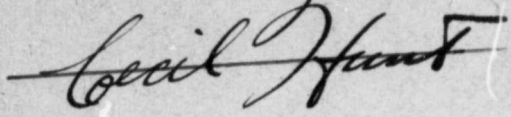

# Physical Training

FIRST AID TO THE INJURED
AND
ATHLETICS

BY
Jas. W. Barton, M.D.
Physical Director, University of Toronto

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TO MY MOTHER

# PREFACE

In presenting this book to students and to the general public, I am not unmindful of the fact that books on this subject are being published with great frequency.

However, the need of a book free from the fads which have spoiled otherwise helpful books, has been most apparent.

My own actual need of such a work has been most clearly shown in my capacity of Lecturer in Physical Training in the Faculty of Education, University of Toronto.

Almost daily I have been asked to recommend some work which would enable these embryo school teachers to learn something of their bodies, and the effect of exercise thereon.

As these teachers are no further enlightened in the subject of physical training than the general public, it is not necessary to write anything but a simple, concise work on the subject.

By dividing same into five parts, one is enabled to secure what is wanted without wading through unnecessary reading.

My reason for inserting the part on apparatus work is because I believe in it most thoroughly. A casual glance will show that the work conforms to Prof. Roberts' old motto, "Safe, Easy, Beneficial and Pleasing."

My reason for inserting the chapter on Athletics, is also because I believe in it. Further, it is

being recommended by the educational departments of many countries as a part of Physical Training.

In preparing the following pages, have used Gray's Anatomy, Collins and Rockwell's Physiology and La Grange's Physiology of Exercise. In the cuts for the muscle charts, have used cuts illustrating Sandow's Dumb-bell Drill.

In conclusion, I wish to say that I recognize the imperfections of the work, because of my effort to cover so many parts of the subject in one little book.

# CONTENTS

## PART III



## PART IV



## PART V

# FIRST AID TO THE INJURED

The following directions are necessarily condensed, but I trust that they will be found of practical value.

## *BLEEDING*

The only point to think of is the stopping of the flow of blood as soon as possible, irrespective of whether it is from an artery or a vein.

This is accomplished by placing the fingers or a pad of any kind directly over the bleeding point. Elevate the bleeding part. Cold water or ice retards bleeding. Warm water or warmth of any kind increases bleeding.

Bleeding from the nose is sometimes obstinate. The injection of cold or ice water into the nose is effective. Applications of cold water to the forehead or back of neck are also useful.

Bleeding from the lungs (bright red and frothy) is treated by having patient rest quietly in bed.

Bleeding from stomach (dark red) is treated by rest in bed, and the swallowing of small pieces of ice.

## *BURNS*

To keep air from the burn is the first consideration.

Baking soda is usually the handiest and most effective remedy. Cover the part with baking soda, and lay wet cloths over it. Carron oil (equal parts of linseed oil and lime water) is an old but efficient remedy. Apply the carron oil freely, and cover with cotton batting.

## *FROST BITE*

The frozen part should be put into cold water or rubbed with snow. Putting parts in coal oil is effective treatment.

## *SPRAINS*

The successful treatment of a sprain is to secure absolute rest. Many people think it wise to "work

out a sprain." This is a serious error and leaves the joint weakened for life.

*A Sprain* is the twisting, stretching, and partial tearing of the ligaments surrounding a joint. Place the injured joint in hot water for an hour if possible. Keep the water hot by adding more hot water all the time. Then bandage the joint firmly, and elevate it. After a couple or three days, if the sprain is not severe, the joint may be massaged, and be moved gently without any weight on it.

## *FRACTURES AND DISLOCATIONS*

The difference between a fracture and a dislocation should be remembered, because, while a fracture can go untreated for some time, a dislocation should be corrected as soon as possible. However, where the fracture is near the joint it is often hard to distinguish it from a dislocation. It is usually better to leave a doubtful case until the surgeon arrives.

The symptoms of a fracture are:

1. Motion at a point where there should be none.
2. Deformity. The limb is altered in shape.
3. There is a fixed pain at one point.
4. Loss of voluntary movement due to this pain.

*Treatment.*—If it is possible to secure a surgeon, leave the patient alone, except to make him comfortable.

If a surgeon is not available, draw the bone into its natural position by placing one hand above and the other below the point of the fracture. Then take a couple of thin splints as long as the broken bone, and pad them with cotton batting or cloth of any kind. Place the splints on either side of the injured bone, and tie them in position with cloths or handkerchiefs.

*Dislocation.*—Where a bone is displaced from another at a joint, it is called a dislocation.

Before deciding that a bone is "out of joint" com-

pare the injured joint with the joint on the other side. The point to remember is that where there should be a nice, smooth-working joint, there is no motion whatever. Also there is *always* a deformity.

The general rule of treatment if a surgeon is not available is to exaggerate the deformity slightly, and then draw the bone or bones into position. Retain in position by bandages.

## *SHOCK*

The most important thing in the treatment is the application of heat in some form to the spine, abdomen and extremities. The patient should be placed in the recumbent position, the head on a level or slightly lower than the trunk.

Small doses of hot coffee may be given by the mouth.

## *POISONS*

After sending for a physician the first thing to do is to try and induce vomiting by tickling the throat with a feather or the finger, or having patient drink hot water, or mustard and water.

If the poison was an irritant, after vomiting has been induced, give the whites of eggs, or flour and water. If an acid poison was taken use a mild alkali, such as lime water or cooking soda. If an alkali, use a mild acid such as vinegar or lemon joice. In a case of opium poisoning, keep the patient awake by making him walk about. Strong coffee helps also.

## *SUFFOCATION*

The treatment is the same whether caused by gas, smoke, hanging or choking. Dash cold water in the face and hold ammonia to nostrils. If breathing does not ensue, use the "Schafer" method of resuscitation.

## DIAGRAM FOR FIRST AID TO THE UNCONSCIOUS

| | FACE | EYES | MOUTH | RESPIRATION | PULSE | MOTION |
|---|---|---|---|---|---|---|
| **Concussion Compression Apoplexy** | Flushed | **Unequal to Light & Touch & in Size** | To One Side | Snorting | Very Full Slow | One Sided |
| Intoxication | Flushed | Alike Normal | — | Deep | Full Fast | Present |
| Sunstroke | Flushed | Alike | — | Deep | Full Slow | Present |
| Epilepsy | Pale | Alike Normal | Twitching | Irregular | Normal | Rigid |
| Fainting | Pale | Alike | — | Shallow | Weak | More or Less Present |
| Opium Poisoning | Often Pale | Like Pin Heads | — | Deep | Slow | More or Less Present |

This diagram was arranged by Dr. G. T. Swarts, R. I. State Registrar and Secretary State Board of Health, for First Aid Classes.

## *FIRST AID TO THE UNCONSCIOUS*

Under each heading in the top line is given the symptom expressed for the causes in the first column. It will be noted that each cause of unconsciousness has some peculiar expression that distinguishes it from others, while other expressions may be alike for several causes. As, for instance, inequality of eyes and motion for apoplexy—full, fast pulse for intoxication, etc. These peculiar expressions should be looked for before deciding on any cause, as what might be taken for a case of intoxication may be sunstroke, requiring prompt and skilful treatment.

NOTE.—The distinguishing expression of intoxication is the fast pulse as compared with the slow pulse of sunstroke, concussion and apoplexy.

Send for a physician at once and apply the treatment given below until he comes.

*Brain Concussion, Compression or Apoplexy.*—Lay the patient down, head slightly raised, loosen clothing, keep the head cool and feet warm. Keep quiet and don't give stimulants.

*Intoxication.*—Give an emetic. If the skin is cold and pulse feeble, apply heat and friction.

*Sunstroke.*—Lie down in shade. Apply continuously ice or cold to the entire surface of the body. Ice pack behind ears and about head.

*Epilepsy.*—Lay the person down and keep him from injuring himself.

*Fainting.*—Lay down with head lower than body—apply smelling salts to nose and sprinkle cold water on face.

*Opium Poisoning.*—Empty stomach. Keep patient walking, slapping with a towel. Keep him awake.

*Lightning.*—Or electric shock, treat as in resuscitation for drowning.

*Venomous Insect Stings.*—Alcoholic solution of menthol.

This diagram was arranged by Dr. G. T. Swarts, R. I. State Registrar and Secretary State Board of Health, for First Aid Classes.

## *RESUSCITATION OF THE DROWNED*

*Schafer Method.*—Send for a doctor, but don't wait. Place the patient face downwards on the ground, then, without stopping to remove clothing, commence artificial respiration, as every instant of delay is serious.

To effect artificial breathing, put yourself astride or on one side of the patient's body, in a kneeling position, facing his head. Placing your hands flat in the small of his back, with the thumbs nearly touching and the fingers spread out on each side of the body over the lowest ribs, lean forward, and steadily allow the weight of your body to fall over upon them, and so produce a firm downward pressure, which must not be violent.

By this means the air (and water, if there be any) is driven out of the patient's lungs. Immediately thereafter swing backward, rapidly releasing the pressure, but without lifting the hands from the patient's body. Repeat this forward and backward movement (pressure and relaxation of pressure) every four or five seconds.

Keep this up until natural respirations are resumed. If they again tend to fail, the process must be repeated.

Whilst the operator is carrying out artificial respiration, others may apply hot flannels to the limbs and body, and hot bottles to the feet, or by rubbing upward promote warmth by friction; but no attempts should be made to give any restoratives by the mouth until natural breathing has recommenced.

When natural respiration is once established, cease to imitate the movements of breathing.

# FORMATION OF A CLASS

**The methods of lining out a class as illustrated, might also be useful to some teachers.**

In "lining out" a class for calisthenics, where there is plenty of room, the following plan is most effective in enabling each member of the class to see the instructor:

The class numbers, say, in "sixes." The even numbers go as far as possible from the line, and the odd numbers go the least possible distance. Thus:

No. 1 remains stationary.

No. 2 takes (2 x 6)—2=10 paces forward. This is attained by remembering that there is at least a two-pace interval between any two members of the class, so that if No. 1 remains stationary, and you wish No. 2 to be the greatest possible distance from No. 1, he takes (6 x 2)—2=10 paces.

No. 3 takes 2 paces forward—least possible number.

No. 4 takes 8 paces forward—next greatest possible number.

No. 5 takes 4 paces forward—next least, etc.

No. 6 takes 6 paces forward.

Or if you numbered, say, in "sevens."

No. 1 remains stationary.

No. 2 takes (7 x 2)—2=12 paces forward.

No. 3 takes 2 paces forward.

No. 4 takes 10 paces forward, etc.

Another method, which is more economical in space, is as follows:

Have your class form in one line from the right, with the tallest pupil at extreme right and others lining up on his left, as in military drill.

Now figure how many can conveniently occupy the width of the floor, allowing six feet per pupil. If your floor is, say, about forty feet or more, number in sixes or sevens.

The class is then turned to the right and marched to extreme end of room. On arrival here, number one (of the first six) wheels to the left and marches to opposite side, number two follows a little more than two paces behind, number three the same distance behind number two, number four the same distance behind number three, number five the same behind number four, and number six the same distance behind number five. The first six are thus stretched across the room. They then turn together and march down to the opposite end of the room.

The next six come to extreme end, turn at same point and march across without pause, but instead of covering the first six they take up the intervals between and march down to other end to within about six feet of first six. That is, number one occupies the interval between one and two of first line, number two the interval between two and three, and so on.

Then the third section of sixes marches across at the end, covers the first section of sixes, and marches down to within six feet of the second section. The next section of sixes covers the second section and so on, thus:

# PHYSICAL TRAINING

## PART I

## Anatomy, Physiology, Physiology of Exercise, Hygiene

*Anatomy.*—Bone consists of two kinds of tissue, a hard, ivory-like tissue on the outside, and a fibrous, meshwork-like tissue on the inner side called cancellous tissue. Bone consists of one-third animal matter and two-thirds mineral matter.

There are 207 bones in the body.

| | |
|---|---|
| The spine or vertebral column..... | 33 |
| Cranium ..... | 8 |
| Face ..... | 14 |
| Os Hyoides (Adam's apple) ..... | 1 |
| Sternum (breast-bone) ..... | 1 |
| Ribs ..... | 24 |
| Upper extremities ..... | 64 |
| Lower extremities ..... | 62 |
| | 207 |

Bones are divided into four classes: long, short, flat and irregular.

*Long Bones.*—As in the limbs, sustaining weight and permitting locomotion. Long bone consists of a shaft and two extremities. The shaft is cylindrical, contracted and narrowed to give space for the bellies of the muscles. Internally it is hollow for the marrow or fat. The extremities are enlarged to form joints and to give surface for muscular attachment. The long bone is usually curved in two directions, thus adding strength to the bone. Examples—humerus, femur, arm and leg bones.

*Short Bones.*—Are found where strength and compactness are required. They consist of spongy tissue for the most part, but have a thin veneer of compact tissue on outer side; as carpus or wrist-bones, patella or knee-cap.

*Flat Bones.*—For protection and muscular attachment. Composed of two thin layers of compact tissue, with a spongy layer between them. Example—bones of the skull.

*Irregular Bones.*—Those that cannot be grouped in the preceding three divisions, as the jaw-bone, superior maxillary, and the hip-bone, or os innominatum.

The spine consists of thirty-three bones called vertebrae piled one on top of the other, which receive their names according to their situation. There are seven cervical (in the neck), twelve dorsal, corresponding to the number of ribs, five lumbar, five sacral, and four coccy geal. The latter two divisions form but two bones in adult life—the sacrum and coccyx.

Each vertebra consists of two parts, a body in front to give support to the head and trunk, and an arch behind, which, with its fellows, forms a protection for the spinal cord. The arches have processes extending from them for the attachment of muscles. The spinal column is about twenty-seven inches long.

The skull, which is an expansion of the vertebral column, consists of eight bones. The Occipital, situated at the back and lower part; the two Parietal, forming the roof and sides of the skull; the Frontal, situated immediately in front of the skull, forming the forehead; the two Temporal, helping to form the sides and base of the skull; the Sphenoid, or Wedge, is situated at the front of the base of the skull, articulating with, and binding together all the bones of the skull, and the Ethmoid, a spongy, sieve-like bone, situated between the two orbits.

The face consists of fourteen bones.

Two Nasal, two Maxillary (upper jaw), two Lachrymal (outer part of orbits), two Malar or cheek-bones. two Palate, two Inferior Turbinated—small scroll-like bones on the outer wall of the nasal cavity, the Vomer—forming part of division between the nostrils and the Inferior Maxillary (lower jaw).

The Hyoid bone, or Adam's apple, gives attachment to the muscles of the tongue. Sternum, breast-bone, is flat. The ribs are attached to it in front by means of cartilages. The Ribs—twelve on each side. The first seven are connected to the spine behind and to the sternum in front, and are called *true* ribs. The remaining five are *false* ribs, the two lowest of which are called floating ribs.

## *BONES OF THE UPPER EXTREMITY*

*Upper Extremity.*—Consists of bones of the shoulder, upper arm, forearm and hand.

*The Clavicle*, or collar-bone, a long bone curved like the letter "f." It is attached on inner side to sternum, and outer side to scapula or shoulder-blade. Prevents shoulder falling forward.

*The Scapula*, or shoulder-blade, situated opposite to and on outer side of, the second to seventh ribs behind. Its upper portion has a cavity—the glenoid cavity—into which the head of the Humerus, or upper-arm bone, finds lodgment. It is triangular in shape, convex on its outer side and concave beneath. It has a spine or prominent plate of bone running across its upper outer portion, which strengthens it, and gives attachment to muscles.

*The Humerus.*—The upper-arm bone, a typical long bone, one extremity forming the lower portion of the shoulder-joint, and the other extremity forming the upper portion of elbow-joint.

*Forearm: Ulna and Radius.*—Ulna on inner side (that is, with little finger touching thigh, palm to front). It is a typical long bone, forming the lower

portion of elbow-joint and running parallel with the radius which is on the outer side. Radius, on outer side of forearm, forms the upper portion of wrist-joint. Its upper extremity is small, lower extremity large. It crosses the ulna when the palm is turned downward, the two bones thus forming an "X."

*The Hand* consists of Carpal, or wrist-bones; Metacarpal, or hand-bones, and Phalanges, the bones of the fingers.

*The Carpal*, or wrist-bones, are eight in number, arranged in two rows.

*The Metacarpal*, the bones of the hand, are five in number, and extend from wrist to fingers, corresponding with each finger.

*The Phalanges*, finger-bones, fourteen in number, three for each finger and two for the thumb. Although not very large, they are long bones, with a shaft and two extremities.

## *THE LOWER EXTREMITY*

*Lower Extremity.*—Three parts, the thigh, leg, and foot. It is connected to the trunk by means of the Os Innominatum, or hip-bone.

*Os Innominatum* (nameless bone).—Hip-bone is a large, irregularly-shaped bone, which, with its fellow on the opposite side, forms the sides and front of the pelvic cavity, which latter is completed behind by the sacrum. At about the centre of its external surface is a large cavity, the acetabulum, into which lodges the head of the femur, or thigh-bone.

*The Thigh.*—Femur, or thigh-bone, is the longest, largest and strongest bone in the body. Slants inward from hip to knee. There is more slant in the female than in the male, owing to the greater width of the pelvis of the former. It is a typical long bone, forming the lower portion of the hip-joint and the upper portion of the knee-joint.

*The Leg.*—Three bones, the Patella, Tibia and Fibula.

*Patella*, or knee-cap. Small bone situated in front of knee-joint. It is really a sesamoid bone (a bone developed within a tendon), common to the muscles, extending the leg on the thigh, *i.e.*, straightening the knee.

*The Tibia.*—Situated at the front and inner side of the leg. A large, strong long bone, running parallel with the Fibula, which is on the outer side. It forms the entire lower portion of the knee-joint. It runs vertically in the male, but obliquely outward in the female to compensate for the inward oblique direction of the femur in the latter. Its lower end forms inner ankle.

*The Fibula.*—On outer side, its upper portion or head being underneath the expanded head of the Tibia, thus helping to brace the latter, as it were, It is a slender long bone. Its lower end forms the outer ankle.

*The Foot.*—Three divisions: the Tarsal, or ankle-bones, seven in number; the Metatarsal, or foot-bones, five in number, and the Phalanges, or bones of the toes, fourteen in number, as in the hand.

## *JOINTS OR ARTICULATIONS*

There are three classes of joints: Immovable, Movable and Mixed.

*Immovable Joints.*—The surfaces are in direct contact, fastened together with an intervening mass of connective tissue, and in which there is no appreciable motion, as between the bones of the head.

*Movable Joints.*—Formed by the approximation of two contiguous bony surfaces covered with cartilage, connected by ligaments, and lined by synovial membrane, which secretes the synovial fluid that keeps the joint lubricated.

There are six classes of movable joints:

(a) *Hinge Joint.*—Motion in one plane only, *e.g.*, the knees.

(b) *Pivot Joint.*—Movement limited to rotation, as in the upper radio-ulnar articulation.

(c) Condyloid.—Egg-shaped head received into an elliptical cavity, permitting of flexion, extension, abduction, adduction, circumduction, but no axial rotation, *e.g.*, the wrist-joint.

(d) *Reciprocal Reception (Saddle Joint).*—Articular surfaces inversely convex in one direction and concave in the other, *e.g.*, carpo-metacarpal joint of the thumb.

(e) *Ball and Socket Joint.*—Movement in all directions, *e.g.*, hip and shoulder joints.

(f) *Gliding Joint.*—Surfaces gliding upon one another, *e.g.*, the carpal and tarsal articulations.

*Mixed Joints.*—Joints that move but slightly, as the joints between the vertebrae and the joints of the pelvis.

## *MUSCLES*

Muscles are all sizes and shapes, being small, broad, long and so forth. Their names are given for various reasons, as:

1. Their situation, as the Tibialis Anticus.
2. Direction in which they run, as the Rectus and Obliquus Abdominis.
3. Uses, as Flexors, Extensors.
4. Shape, as Trapezius, Deltoid.
5. Number of Divisions, as Triceps, Biceps.
6. Points of Attachment, as Sterno-mastoid.

