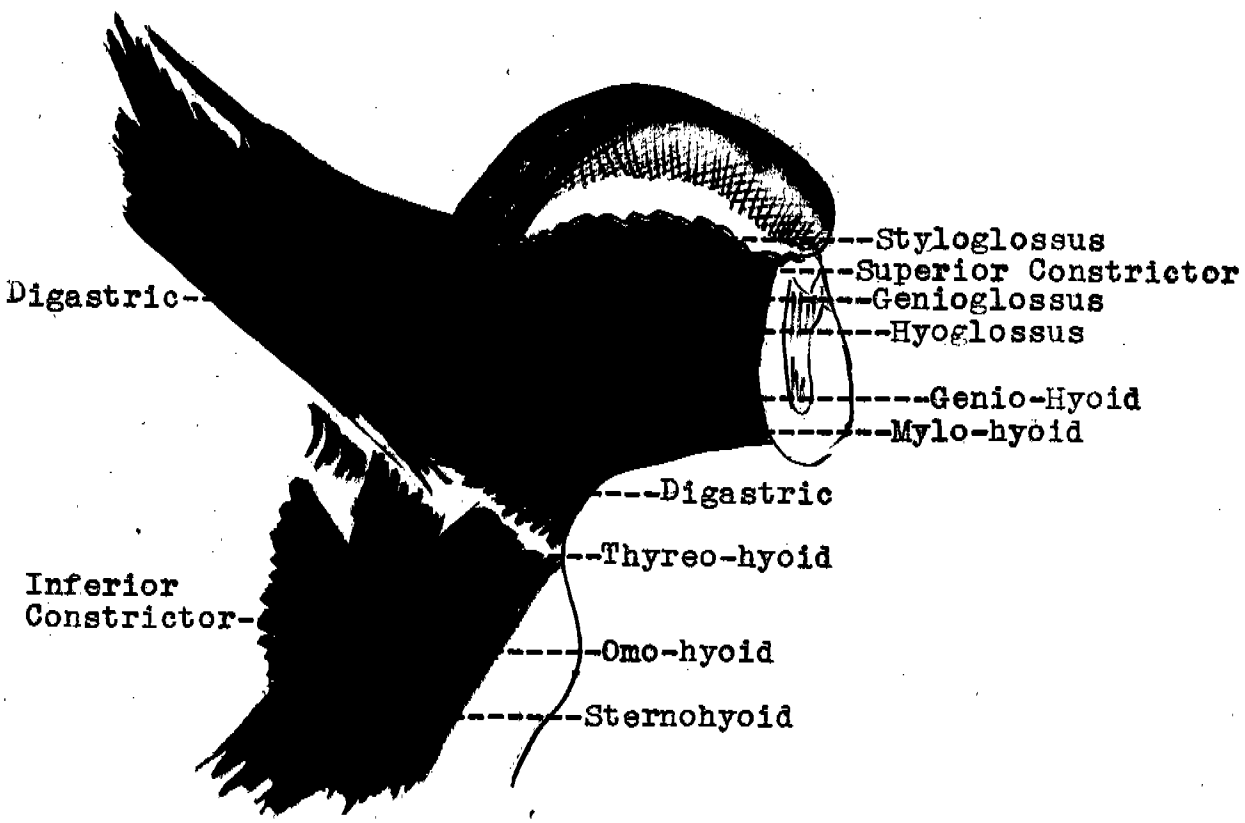
✗ ✗ ✗ ✗ ✗ The Origin, Insertion and Functions of the muscles.

The Muscles of the Tongue

GENIOGLOSSUS
Origin-Symphysis of mandible
Insertion-Hyoid bone and under surface of tongue
Function-Thrusts the tongue forward, retracts it, and also depresses it.

STYLOGLOSSUS
Origin-Styloid process of temporal bone
Insertion-Whole length of side and under part of tongue
Function-Draws the tongue upward and backward.

The Muscles of the Tongue



Muscles of Expression

ORBICULARIS OCULI
Origin-Nasal portion of frontal bone, frontal process of maxilla, and a short fibrous band, the medial palpebral ligament
Insertion-Palpebral portion is inserted into lateral palpebral raphe
Orbital portion surrounds orbit--upper fibers blend with the frontalis muscle.
Function-Palpebral portioncloses the lids as in blinking. This action is involuntary.
Entire muscle closes lid more forcibly.

ORBICULARIS ORIS
Origin-Facial muscles and partition between nostrils and maxillae.
Insertion-Lips and mandible
Function-Closes the lips and sphincter of mouth.

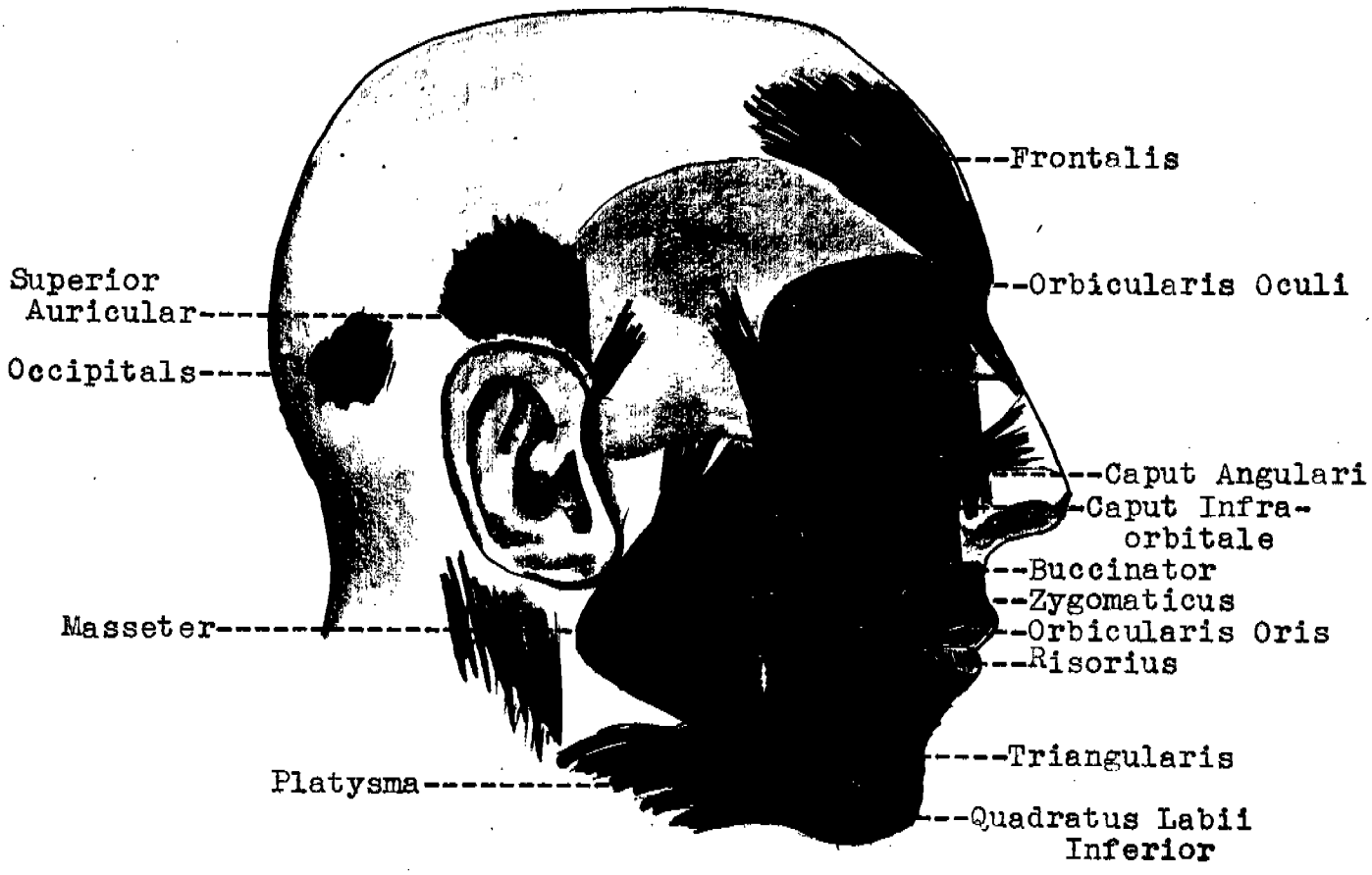
ZYGOMATIC
Origin-Zygomatic bone
Insertion-Orbicularis oris muscle
Function-Draws angle of the mouth backward and upward as in laughing.