Every muscle has an Origin and an Insertion.

The Origin is the more fixed or central attachment.

The Insertion is the more movable point toward which the force of the muscle is directed.

Tendons are white, glistening cords which connect muscles and bones.

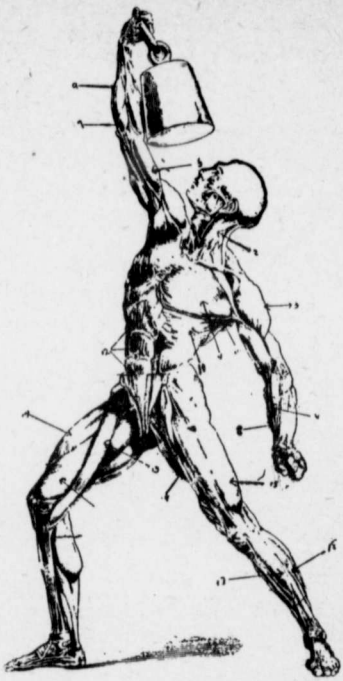
Fasciae are a sort of bandage, superficial and deep, which, running between and about the muscles, serve to bind them together.

There are over 500 muscles in the body of the

three varieties: Striated Voluntary, Striated Involuntary, and Non-striated Involuntary, the functions of which will be mentioned under the part on the Physiology of Muscle.

The following muscles give a fair idea of the movements of the body. Some of the most important muscles of the back and abdomen cannot be shown on a chart.

In giving the Origin and Insertion of the following muscles, the attempt is made to give the general idea of the location, as such things as lines, tubercles and condyles might be too confusing in a short work on the subject:

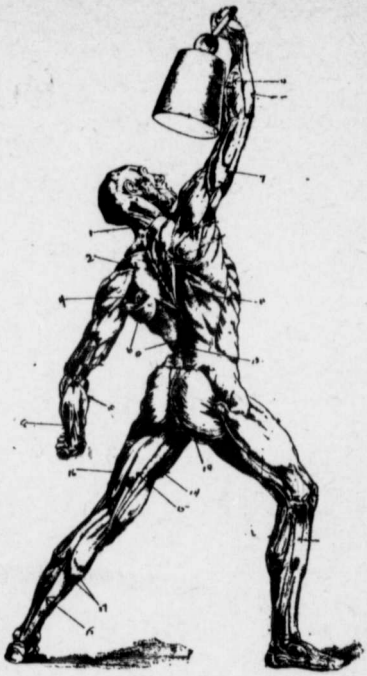


*MUSCLES—ANTERIOR ASPECT*

| No | Name | Origin | Insertion | Action |
|---|---|---|---|---|
| 2 | Sterno-Mastoid | From upper part of sternum. | Mastoid portion of Temporal Bone (the lump behind the ear). | Draws head to side, and helps rotate it. |
| 3 | Deltoid | From outer end of clavicle (collar-bone) and from upper part of scapula (shoulder-blade). | Into outer surface of humerus (upper arm bone). | Raises the arm to height of shoulder. |
| 4 | Pectoralis Major | From half the width of sternum (breast-bone) and cartilages of first seven ribs. | Into anterior and upper surface of humerus. | Draws arm across the chest and downward. |

## *MUSCLES—ANTERIOR ASPECT—Continued*

| No. | Name | Origin | Insertion | Action |
|---|---|---|---|---|
| 5 | Biceps. | From two points on upper part of scapula. | Into upper end of radius. | Bends the fore-arm on the upper arm. |
| 6 | Supinator Longus | From lower and outer end of humerus. | Into lower end of radius. | Turns the palm upward. |
| 7 | Pronator Teres. | From lower and inner end of humerus. | Outer border of radius. | Turns the palm downward. |
| 8 | Flexor Radialis | From lower and inner end of humerus. | Bone of palm corresponding to index finger. | Helps bend the wrist. |
| 9 | Flexor Ulnaris. | From lower and inner end of humerus. | Inner wrist-bones, and bone in palm corresponding with little finger. | Helps bend the hand on wrist. |
| 10 | Serratus Magnus. | From outer surface and outer border of the eight upper ribs. | Inserted into scapula or shoulder-blade. | Carries the shoulder-blades forward—a muscle used in pushing. |
| 11 | Obliquus Externus | From outer surface and lower border of the eight lower ribs. | Into upper and outer portion of the hip-bone. | Draws the pelvis upon trunk or trunk down on pelvis. |
| 12 | Rectus Abdominis. | From upper and front portion of hip-bone. | Into cartilages of 5th, 6th, and 7th ribs. | Draws the pelvis upon trunk or trunk down on pelvis. |
| 13 | Sartorius. | Outer portion of hip-bone. | Inner side of head of tibia (shin bone). | Helps raise the knee. |
| 14 | Rectus Femoris. | Lower and inner portion of hip-bone. | Into patella or knee-cap. | Helps straighten the leg. |
| 15 | Vastus Externus. | Outer and upper end of femur. | Into patella or knee-cap. | Helps straighten the leg. |
| 16 | Vastus Internus. | Inner and upper end of femur. | Into patella or knee-cap. | Helps straighten the leg. |
| 17 | Adductors. | Inner and lower portion of hip-bone. | Into inner side of femur and tibia. | Brings leg toward the middle line. |
| 18 | Tibialis Anticus. | Upper and outer surface of shaft of tibia. | Lowest inner ankle bone and bone in sole of foot corresponding to big toe. | Raises the toes. |
| 19 | Peroneus Longus. | Upper and outer surface of fibula. | Lowest inner ankle bone and bone in sole of foot corresponding to big toe. | Raises the toes and turns foot outward. |



*MUSCLES—POSTERIOR ASPECT*

| No | Name | Origin | Insertion | Action |
|---|---|---|---|---|
| 1 | Splenius. | From last cervical and the six upper dorsal vertebræ. | Into occipital bone. | Draws head backward and to the side. |
| 2 | Trapezius. | From last cervical and all the dorsal vertebræ. | Into the scapulæ or shoulder-blades. | Brings the shoulder-blades together, squares the shoulders. |
| 4 | Infraspinatus. | From the lower portion of outer surface of scapula. | Into head of humerus. | Rotates humerus outward. |
| 5 | Rhomboidii (major and minor). | From last cervical and first four dorsal vertebræ. | Into the scapulæ. | Draws shoulder-blades backward and upward. |

## *MUSCLES—POSTERIOR ASPECT—Continued*

| No | Name | Origin | Insertion | Action |
|---|---|---|---|---|
| 6 | Teres major. | Lower angle of scapula. | Into posterior surface of humerus. | Draws arm downward and backward. |
| 7 | Triceps. | One origin from below the cavity of the scapula into which the head of humerus fits. Other two origins from posterior surface of humerus. | Into the upper posterior end of ulna. | Straightens the arm. |
| 8 | Extensor communis. | From lower and outer end of humerus. | Into second and third phalanges of the fingers. | Straightens the fingers. Opens the hand. |
| 9 | Extensor ulnaris. | From lower and outer end of humerus. | Into bone in palm corresponding to little finger. | Straightens the wrist—extends the wrist. |
| 10 | Extensor pollicis. | Posterior surface of ulna. | Into base of last phalanx of thumb. | Extends the thumb. |
| 11 | Latissimus dorsi. | From the six lower dorsal vertebræ and from the lumbar and sacral vertebræ. | Posterior surface of humerus. | Draws arm downward and backward. |
| 12 | Sacro-lumbalis (part of Erector spinæ). | From the sacrum. | Into angles of six lower ribs. | Helps hold trunk erect. |
| 13 | Quadratus lumborum. | Upper posterior portion of hip-bone. | Into last rib. | Draws down last rib —assists in forced expiration. |
| 14 | Gluteus (major, medius, minor). | From outer surface of hip-bone. | Into upper posterior portion of femur, or thigh-bone. | Serves as cushion when seated—draws back femur. |
| 15 | Semimembranosus. | Lower part of hip-bone. | Into upper part inner surface of tibia. | Bends knee. |
| 16 | Semitendinosus. | Lower part of hip-bone. | Into upper part inner surface of tibia. | Bends knee |
| 17 | Biceps femoris. | Lower part of hip-bone, and from upper posterior surface of femur. | Into outer side of head of fibula. | Bends knee |
| 18 | Gastrocnemius | From lower posterior inner and outer ends of femur. | Into tendo achillis. | Raises body on toes. |
| 19 | Tendo Achillis | Tendon of gastrocnemius and soleus. | Into heel-bone. | Raises body on toes. |

## *PHYSIOLOGY*

Anatomy treats of the structure of the body, and Physiology treats of the workings of the healthy living body.

The living body is often compared to a machine; more frequently to a steam engine. There is considerable likeness, in that both consume fuel and liberate energy in the form of heat and motion. However, the fuel supplied a boiler never becomes a part of the boiler; in man the foods are absorbed and go to form a part of the individual himself. Metabolism consists of the building up of the absorbed foodstuffs into a part of the body, and the breaking down and casting out of the body of the used portions.

Oxidation, or burning, is the source of the energy of the body, manifested as heat and visible motion, and the giving off of the waste products, breath from the lungs, sweat from the skin, urine from the kidneys, and faeces from the intestines.

## *THE BLOOD*

The blood is the fluid medium nourishing all the tissues either directly or indirectly. It also removes all such materials which result from Metabolism, and are of no further use to the body, to the excretory organs, and thence from the body. The blood consists of a fluid portion, the Liquor Sanguinis, in which are suspended rounded masses of protoplasm called blood corpuscles. Most of these corpuscles are reddish in colour, hence the red colour of the blood. The remainder are white. The red corpuscles are small, rounded bodies carrying the food and oxygen to all parts.

The white corpuscles are irregular in shape, larger than the red ones, and are known as the disease fighters, as they have the power of rendering disease germs inert.

The quantity of the blood is about 1-12 of the

body weight. The blood is alkaline, taste saltish, and temperature about 100 degrees F., although it is considerably warmer during certain physiological processes.

### *USES OF THE BLOOD*

1. It receives and stores matter (oxygen and digested food) from the outer world and carries it to all parts of the body.

2. The source from whence the various tissues of the body may take the materials necessary for their maintenance and nutrition, and whence the secreting organs may take the constituents of their various secretions.

3. Is the medium for the absorption of refuse matters from all the tissues, and for their conveyance to those organs whose function it is to separate them and cast them out of the body.

4. It warms and moistens all parts of the body.

### *CIRCULATION OF THE BLOOD*

The blood circulates within a system of closed tubes by means of the alternate contraction and relaxation of the heart. The heart is a hollow muscular organ, four chambers, two auricles and two ventricles arranged in pairs, a ventricle and an auricle communicating on each side, which, however, do not communicate directly with auricle and ventricle on other side. The blood is conveyed away from the left side of the heart by the arteries and returned to right side by the veins, the arteries and veins being continuous with each other on one end by means of the heart, and on the other end by a fine network of vessels—the capillaries. From the right ventricle the blood passes through the pulmonary artery to the lungs to be purified, then after passing through the pulmonary capillaries and veins it passes through the pulmonary vein to the left ventricle, from whence it is pumped through the aorta to all parts of the body.

The normal sounds of the heart have been likened to that expressed by "lubb-dup." The first part, "lubb," occurs when blood is pumped out of the heart through the pulmonary artery and aorta to the lungs and body respectively. The second sound, "dup," occurs when the heart expands to receive the blood from body and lungs.

## *RESPIRATION*

Respiration consists of the absorption of oxygen and the excretion of carbonic acid. A lung is simply a fine transparent membrane, one surface exposed to the air, and on the other surface a network of blood-vessels, the only separation between the blood and the aerating medium being the thin wall of the blood-vessels.

The lungs are only the medium of exchange, as the processes of combustion occur in the tissues throughout the body. The lungs are in the chest cavity, and have no other opening except that leading from the mouth and nose, that is, the wind-pipe or trachea. The proper idea of the lungs is to think of them as really outside the body, because the air passages open directly to the atmosphere. The wind-pipe is about four inches long and one inch in diameter, and is held open by rings of cartilage which are situated at front and sides. At the back of the wind-pipe a layer of unstriped muscular tissue extends transversely between the ends of the cartilaginous rings to which they are attached. The bronchial tubes, one for the right and one for the left lung, branch from the wind-pipe to the lungs. They also have rings, keeping them distended.

The Pleurae consist of serous membranes, one layer adhering to lung surface, the other to the inner surface of chest wall. This membrane secretes a serous fluid which allows the lung to glide easily. There is really no space between the lung and chest wall. The Lungs are divided into lobes

or sections, three in the right lung and two in the left. The bronchial tube divides and subdivides, the walls becoming gradually thinner, until at last there is only a thin membrane of connective and elastic tissue, lined by a layer of lung cells proper. The small, branched tubes, now called bronchioles, end in small funnel-shaped dilatations lined with air cells, really a group of air cells. Thus, between the air in the cells and the blood in the vessels, nothing really intervenes but the thin walls of the cells and capillaries.

Respiration consists of the alternate expansion and contraction of the chest, by means of which air is drawn into or expelled from the lungs. Inspiration, the enlargement of the chest, is a muscular act, the chest being enlarged in three diameters, (a) vertically, (b) laterally, (c) from front to back. It is increased in the vertical diameter by the contraction and consequent descent of the diaphragm. The muscles between the ribs prevent the diaphragm from drawing in the sides of the chest, during its contraction. It is increased laterally, and from front to back by the raising of the ribs, most of which are attached obliquely to the spine behind, and to the sternum or breast-bone in front.

Expiration.—The lungs contract or return by the elasticity of the lung cells, no muscular power is used or needed. Of course, forced expiration, such as blowing or coughing, calls for muscular effort, particularly from the abdominal muscles.

A normal adult breathes about eighteen times to the minute. The lungs, if filled to their utmost, contain about 325 cubic inches in the average man, divided as follows: (a) Tidal air, (b) Reserve air, (c) Residual air, (d) Complementary air.

Tidal air, about 30 cubic inches, is the air that passes in and out in an ordinary breath. Reserve air, about 100 cubic inches, is the amount of air in addition to the tidal air that one can expel from the lungs in a forced expiration. Residual air is that which remains

in the lungs even after a forced expiration. It is nearly 100 cubic inches. Complementary air is the air taken in, in addition to the tidal air, in a forced inspiration. It is about 100 cubic inches. The average capacity (exclusive of residual air) is about 225 cubic inches for an adult man of 5 ft. 7 ins. That is the amount he should, at least, blow into a spirometer after inhaling a long breath. Ten inches is added for each inch increase in height, and 10 subtracted for each inch below the height named. For women of average height, 5 ft. 4 ins., 180 cubic inches is a good average.

The atmosphere, air breathed in, consists of 21 parts oxygen, 79 nitrogen, and 4 parts in 10,000 of carbon dioxide. Expired air consists of 16.5 parts oxygen, 79 nitrogen, and 4 parts in 100 of carbon dioxide. Thus there is an enormous increase in carbon dioxide during the sojourn of the air in the lungs.

The nitrogen simply dilutes the oxygen, which would be too powerful for respiration.

By virtue of the law of diffusion of gases, the oxygen in the tidal air is diffused into the reserve air, and the carbon dioxide and other wastes of the reserve air are diffused into the tidal air. A similar exchange takes place between the reserve air and the residual air.

The interchange throughout the tissues is carried on in the same manner, due to differences in pressure.

## *DIGESTION*

The object of digestion is to bring the materials of the food into such a condition that they may be taken up by the blood and lymphatic vessels and rendered available for the wants of the system. Foods in the ordinary state are unfit, and are therefore useless unless digested. (The different classes of foods are treated under Diet). When food enters the mouth it is moved by the tongue to a position between the upper and lower teeth to be crushed,

and also mixed with the first digestive juice, the Saliva. The Saliva is a watery juice, alkaline in reaction, serving to keep the mouth moist, and converting starchy foods into sugar. About three pints is secreted in 24 hours, most of which is secreted during mastication or chewing. From the mouth the food passes through the Pharynx to the Oesophagus, and thence to the Stomach, where it meets the second digestive juice, namely, the Gastric juice. The passing of the food through the mouth to the Pharynx is voluntary, through the Pharynx and Oesophagus is involuntary, which explains why people are unable to throw up a poison taken by mistake. The Pharynx is about 3 inches long, and the Oesophagus about 10 inches in length.

The Stomach is about 15 inches long, and 5 inches in diameter. It is a hollow organ with an outer peritoneal coat, and a mucous membrane lining with a muscular layer between. The muscular layer has fibres running longitudinally, circularly and obliquely, enabling the organ to thoroughly mix the food with the Gastric juice before expelling it into the intestine. The juice itself is made up of pepsin, hydrochloric acid, salts and water. It is manufactured by the glands situated in the mucous membrane lining. Amount secreted is about 15 pints in 24 hours. The stomach capacity is about 3 pints. The Gastric juice acts on the proteids in the food, turning them into peptones. The peptones are diffusible (proteids are not), which permits them to be absorbed when they are thrown into the intestines.

The time required for food to pass through the stomach varies with the kind and amount of food taken. From one to four hours is the usual time.

When the stomach is empty, there is no secretion of juice . When food enters the stomach there is a flow of blood there, and secretion begins. No absorption takes place in the stomach, the food (chyme) is thrown into the small intestine by the action of the muscular walls of the stomach.

The Small Intestine is about 20 feet in length, separated from the large intestine by the ileo-caecal valve. It has four coats—(a) serous or outer coat, (b) muscular coat, longitudinal and circular fibres; (c) submucous coat, (d) mucous coat.

In the mucous coat we have (1) valvulae conniventes, (2) villi, and (3) glands. These Valvulae Conniventes are simply a doubling or folding of the mucous membrane of the intestines at right angles to its long axis, and going about half way round. These folds retard the too rapid advance of food and give an increased surface for absorption.

The Villi are minute teat-like projections from the surface of the wall of the small intestine. Briefly, there are three parts to each villus: 1. The mucous selective action layer of cells of the intestine. (2) Within this is a small blood vessel or capillary. (3) Within this is the ending of a lymphatic or lacteal vessel.

The Large Intestine is from four to six feet long. It likewise has four coats, but its mucous coat has no villi nor valvulae conniventes.

*Digestion in Intestines.*—From the stomach the food goes to the small intestine, where it is acted on by the Bile and Pancreatic juice, and also by the Succus Entericus, which is poured out by the intestinal glands. The Pancreatic juice, secreted by the Pancreas, has a threefold use.

1. It turns proteids into peptones.
2. Turns starch into sugar.
3. Emulsifies fats.

It is poured out on the food in the intestine along with the bile from the liver, through a common duct about two and a half inches from the right or intestinal end of the stomach. It is composed of salts, water and organic matter. About a half pint is secreted in 24 hours. The Bile is secreted by the liver, which is in the right upper portion of the abdominal cavity. During digestion the bile is carried directly to the intestine, but when digestion is not

going on the bile is stored up in the gall bladder, where it remains until required.

*Functions of the Bile*:

1. Assists in emulsifying the fats, thus rendering them capable of passing into the lacteals by absorption.
2. Is a natural antiseptic, destroys many injurious germs.
3. Is a natural purgative.

*Digestive Changes in Small Intestine*:

1. Fats are emulsified and made fit for absorption.
2. Proteids turned into peptones.
3. Starchy substances changed to sugar.
4. Liquids absorbed.

*Absorption.*—The villi absorb the proteids (peptones) and starches (sugars), while the lacteal vessels absorb the emulsified fats. The food absorbed by the blood capillaries in the villi is brought to the liver by the portal veins. Here the most of the starchy (sugar) stuffs are made into glycogen and stored in the liver, the proteid foodstuffs pass through the liver into the general circulation. The lacteal vessels pour their product into blood current, in large veins of the neck.

*Digestive Changes in Large Intestine*:

Anything not absorbed in small intestine is absorbed here. It acts as a reservoir for waste products. However, the fact that people can be nourished by food injections into lower bowel, shows that it has absorbing power.