TRIANGULARIS
Origin-Oblique line of the mandible
Insertion-Orbicularis oris muscle
Function-Depresses angle of mouth.

QUADRATUS LABII INFERIOR
Origin-Oblique line of the mandible below danine and premolar teeth.
Insertion-Skin of lower lip and orbicularis oris.
Function-Draws lowere lip downward and lateralward as in expression of irony.

RISORIUS
Origin-Fascia over the masseter muscle
Insertion-The skin of the angle of the mouth
Function-Retracts angle of the mouth, produces and unpleasant greining expression.

Muscles of Expression

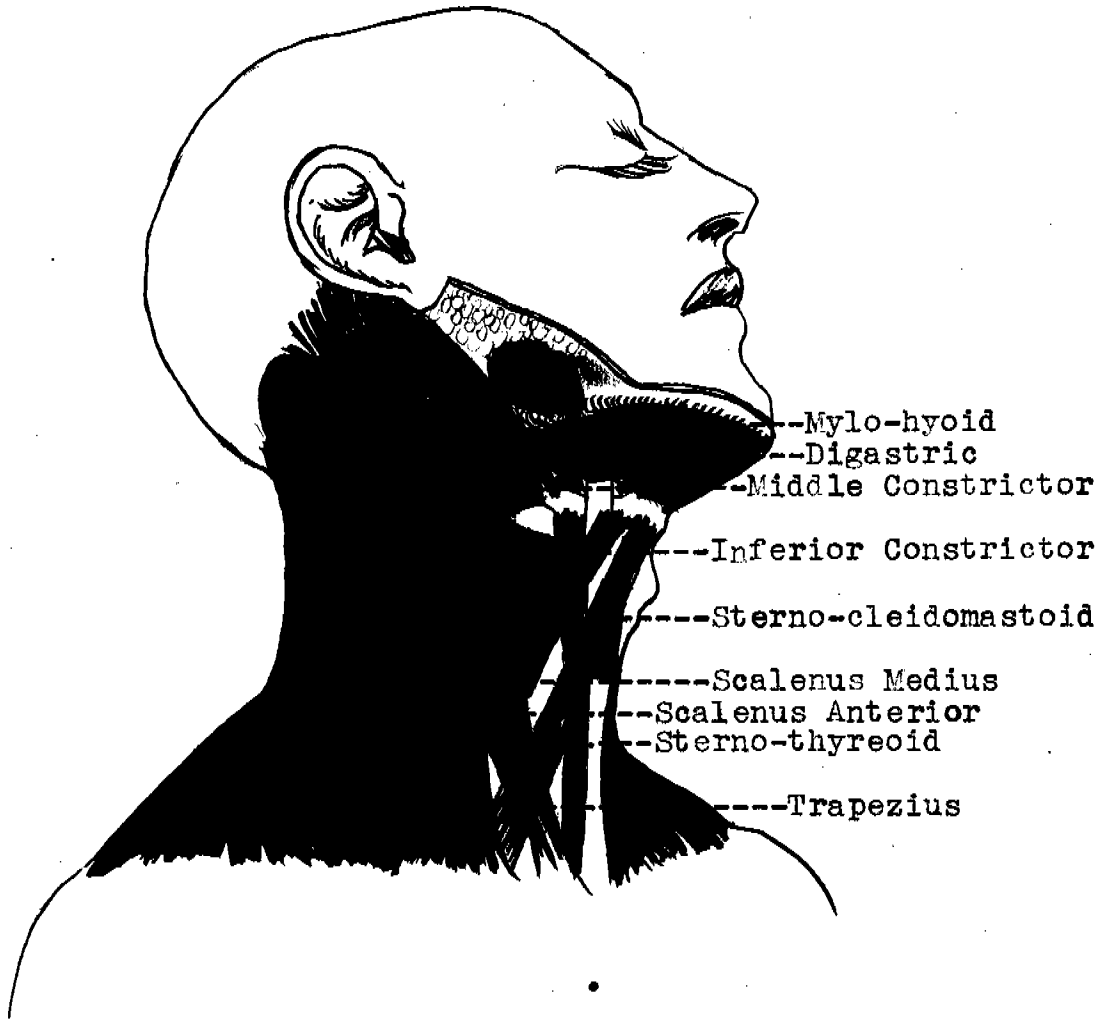


Muscles of the Neck

STERNO-CLEIDOMASTOID
Origin-Sternum and clavicle
Insertion-Mastoid portion oftemporal bone
Function-Each muscle action alone draws the head toward shoulder of same side; both acting together flex the head on the chest or neck.