The movement is affected along the intestine by what is known as peristaltic action, a worm-like motion, alternate contractions and dilatations of successive portions of the muscular coats. The contractions extend in a wave-like motion along the tube. The long fibres draw back behind food to be propelled, and the circular fibres then contract and push it along.

Duration of digestion in small intestine is about 12 hours, and in the large intestine 24 hours.

Defaecation, or the act of the expulsion of the faeces, is due to an increased peristaltic action of the lower part of the large intestine, aided by the action of the abdominal muscles.

## *NUTRITION*

Nutrition is the physiological principles which preserve the normal conditions of the structure and function of the body, so far as refers to the balance between the income and outgo of material. Naturally the income and outgo vary. There is the differences in climate, in physique and in the amount of manual labor performed.

Collins and Rockwell give the following table for an adult male, doing an average amount of work:

*Sources of Income.*—Food, drink, and oxygen are the factors of the income, and may be calculated about as follows for the 24 hours:

| | Ounces. |
|---|---|
| Food (chemically dry) | 16 |
| Water (as drink, and as combined with solid food) | 80 |
| Oxygen (absorbed by lungs) | 26 |
| Total | 122 |

Expenditures of the body for 24 hours—

From the Lungs:

| | Ounces. | |
|---|---|---|
| Carbonic acid | 30 | |
| Water | 10 | |
| Traces of organic matter | — | 40 |

From the Skin:

| | Ounces. | |
|---|---|---|
| Water | 23 | |
| Solid and gaseous matter | 1 | |
| | — | 24 |

From the Kidneys:

| | Ounces. | |
|---|---|---|
| Water | 50 | |
| Organic matter | 1½ | |
| Minerals and salines | ½ | |
| | | 52 |

From the Intestines:

| | Ounces. | |
|---|---|---|
| Water | 4 | |
| Organic and mineral substances | 2 | |
| | | 6 |
| Total | | 122 |

In return for this food, drink and oxygen which the body has consumed, we have to show for it:

1. The growth of the body and secretion of its necessary materials, as well as the maintenance of the tissues.

2. The continuance of physical conditions suitable to life in the form of heat and motion. The actual combustion of carbon must be sufficient to maintain the animal heat, and the nourishment of the muscles upon which the continuance of life depend.

3. Nervous energy as in the regulation of all the physiological processes, reflex or voluntary.

Over 80 per cent. of the income is used to maintain animal heat, and the balance for motion voluntary or involuntary.

The daily work of the body has been estimated at about 3,400 foot tons, or force sufficient to raise the body of a man weighing 150 pounds, to a height of 8½ miles.

## *NERVOUS SYSTEM*

The nervous system is an aggregation of tissues so arranged as to adjust the workings of all parts of the body to one another, and to suit the body to its environment. The Elementary Tissues are:

(a) Fibres. (1) Medullated. (2) Non-medullated.

(b) Cells.

*Nerve Trunks* are made up of bundles of fibres, held together by connective tissue. The function of nerve fibres is the transmission of a stimulus. The centre, or cylinder (axis cylinder) of a nerve fibre connects the centre and periphery cells, and conveys the stimuli between them. Stimuli are of three kinds:

(a) Afferent, or sensory, stimulus going from periphery, or surface, to the brain, as such sensations as heat and pain.

(b) Efferent, or motor, stimulus going from brain to the periphery, as motions of any kind.

(c) Intercentral, connecting nerve centres.

*Nerve Cells.*—Every nerve fibre starts or ends in a nerve cell, which is the origin of impulse in the case of an efferent nerve fibre, or the recipient of sensation in an efferent nerve. A satisfactory explanation of the nature of a nerve impulse has not been given. It is not chemical, because no heat is liberated. It is not thermal, as the temperature remains the same. It is not electrical, as although some fibres are insulated or protected with a fatty substance, there is not the perfect insulation necessary.

## *MUSCLES*

*Varieties*:

1. Non-striated—Plain muscle fibre. Involuntary, not under the control of the will—Intestines, Blood-vessels.

2. Striated—Under control of will. Voluntary—Biceps.

3. Striated—Not under control of will. Involuntary—Heart.

*Non-striated Muscle Tissue* is made up of bundles of elongated spindle-shaped cells, 1-600 of an inch in length, and about 1-4000 of an inch in width. Cells are bound into bundles by an albuminous cement, and these again into larger bundles by connective tissue.

*Striated Voluntary Muscle Tissue* consists of bundles of long muscle cells or fibres. Each fibre is completely enveloped in a sheath, the sarcolemma, and the whole bundle of fibres is bound together by a delicate connective tissue framework. A number of these fasciculi are joined together to make up the gross anatomical muscle. On examining the muscle fibre itself, it will be seen to consist of alternate segments of light and dark matter, giving the fibre a striped appearance. These fibres are about an inch in length and about 1-400 parts of an inch in diameter. They join the connective tissue cells of a tendon or aponeurosis, or another muscle fibre by adhesion of the sarcolemma at the ends, thus uniting the muscle bundles into a firm mass.

*Heart Muscle.*—Striations not so marked, fibres more slender and branching.

General Properties of Muscle:

1. *Unstriated.*—Acts slowly, is not under the control of the will, acts continuously for a long time, is slowly exhausted.

2. *Striated Involuntary.*—Heart, acts quickly, is not under the control of the will, acts for a short period, recuperates rapidly.

3. *Striated Voluntary* (skeletal).—Acts quickly, is under control of the will, and recuperates rapidly.

*Muscle Composition:*

| | Parts. |
|---|---|
| Water ..... | 75 |
| Proteids ..... | 15 |
| Fats, glycogen and salts ..... | 10 |
| | 100 |

*Physiology of Muscles*: Exists in three different conditions—(1) Rest, (2) Activity, (3) Rigor.

*Muscle Rest.*—During rest a muscle has a slight but very perfect elasticity. It can be stretched considerably, but always returns at once to its former condition. In the living body muscles are always in

a state of slight tension. Even during rest, muscle takes oxygen from the blood and gives carbon dioxide to it.

*Muscle During Activity.*—The peculiar property of muscle fibre is its contractibility, which is excited by all kinds of stimuli, direct and indirect. This property is soon lost unless the supply of arterial blood is kept up.

*Actions of Muscles as Levers.*—Most of the voluntary muscles in the body may be regarded as sources of power of moving the bones, viewed as levers. Each muscle fibre has a little plate called an end plate, which is the termination of the nerve supplying the muscle. The time consumed between the arrival of the impulse at the muscle and the beginning of contraction is called the latent period. This is about one one-hundredth of a second.

When a muscle begins to be fatigued the latent period is longer in duration.

*Oxygen Supply.*—Muscle receives its oxidizing agent, oxygen, from the blood coursing through the vessels contained in the muscle. Even during repose the muscle takes its oxygen from the blood and gives up carbon dioxide. The muscle also stores up within itself a certain amount of oxygen, which can be called upon to do work, even if the blood supply be stopped.* This has been proven by cutting a muscle out of the body and causing it to contract in a chamber of nitrogen. During muscular activity a greater amount of blood is needed, and this is supplied by a dilatation of the blood vessels of the part.

*Systematic exercise of a muscle educates the arteries supplying that muscle to remain in a condition of dilatation.* This increase in the blood supply not only provides an increase of oxygen during activity, but during repose carries an increased amount of nourishment to the muscle, with the result that the muscle increases in size and power. Hence the value of systematic body-building work.

*This is now disputed.

*Rigor Mortis.*—The stiffness seen in the muscles after death is due to a fermentative change, causing a coagulation of the blood plasma in the muscle. It passes away because a putrefactive process begins, which destroys the coagulum.

## *FATIGUE*

*Fatigue* is the powerlessness overtaking a muscle during exercise.

In what is known as Experimental Fatigue we have what is called Relative Fatigue and Absolute Fatigue.

*Relative Fatigue* is where the muscle becomes powerless to contract after stimulation by the passage of an electric current for some time.

*Absolute Fatigue* is when the muscle becomes powerless to contract even during the stimulation by the most powerful electric current. A human muscle never reaches the condition of absolute fatigue. That is from exercise or work. The reason is, that such severe pain ensues before absolute fatigue is reached that we stop work. Sometimes, driven by the will we may endure the pain for some time further, until the muscle stops contracting absolutely. Even now the muscle is not absolutely fatigued, because at the moment that it seems completely exhausted, further contraction can be induced by electric stimulus. Therefore, the strongest will is unable to use up the contractile power of a muscle as completely as a mechanical or electrical stimulus.

The pain experienced is due to the fact that during exercise the muscle fibres swell and thus crush or strike against the nerve filaments in the muscle. These repeated knocks kept up for some time induce pain in the muscle.

While this pain causes us to cease work, it is not the cause of the powerlessness or fatigue. During contraction a muscle becomes heated. This heat comes from the chemical actions taking place, and

new products are manufactured which remain in the muscle. These products of dissimilation have the power of paralyzing the contractile force of the muscle fibres.

If these products are not formed in excessive quantity, they are carried off readily by the blood current, and if not renewed too soon, no fatigue ensues. If the exercise or work continues too long, the products accumulate in excessive quantity, paralyze the muscle fibres and prevent contraction. Thus the pain of fatigue is due to the rubbings, stretchings and knockings of the muscle itself and the nerve filaments, and the powerlessness of fatigue is due to the paralyzing influence of the products manufactured in the muscle by prolonged exercise.

That these products actually paralyze the muscle has been proven by an interesting experiment recorded by La Grange.

The limbs of a frog were subjected to a prolonged and powerful stimulation until fatigue was complete. A small portion of the fatigued muscle rubbed up in a mortar and made into a fine soup, was injected into a healthy muscle, producing all the phenomena of fatigue.

When we push exercise past the point of slight fatigue, by the effort of the will, we create a disturbance in the gray matter of the brain, and when this disturbance is excessive it becomes painful.

Fatigue is Subjective and Objective.

*Subjective Fatigue* consists of a feeling of discomfort or a slight painful sensation in muscle which results from a slight change in its structure.

*Objective Fatigue* is due to a profound alteration in the chemical composition of the muscles, an alteration which causes them to lose their power of contraction.

Fatigue acts as a sort of regulator, warning us when we are exceeding the limits of useful exercise. The sensation of fatigue has its seat for the most part in the nerve centres. Where the brain takes

part in the exercise, fatigue is more quickly induced.

In Chorea, or St. Vitus dance, the patients make violent movements all day. A person imitating those movements would have to stop and rest every few minutes.

Very nervous or irritable people become fatigued or feel the sensation of fatigue very keenly. In order to "hold up their end," as the saying is, they will continue work past the point of slight fatigue with injury to themselves.

Short resting periods whilst performing the same amount of work would give the muscle an opportunity to recuperate, as the blood current would carry off the paralyzing products gradually. Likewise exercise that required but little intervention of the mental faculties would be more suitable to such cases.

## *OVERWORK*

*Overwork* is really fatigue pushed to an extremity. Between fatigue and overwork there is simply a difference of "dose" in the substances which poison the organism. The substances are always the same, that is, the waste products of combustion produced by work. Carbonic acid is the product most rapidly formed, and in largest quantity during work. It is also the most dangerous, because an excess of it created within a period of time too short for its elimination causes death. Death from breathlessness is the type of acute overwork, *i.e.*, asphyxia from auto-intoxication.

*Sub-acute Overwork* is rare in man, but common in animals. Hunted animals frequently die, even after escaping their pursuers. One instance in man, is that handed down in the history of the man who ran from Marathon to Athens without stopping, and fell dead on arrival.

The effect of overwork on animals is very well understood. In many instances diseases such as Typhus fever have arisen from the eating of meat

of animals slaughtered too soon after extreme fatigue. In some instances this very effect on the meat when not dangerous, gives the meat a more delicate flavour and it is more highly prized by many.

*Chronic Overwork*, due to the accumulation of waste products, the same as sub-acute overwork. The course, however, is not so rapid, and the termination less fatal, the dose being smaller, the exercise producing it being less violent.

This condition is observed in persons whose bodies are subjected to work too long sustained, or fatigue too often repeated, and not followed by sufficiently long periods of repose.

While any particular disease may not be occasioned, still, the body is in a low or weakened condition, and any slight disturbance in health might cause a serious sickness and death ensue.

Chronic overwork often causes a sort of fever resembling Typhoid fever. Sometimes it causes a condition of languor or prostration which predisposes the person to any prevailing illness or epidemic. The simplest ailment may become a dangerous disease in an overworked man, and simple wounds may develop into blood poisoning. The idea is that the body or the wound is being actually poisoned by the waste products of the body itself.

In Training, we see the effects of overwork in the drawn face and dull eye of the athlete. He loses his resiliency, and becomes, as we call it, "stale." It is generally understood among our athletes that a rest of two to three days is essential before any race requiring endurance. G. W. Orton, Canada's best mile runner, always rested at least three days before any mile race.

Staleness means that the reserve materials have been used up, and that any work whatever uses up the actual body itself. This is what La Grange calls *Organic Exhaustion.*

A man exhausted by hard muscular work exhibits a diminution in the size of the muscles over-

worked. Thus we see a muscle grow smaller from over-use just as we see it grow smaller from lack of use. Moderate use increases its size.

*Nervous Exhaustion* is the termination of intellectual or physical overwork, or both. Any physical, mental or moral overwork induces fatigue in the nerve centres, similar to that observed in the muscles after use.

Where the brain enters into the exercise, fatigue ensues earlier, hence the simplest forms of exercise are essential for those whose nerve centres are already overworked by intellectual exercise.

## *BREATHLESSNESS*

We are all familiar with the sensation, that of being, as we say, completely "winded." "Breathlessness is the distress due to violent exercise or intense muscular work, characterized by an exaggeration of the respiratory need."

During some exercises, sawing wood for instance, we stop work because of fatigue; in other forms of work, sprinting, we stop for want of breath.

This stopping for want of breath is because there is a great expenditure of force in a short period of time.

This expenditure of force may be necessary, as even a trained runner gets out of breath, or it may be the unnecessary expenditure of the novice, who uses more muscular energy than is required for the work or exercise being done.

A person is sometimes surprised to find himself out of breath, or breathing very heavily, after running upstairs. It is the same cause, a great expenditure of energy in a short time. In running upstairs, or running at any time, the body is lifted clear of the ground. That means an enormous amount of work; the weight of the body, 150 lbs., perhaps, is thrown into the air three or four times each second. This does not occur in walking, as the

body is always supported by one foot, and never leaves the ground.

Thus, while walking is a splendid exercise, it can be readily seen that it is of considerably less value as an exercise than running. "In every muscular exercise the intensity of the breathlessness is in direct ratio to the quantity of force expended in a given time."—La Grange.

This being out of breath, this respiratory need is important, as it is a warning that too much carbon dioxide has been manufactured and must be eliminated from the system at once.

Physiologists differ in their opinion as to the cause of respiratory need. Some claim that it is the lack of oxygen in the air cells, or a lessening of the amount of oxygen bathing the respiratory centre in the brain, that excites the respiratory muscles to act.

Others are of the opinion that it is the excess of carbon dioxide in the blood bathing the respiratory centres that stimulates the inspiratory muscles to act.

In proving the latter assertion, they say that a dog injected with carbon dioxide dies of asphyxia, the amount of carbon dioxide thus deciding the respiratory need.

While asleep or resting, less carbon dioxide is manufactured than whilst standing or running. Thus during running or exercising, the lungs begin to work faster, and thereby they keep up the necessary supply of oxygen and throw off the increased amount of carbon dioxide for awhile.

For breathlessness is really due to a kind of poisoning of the body, by one of its own products of dissimilation, that is, a poisoning by carbon dioxide.

The intensity of breathlessness during exercise is in direct proportion to the expenditure of force demanded by the exercise in a given time. The value of "training," as far as breathlessness is concerned, is that by practising an exercise, running for instance, the intensity of muscular action can be regulated by

respiratory power, in such a manner that there will be an equilibrium between the carbon dioxide produced and eliminated.

Running then is, perhaps, one of the best, if not the best exercise for the lungs. The huge bulk of muscle in the legs when exercised demands a tremendous amount of oxygen to keep it going. Thus, when we use the smaller bulk of the arm, as in sawing wood, we do not stop because we are out of breath, but because the muscles are tired and fatigued. When we run, however, we do not stop because the legs are tired, but because we are out of breath; we have induced breathlessness because we have sent repeated calls to the lungs for more oxygen, faster than it can be supplied. We can thus readily see the value of training for running, or running for training.

The attaining of "second wind" in running is the adjusting of blood and oxygen, or heart and lungs, to the regular rhythmical need.

## *VENTILATION*

*Air* is composed of two gases, nitrogen, 77; oxygen, 23, by weight; small quantity of carbon dioxide and ammonia, and some water. Main use of the nitrogen is to so dilute the oxygen that the lungs can breathe it. If we were to decrease the nitrogen in a certain ratio, we have Nitrous Oxide (laughing gas), which in a short time would wear out the system by the increased action which it occasions. Decrease nitrogen further and the result is the proportion of the two gases that form nitric acid, which will eat the flesh, and nearly all metals except gold. If we diminish the oxygen, we diminish its adaptability to breathing. When the diminution of oxygen reaches a certain point, the air becomes wholly unfit for fulfilling its functions, and death ensues.

The great difficulty about modern civilization, is the proper ventilation of the home. Vitiated air, air

that has been breathed, must be driven out, and pure, fresh air taken in.

The special function of the act of breathing is to keep the blood constantly supplied with its due amount of oxygen. Day and night, sleeping or waking, the chest contracts and expands about 18 times a minute, and about 30 cubic inches of air is flowing in and out. This is Tidal air.

The blood, in its passage through the system, gives to the various tissues of the body most of the oxygen it has received from the lungs, and takes from them carbon dioxide, and when it is collected in the pulmonary artery is a dark, purplish blue, instead of a bright scarlet.

The first and last act of a human being is to breathe. How essential that we breathe properly and the right kind of air! The act of breathing must be kept up constantly and continuously. One may do without breakfast, dinner or supper, one may do without them for days; may live for hours, even days without drinking, but only for a very few minutes can one do without breathing.

So essential, indeed, is this function that we really have nothing to do with it. For the most part it is placed beyond the will. In some cases the functions of eating and drinking were better performed if beyond the control of the will.

Now, it is essential to the proper function of breathing that the inhaled air be pure. If it departs to any extent therefrom, then to that extent the function of breathing is imperfectly performed. We are all familiar with the effects of breathing a vitiated atmosphere. At the outset, perhaps, it is not noticeable, that is, from day to day, but the whole tone of the system is lowered. We cannot estimate the slow, insidious inroads that disease makes upon us when we are breathing a vitiated atmosphere. However, we must not think that vitiated air in a room or dwelling is entirely due to the breathing and rebreathing thereof. Stoves and gas render air

unfit for breathing. An ordinary gas burner will consume four times as much carbon dioxide as will a single person breathing. Hence, gas in a room crowded with people affects them, they grow tired, sleepy and inattentive. Electricity does not use up the oxygen, as the platinum wire is in a hermetically sealed globe.

The object of ventilation is to keep the air of an apartment in its normal condition. This condition is affected in two ways; first by the abstraction of a portion of its elements; second, by the introduction of ingredients positively injurious. From the pure outside air, for instance, enter a poorly-ventilated room in which people have slept during the night and you are aware of a disagreeable sensation. The air is close and offensive. This closeness arises from the partial absence of oxygen and a considerable quantity of carbon dioxide. The foul smell is not due to the carbon dioxide (which is inodorous), but is due from exhalations from the body—organic particles.

To secure ventilation theoretically there must be a difference between the temperature of the outer atmosphere and that within the room to be ventilated. The colder air will always drive out the warmer, provided there is any means by which warmer air can escape. Practically, air within a room is warmer than that without, so current of fresh air is always inward.

*Tobin's Tubes.*—Waist high, turn upward at an angle, discharging fresh air toward ceiling.

*Best Method.*—Lower upper sash 10 inches, fill opening at top with a closely-fitting board. Space an inch wide and as long as the width of window is left. Through this an inward ascending current of cold air will flow inward and gradually sink to floor. This is excellent for sleeping rooms, as the rain does not come in. If no chimney flue, have a transom over door into cool hall. Fire with a good draught gives a good ventilation.

We are all more or less familiar with the rules of ventilation and air space as laid down in the text-books. Each person to have 1,000 cubic feet of air space, and the air to be changed three times each hour.

But the shape of the room influences ventilation. Floor space is more important than height. Ceilings in schools should not be more than 12 feet, and 9 feet is considered the proper height in dwellings.

The theory of proper ventilation is now based on the fact that air that is "in motion" is essential. In still air the body becomes surrounded by a warm, moist aerial envelope which causes an overheating of the surface of the body. In a still atmosphere we are soon surrounded by a blanket of stagnant and impure air, whether indoors or outdoors.

If the air in a poorly ventilated room can be kept in motion, say with an electric fan, many of the ill-effects of a vitiated atmosphere are avoided, for the products of respiration are diluted and evaporation and heat interchange are favored. Thus, Leonard Hill placed eight students in a small sealed chamber which held three cubic meters. He states that "at the end of half an hour they had ceased laughing and joking and their faces were congested. Three electric fans were turned on, which merely whirled the air about just as it was. The effect was like magic; the students felt perfectly comfortable, but immediately the fans were stopped they again felt as bad as before."

## *WATER*

Pure Water is about as essential as pure air. Water has the faculty of taking up, or dissolving to a greater or less extent, almost everything with which it comes in contact. Rain water is, perhaps, its purest natural form. This statement requires qualification, however. Rain, in its descent, carries ammonia and organic particles from the atmosphere. This is what makes rain water putrid frequently, after remaining some time. In thickly populated centres,

and near many factories the rain water is polluted.

These pollutions may not be noticeable, the water may be perfectly clear, colorless and sparkling, no unpleasant taste nor odor, and yet be positively dangerous from an excessive amount of organic matter.

Simple test for suspected water: Put into a clear, colourless, glass-stoppered bottle a pint of water with a few grains of lump sugar. Expose bottle to daylight in window of warm room. If in 10 days water becomes turbid, there is enough organic pollution to render it unfit for use. If water has taste or smell, better boil before using. Filtering is usually sufficient.

Improvise a filter, camp or elsewhere: Large, unglazed earthen flower-pot. Cover hole in bottom with a piece of clean flannel, put in three inches of gravel, three inches of white sand, three inches of charcoal—pour your water through this. Burn your charcoal occasionally, and change sand and gravel from time to time. This, with boiling, will help to prevent typhoid, cholera and dysentery.

### *A SIMPLE METHOD OF WATER PURIFICATION.*

*Advised by Ontario Board of Health.*

A level teaspoonful of chloride of lime should be rubbed into a teacupful of water. This solution should be diluted with three cupfuls of water, and a teaspoonful of the whole quantity added to each two-gallon pailful of drinking water. This will give .4 or .5 parts of free chlorine to a million parts of water, sufficient to destroy in 10 minutes all typhoid and colon bacilli or other dysentery-producing organisms in the water. Moreover, all traces of the chlorine will rapidly disappear.

This method of purification has been tested with Toronto Bay water inoculated with millions of bacteria. Every germ has been destroyed and it has been unnecessary to boil the water.

This method should be very valuable for miners, prospectors, campers, soldiers, and those living in summer resorts where the condition of the waters might not be above suspicion.

Water of lakes and large ponds, usually pure—often purer than that of springs or rivers, because these derive most of their water from under-ground streams, which are more or less affected by the soil through which they pass. Some soils, however, are natural filterers, while lakes and ponds receive rain water directly from the clouds. River water is usually good, has considerable mud in suspension, but when the water stands, and mud settles, water is excellent. Water from lakes, ponds and rivers usually used in cities. Properly handled it is good. Ice water helps in summer, but it is safer not to put ice in water, but to have the ice in vessel and water about vessel. Ice is often cut in an uncleanly manner.

If river water is used where factories, barns or stables drain, there is great danger of pollution and disease. Water should be obtained at a point above these polluting sources. Running water purifies itself, but it must run many miles in some cases.

Hard Water.—Water containing carbonate or sulphate of lime in solution.

Soft Water.—Water free from carbonate or sulphate of lime in solution.

If water is too hard, boil water; carbonate of lime adheres to side of vessel.

Lead pipes to convey drinking water is dangerous—unnoticeable from day to day, but many cases of lead colic are due to it. If lead pipes are used, water in pipes for any time should be drawn off first.

*Amount of Water Required.*—Varies according to our work, liquid food, etc.

Thirst is good guide, but when very thirsty drink a little at a time, but oftener. It is not the stomach that needs it, and it is foolish to pour a quart in at once. Blood and other tissues require it, so we should give it time to become absorbed.

We give off about five pounds of water daily. We do not drink that much, but the various foods contain a large percentage of water. Amount required varies with work and climate. A foundryman will drink gallons of water a day. In the army the allowance per man for all purposes is about two gallons in active service, up to ten gallons in some forms of camp life.

## *DIET*

*Diet.*—Many and varied are the articles and books on "Diet." From Spencer's time, with his great belief in the value of meat as a diet, to the vegetarians of to-day, there has been the long drawn-out but futile arguments as to whether the vegetable diet or the mixed diet is the proper one. I have seen two men in the gymnasium, rivals in the various exercises and tests of endurance, and it was indeed difficult to say which was the better all-round man. Yet one ate meat three times a day, and the other had not eaten meat in years. Chambers, Gilman Thompson, and others, have studied the matter from all standpoints, age, sex, climate, heredity and race, and their conclusion is: "The best diet in the abstract is a mixed diet, and mixed in the proportion selected by the experience of most civilized nations, and it is also best for the individual who is accustomed to it to adhere to, under whatever sky he may be wandering."

Meat eaters find it easier to adopt quickly another form of diet than do vegetarians. English and French soldiers in Africa have done best on a mixed diet. The Surgeon-General's Report for 1900 (United States), "Experiences in Philippines": "Our soldiers, during active operations, last year have shown no marked tendency to lessen the quantity of fresh meat eaten. Exhausting, laborious fatigues, with corresponding wear and tear of the muscular system, require a liberal meat issue, which the soldier uses with satisfaction and advantage."

Children should be encouraged to eat heartily of the various kinds of food. If a growing boy eats as much as his father, or a growing girl eats as much as her mother, they should not be made to feel ashamed of it. It is perfectly right from a physiological standpoint. The boy, if active, creates about as much waste as a man. In proportion to his size he gives off more heat than the man, because he exposes more surface in proportion to his mass than does the latter. In addition to this, he needs material upon which to grow. It is therefore natural for a growing boy or girl to eat as much or more than the adults of the family. It is also natural and founded on a physiological principle that a child should like candy and starchy foods, making up for this by a dislike for fat.

### *USES OF FOOD*

1st.—To supply body with material for growth and renewal.

2nd.—To supply body with energy or capacity for doing work.

The energy is liberated as heat and as motion. Four-fifths of the force is expended in maintaining the body temperature at its normal average. In the most perfectly constituted engine the fuel gives one of motion and eight of heat. In a boiler, if ashes or waste are allowed to accumulate, there is interference with the draft, and thus with oxidation. Similarly, if waste products are allowed to accumulate in the body, the process of oxidation is retarded and a predisposition to sickness ensues.

### *CLASSIFICATION OF FOODS*

Baron Von Liebig's classification—Nitrogenous and Non-nitrogenous:

*Nitrogenous.*—All forms of animal foods, excepting fats, glycogen, and such substances as milk, sugar and honey. It includes eggs, fish, flesh and fowl. They are tissue-builders or flesh-formers.

*Non-nitrogenous.*—Respiratory, or heat-making foods, because their function is to furnish fuel, or maintain animal heat.

Sometimes in emergencies the tissue-builders are used as force producers and heat producers as well.

The Non-nitrogenous group includes vegetables, fruits, cereals, starches, sugars, gums, fats and oils (these two are both animal and vegetable). Of course, many vegetables contain nitrogen also, but their main bulk consists of starches and sugars—carbohydrates.

The usual classification of foods by most physiologists is under the following convenient headings: Animal Foods, Vegetable Foods, Fats and Oils, Water, and Salts.

*Water.*—Comprises about 70 per cent. of body weight. Its importance is, therefore, apparent. It is estimated that the average healthy man requires about 80 ounces of water a day. Three-fourths of this is taken as a beverage, the balance as an ingredient of the food. It has a variety of uses in the body, aside from being the chief constituent of the tissues.

1. Being the chief medium from which the organs manufacture their necessary juices.

2. Regulates body temperature by absorption and evaporation.

3. Prevents friction by moistening the various surfaces in the body.

4. Fluid medium, enabling the blood to carry food to, and waste from, all parts of the body.

***Salts.***—Principal salts are : Sodium, Potassium, Magnesium and Calcium.

Uses of Salts.—1. Preserve the tissues from disorganization and putrefaction.

2. Enter into composition of bones, teeth, etc.

3. Enable blood to hold certain materials in solution.

4. Regulate the chemical reaction of the blood and various secretions and excretions.

Too much salt with the food induces indigestion by irritating the mucous membrane of the stomach and intestines. Deprivation of salt likewise causes indigestion, with a loss of nutrition.

## *ANIMAL FOODS*

*Milk.*—Complete food. As milk contains Proteids, Carbohydrates, Fats, Water and Salts, it is called the perfect food. Many people have been able to live exclusively on it. Gilman Thompson estimates that one pint of good milk has the nutrition contained in six ounces of beef or mutton. It is not used very much by athletes, as it has insufficient nitrogenous products, and "cuts the wind" in athletic parlance.

*Eggs.*—Also a perfect food, containing all the ingredients necessary to support life. Raw eggs are especially nutritious, and are digested in about one-third to one-half the time required for cooked eggs.

*Beef.*—Best meat, furnishing from 18 to 20 per cent. nitrogenous matter.

*Veal.*—Tender, less nutritious than beef.

*Mutton.*—About as good as beef, hardly as digestible.

*Lamb.*—Good, but not as nourishing as beef or mutton.

*Pork.*—About 10 to 12 per cent. nitrogenous material, least digestible of all.

*Fowl.*—Good food, rich in nitrogenous material.

*Fish.*—"Less stimulating, sustaining and satisfying than meat."—Thompson.

Fish twice a week is beneficial.

## *VEGETABLE FOODS*

*Sugars.*—Good food, supply heat, force and help maintain the body. Excellent to stimulate and strengthen the body against fatigue. Ordinary molasses taffy and other candies are used by football men during half-time, or the "rest" periods of a

match. Athletes, weight-lifters and professional strong men use sugar and candy to sustain them. Sugars and starches have the same uses, as starches are turned into sugars before they are assimilated.

*Starches.*—Cereal, wheat, corn, barley—these are good foods, as they contain also a good percentage of nitrogenous material.

*Legumes.*—Peas, beans, lentils—good food, very rich in nitrogenous material.

*Roots and Tubers.*—Fattening, but not as good foods as cereals or legumes.

*Potatoes.*—Fattening, but contain very small quantity of nitrogenous material.

*Carrots, Parsnips, Turnips and Radishes.*—Good food, when fresh.

*Green Vegetables, Spinach, Lettuce, Cabbage.*—Not very nourishing, pleasing to the palate.

*Fruits.*—Mostly starch, sugar and water. Very useful to the body because of their salts and water also.

*Fats and Oils.*—One-fifth of the weight of body is made up of fat which is derived from the starches and sugars. It can be derived from fats, but the idea that fat makes fat is only true indirectly, as we will point out in the section on Corrective Work.

*Uses of Fat.*—1. Supplies heat and force. 2. Serves as a protection in the body. 3. Saves tissues from disintegration. 4. Stores latent energy.

The main use of fats, and the most important from the standpoint of physical training, is that it preserves the tissues by supplying the force and heat necessary in the ordinary physiological process. To put weight on a person, and give them strength, we give them fats, not with the idea of depositing fat on them, but that the fat may supply the body with the force and heat required, and the tissues of the body will not only be maintained, but the other articles of food given (nitrogenous foods) will build up the structure of the body, because they will not be called upon to supply heat and force.

*School Hygiene.*—In these days of medical and dental inspection a long step forward has been made in school hygiene.

However, it is only right to the state that school teachers should learn the rudiments of hygiene and teach same to the children.

The children should not be required to remain too long at their desks.

Simple freehand exercises help the growing body and give relief from the fatigue of sitting at the desks.

The position of the child sitting and standing is important. In sitting, the small of the back should be against the seat. In standing, the military position, if not exaggerated, is correct.

Every school should have playgrounds connected with it. About 30 square feet for each pupil is none too much for play purposes.

In the schoolroom itself, the minimum amount of floor space to each pupil should be 16 feet.

The seats and desks are important matters from the standpoint of hygiene and physical training. The seat should be of such a height that the thigh of the pupil when seated will be perfectly level, the lower leg being in an exactly vertical position, with the foot resting wholly upon the floor. The seat should have a back rest that will support the small of the back properly. Dr. F. J. Cotton, of Boston, has invented a school chair with an adjustable back, which supports the lumbar spine. It gives the erect posture to the body and prevents "slouching" in the seat, which is the forerunner of round shoulders and spinal curvature.

The slope of the desk theoretically should be 30° to 40°, but as these angles are not practicable, 15° is about the standard.

The seat should not be too wide, as wide seats predispose to slouchy attitudes. It should be about two-thirds the length of the thigh.

The front edge of the seat should be about one inch behind the front edge of the desk. The back support should not come above the hollow of the back, as it

offers a support for the common slouching attitude seen in children when sitting on the forward edge of the seat.

It must be conceded, whether school boards admit it or not, that the majority of cases of spinal curvature and round shoulders are developed in our schoolrooms. Further, those children with defects have them accentuated in the schoolroom.

Posture during sitting is of greater consequence than posture during standing, on account of the longer time the child sits and the muscular fatigue caused by the inactivity of a great number of muscles of the body for a long period.

Stooping over the desk contracts the chest, causes round shoulders, and curvative of the spine.

### *EXERCISE AND TRAINING—BENEFITS IN GENERAL*

1st.—The body is a machine given to us to take care of. If we take care of it, we get an enjoyment out of life that nothing else can give. If we neglect the body we suffer for it, for Nature pays all her debts. We have celebrated cases of men, successful in business to the extent of amassing a fortune, and dying in middle age from a neglected body. Other successful men have renewed their strength by daily exercise, retaining their faculties to a ripe old age, Mr. Gladstone furnishing a valuable example.

2nd.—Exercise adds to the youth of a person. He is a boy or young man years longer than the man who does not exercise. Of course, the strain some athletes undergo by overtraining, saps the youth and vitality, as would any other excess. But suitable exercise, properly taken, gives to, and retains for the body a resiliency that adds five to ten years to the youth of the individual.

3rd.—It will brace up the nervous system and give the brain clearness. The exercise of the body draws the blood from the brain, giving it fresh blood more frequently.

4th.—Breathing exercises, outdoor exercises with proper diet, is the basis of the cure for Tuberculosis.

5th.—Exercise strengthens a weak, muscular heart, so that one is enabled better to combat diseases such as Pneumonia, Appendicitis or Typhoid Fever. Even valvular diseases of the heart are now helped by the Schott system of exercise and the Nauheim baths.

6th.—It clarifies the complexion, more blood is called for, and it is better aerated.

7th.—It increases weight and decreases weight, when intelligently used.

8th.—Systematic exercise of a muscle educates the small arteries supplying the muscle to remain in a condition of dilatation, so that the muscle not only receives an increased supply of nourishment during exercise, but even during repose the part receives an increased amount of nourishment, due to the educated arteries remaining wider open.

## *BATHS AND BATHING*

We know that our skin gets dirty, and there is only one way to remove said dirt, that is, by washing. A daily bath is about as good a practice as we can establish. Let us consider this skin of ours. Some people think of it as a sort of bag holding us together—a mere covering for the body. Yet it is as delicately organized as, perhaps, any other organ. It is a great excretory. When we think of excretory organs, we think always of the intestines and kidneys, and perhaps the lungs, but as a matter of fact, of the eight pounds of excreta daily thrown off from the body, the skin throws off nearly one-fourth. In order to do this enormous work, it has about 30 miles of tubing in the form of small perspiration tubes, opening from within the body on to the surface. If these pores become clogged, the matter does not come out that way, it has to go by way of kidney, lungs or intestines, giving them extra work. The pores become filled up frequently, hence the necessity of bathing. It is usually

only the upper layers that are thus removed. A good sweat, or a good hot bath, removes most of the dirt. If a person cannot sweat properly he should use a good hot bath or a good "steam bath." Steam bath is, however, unnecessary for cleanliness. Some people bathe too frequently.

Bathing is essential and beneficial for two reasons:

1. Removes noxious and obstructive material from the skin.

2. Promotes circulation in part bathed, especially the skin.

Bathing, like exercise, is beneficial because of the reaction. If, after a bath, a person feels weary and depressed he is bathing too often or improperly. Twice or three times a week is sufficient where this depression occurs.

*Proper Temperature.*—That which is most agreeable. For a good, sturdy person, a cold bath is refreshing and useful, 32 to 60 degrees F.; 60 to 75 degrees F. is nice during the summer; 92 to 98 degrees is warm. Warm baths give a feeling of languor and sleepiness, and are good taken before retiring. They should not be taken in the morning. Temperature of room should be about 70 degrees.

Best time to bathe is when stomach is empty. One should not bathe when the stomach is full. The cold morning bath has been recommended by so many, for such a long time, that it seems a pity to have to advise that it is suitable for only about one person in four. The test as to whether it is suitable to the individual is simple. Everybody feels better immediately after the morning cold bath. But if an hour or two afterwards there is a feeling of lassitude and weakness, the bath should be a tepid one in the morning. A hot bath is excellent to take the soreness out of the muscles. A hot shower bath is refreshing, but should last but two or three minutes, and care taken not to have too prolonged a spray on the spinal column. A cold shower to finish off, prevents the tendency to catch cold.