TRAPEZIUS
Origin-Occipital bone, ligamentum nuchae, spinous process of the seventh cervical and the spinous processes of the twelve thoracic vertebrae.
Insertion-Clavicle, acromion process, and spine of scapula
Function-If upper end is fixed, shoulder is raised. If shoulders are fixed, both muscles draw head backward.
Contraction of whole muscle retracts the scapula and braces back the shoulder.

Muscles of the Neck



Serratus Anterior

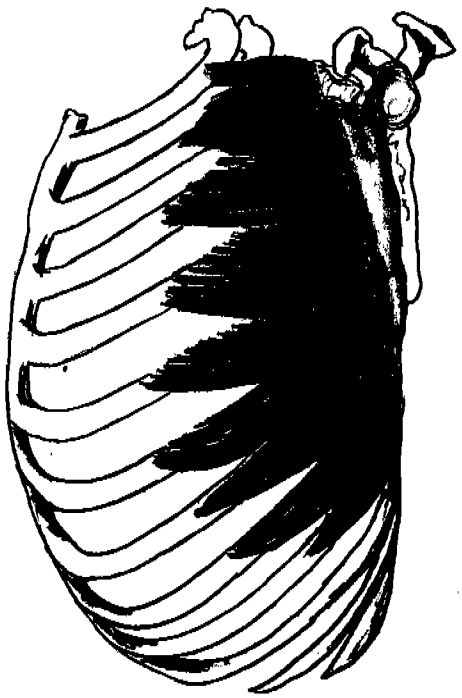
SERRATUS ANTERIOR

Origin-Surfaces and superior borders or upper eight or nine ribs

Insertion-Barious portions of the ventral surface of scapulae.

Function-Carries scapula forward and raises vertebral bonder as in pushing; assists deltoid in raising the arm.

Serratus Anterior



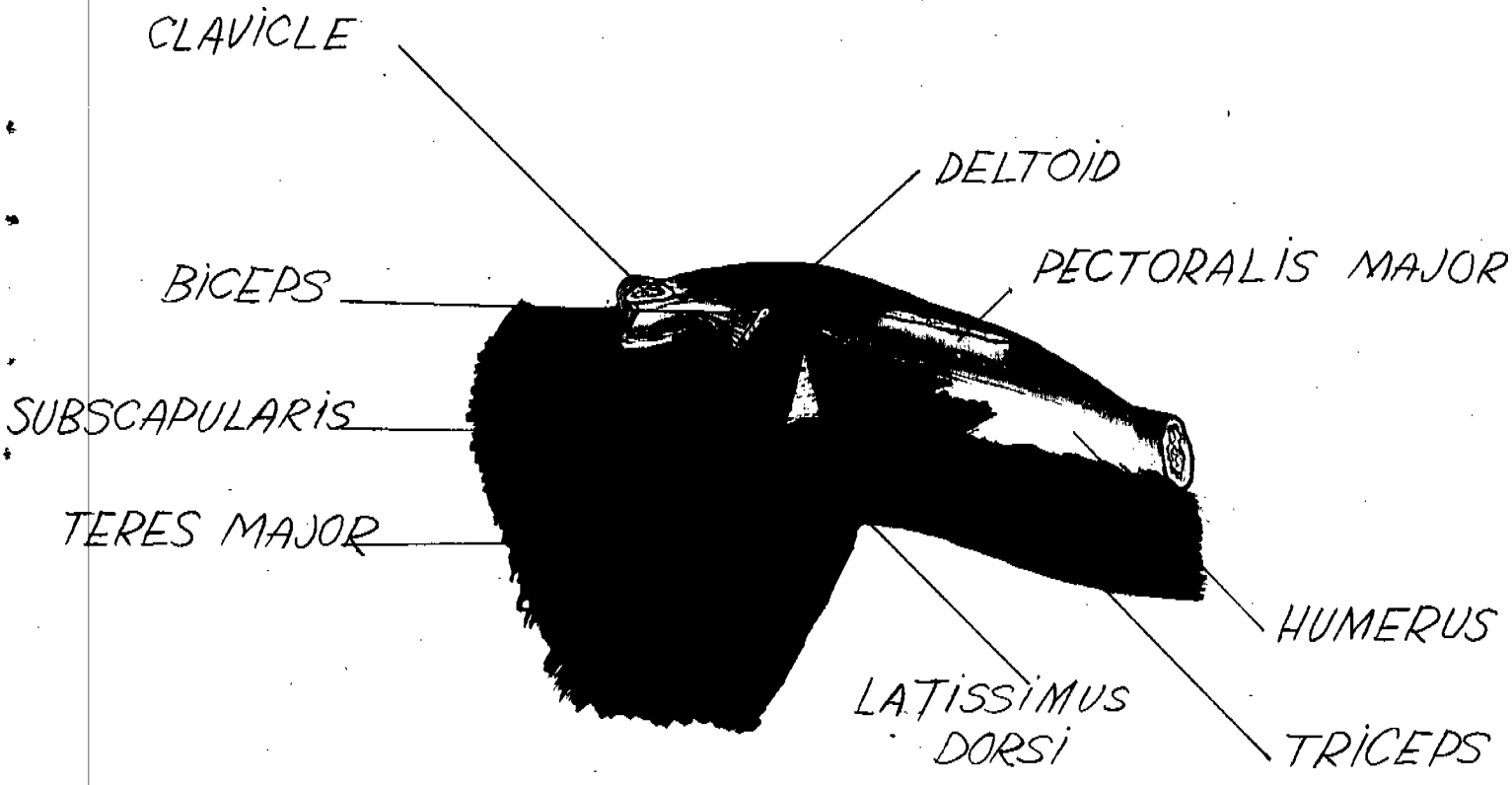
Shoulder Muscles

DELTOID
Origin-Clavicle, acromion process and spine of scapula.
Insertion-Lateral side of the body of the humerus.
Function-Abducts the arm.

SUBSCAPULARIS-
Origin-Subscapular fossa of scapula
Insertion-Lesser tubercle of humerus
Function-Inward rotation of arm.

TERES MAJOR
Origin-Axillary border of scapula
Insertion-Great tubercles of humerus
Function-Adduction and rotation of arm.