# PART II

## Calisthenics

*FREEHAND DRILL*

*Position*—Feet together, head up, chest out, chin drawn slightly back.

| Exercise | Explanatory Note | Object of Exercise |
|---|---|---|
| 1. Open and shut fingers. | Extend fingers widely and close tightly. | Fore-arm muscles. Extensors and flexors. |
| 2. Wrist extensions. (Fig. 1). | Elbows straight, fingers together, bend only at the wrist. | Fore-arm muscles. |
| 3. Wrist shakes. | Elbows straight, shake wrist forward and back. | Fore-arm muscles. Aids circulation. |
| 4. Flex fore-arm on upper arm. (Fig. 2). | (a) Elbows at sides, bend fore-arm on upper arm until closed fist touches shoulder. (b) Drop arms to side without force. | Develops biceps, or front upper arm. |
| 5. Extend arm from fourth position down to sides. | (a) Extend arms down until fist touches thigh, throw chest out. (b) Bring fore-arms up without force. | Develops triceps, or back upper arm. |
| 6. Muscular chest exercise. (Fig. 3). | (a) *Elbows straight.* Bring right arm over left arm and *vice versa* in front of chest. (b) Position, hands at the sides. | Develops the large pectoral or chest muscles. |

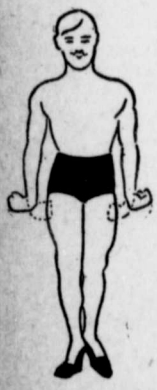


Fig. 1

Fig. 2

Fig. 3

| Exercise | Explanatory Note | Object of Exercise |
|---|---|---|
| 7. Roll the shoulders back and down. | (a) Let shoulders drop forward without effort.<br>(b) Raise them as high as possible and draw them well back.<br>(c) Drop the shoulders down, keeping them still well back.<br>(d) Position. | Develops Nature's shoulder braces, Trapezius muscle; also straightens the shoulders by drawing shoulder-blades together. |
| 8. Twist neck from side to side. (Fig. 4). | Chin drawn in, work against an imaginary resistance. | Develops muscles at side of neck. |
| 9. Bend head backward and forward. | Keep head well back and back arched. | Develops back and front of neck. |

Fig 4

Fig. 6

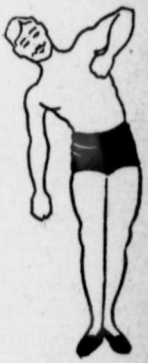


Fig. 7

| | | |
|---|---|---|
| 10. Bend body forward and backward; hands at waist. | Keep head well back and back arched. | Abdomen and small of back muscles. |
| 11. Bend body from side to side. | Lift upper part of body and bend well over to sides. Keep hips steady. | Develops side of waist and oblique abdominal muscles. Great factor in squeezing the liver. |
| 12. Circumduct body from right to left and left to right. | Hips as a pivot, circumduct the body about the hips. | Abdominal and small of back muscles. |

## *LEG WORK*

| Exercise | Explanatory Note | Object of Exercise |
|---|---|---|
| 13. Raise on toes. | Raise as high as possible. | Develops the calves. |
| 14. Raise the toes. (Raise on heels.) | Hips kept steady, raise the toes with muscles below the knee in front. | Develops the muscles below the knee in front |

| Exercise | Explanatory Note | Object of Exercise |
|---|---|---|
| 15. Spread toes as far apart as possible (heels together), and then bring together again. | Keep knees straight and well drawn back. | Develops muscles at sides of thigh and leg. |
| 16. Squat quarter way down. | Keep heels on floor, bend knees and let body sink partly down. Head up, chest out. | Develops front and back of thighs. |
| 17. Squat all the way down. (Fig. 6). | Raise heels from floor, and sit on them. | Develops thighs. |
| 18. Run. | Keep knees down in front, kick up well behind. | Develops all the muscles of the leg, heart and lungs. |

## *ADVANCED DUMB-BELL DRILL*

*Position.*—Head up, chest out, chin drawn slightly back, heels together, bells at side.

| Exercise | Explanatory Note | Object of Exercise |
|---|---|---|
| 1. Flex fore-arm on upper arm. (Fig. 2). | Elbows at side. | Develops biceps, or front upper arm. |
| 2. Extend bells to sides from shoulders. | Elbows at side. | Develops triceps, back upper arm. |
| 3. Muscular chest exercise. | (a) Bells to side horizontals. (Fig. 10).<br>(b) To front horizontals.<br>(c) To side horizontals.<br>(d) Cross bells over chest.<br>*Elbows straight.* | Develops chest muscles. |
| 4. Roll shoulders back and down. | (a) Let shoulders drop forward without effort.<br>(b) Raise shoulders as high as possible and draw them well back.<br>(c) Keeping shoulders well back drop them down.<br>(d) Back to position. | Draws shoulders back, corrects round shoulders. |
| 5. Sandow's Rock. (Fig. 7). | (a) Right bell extended down to right side as far as possible. Left bell under arm-pit, knees kept straight, head kept back.<br>(b) Left down, right under arm-pit. | Develops side of waist squeezes liver and corrects constipation. |
| 6. Twist body. | Bells at side horizontals. (Fig. 10). Twist from right to left and from left to right. Elbows kept straight and well back. | Abdominal and waist muscles. |

| Exercise | Explanatory Note | Object of Exercise |
|---|---|---|
| 7. Raise on toes. | (Same as in Freehand Drill). | |
| 8. Raise on heels. | | |
| 9. Spread the toes. | | |
| 10. Squat quarter way down. | | |
| 11. Squat all the way down. (Fig. 6). | | |
| 12. Alternate Nos. 10 and 11. | | |

Jump to Stride Stand, feet 27 inches apart, knees kept straight during the next six exercises, Nos. 13-18

| Exercise | Explanatory Note | Object of Exercise |
|---|---|---|
| 13. Swing between the legs and side pushes. | (a) Swing bells between legs. (Fig. 8).<br>(b) Bells at tops of shoulders. (Fig. 9).<br>(c) Bells to side horizontals. (Fig. 10).<br>(d) To tops of shoulders. | Develops abdominal, upper arm, and small of back, muscles. |
| 14. Flip. | (a) Swing between the legs. (Fig. 8).<br>(b) Bring bells behind head. (Fig. 11).<br>(c) Swing between legs.<br>(d) Bells high over head, bend body well back. (Fig. 12). | Abdominal and small of back muscles. |
| 15. Stretch. | Bells as in Fig. 12, stretch as high as possible. | Relaxation. |

Fig 8.

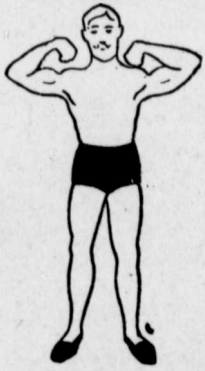


Fig. 9

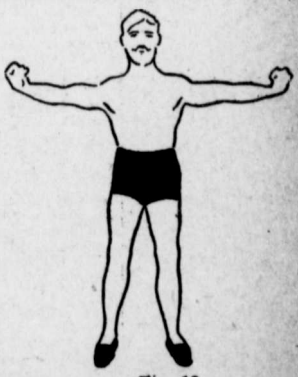


Fig. 10

| Exercise | Explanatory Note | Object of Exercise |
|---|---|---|
| 16. Chopping. | (a) Bells top of right shoulder, swing between legs.<br>(b) Top of left shoulder.<br>(c) Between legs.<br>(d) Top of right shoulder. | Abdominal and small of back muscles. |
| 17. Liver squeezer. | (a) Right bell high over head, left bell touching floor beside left foot. (Knees straight).<br>(b) Both bells at tops of shoulders.<br>(c) Left bell over head, right at floor.<br>(d) Tops of shoulders. (Fig. 9). | Squeezes the liver and develops abdominal muscles. |
| 18. Diving motion. | (a) Keep head between arms, bend over to right side, touching bells to floor at right foot.<br>(b) Tops of shoulders.<br>(c) Over to left side.<br>(d) Tops of shoulders. | Develops small of back and side abdominal muscles. |
| *Jump Feet Together:* | | |
| 19. Push ups. (Figs. 13 and 14). | (a) Bells to floor, throw feet well back, resting body on bells and toes.<br>(b) Let body sink and push up from floor repeatedly. | Chest and back arm muscles. |

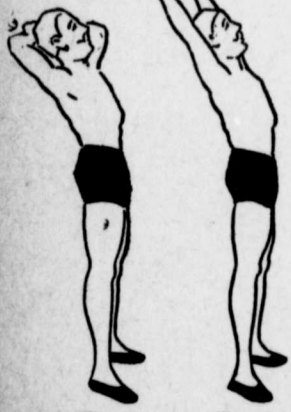


Fig. 11



Fig. 12

Fig 13

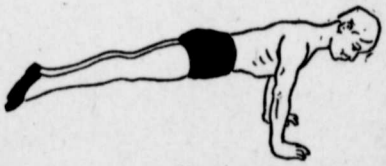


Fig. 14

## *LEG WORK*

The next five exercises are to be done without a pause between them.

| Exercise | Explanatory Note | Object of Exercise |
|---|---|---|
| 20. Jump feet apart and together again. | (a) Jump feet apart 27 inches. (b) Jump feet together again. | These exercises develop the legs, but what is more important is that they develop heart and lungs better than any other exercise or series of exercises. (Read Section on Fatigue and Breathlessness, Part I.) |
| 21. Cross legs. | Jump crossing legs alternately one over the other. | |
| 22. Run. | Ordinary run, knees kept down in front, bring heels well up behind. | |
| 23. Run, knees up. | Raise knees up in front as high as possible. | |
| 24. Run, knees straight. | Raise legs in front of body, knees kept straight. | |

## *THE ELEMENTARY DUMB-BELL DRILL*

*Position.*—Head up, chest out, bells at the side.

| Exercise | Explanatory Note | Object of Exercise |
|---|---|---|
| 1. Flex fore-arm on upper arm. (Fig. 2). | Elbows at sides. | Develops biceps, or front upper arm. |
| 2. Extend bells to sides from shoulder. | Elbows at sides. | Develops triceps, or back upper arm. |
| 3. Muscular chest exercise. (Cross arms over chest, Fig. 3). | *Elbows straight.* | Develops the large pectoral, or chest muscles. |
| 4. Roll shoulders back and down. | Same as in previous drills. | Draws shoulders back and corrects round shoulders. |

## *LEG WORK*

| Exercise | Explanatory Note | Object of Exercise |
|---|---|---|
| 5. Raise on toes. | (Same as in Freehand and Advanced Dumb-bell Drill). | |
| 6. Raise on heels. | | |
| 7. Spread toes apart, and together again. | | |
| 8. Squat quarter way down. | | |
| 9 Squat all the way down. (Fig 6). | | |

*Position.*—Bells under chin, back of hands facing out, have ends of bells touching one another

| Exercise | Explanatory Note | Object of Exercise |
|---|---|---|
| 10. Strike bells behind the back hard, and return strike them under chin easy. | When bells are behind back, backs of hands are facing the body. | Draws shoulders back. |
| 11. Strike bells overhead hard, return strike under chin easy. | When bells are overhead (elbows straight) palms are facing to the front away from body | Raises shoulders and widens chest. |
| 12. Alternate Nos. 10 and 11. | | |
| 13. Strike bells in front of toes hard, knees kept straight, under chin easy. | Backs of hands facing away from body. | Develops the abdominal and small of back muscles. |
| 14. Alternate Nos. 11 and 13. | | |
| 15. Alternate No. 10 with Nos. 11 and 13. | | |
| 16. Run, with arm expressions. | While running put bells at side horizontals, overhead, front horizontals, behind the back, etc. | Develops legs, and heart and lungs. |

## *THE ELEMENTARY WAND DRILL*

*Position.*—Wand at right side, right hand down at full extent, left hand at left side. On the command 1, grasp wand with left hand, index finger in line with right shoulder. Command 2, bring wand down to full extent of arm in front of thighs.

| Exercise | Explanatory Note | Object of Exercise |
|---|---|---|
| 1. Shoulder exercise. | (a) Wand high overhead. (Fig. 15, but feet together.)<br>(b) Wand behind shoulders.<br>(c) Wand high over head.<br>(d) Wand to front of thighs. | To square the shoulders. |
| 2. Shoulder exercise. | (a) Wand at front horizontal in line with shoulders.<br>(b) Wand behind shoulders.<br>(c) Wand at front horizontals.<br>(d) Wand down front of thighs. | Develops chest and squares the shoulders. |
| 3. Flex fore-arm on upper arm. | Elbows at sides. | Develops front upper arm. |
| 4. Extend wand from height of shoulders to thighs. | Elbows at sides. | Develops back upper arm. |

## *LEG WORK*

*Position.*—Wand behind shoulders, elbows close to sides

| Exercise | Explanatory Note | Object of Exercise |
|---|---|---|
| 5. Raise on toes. | (Same as in previous drills). | |
| 6. Raise on heels. | | |
| 7. Spread toes. | | |
| 8. Squat quarter way down. | | |
| 9. Squat all the way down. (Fig. 6). | | |
| 10. Rock. | Bend from side to side, knees straight. Try to get wand to perpendicular position. | Develops the waist, aids digestion. |
| 11. Twist. | Twist from side to side, keep shoulders back, knees straight. | Develops oblique abdominal muscles. |
| 12. Forward and backward bend. | Bend body forward and back, keep hips steady, back straight, eyes looking straight ahead as the body is bent forward. | Develops the abdominal and back muscles. |
| 13. Front to side horizontals, right side. | (a) Wand at front horizontals in line with shoulders.<br>(b) Wand to right side horizontal.<br>(c) Wand to front horizontal.<br>(d) Wand back to position in front of thighs. | Develops chest and abdominal muscles. |
| 14. Same, left side. | | |
| 15. Leg work. Running exercises. | | |

## *THE ADVANCED WAND DRILL*

*Position.*—Feet together, wand in front of thighs, arms at full extent.

| Exercise | Explanatory Note | Object of Exercise |
|---|---|---|
| 1. Back of shoulder. | (a) Wand high overhead.<br>(b) Wand behind shoulders.<br>(c) Wand high overhead.<br>(d) Wand back to front of thighs. | Squares the shoulders and corrects round shoulders. |
| 2. Shoulder and chest exercise. | (a) Wand in front horizontals.<br>(b) Wand behind shoulders.<br>(c) Wand in front horizontals.<br>(d) Wand to front of thighs. | Develops chest muscles and squares the shoulders. |

Fig. 15

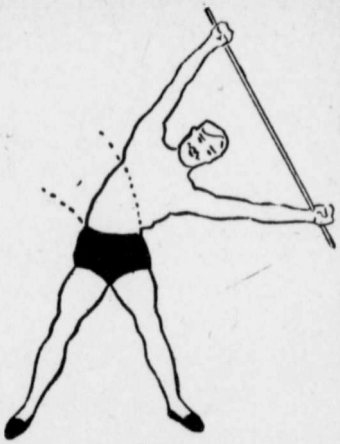


Fig. 16

*LEG WORK*

*Position.*—Wand behind shoulders

| Exercise | Explanatory Note | Object of Exercise |
|---|---|---|
| 3. Raise on toes. | (Same as in previous drills) | |
| 4. Raise on heels. | | |
| 5. Spread the toes. | | |
| 6. Squat quarter way down. | | |
| 7. Squat all the way down. | | |
| 8. Alternate 6 and 7 | | |
| *Position.*—Jump to stride stands, feet 27 inches apart, wand high over head, head midway between the arms. (Fig. 15.) | | |
| 9. Rock. (Fig. 16). | Keep the feet on ground, keep the head halfway between the arms as the body is bent. | Develops the waist muscles and aids digestion. |
| 10. Twist. | Keep the knees steady and well back. Twist the wand from right to left and left to right, keeping it well overhead. | Develops the waist muscles and aids digestion. |
| 11. Swing between legs with twist. (Fig. 17). | (a) Swing between legs, right hand leading.<br>(b) High overhead, twist left hand to front.<br>(c) Swing between legs, left hand leading.<br>(d) High overhead. | Squeezes liver, aids digestion and corrects constipation. |

| Exercise | Explanatory Note | Object of Exercise |
|---|---|---|
| 12. Combination Twist and Bend. | (a) From position wand over head, Fig. 15, twist to left.<br>(b) Down to floor on left side, wand parallel with the floor, knees kept straight.<br>(c) From left side come round in front of toes as far as possible to right side, knees kept straight.<br>(d) Up to high overhead on right side, bend back. | Development of waist muscles, squeezer, etc. |
| 13. Same, opposite side. | Begin by twisting from position (wand over head) to right side. | Development of waist muscles, squeezer, etc. |
| | *Position.*—Wand in front of thighs. | |
| 14. Flex fore-arm on upper arm. | Elbows at sides, some to height of shoulder. | Develops the front upper arm. |
| 15. Extend fore-arm from shoulder. | Extend down to position. | Develops back upper arm. |
| *Position.*—Wand behind shoulder. This series of five exercises to be done without pause. | | |
| 16. Jump feet apart and together again.<br>17. Jump crossing legs one over the other.<br>18 Run<br>19. Run knees up in front<br>20 Run, knees straight in front. | (Same as in Advanced Dumb-bell Drill). | |

Fig. 17

*ELEMENTARY CLUB SWINGING.*

Hold the club in a firm but not too rigid grip, the little finger at the knob.

1 lb. clubs are most generally useful.

Position—As in Fig. 1A.

1. Outer circle right, with pause. Right club is extended upward and outward to right with a full sweep back to position again. (Fig. 2B).

2. Outer circle left, with pause.

3. Alternate 1 and 2.

Fig. 1A

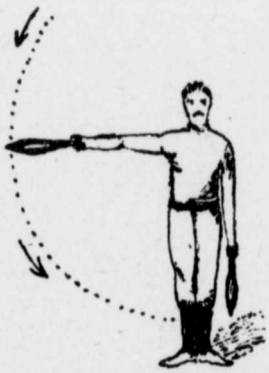


Fig. 2B

4. Combine 1 and 2.

5. Inner circle right with pause. Right club is extended upward and inward (toward left) with full sweep back to position again. (Fig. 3C).

6. Inner circle left, with pause.

7. Alternate 5 and 6.

8. Combine 5 and 6.

9. Outer circle right, without pause.

10. Outer circle left, without pause.

11. Alternate 9 and 10.

12. Combine 9 and 10.

13. Back of head circle outward right. Begin the movement the same as the outer circle (Ex. 1, Fig.

2B), but swing behind head (short outer circle). See Fig 4D.

14. Back of head circle outward left.

15. Outer circle right—add back of head circle outward, with pause.

16. Outer circle left—add back of head circle outward, with pause.

17. Alternate 15 and 16.

18. Combine 15 and 16.

19. No. 15, without pause.

Fig. 3C

Fig. 4D

20. No. 16, without pause.

21. No. 17, without pause.

22. No. 18, without pause.

23. Back of head circle inward right. Begin the movement the same as inner circle left (Ex. 5, Fig. 3C), but swing behind head. See Fig. 5E.

24. Back of head circle inward left.

25. Inner circle right—add back of head circle inward, with pause.

26. Inner circle left—add back of head circle inward, with pause.

27. Alternate 25 and 26.

28. Combine 25 and 26.

29. No. 25, without pause.

30. No. 26, without pause.
31. No. 27, without pause.
32. No. 28, without pause.
33. Double circle to right with pause, both clubs to right.
34. Double circle to left with pause, both clubs to left.
35. Double circle to right, without pause.
36. Double circle to left, without pause.
37. Double circle to right—add small outer back of head circle, with pause.

Fig. 5E

38. Double circle to left—add small outer back of head circle with pause.
39. No. 37, without pause.
40. No. 38, without pause.
41. Outer circle right and left—add small outer circle at side horizontal position. See Fig. 6F.
42. Inner circle right and left—add small inner circle at side horizontal position.
43. Outer circle right and left—add back of head outer circle and then small outer circles (in front and behind forearm) at side horizontal position.
44. Small outer circle right behind head—add small outer circle in front of face.

45. Small outer circle left behind head—add small outer circle in front of face.

46. Combine 44 and 45.

47. Outer circle right, small outer circle behind head, outer circle in front of face, and small outer circle behind head.

48. Outer circle left, small outer circle behind head, outer circle in front of face, and small outer circle behind head.

49. Combine 47 and 48.

50. Double outer circle to right, small outer circle

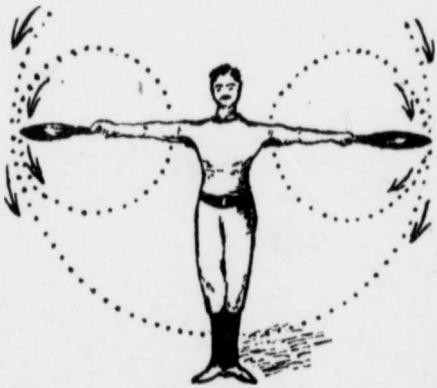


Fig. 6F

behind head, small outer circle in front of face, and small outer circle behind head.

51. Double outer circle to left, small outer circle behind head, small outer circle in front of face, and small outer circle behind head.

52. Double circle to right, small outer circle in front of hips, add small outer circle behind head.

53. Double circle to left, small outer circle in front of hips, add small outer circle behind head.

54. Combination of circles behind head, front of hips, and front of face.

## *ANDERSON'S TWIST WAND DRILL.*

Wand ¾ to 1 inch diameter, 40 to 42 inches long.

*Preparatory Position.*—Wand at right side, little finger against thight, left hand at left side.

On the command 1, grasp wand with left hand, little finger in line with right shoulder. On command 2, bring wand down to full extent of arms in front of thighs, palms facing outward.

*Explanatory Note.*—The twist is done in the same manner for all the positions. To teach this, instruct the class to bring the "twisting" hand up as high as the chest, the other hand holding wand very loosely; then with a motion as if to strike the chest with the thumb, raise elbow and push downwards thumb next to body, palm facing backward. The other hand, holding wand loosely, allows the completion of the twist without stiffness.