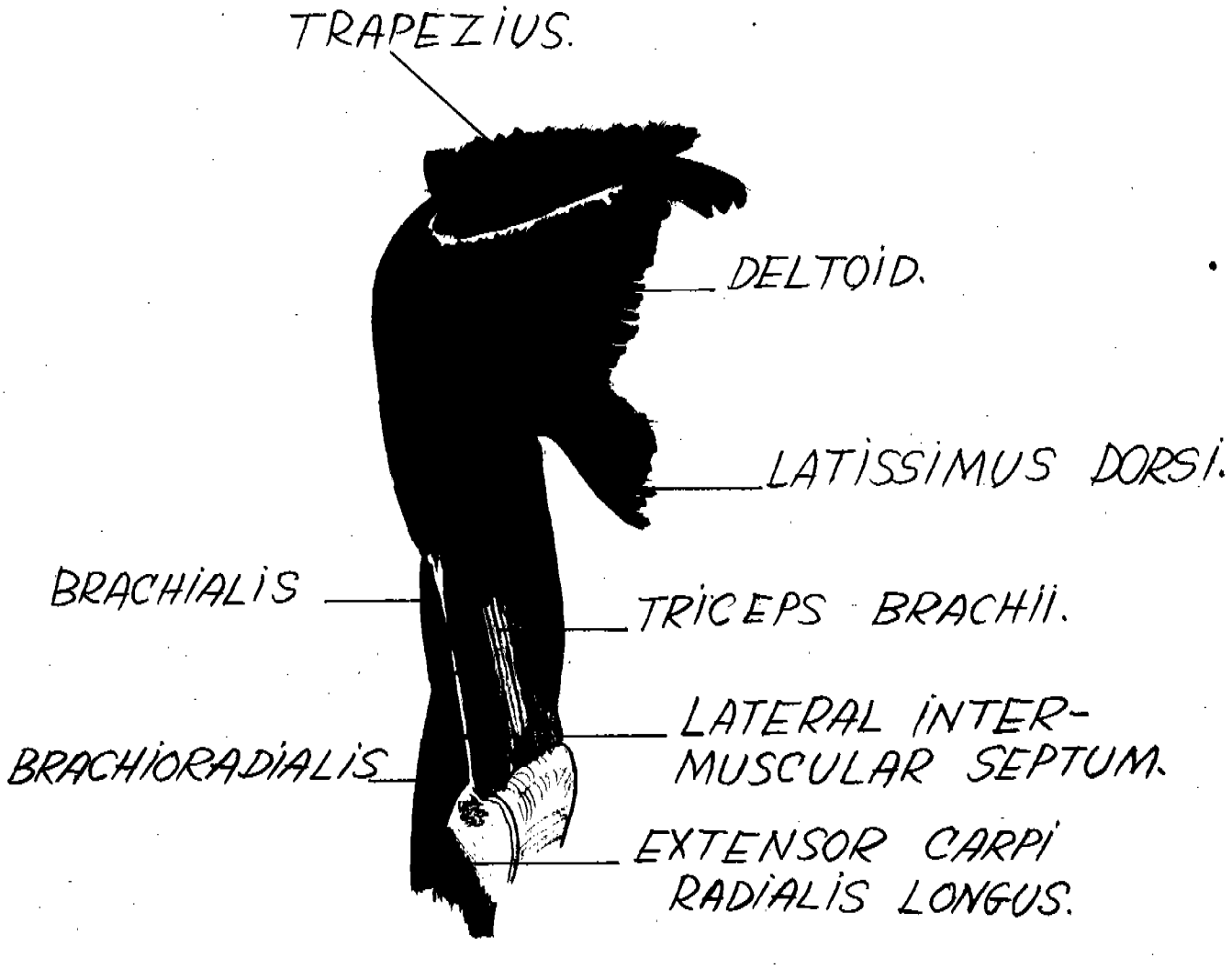
SHOULDER MUSCLES
(VENTRAL VIEW)



Posterior Arm Muscles

TRICEPS BRACHII
Origin-Long head from infraglenoid tuberosity of scapula, lateral and medial heads from body of humerus.
Insertion-Olecranon of the ulna
Function-Great extensor muscle of forearm.

POSTERIOR ARM MUSCLES

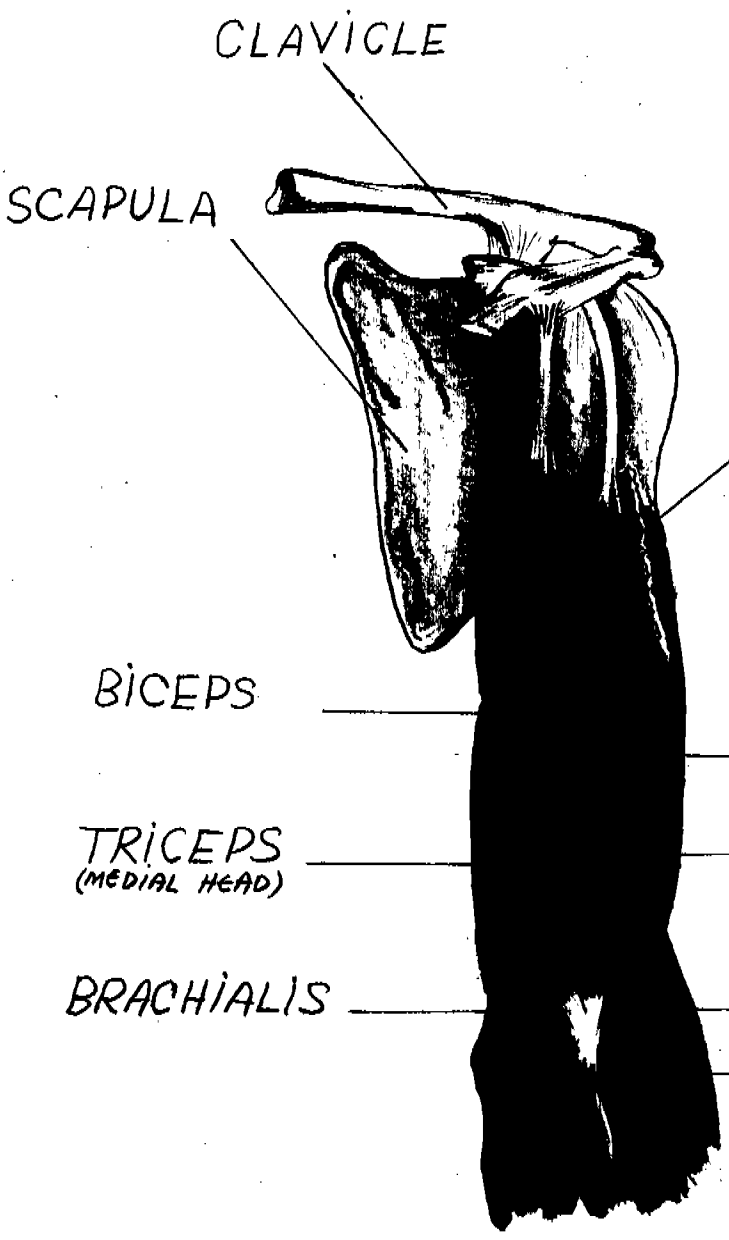


Anterior Arm Muscles

BICEPS
Origin-Long head from tuberosity at upper margin of glenoid cavity.
Short head from coracoid process of scapula.
Insertion-Tuberosity of the radius
Function-Flexes the elbow and supinates the hand.

BRACHIALIS
Origin-Lower half of fron of humerus
Insertion-Tuberosity of ulna and coronoid process
Function-Flexes the forearm.

ANTERIOR ARM MUSCLES



Forearm

FLEXOR CARPI ULNARIS
Origin-Humerus and ulna
Insertion-Pisiform, hamate, and fifth metacarpal.
Function-Flexor and avductor of wrist, assists in bending of the elbow.

EXTENSOR CARPI RADIALIS BREVIS
Origin-Lateral epicondyle of humerus
Insertion-Dorsal surface of base of third metacarpal.
Function-Extends wrist, may abduct the hand.

EXTENSOR RADIALIS LONGUS
Origin-Supracondylar ridge of humerus
Insertion-Dorsal surface of base of second metacarpal.
Function-Extends the wrist, may abduct the hand.

EXTENSOR DIGITORUM COMMUNIS
Origin-Lateral epicondyle ofhumerus
Insertion-Second and third phalanges of fingers
Function-Extends the phalanges, then the wrist, finally the elbow.

ABDUCTOR POLLICIS LONGUS
Origin-Dorsal surface of body of ulna.
Insertion-Radial side of base of first metacarpal bone
Function-Carries thumb laterally from the palm of the hand.

EXTENSOR POLLICIS BREVIS
Origin-Dorsal surface of body of radius
Insertion-Base of first phalanx of thumb
Function-Extends proximal phalanx of thumb

EXTENSOR ULNARIS CARPI
Origin-Lateral epicondyle of humerus and dorsal border of ulna.
Insertion-Ulnar side of fifth metacarpal bone
Function-Extends the wrist.

FOREARM

TRICEPS BRACHII TENDON.

BRACHIORADIALIS.

ANCONAEUS.

EXTENSOR CARPI RADIALIS LONGUS.

DORSAL MARGIN OF ULNA.

EXTENSOR CARPI RADIALIS BREVIS.

FLEXOR CARPI ULNARUS.

EXTENSOR DIGITORUM COMMUNIS.

EXTENSOR DIGITI QUINTI PROPRIUS.

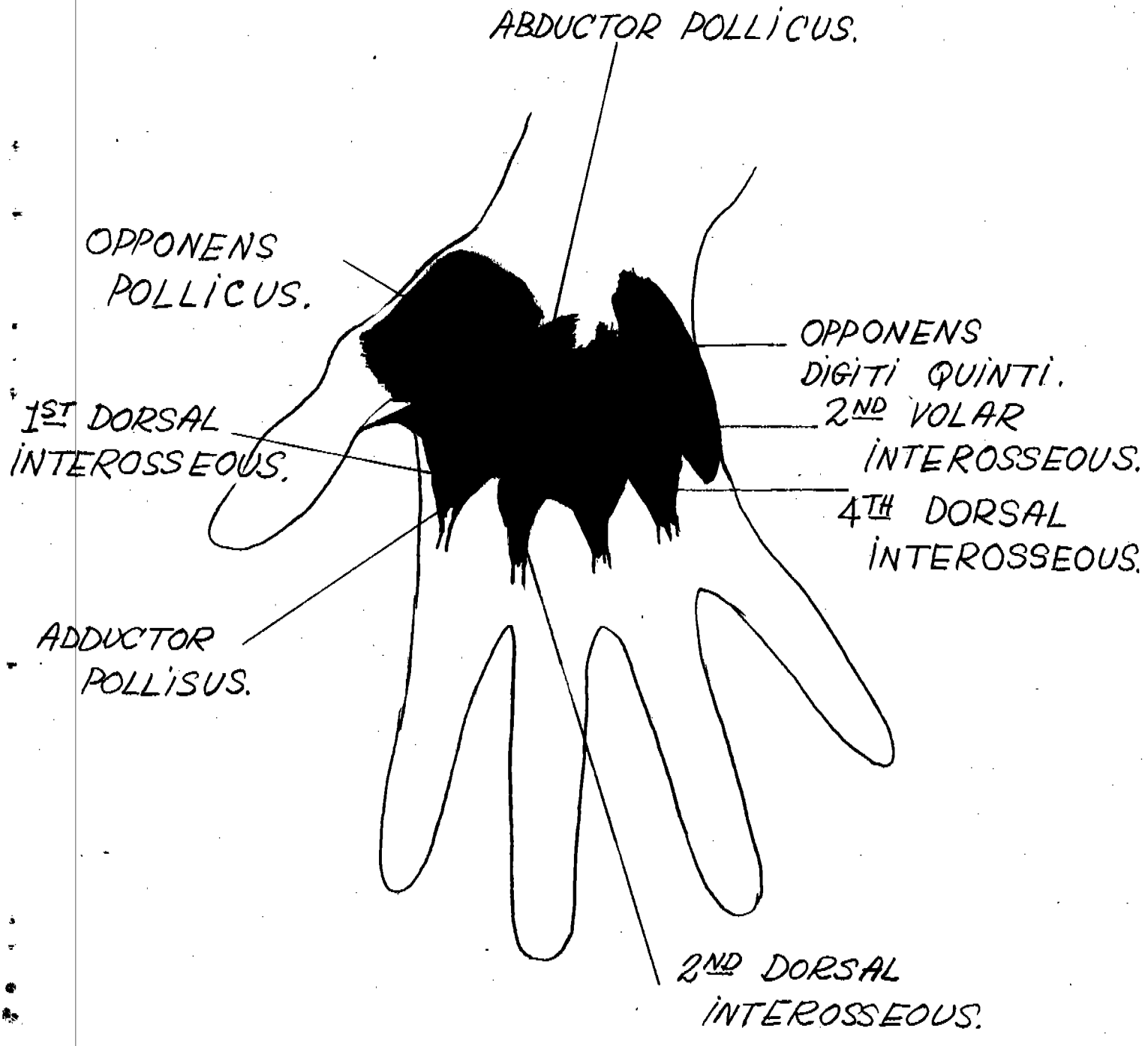
EXTENSOR CARPI ULNARIS.

ABDUCTOR POLLICIS LONGUS.

EXTENSOR POLLICIS BREVIS.

CARPAL LIGAMENT.

PALM MUSCLES.