1. Twist to right shoulder. Twist with right hand through "twist" position as above, right hand (in twist) finishing the movement at right side, left hand at right shoulder.
2. Twist to left shoulder.
3. Twist to right side, horizontal. Right hand twisted, is extended to right side in line with the mouth, eyes following extended hand, left hand at mouth.
4. Twist to left side horizontal.
5. Twist to right oblique. Right hand twisted, is extended to right front oblique position as high as possible, the left hand dropped behind head.
6. Twist to left oblique.
7. Same as No. 3, but left hand is dropped behind head instead of being left in front at mouth. *Note.*—This exercise is not in Dr. Anderson's drill, but is put in to make with No. 8 an even eight counts for the use of music with the drill.
8. Same as No. 4, but drop right hand behind head.
9. Alternate 1 and 2.

10. Alternate 3 and 4.
11. Alternate 5 and 6.
12. Alternate 7 and 8.
13. Alternate 1, 2, 3, 4, 5, 6, 7, and 8.
14. Twist to right shoulder (No. 1), adding lunge to rear with right foot. Weight of body on lunging foot always, keep body facing to front.
15. Twist to left shoulder, adding lunge to rear with left foot.
16. Twist to right side horizontal (No. 3), adding lunge to right with right foot.
17. Twist to left side horizontal, add lunge to left with left foot.
18. Twist to right oblique (No. 5), add lunge to front right oblique (Swedish outward lunge position) with right foot.
19. Twist to left oblique, add lunge to front left oblique with left foot.
20. No. 7, adding lunge to right side with right foot.
21. No. 8, adding lunge to left side with left foot.
22. Alternate 14 and 15.
23. Alternate 16 and 17.
24. Alternate 18 and 19.
25. Alternate 20 and 21.
26. Alternate 14, 15, 16, 17, 18, 19, 20, and 21.
27. Combine 1 and 2. *Note.*—From 1st exercise go directly to 2nd exercise without pausing. Do *not* come down to No. 2 position of Preparatory Position.
28. Combine 3 and 4.
29. Combine 5 and 6.
30. Combine 7 and 8.
31. Combine 1, 2, 3, 4, 5, 6, 7, and 8.
32. Final Movements—Retiring and Advancing.—Four twists to shoulders with lunges to rear (Nos. 14 and 15), and four twists to oblique with lunges forward (Nos. 18 and 19).

Command 1. Twist to right shoulder, add lunge to rear with right foot.

Command 2. Bring left foot back, bringing feet

together, and wand front of thighs, No. 2 in Preparatory Position.

Command 3. Twist to left shoulder, add lunge to rear with left foot.

Command 4. Bring right foot back.

Command 5. Twist to right shoulder.

Command 6. Bring left foot back.

Command 7. Twist to left shoulder.

Command 8. Bring right foot back.

Command 9. Twist to right oblique, add lunge forward right oblique with right foot.

Command 10. Bring left foot up even with right, wand front of thighs.

Command 11. Twist to left oblique, add lunge forward left oblique with left foot.

Command 12. Bring right foot up to left, wand front of thighs.

Command 13. Right oblique.

Command 14. Position.

Command 15. Left oblique.

Command 16. Position.

# PART III

## Apparatus Work

1. Side Horse.
2. Parallel Bars.
3. Buck.
4. Vaulting Bar.
5. Horizontal Bar.
6. Horizontal Ladder.
7. Rings
8. Mats.

### *HORSE WORK*

Care must be taken not to confuse the direction in the vaults and in the circles. In the vaults, a vault to right, is a vault over the part of the apparatus opposite the right side of the body. In the Circles it is the reverse, a circle to right might begin at the left side, and corresponds with the direction of the hands of the clock. A circle, or half circle to left, would be the reverse. To secure further work in Grade I use such exercises as squatting on, and jumping off, with quarter and half turns, touching toes and heels. Also straddling on and off as above, kneeling on, etc. To secure further work in Grade II use full circles (single or double), combining with feints and vaults.

### *SIDE HORSE WORK*

When standing facing the side of the horse, the left end is called the neck, the middle portion the saddle and the right end the croup.

#### Grade I

*Vaults.*—Vaults get their name from the part of

body turned toward the apparatus during the execution of the movement.

1. Flank vault to right (Fig. I).
2. Flank vault to left.

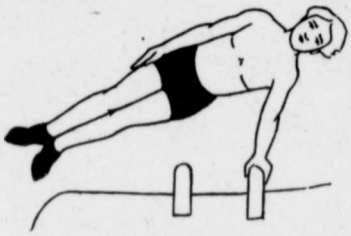


Fig. I.

3. Flank vault to right, half right turn before alighting.
4. Flank vault to left, half left turn before alighting.
5. Front vault to right.
6. Front vault to left.
7. Rear vault to left (Fig. III), keep back turned toward apparatus.

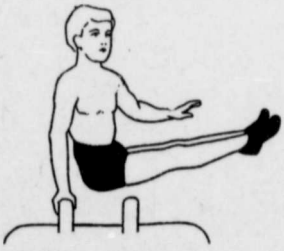


Fig. III.

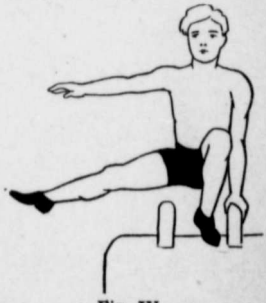


Fig. IV.

8. Rear vault to right.
9. Rear vault to right, quarter right turn, facing croup.
10. Rear vault to left, quarter left turn, facing neck.
11. Wolf vault to right (Fig. IV).

12. Wolf vault to left.
13. Wolf vault to right, quarter left turn, head being to left.
14. Wolf vault to left, quarter right turn, head being to right.
15. Screw vault to right. Right hand reversed on right pommel, vault over croup, making three-quarter left turn of body, land facing the right.
16. Screw vault to left.
17. Squat vault, between pommels (Fig. V).

Fig. V.

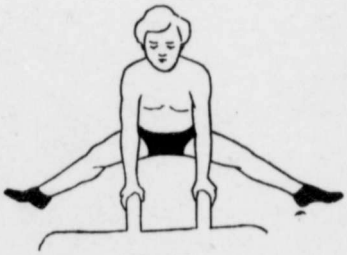


Fig. VI.

18. Squat vault, quarter right turn.
19. Squat vault, half left turn.
20. Straddle vault on, right foot on croup, left on neck. (Instructor in position to catch pupil.)
21. Straddle vault over (Fig. VI).
22. Straddle vault over for height.
23. Straddle vault over for distance.
24. Straddle vault over, adding quarter and half turns.

## Grade II

*Explanatory.*—Feints: When the right leg is swung around the right arm to the other side of the Horse, and then swung back again, it is called a right feint. Both legs would be double feint to right, etc.

Circles: Circle is to the right—follows directions of hands of a clock—left is the reverse.

1. Front rest (Fig. VII), feint right, front vault left.
2. Front rest, feint left, front vault right.
3. Front rest, feint right, flank vault left.
4. Front rest, feint left, flank vault right.
5. Front rest, double feint right, rear vault left.
6. Front rest, double feint left, rear vault right.
7. Half circle to left with right leg to side riding seat in saddle (Fig. VIII), squat right leg back to front rest—off.

Fig. VII.

8. Same, half circle to right, with left leg, etc.
9. Front rest, half left circle with right leg to side riding seat in saddle (Fig. VIII), three-quarter right circle, with left leg to cross riding seat on croup—front vault off.
10. Same, beginning with half right circle left leg to side riding seat on neck.
11. Feint to right, front vault swing left to riding seat in saddle, front vault off left.
12. Feint to left, front vault swing right, etc.
13. Feint right, rear vault swing left to riding seat in saddle, place hands on pommel behind back, rear vault off left.

14. Feint left, rear vault swing right, etc.

15. Feint right, feint left, half circle left with right leg to riding seat in saddle (Fig. VIII), three-quarter right circle with left leg to riding seat on croup, front vault to right.

16. Feint left, feint right, half circle with left leg, etc.

17. Thief jump, right foot, arch the back before alighting (Fig. IX). The thief jump is done from one foot, and the jump is made before the hands are placed on the pommels.

Fig. VIII.

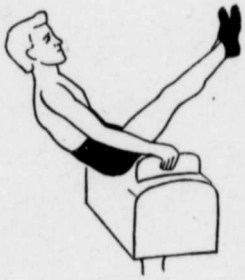


Fig. IX.

18. Thief jump, half right turn before alighting.

19. Thief jump, half left turn before alighting.

20. Thief jump, for distance.

## *PARALLEL BARS*

*Explanatory Note.*—A cross position (seat, rest, riding seat) is when the shoulders are across or at right angles to the apparatus, *e.g.*, (Fig. X) cross rest. A side position is when shoulders are parallel with apparatus.

*Vaults.*—A vault (as in horse work) gets its name from the part of the body facing the apparatus during the execution of the movement. Also, the

right bar when you begin an exercise is always the right bar during the exercise, even if you are turned about.

### Grade I

At end of bars.

1. Jump to cross rest (Fig. X).
2. Jump to cross rest, raise knees to chest.
3. Jump to cross rest, raise right leg over left bar, knee straight.
4. Jump to cross rest, raise left leg over right bar.

Fig. X.

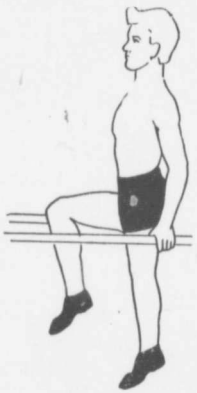


Fig. XI.

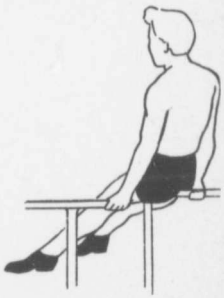


Fig. XII.

5. Walk two steps, each hand, to half way through.
6. Walk, raising corresponding knee with each step to half way through.
7. Jump with short jumps to half way through.
8. Jump to inside cross seat on right bar, in front of right hand (Fig. XI).
9. Jump up, and spread down to riding seat on right bar (Fig. XII).
11. Spread to riding seat, left bar.
12. From riding seat on right bar, swing up, and spread down to riding seat on left bar.

13. From riding seat on left bar swing to inside cross seat on right bar.

14. Jump to outside cross seat on right bar, in front of right hand (Fig. XIII).

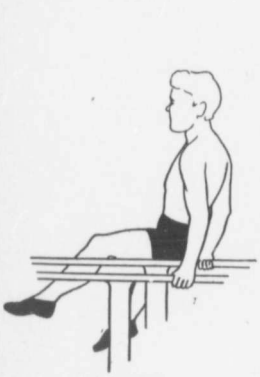


Fig. XIII.

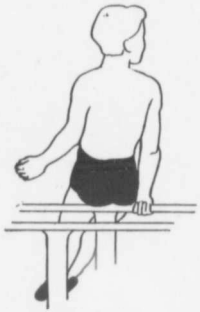


Fig. XIV.

Fig. XV.

15. Jump to outside cross seat, left bar.

16. Jump to outside cross seat, right bar, jump to inside cross seat, left bar.

17. Jump from outside cross seat, left bar, to outside cross seat, right bar.

18. Jump from an outside cross seat, right bar, to riding seat, left bar.

19. Jump to an outside seat, right bar (Fig. XIV).

20. Jump to an outside seat, left bar, and swing to outside seat, right bar.

21. Combine jumps from outside seats to riding seats, to cross seats, etc.

22. Jump to an outside seat on right bar, quarter left turn, put both hands on left bar, three-quarter circle left with right leg to riding seat on both bars, front vault right.

23. Outside side seat, left bar, quarter turn right, etc.

24. Right hand on left bar, jump to cross rest,

facing out (Fig. XV), swing to riding seat on both bars, rear vault over left bar.

25. Left hand on right bar, jump to cross rest facing out, travel backwards in riding seats on both bars.

26. Jump to outside cross seat on right bar, swing between to outside cross seat on left bar, continue across the bars.

27. Jump to outside seat on left bar (Fig. XIV), swing between to same position again further along the same bar, continue across.

28. Rear vault over right bar.

29. Rear vault over left bar, half right turn.

30. Rear vault over right bar, half left turn.

31. Rear vault over right bar, half right turn.

32. Rear vault over left bar, half left turn.

### Grade II

1. Jump to outside side seat on right bar (Fig. XIV), rear vault over left bar.

2. Jump to outside cross seat on left bar, rear vault over right bar, half left turn.

3. Outside side seat on right bar, swing to outside side seat on left bar, rear vault over right bar.

4. Outside cross seat on left bar, swing to outside side seat on right bar, rear vault over left bar, half right turn.

5. Cross rest, raise legs to right angles with body (half lever), knees straight.

6. Cross rest, raise legs to half lever, spread right leg over right bar, and left leg over left bar, simultaneously.

7. Jump to cross rest (Fig. X), sink to bent arm rest (Fig. XVI).

8. From cross rest sink to bent arm rest, push up to cross rest again.

9. Bent arm rest, swing forward and backward, rear vault over right bar from forward swing.

10. Bent arm rest, swing forward and backward, front vault over left bar from backward swing.

11. Bent arm rest, walk forward a few steps.

12. Bent arm rest, swing forward and backward, jumping forward with each forward swing.

13. Jump up, and spread down over right bar to floor (Fig. XVII).

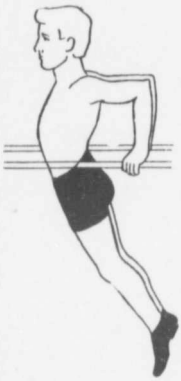


Fig. XVI.

Fig. XVII.

14. Spread up over left bar, and down between bars to floor.

15. Spread up over right bar to inside cross seat on left bar, rear vault over right bar.

16. Spread up over left bar to outside cross seat on right bar, rear vault over left bar, half right turn.

17. Spread up over right bar, and spread down over left bar (make continuous swing).

18. Spread up over left bar, rear vault over right bar.

19. Spread up over right bar, rear vault over left bar, half right turn.

20. Cross rest (Fig. X), swing forward and back, jumping forward across the bars on the forward swings.

21. Spread up over left bar to outside side seat

on right bar (Fig XIV), fall over backwards to mat (Fig. XVIII).

22. Spread up over right bar to outside side seat on left bar, half right turn to front rest on right bar, fall over forwards to mat (Fig. XIX).

23. Cross rest, half lever, drop legs to riding seat over both bars, hands in front, swing legs between, and up to half lever again, continue slowly across the bars.

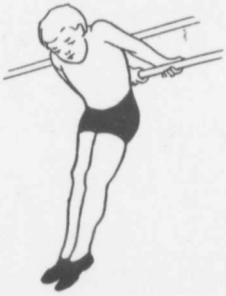


Fig. XVIII.

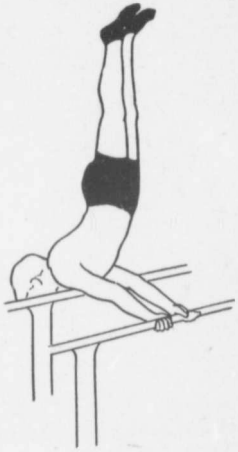


Fig. XIX.

24. Cross rest, swing forward and backward, jumping forward and holding a momentary half lever on the forward swing.

## *VAULTING BUCK*

The Buck can be used at a height of three feet for the various vaults from the floor. Using the spring-board, the various exercises can be done at a height of about five feet. The Buck can be raised to a height of about six feet for those wishing to try high straddle or squat vaults without the spring-board.

The Buck can also be used lengthwise.

GRADE I

1. Jump to front rest, push off strong, back arched (Fig. XX).

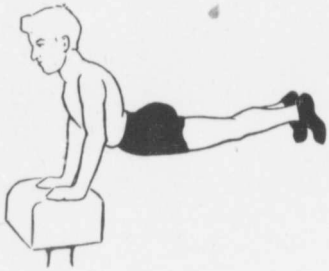


Fig. XX.

2. Front rest, push off strong, add quarter turn left.

3. Front rest, push off strong, add half turn right.

Fig. XXI.

Fig. XXII.

4. Front vault, right.
5. Front rest, front vault left.
6. Wolf vault, right.
7. Wolf vault, left, quarter turn left.

8. Flank vault, right.
9. Front rest, flank vault left.
10. Rear vault, left.
11. Rear vault, left, half left turn.
12. Jump to knees on (Fig. XXI).
13. Jump to knees on, jump off to mat from knees.
14. Jump to knees on, jump off to mat, half right turn.
15. Jump to knees on, jump to stand on buck, jump off to mat.

Fig. XXIII.

16. Jump to squat on (Fig. XXII).
17. Jump to squat on, stand erect, jump off, half right turn.
18. Jump to squat on, stand erect, jump off, touch toes in front, knees straight.
19. Jump to squat on, stand erect, jump off, touch toes astride.
20. Squat over the buck.
21. Squat over, half right turn.
22. Squat over, for distance.
23. Straddle vault over (Fig. XXIII).
24. Straddle vault over, half left turn.

GRADE II

1. Straddle over for height (Fig. XVIII).
2. Straddle over for distance.
3. Straddle over, half right turn.
4. Straddle over, three-quarter left turn.
5. Straddle over, use right hand only.
6. Straddle over, left hand only.
7. Straddle over, without hands.

Fig. XXIV.

Fig. XXV.

8. Straddle over, without hands, half right turn.
9. Jump to balance rest (Fig. XXIV).
10. Jump to balance rest, walk forward and off.
11. Jump to balance rest, throw legs backward and push off strong.
12. Rear straddle on buck (Fig. XXV), crossing one leg in front of other before landing on buck.
13. Rear straddle over buck.
14. Jump to front lever (Fig. XX), and come to squat on buck (Fig. XXII).
15. Jump to front lever, and squat over buck.
16. Jump to front lever, straddle over buck, half left turn.

## *VAULTING BAR*

### Grade I

Height: 4 ft. to 4 ft. 6 ins.

1. Front vault over bar (Fig. XXVI).

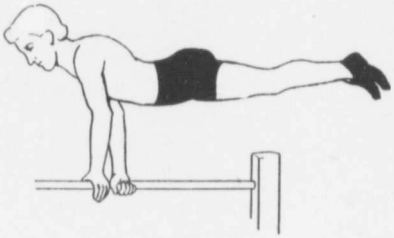


Fig. XXVI.

2. Front vault over bar, push off for distance.
3. Rear vault over bar (Fig. XXVII).
4. Rear vault over bar, quarter turns.
5. Rear vault over bar, half turns.
6. Flank vault over bar (Fig. XXVIII).
7. Flank vault over bar, push off for distance.
8. Flank vault over bar, quarter and half turns.
9. Underswing (Fig. XXIX).
10. Underswing, quarter turn right.
11. Underswing, half turn left.
12. Underswing, three-quarter turn right.

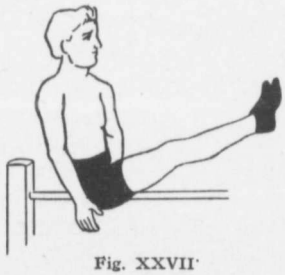


Fig. XXVII.

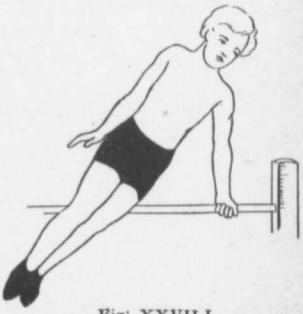


Fig. XXVIII.

13. Underswing, full turn left.
14. Underswing for distance.
15. Underswing for height.

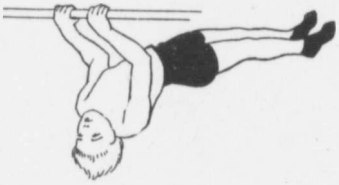


Fig. XXIX.

16. Walk under bar, bending body backwards, keeping knees straight.

GRADE II

1. Underswing for height.
2. Underswing, full turn right and left.
3. Flank vault swing to seat on bar (Fig. XXX), back seat circle around the bar. (Note.—Throw head well back to secure good swing).