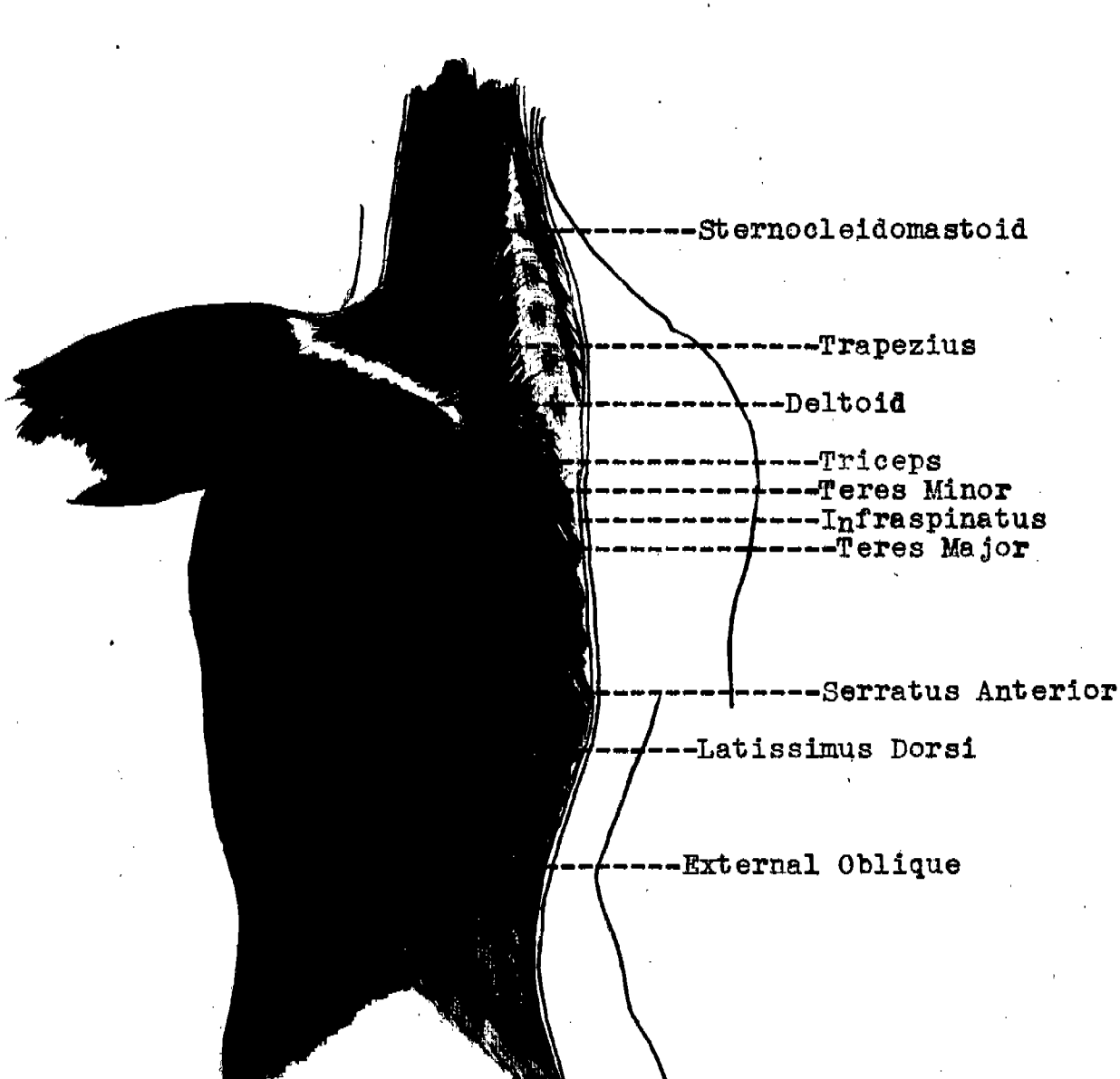


Muscles of the back.

LATISSIMUS DORSI
Origin-Lower six thoracic vertebrae, lumbar and sacral vertebrae, crest of illium, and lower three or four ribs.
Insertion-Intertubercular groove of humerus
Function-Lower fibers help to depress scapula.
Depresses the humerus, draws it backward and rotates it inward.

TRAPEZIUS
ALready mentioned in the "neck muscles".

Muscles of the Back.



Buttocks

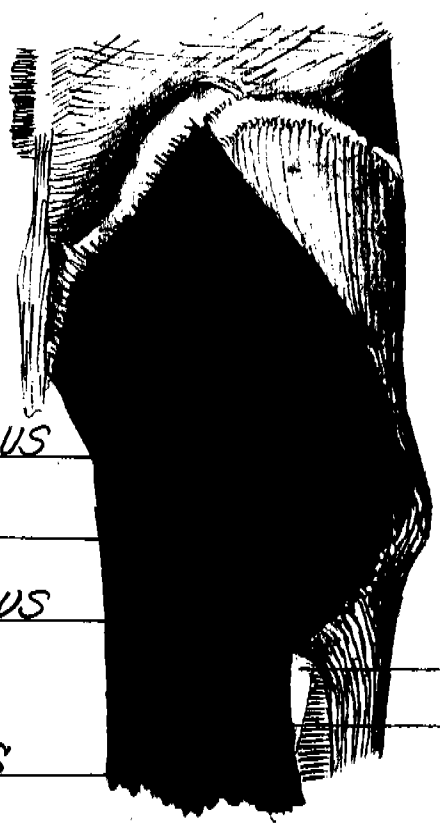
GLUTEUS MAXIMUS

Orig in-Iliac crest, sacrum, side of coccyx, and aponeurosis of sacrospinalis.

Insertion-Fascia lata and gluteal ridge of femur

Function-Extends the femur and abducts it.

BUTTOCKS



GLUTEUS MAXIMUS

GRACILIS

ADDUCTOR MAGNUS

SEMITENDINOSUS

SCIATIC NERVE

BICEPS

Anterior Thigh Muscles.

SARTORIUS
Origin-Anterior superior spine of ilium
Insertion-Upper medial surface of bidy of tibia
Function-Flexes the leg upon the thigh and the thigh upon the pelvis.

RECTUS FEMORALIS
Origin-Anterior inferior iliac spine and b rim of acetabulum.
Insertion-
Function-

VASTUS MEDIALIS
Origin-Medial lip of linea asperia
Insertion-
Function-

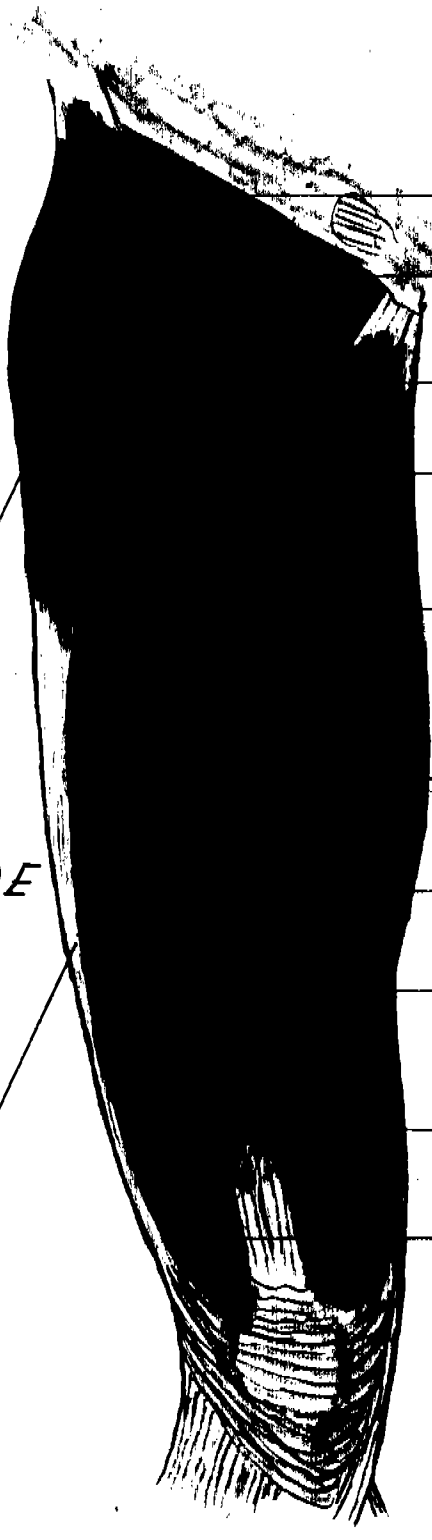
GRACILIS
Origin-Symphysis pubis and pubic arch.
Insertion-Medial surface of tibia below condyle.
Function-Adducts the thigh and flexes the leg.

ADDUCTOR LONGUS.
Origin-Front of pubis
Insertion-Linea aspera of femur
Function-Adducts, flexes and rotates thigh outward.

ADDUCTOR MAGNUS
Origin-Inferior ramus ofpubis and tuberosity of ischium
Insertion-Linea aspera of femur
FUNction-Adducts , flexes, and rotates t high outward.

PECTINEUS
Origin-Pectineal line
Insertion-Lesser trochaster and lineaaspera of femur
Function-Same as the one above.

ANTERIOR THIGH MUSCLES.



ILIACUS.

PSOAS MAJOR

PECTINEUS

ADDUCTOR LONGUS

GRACILIS

ADDUCTOR MAGNUS

SARTORIUS

RECTUS FEMORIS

VASTUS MEDIALIS

VASTUS LATERALIS

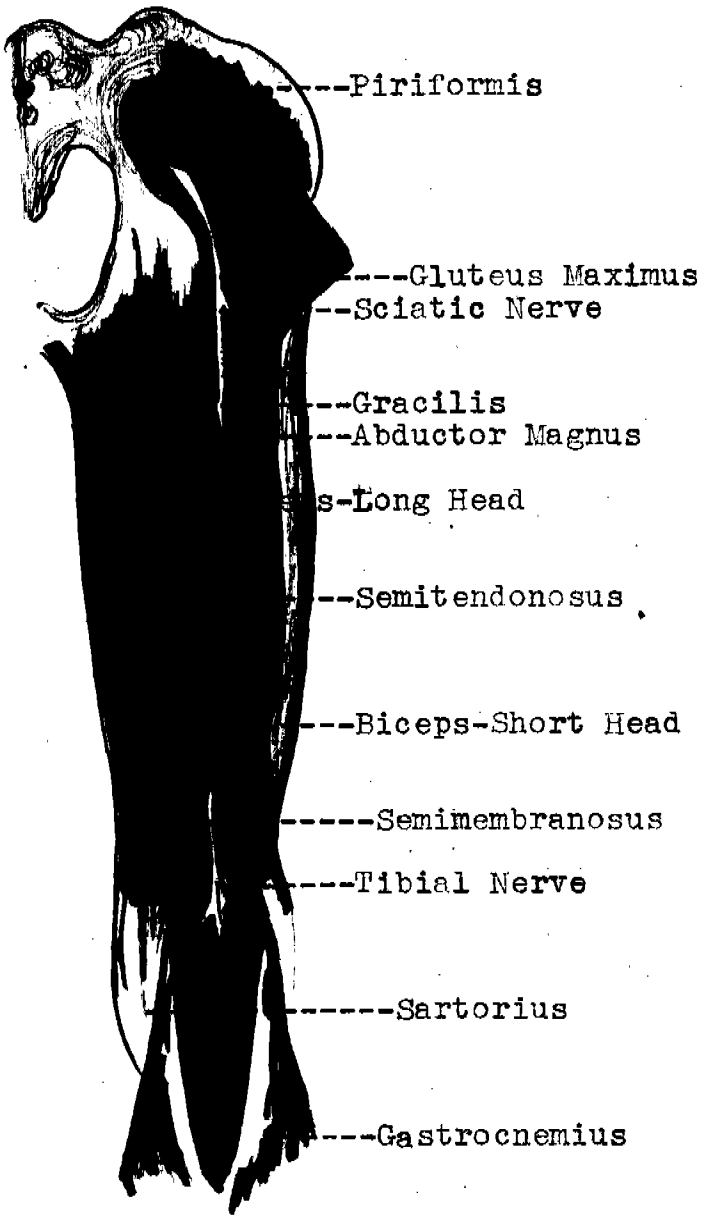
TENSOR FASCLAE LATAE

ILIO-TIBIAL TRACT

SEMITENDONOSUS
Origin-Tuberosity of ischium
Insertion-Medial surface of body of tibia
Function-Flex the leg upon the thigh and extend the thigh.