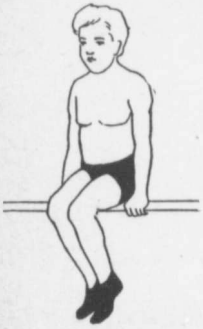


Fig. XXX.

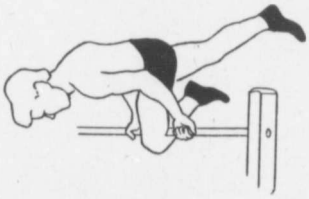


Fig. XXXI.

4. Squat over bar, between hands.
5. Straddle over bar, outside the hands.
6. Flank vault swing, left leg over bar, forward knee circle, reverse grasp, throw head well forward (Fig. XXXI).

7. Squat leg through, back knee circle (Fig. XXXII).

8. Knee circle forwards, reverse grasp, knee circle backward, ordinary grasp.

9. Knee circle backward, continue round, and underswing to mat.

10. Front rest, back circle (Fig. XXXIII. Note—keep thighs close to bar).

Fig. XXXII.

Fig. XXXIII

11. Front rest, back circle, continue round, and underswing, half right turn.

12. Right hand rear vault, use right hand only.

13. Left hand, rear vault, half left turn.

14. Jump, and back free circle (do not let body touch bar.)

15. Jump, back free circle, and underswing to mat.

16. Jump to front rest, back free circle, underswing to mat, half left turn.

(Vaults—front, rear, flank, etc., can be done at increased heights.)

## *HORIZONTAL BAR*

*Height of Bar.*—Height requiring an easy jump to reach.

### Grade I

1. Ordinary hang (Fig. XXXIV).
2. Ordinary hang, release left hand to side and return.
3. Ordinary hang, raise knees to chin.

Fig. XXXIV.

Fig. XXXV.

4. Ordinary hang, raise right and left leg alternately.
5. Ordinary hang, raise toes to bars, knees straight.
6. Ordinary hang, jump, hands apart and together again.
7. Jump to cross hang (Fig. XXV).
8. Jump to cross hang, travel to left.
9. Jump to cross hang, travel to right, knees up.
10. Jump to hang, reverse grasp.
11. Hang, reverse grasp, pull to bent arm hang (Fig. XXXVI).

12. Bent arm hang, reverse grasp, sink slowly to hang.

13. Reverse grasp, pull to bent arm hang, legs half lever.

14. Hang, ordinary grasp, swing forward and backward.

15. Hang, ordinary grasp, swing forward and backward, spreading legs apart and together at end of each swing.

16. Hang, ordinary grasp, jump to reverse grasp.

17. Hang, ordinary grasp, swing forward and backward, push off strong from back swing.

18. Hang, ordinary grasp, swing forward and backward, push off strong from forward swing. (Caution.—Throw out chest as you leave the bar).

19. Repeat No. 17, adding half turn right and left.

20. Repeat No. 18, adding half turn right and left.

21. Hang, reverse grasp, raise legs to half lever, pull to bent arm hang.

22. Hang, ordinary grasp, hold half lever. spread legs apart and together again twice.

23. Hang, ordinary grasp, jump sideways across bar to right.

24. Hang, ordinary grasp, jump to reverse grasp, back to ordinary grasp.

### Grade II

1. Hang, ordinary grasp, swing forward and backward.

2. Hang, swing forward and backward, then at end of front swing, bring toes to bar, arms and legs perfectly straight.

3. Hang, swing forward, and at end of forward swing bring toes to bar, as in No. 2, then throw feet out strongly, and pull with the arms to a front rest (the upstart or kip). Note.—To get a good swing, bring feet up near bar, and bend arms, thus

raising body, and throw upward and outward to the front, to the full extent of the arms.

4. Swing forward strong, and at end of forward swing put left leg between arms, and come to top of bar (Fig. XXXII).

5. Same as No. 4, back knee circle, and underswing off.

6. Same as No. 4, reverse grasp, and forward knee circle.

7. Swing, at end of forward swing put both legs between hands, and come to seat on bar.

Fig. XXXVI.

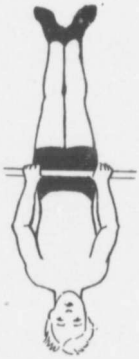


Fig. XXXVII.

8. Same as No. 7, add double back knee circle, and underswing off.

9. Same as No. 7, add double knee circle forwards, reverse grasp.

10. Hang, reverse grasp, pull to bent arm hang, travel sideways to left.

11. Hang, reverse grasp, pull to bent arm rest, sink slowly to hang again.

12. Hang, hold half lever, pull to bent arm hang.

13. Hang, reverse grasp, pull to chin, release left hand, lower to side, regrasp.

14. Hang, reverse grasp, pull to bent arm hang,

hold half lever, release left hand, lower to side, regrasp.

15. Swing right leg between hands to side riding seat (Fig. XXXII), short underswing to squat.

16. Circle backward (without swing) around bar to front rest (Fig. XXXVII), underswing off.

17. Same as No. 16, add back circle around bar, underswing off.

18. Hang, ordinary grasp, pull to bent arm hang, push up to front rest.

## *HORIZONTAL LADDER*

### Grade I

1. Jump to side hang, on rail, ordinary grasp (Fig. XXXVIII).

Fig. XXXVIII.

2. Side hang on outside rail, ordinary grasp, travel sideways right.

3. Side hang on rail, ordinary grasp, travel sideways to left, two steps each hand.

4. Side hang on rail, travel sideways to right, crossing left hand over right.

5. Jump to cross hang on rundle, walk forward on rundles.

6. Cross hang, walk backward on rundles.

7. Cross hang on rundles. jump to cross hang on outside of rails.

8. Side hang on rundles, travel sideways, skipping one rung (without swing).

9. Same, skipping two rundles.

10. Same, skipping three rundles with swing.

11. Side hang on outside of rails, raise toes as near the hands as possible, knees straight.

12. Side hang, raise knees to chin.

13. Cross hang on rundle, pull up, and jump forward to next rundle.

14. Same, jump backward.

## Grade II

1. Side hang on outside of rail, hop across.

2. Cross hang on outside of rails, jump forward across.

3. Cross hang on rundles, jump forward to outside of rails, jump forward to rundles, continue across.

4. Cross hang on rundle, pull to bent arm hang.

5. Cross hang, raise legs to half lever.

6. Cross hang, pull to bent arm hang, legs at half lever.

7. Bent arm hang, travel sideways on outside of rail.

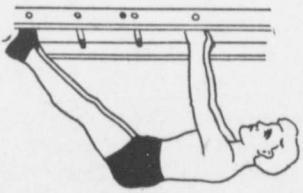


Fig. XXXIX.

8. Cross hang, raise toes to rundles, walk forward to full extent of arms (Fig. XXXIX).

9. Side hang on rail, ordinary grasp, jump to reverse grasp on opposite rail.

10. Side hang on rundles, travel sideways with swing, skipping three rundles.

11. Travel forward on rundles in a cross hang, legs at half lever.

12. Jump forward on rundles, skipping one.

13. Cross hang on outside of rails, swing forward and backward, jump forward on forward swing.

14. Same, hold half lever at end of each jump.

## *RINGS*

### Grade I

Rings at height of shoulders.

1. Hanging stand, swing forward and backward, full extent of arms. (Fig. XL).

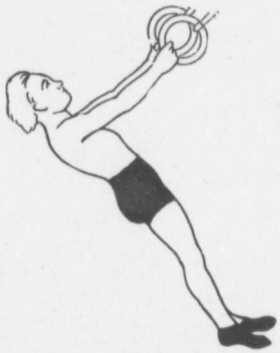


Fig. XL.

2. Hanging stand, swing from side to side full extent of arms.

3. Alternate Nos. 1 and 2.

4. Hanging stand, swing around to left in circle, full extent of arms, feet on floor.

5. Same as No. 4, to right.

6. Jump, put toes in rings, return to mat.

7. Jump, put toes in rings, hollow the back to hammock hang.

8. Same as No. 7, release right hand and left foot, hanging by left hand and right foot (Fig. XLI), regrasp.

9. Same as No. 8, release left hand and right foot.

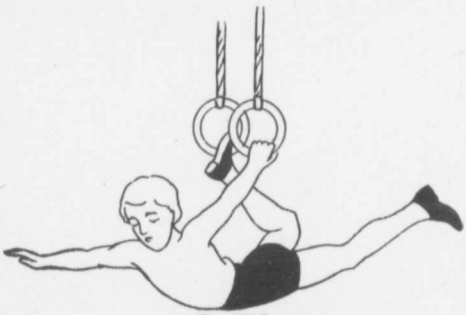


Fig. XLI.

10. Turn over backward to hang, head down (Fig. XLII).

11. Same as No. 10, raise and lower the body by bending the arms.

12. Swing up, cut or spread down the left leg over left arm, return (Fig. XLIII).

13. Swing up, cut or spread down over right arm with right leg, release right hand, and regrasp before foot reaches mat.

14. Spread down over right arm with right leg, regrasp, spread down over left arm with left leg, regrasp.

15. Spread down over right arm with both legs and regrasp.

16. Jump to height of chin, push right hand to right side horizontal (Fig. XLIV).

17. Hanging stand, raise right leg up in front, knees straight.

18. Hanging stand, raise legs to half lever.

19. Hanging stand, drop back to full extent of arms, bend arms and pull up to stand.

20. Jump to height of chin, sink slowly to mat.

21. Same as No. 20, twist arms quickly on descent.

Fig. XLII.

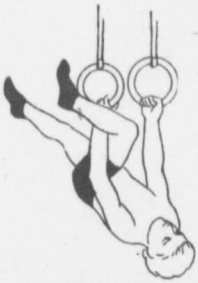


Fig. XLIII.

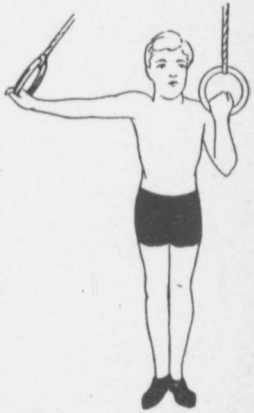


Fig. XLIV.

22. Hang, legs to half lever, spread legs apart and together again.

23. Jump to chin, push arms through to elbow hang (Fig. XLVI).

24. Throw body forward and backward in elbow hang.

### Grade II

*Height of Rings.*—Within reach by easy jump (7½ to 8 ft).

1. Hang, pull to chin.

2. Hang, pull to chin, sink slowly to mat.

3. Hang, pull to chin, push right hand to right side horizontal (Fig. XLIV).

4. Pull to chin, right hand grasping left wrist.

5. Pull to chin, left hand grasping right forearm.

6. Hang, raise knees up in front, pull to chin.
7. Hang, raise legs to half lever, pull to chin.
8. Hang, circle body to right (Fig. XLV).
9. Hang, circle body to left.

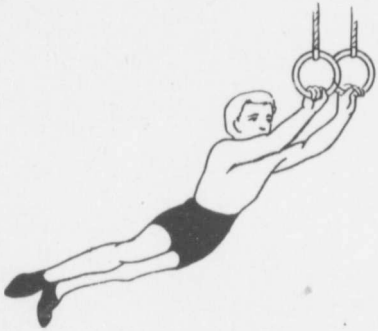


Fig. XLV.

10. Hang, raise knees in front, turn over slowly to back hang, return (skin the cat).
11. Hang, spread both legs over right arm, regrasp, spread both legs over left arm, regrasp.
12. Hang, pull to chin, raise legs to half lever, push left hand to side horizontal.

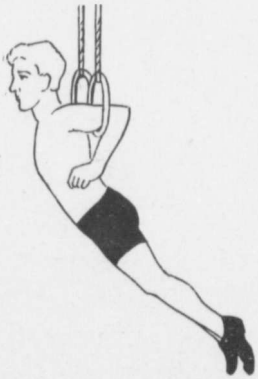


Fig. XLVI.

13. Hang, turn over slowly to back hang, backward dislocate.
14. Hang, raise legs to half lever, circle body to right.
15. Pull to chin twice.
16. Hang, raise legs to half lever, straighten to hang, head downwards (Fig. XLI).

## *EXERCISES ON THE MATS*

### Grade I

1. Short standing jumps across the mat.
2. Hop on right foot across the mat.
3. Three standing long jumps.
4. Jump with quarter right turns across the mat.
5. Jump with half left turns across the mat.
6. Hop, step and jump.
7. Jump, three-quarter turn to right.
8. Jump, full turn to left.
9. Front roll (Fig. XLVII).

Fig. XLVII.

Fig. XLVIII

10. Standing jump, front roll.
11. Back jumps across the mats.
12. Back jump, with half turns right and left.
13. Back jump, half turn right, front roll.
14. Jump sideways across the mat.
15. Walk, touch toes in front of body, knees straight.
16. Back roll (Fig. XLVIII), push off hard with hands when feet to position in figure.
17. Standing jump, half left turn, back roll.

18. Front roll, back roll.
19. Back roll, front roll.
20. Front roll, jump, half right turn, front roll.

GRADE II

1. Jump, full turn to right.
2. Standing jump, full turn to left.
3. Jump, full turn to right, back roll.
4. Three quick front rolls
5. Front roll, back roll, front roll, back roll (quickly).

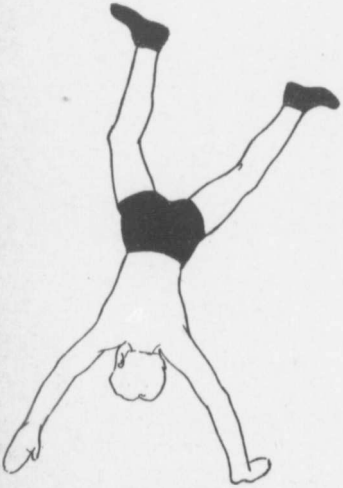


Fig. XLIX.

Fig. L.

6. Forward dive, jump slightly and land as in front roll (Fig. XLVII).
7. Forward dive for distance.
8. Cartwheel (Fig. XLIX).
9. Cartwheel, add front roll.
10. Two cartwheels, add back roll.
11. Stand on head (Fig. L), head about a foot in front of hands.

12. Stand on head, down to feet again, back roll.

13. Hand stand (Fig. LI), head up high, do the bending at middle of back.

14. Hand stand, bend arms, sink to front roll position, to feet.

15. Hand stand, back to feet, back roll.

16. Hand spring (Fig. LII). Take short run, go off one foot, just as the feet are above the head push off strongly with the arms.

Fig. LI.

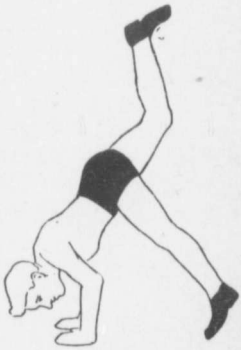


Fig. LII.

# PART IV.

## Anthropometry—Body Building and Corrective Work

Anthropometry—measuring man—is not used to the extent that it should be. While one must admit that the increase in the girth of the Biceps or Upper Arm, for instance, does not indicate the quality of the digestion, nor the vitality of the individual, still there is usually improvement of health with improvement of girth. Also, enthusiasm is lent to the exercise when the improvement or increase can be actually measured. Further, in the case of the Instructor, it enables him to get a complete view of the body, and so defects and deficiencies are readily detected. The apparatus need not be extensive, the following being a complete outfit:

(a) A pair of accurate scales with height attachment.

(b) A tape-line marked off in tenths, five feet long.

(c) Calipers to measure shoulder breadth, chest depth and chest width.

(d) A spirometer to measure the lung capacity.

(e) A mirror to give the person being examined a practical optical demonstration of his needs, and the effects of the prescribed exercise.

(f) A proper card index system with measurements and prescription of exercise thereon. One card to be given to the person being examined, and one retained by the examiner.

(g) A stethoscope.

If this outfit be too extensive, the scales, tape-line and mirror will be sufficient.

The measurements usually taken are:

*Girths—*

Neck.—Just below Adam's apple.

Chest, Deflated.—In line with the nipples in front and just above the lower edge of the shoulder blade behind.

Chest, Inflated.—In line with the nipples in front and just above the lower edge of the shoulder blade behind.

Waist.—Smallest part.

Hips.—Largest part.

Left Fore-arm.—Largest part, fist clenched.

Right Arm Extended.—Largest part.

Right Upper Arm Contracted.—Largest part.

Left Fore-arm.—Largest part.

Left Arm Extended.—Largest part.

Left Upper Arm Contracted.—Largest part.

Right Thigh.—Largest part. Do not hold the tape obliquely.

Right Calf.—Largest part.

Left Thigh.—Largest part.

Left Calf.—Largest part.

*Breadths—*

Shoulder Breadth.—Shoulders square, measure across the back from shoulder point to shoulder point with calipers.

Chest Breadth.—Chest held in normal position, measure with calipers from arm-pit to arm-pit in line with, or slightly above the nipple.

Chest Depth.—From front to rear in line with nipples. Calipers on breast-bone and spine.

Lung Capacity.—Have the person take a long breath and then expel completely into spirometer.

## *BODY BUILDING*

After the measurements have been made, exercise can then be given to build up the deficient parts. In the following pages I am outlining the simplest exercises used to develop the body.

In the section on Corrective Work, which follows, more detail is given because more is required. It must necessarily happen that I will repeat myself, because Body Building and Corrective Work are really inseparable.

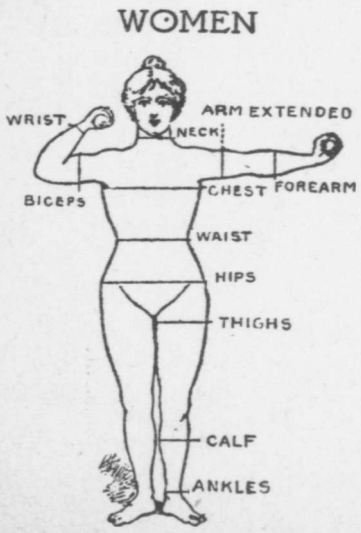
*The Neck.*—A poor neck gives one a weak appearance and an awkward carriage of the head. The neck exercises of the freehand drill, Exercises 8 and 9, each practised 12 to 18 times daily, would be sufficient to strengthen the neck. Wrestling is particularly good also, as resisting the Nelson holds, and "bridging" is done entirely by the muscles back of the neck.

*The Chest.*—The chest is developed from two standpoints, namely: (a) lung capacity, and (b) muscular chest.

Lung capacity is increased by breathing exercises. These are many and various. My advice is simply this—endeavor to fill the lungs to their full capacity, beginning at the abdomen. *Do not hold the breath.* This holding of the breath, so frequently taught, is a mistake. The strength of the lung cell, its vitality to expel the impure air, its resisting power toward disease, consists in its elasticity. Holding the breath decreases the resiliency of the air cells, even as over-stretching takes away the resiliency of an ordinary piece of elastic.

Fill the lungs to the full extent, and immediately begin to slowly expel it. A half-dozen long breaths, four to six times a day, as one walks along the street, is sufficient.