BICEPS
Origin-Tuberosity of ischium linea aspera of femur
Insertion-Head of fibula and lateral condyle of tibia
Function-Flex knee

Thigh-Posterior Aspect



Front and Dorsum of Leg

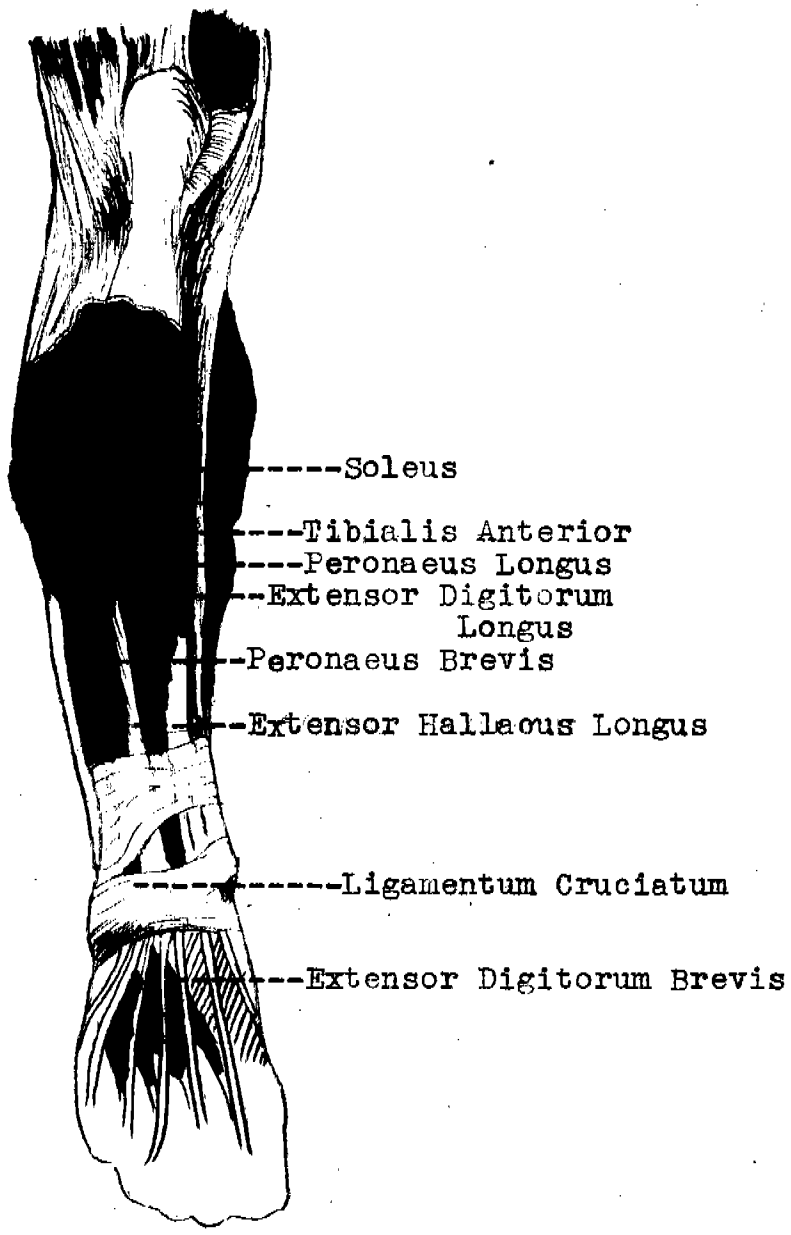
SOLEUS
Origin-Head of fubula and medial border of tibia
Insertion-Calcaneus or heel bone
Function-Extend the foot at the ankle joint

TIBIALIS ANTERIOR
Origin-Lateral condyle and upper portion of body of tibia
Insertion-Under surface of first duneiform and base of first metatarsul

EXTENSOR HALLUCUS LONGUS
Origin-Anterior surface of fibula
Insertion-Distal phalanx of great toe
Function-Flexes foot at ankle joint

EXTENSOR DIGITORUM LONGUS
Origin-Lateral condyle of tibia and anterior surface of fubula
Insertion-Second and third phalanges of four lesser toes.

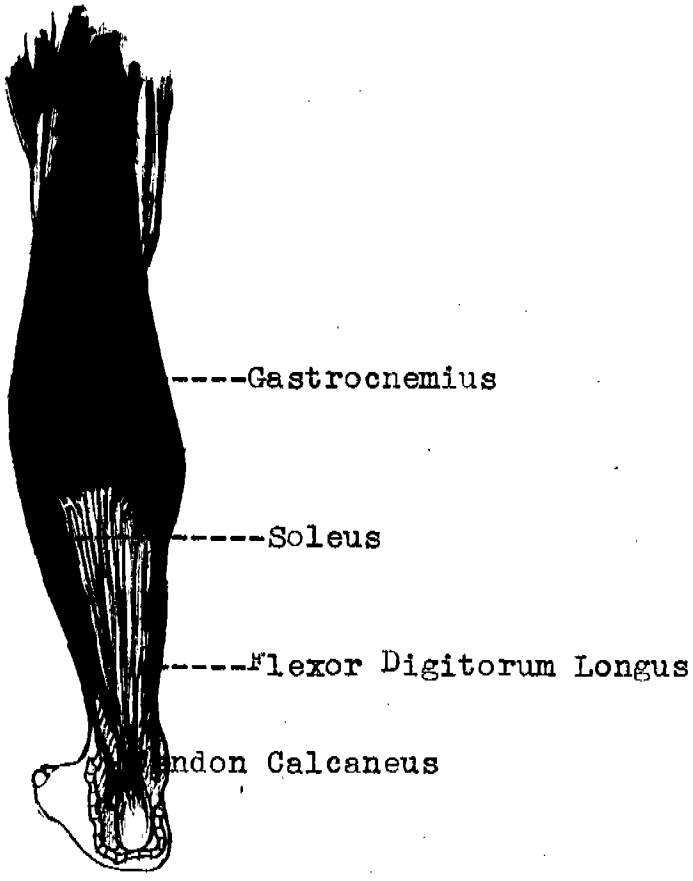
Front and Dorsum of Leg



Back ofthe Leg.

GASTROCNEMIUS
Origin-Medial and lateral condyles of femur
Insertion-Calcaneus of foot
Function-Flexes the leg.

SOLEUS
Origin-Head of fubula and medial border of tibia
Insertion-Calcaneus or heel bone
Function-Extends the foot at the anklejoint.


----Gastrocnemius
-----Soleus
----Flexor Digitorum Longus
ndon Calcaneus

BIBLIOGRAPHY

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References used are listed below:

Edwards, L.F.
Anatomy for Physical Education
Philadelphia: The Blakiston Co.

Hickman, C.P.
Physiological Hygiene
New York: Prentice-Hall Inc.

Kimber, D.C.
Textbook of Anatomy and Physiology
New York: The Mac Millan Co.

Robinson, A.
Cunningham's Textbook ofAnatomy
New York: William Wood and Co.

Schaeffer, J.P.
Morris' Human Anatomy
Philadelphia: The Blakiston Co.

Whitelaw, R.M
Normal and Elementary Diagnosis
Philadelphia: Lea and Febiger.