What is known as the chair exercise, I have found wonderfully efficient in developing the lung



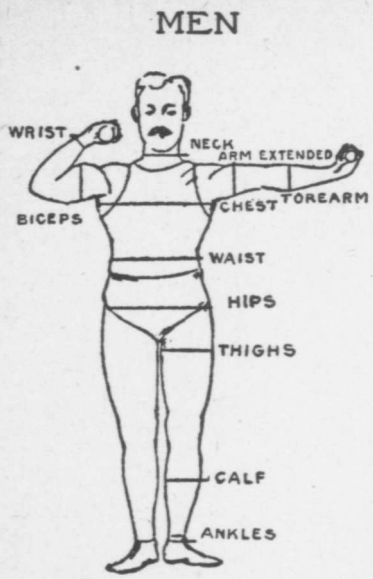

AVERAGE TABLE FOR WOMEN

| Height | Weight | Neck | Chest | Chest Full | Waist | Hips | Thigh | Calf | Arm | Fore-arm | Lungs |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 feet ..... | 100 | 11½ | 27 | 29½ | 22¾ | 32¼ | 19½ | 12¼ | 9½ | 7¾ | 128 |
| 5 feet 1 inch.... | 106 | 11¾ | 27¼ | 30 | 23 | 33 | 20 | 12½ | 9¾ | 8 | 136 |
| 5 feet 2 inches.. | 112 | 12 | 28 | 30½ | 23¾ | 34 | 20¾ | 13 | 10 | 8¼ | 144 |
| 5 feet 3 inches.. | 118 | 12¼ | 28¾ | 31½ | 24½ | 35 | 21½ | 13¼ | 10½ | 8½ | 152 |
| 5 feet 4 inches.. | 125 | 12½ | 29½ | 32 | 25¼ | 36 | 22¼ | 13¾ | 10¾ | 8¾ | 160 |
| 5 feet 5 inches.. | 132 | 12¾ | 30½ | 32½ | 26 | 37 | 23 | 14 | 11 | 9 | 168 |
| 5 feet 6 inches.. | 140 | 13 | 31¼ | 33½ | 26¾ | 38 | 24 | 14½ | 11½ | 9¼ | 176 |
| 5 feet 7 inches.. | 156 | 13¼ | 32¾ | 34¾ | 28 | 40 | 25 | 15 | 12 | 9½ | 182 |
| 5 feet 8 inches.. | 166 | 13½ | 33½ | 35½ | 29 | 41 | 25½ | 15½ | 12½ | 9¾ | 192 |

IDEAL MEASUREMENT (WOMEN), WHAT YOU SHOULD BE

| Height | Weight | Neck | Chest | Chest Full | Waist | Hips | Thigh | Calf | Arm Ex'ded | Fore-arm | Wrist |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 feet 3 inches. | 105 | 12¼ | 30 | 32 | 23 | 34 | 20½ | 12½ | 9½ | 8½ | 5¾ |
| 5 feet 3 inches. | 115 | 12½ | 31 | 33 | 24 | 35 | 20¾ | 13 | 10 | 9 | 6 |
| 5 feet 3 inches. | 120 | 12½ | 32 | 34 | 25 | 36 | 21 | 13½ | 10¼ | 9½ | 6 |
| 5 feet 3 inches. | 125 | 12½ | 32 | 34 | 26 | 37 | 22 | 14 | 10½ | 9½ | 6 |
| 5 feet 4 inches. | 110 | 12¼ | 31 | 33 | 24 | 35 | 20½ | 13 | 10 | 9 | 6 |
| 5 feet 4 inches. | 120 | 12½ | 32 | 34 | 25 | 36 | 21½ | 13 | 10¼ | 9 | 6 |
| 5 feet 4 inches. | 130 | 12¾ | 32½ | 34½ | 25½ | 37 | 22 | 13½ | 10½ | 9½ | 6 |
| 5 feet 4 inches. | 140 | 13 | 33 | 35 | 26 | 38 | 23 | 14 | 10¾ | 9½ | 6 |
| *5 feet 3 inches. | | 12.3 | 33.6 | | 27.3 | 36.6 | 21.1 | 14 | 11.4 | 10.6 | 6.5 |

*Measurements of the Venus De Medici.




MEASUREMENTS, WEIGHT, HEIGHT OF THE AVERAGE ADULT

| Height | Weight | Neck | Chest Con. | Chest Inflat'd | Waist | Biceps | Fore-Arm | Thigh | Calf | Lungs |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 feet 2 inches..... | 100 | 12¼ | 29 | 31 | 24½ | 9½ | 8¼ | 17¼ | 12 | 184 |
| 5 feet 3 inches..... | 108 | 12½ | 30 | 32 | 25 | 9¾ | 8½ | 17¾ | 12¼ | 192 |
| 5 feet 4 inches..... | 113 | 12¾ | 31 | 33 | 26 | 10 | 8¾ | 18½ | 12½ | 201 |
| 5 feet 5 inches..... | 122 | 13 | 32 | 34 | 26½ | 10½ | 9¼ | 19 | 13 | 209 |
| 5 feet 6 inches..... | 126 | 13¼ | 32½ | 34½ | 27½ | 10¾ | 9½ | 19½ | 13¼ | 217 |
| 5 feet 7 inches..... | 131 | 13½ | 33 | 35 | 28 | 11¼ | 10 | 20 | 13½ | 225 |
| 5 feet 8 inches..... | 140 | 13¾ | 34 | 36 | 29 | 11½ | 10¼ | 20½ | 14 | 233 |
| 5 feet 9 inches..... | 149 | 14 | 35 | 37 | 30 | 12¼ | 10½ | 21 | 14¼ | 241 |
| 5 feet 10 inches..... | 160 | 14½ | 36 | 38 | 30½ | 12½ | 11 | 21½ | 14½ | 249 |
| 5 feet 11 inches..... | 164 | 14¾ | 37 | 39 | 31 | 13 | 11¼ | 22 | 14¾ | 257 |
| 6 feet..... | 170 | 15 | 38 | 40 | 32 | 13¼ | 11½ | 23 | 15 | 265 |

IDEAL MEASUREMENTS SHOWING WHAT YOU SHOULD BE

| Height | Weight | Neck | Chest inflated | Waist | Biceps | Fore-arm | Thighs | Calves |
|---|---|---|---|---|---|---|---|---|
| 5 feet..... | 103–107 | 11⅜ | 32–33 | 29 | Same measurements as for neck | 8⅞ | 15 | Same measurements as for neck |
| 5 feet 1 inch..... | 107–111 | 11½ | 33–34 | 29½ | | 9¼ | 16 | |
| 5 feet 2 inches..... | 111–116 | 12 | 34–35 | 30 | | 9⅜ | 17 | |
| 5 feet 3 inches..... | 116–121 | 12½ | 35–36 | 30½ | | 10 | 18 | |
| 5 feet 4 inches..... | 121–127 | 13 | 36–37 | 31 | | 10⅜ | 19 | |
| 5 feet 5 inches..... | 127–133 | 13½ | 37–38 | 31½ | | 10¾ | 20 | |
| 5 feet 6 inches..... | 133–140 | 14 | 38–39 | 32 | | 11⅛ | 21 | |
| 5 feet 7 inches..... | 140–147 | 14½ | 39–40 | 32½ | | 11½ | 22 | |
| 5 feet 8 inches..... | 147–155 | 15 | 40–41 | 33 | | 11⅞ | 23 | |
| 5 feet 9 inches..... | 155–164 | 15½ | 41–42 | 33½ | | 12¼ | 24 | |
| 5 feet 10 inches..... | 164–174 | 16 | 42–43 | 34 | | 12⅝ | 25 | |
| 5 feet 11 inches..... | 174–185 | 16½ | 43–44 | 34½ | | 13 | 26 | |
| 6 feet..... | 185–196 | 17 | 44–45 | 35 | | 13⅜ | 27 | |

capacity. It is used by physicians to break up or prevent "Pockets" in Pleurisy. It consists of simply sitting on a suitable plain square-back chair, with the right side of the body pressed strongly against the chair. By taking a long breath, the air is prevented to a large extent from entering the right lung, but an extra, or compensatory amount is forced into the left lung. The right arm should hang over the top of the chair and help to press the chair against the right lung. The same thing is then done on the left side. A dozen long breaths on each side daily often increases the lung capacity from 20 to 40 cubic inches in two or three months.

It is a particularly valuable exercise because it forces the air into the tops or apices of the lungs, where Tubercular trouble almost always begins.

Breathing exercises enlarge the entire structure of the chest in all diameters, owing to the oblique attachment of the ribs and the descent of the diaphragm.

But the best and simplest method to increase the lung capacity is ordinary running. Did you ever notice how the average person puffs and is out of breath after a short run for a car? The explanation is that there is a tremendous bulk of muscle in the legs, and when they are used, as in running, a very large amount of oxygen is necessary to keep the muscles working, and also to get rid of the waste material, principally carbon dioxide. To provide this the lungs have to work harder and faster, hence, more development.

A simple method is to ventilate a room well and run about 150 steps every morning, increasing this each week by ten steps, up to four or five hundred steps. The value of this exercise will be even more apparent when we consider it under the head of Breathlessness.

(b) *Muscular Chest.*—This is developed by the Muscular Chest Exercises in the Freehand and Dumbbell Drills (Fig 3). Also the "Push Up" in the Ad-

vanced Dumb-bell Drill (Fig. 14). All forms of apparatus work are good; in fact, any exercise which brings the arms up in front of the body develops the muscles of the chest. Hanging exercises, hanging on a bar or door with the hands wide apart, will widen the chest most perceptibly in a few months. The hanging should be done twice daily. Hanging about six times, a half-minute at a time.

*Waist and Abdomen.*—With the average individual development here means decrease in size of girth. All bending exercises with the *knees straight;* all twisting and rocking exercises tend to tighten the abdominal muscle which enclose the abdominal cavity. These muscles run straight up and down, transversely and obliquely, hence are called Rectus Transversalis, and Obliquus Abdominal Muscles respectively. Their development, by the exercises spoken of above, tightens or shortens these muscles, so that no sag or protruding abdomen is possible—thus preventing round shoulders and weak back, as will be shown later.

*Fore-arm.*—The fore-arm is developed by simple exercises, such as opening and closing the hands forcibly, or wrist exercises (Fig. 1). By any and all exercises that require grasping or gripping, as in dumb-bell and wand drills, or apparatus work. A well-developed fore-arm may be obtained by taking a one-pound iron dumb-bell in the hand and, after flexing or bending the wrist, twist the bell inwards and outwards while the wrist is in the flexed or bent position.

*Biceps, or Upper Arm in Front.*—This is the muscle that is the pride of the small boy, and very frequently of the man also. It is developed by any exercise which flexes or bends the fore-arm on the upper arm, as in Fig. 2. These exercises can be done with or without apparatus.

The best method is beginning with a one-pound dumb-bell, and keeping elbows well pressed against the side, flex fore-arm strongly on upper arm. Do

not jerk the exercise, but squeeze the bell tightly right from the beginning of the exercise, not just at the termination, as is so frequently done. After a few weeks a heavier bell is necessary, and the weight should be gradually increased up to five pounds.

For men, or well-developed boys, "chinning the bar," that is, drawing the body up to the height of the chin on the bar, is a splendid exercise for the biceps after a few weeks of the light bells.

The exercise of bringing the bells from the side horizontals (Fig. 10), to tops of shoulders (Fig. 9), is also valuable, care being taken not to let the elbows drop below the height of the shoulder.

*The Triceps, or Back Upper Arm.*—This is developed by extending the fore-arm from the flexed position to full extent (Fig. 2).

This muscle is developed by any exercise that straightens out the arm. All forms of calisthenics and gymnastics develop this muscle, because so many exercises are done with the arm straightened out to the full extent.

A particularly valuable, though heavy, exercise is what is known as the "push up" from the floor, illustrated in the advanced dumb-bell drill (Figs. 13 and 14).

*The Thigh.*—The thigh is developed by nearly all the exercises that call for the use of the legs. The front of the thigh is developed by all exercises that straighten the knee. The back of the thigh is developed by all exercises that bend the knee. This seems simple enough, and yet students almost invariably interchange the action of these two groups.

The outer and inner aspects of the thigh are developed by exercises bringing the leg from and to the middle line. Exercises spreading the toes apart and jumping the feet apart and together again in the leg work of the drills reach these groups. The particular exercises in the drill for the muscles of the thigh, front and rear, are the squatting exercises, squatting quarter way down, heels kept on the floor,

and squatting all the way down, letting the heels come up as the body goes down (Fig. 6).

*The Calf.—Gastrocnemius and Soleus Muscles.*—This part is developed by simply raising the body on the toes. Whatever the weight of the body, it is almost entirely lifted and supported by the calf when the body is on the toes. Sometimes, where unusual development is wanted, weights are placed on the shoulders or head, and the calf muscles are made to lift and sustain the extra weight. Running is excellent for developing the calf.

*The Shin, or Tibialis Anticus Muscle.*—This is developed by any exercise that would flex the ankle toward the shin. It is often spoken of as the "Walking" Muscle, being usually well developed in persons accustomed to do considerable walking.

The main exercise used to develop this, as shown in the drill, is raising the body on the heels.

Raising the body on the heels, and turning the toes outward, not only develops the outer aspect of the thigh (as above), but also develops the muscles of the outer aspect of the leg below the knee, that is, the Peroneal muscles.

*Upper Back.*—This is developed by any and all exercises bringing the shoulders back. The particular exercise given in the drills is the "Shoulder Roll." All exercises facing the chest weights, and all hanging exercises, serve to bring the shoulder-blades together. The breast stroke in swimming is also useful.

The first two exercises in the wand drills, where the wand is placed forcibly behind the shoulders, will likewise develop the upper back.

*Lower Back.*—This is developed by all exercises serving to keep the trunk erect on the thighs. All exercises bringing the body from the stoop or bent-over position to the erect position, as in Figs. 8, 11 and 12 of the Advanced Dumb-bell Drill, are valuable.

A most efficient exercise, little known, or at least

practised very little, is the lying on the abdomen and endeavouring to approximate the head and heels, keeping the knees straight.

## *THE CORRECTION OF DEFECTS*

Round Shoulders, Low Shoulders, High Shoulder, Spinal Curvature, Knock-knees, Bow-legs, Uneven Hips, Deficient Lung Capacity, Weak Heart, Poor Circulation, Indigestion, Weak Back, etc.

*Round Shoulders.*—Round shoulders are due for the most part to the every-day occupation of the individual. The daily tasks are done, of course, with the hands in front of the body. The muscles involved, besides those of the arms, are the chest muscles, which are attached to the inner side of the upper part of the humerus, or upper-arm bone, and to the breast-bone, or sternum. Thus, the shoulders are brought nearer to the chest by the working, or exercising of the chest muscles. If exercise or work for the upper-back muscles is not taken, then round shoulders result. The correction, then, is the developing of the upper-back muscles, mainly the Trapezius, which is attached to the bones of the spine and to the shoulder-blades. When these muscles are exercised, as in rolling shoulders back and down (Exercise 7, Freehand Drill), swimming (breast-stroke exercise), or exercises facing the chest-weights, the action of these muscles draws the shoulder-blades together, and so squares or straightens the shoulders. Sometimes round shoulders are due to weak abdominal muscles, which cause the abdomen to sag, bringing the shoulders forward also. The exercise for the abdominal muscles above, will remedy the defect.

*Low Shoulders.*—This is due to the every-day habit of standing with most of the weight on one leg—this raises that hip and lowers the shoulder of the same side. Carrying books on the one side habitually is another frequent cause. To correct it, have the person hang by the hand

corresponding to the low shoulder. The hanging may be done from a bar, a door, a door frame, or anything that will permit the feet to be off the floor. Hanging should be done eight to ten times daily, hanging for fifteen to thirty seconds each time. When this is found to be too difficult rings should be used, one ring being higher than the other, and then hanging by both hands (which is easy) will give the position necessary for correction.

But this is not all that is necessary. This pulls the shoulder up, but muscles must be developed to hold it up. Accordingly, all kinds of work involving hanging by both arms (ring work, high parallels, ladder work, bar work) will give the result sought. A simple, but most effective exercise, is to take a dumb-bell or the handle of the chest-weight in the hand corresponding to the low shoulder, and carry it from the horizontal position at side in line with shoulder, to position high overhead. This should be done about twenty times daily. These exercises develop the muscles that hold the shoulder up in its proper place. Also, it is well to stand on opposite leg frequently.

*High Shoulder.*—This is not so commonly met with as low shoulder, but it is found among officemen and others whose employment causes the faulty position.

It is corrected by hanging exercises, involving the use of both arms on rings or bar, as above. The exercise to hold it in position is the reverse of that for low shoulder. The dumb-bell or chest-weight handle is drawn from the horizontal position in line with the shoulder to a position down at side. This develops the muscles below the shoulder, draws down the shoulder, and keeps it there.

*Narrow Shoulders.*—The shoulders and chest can both be widened by hanging on a bar or door with the hands wide apart. This is important, for it means more room for the lungs and less liability to Tuberculosis.

*Spinal Curvature.*—There are varieties of curvature which space will not allow of classification. It is not hard to recognize the curve laterally in a spine. Some pronounced cases of round shoulders are really an exaggeration of the normal curve, and can really be classed as curvatures. The treatment of spinal curvature is simple, and it is almost criminal that parents will permit curable cases to go untreated. A case that can be corrected perfectly before sixteen years of age, is most difficult to help at twenty, and is almost beyond help thereafter.

The first fact to be remembered is that a straightened spine must be held straight, and all measures that stop short of this are for the most part ineffectual.

To straighten the spine. The most effective means is the hanging by the neck from any simple apparatus, which fits around the chin, and below the base of the skull.

Many people have the idea that hanging in this manner would mean strangulation, but after two or three trials, many are able to hang their full weight for ten minutes at a time. This should be done for twenty minutes every day. The next method in straightening is to adjust the arms so that the spine assumes a straight, or at least a straighter line, and then have the person hang on rings, adjusted so that the arms are at the different heights necessary to bring the spine into the straightest possible line. This hanging could be done from a door-frame, a bar, or anything else that is convenient. It should be done daily, at least eight or ten times, for about half a minute at a time.

This is the straightening process.

Now the development of the muscles of the back to hold the spine in the correct position can be done by the simple exercise given to develop the lower back, that is, lying on the abdomen, and endeavouring to approximate the head and heels, keeping the knees straight. The only difference is that you so

adjust the arms that the spine is in a straight line. This may mean that the right arm will be up beside the head, and the left down across the back, or *vice versa*. This exercise should be done about thirty-six times daily, doing it twelve times and resting awhile.

*Knock-knees.*—Considerable improvement can be made in this condition by utilizing blocks with a wooden screw, which will pull the knees apart, the ankles being held together by means of a strap. The development of the muscles to hold them apart can be done by simply sitting on a chair and spreading the knees apart against the resistance of the hands.

*Bow-legs.*—These are corrected in about the same manner, using blocks to bring the knees together, and the development of the adductor muscles by sitting on a chair and bringing the knees together against the resistance of the hands.

*Uneven Hips.*—This is due, as was pointed out above (low shoulder), to the habit of standing with the weight of the body on one leg. This is corrected by hanging exercises, simply hanging on a bar or door-frame a few times daily. Also by standing on the opposite leg. Such exercises as raising the leg corresponding to low hip, to a position at right angles to the body will also help.

*Deficient Lung Capacity.*—This was fully treated under Development of the Chest.

*Weak Heart.*—This expression is used advisedly. This does not include valvular diseases of the heart, although they are treated and cured now. By the term, weak heart, is meant the weak, muscular heart that is insufficient to withstand any severe illness, as Pneumonia, Appendicitis, or Typhoid Fever.

It can be readily detected by lack of force in the first sound "lubb." Other evidences are cold hands and feet, catching cold easily, retaining a cold for some time, and all the other signs of poor circulation. The correction of this is very simple. The jogging of a few hundred steps daily for three to six

months, is often sufficient to strengthen a weak or deficient heart, so that the above symptoms are entirely eliminated.

I have frequently had patients begin by running about one hundred steps (stationary run) daily, and increase it to six or eight hundred. Others will start by jogging a quarter mile around the running track, and increase it gradually to two or three miles. While I am thoroughly opposed to Marathon races, and to long distance races for growing boys, I am heartily in favour of the cross-country running, and races up to five miles for boys.

There are no better exercises for heart and lungs than the running. As pointed out before, the tremendous bulk of muscle in the legs, doing such a large amount of work, and doing it so rhythmically and regularly, as in the act of running, is exactly the kind of exercise necessary and most suitable for strengthening the heart muscle. The heart must pump regularly and rhythmically the extra blood necessary, and must pump it to the extremities, the farthest point. Any exercise bringing the blood to the extremities, such as opening and closing fingers, raising on toes or heels, all leg or arm exercises are especially beneficial. Of course, all exercises of any kind whatever call on the heart for the extra blood, and so develop the heart muscle.

*Indigestion and Constipation.*—There are many forms of indigestion due to changes in the quantity and quality of the digestive juices, the motor function of the stomach, the condition of the nervous system, and the condition of the teeth.

After many years' experience with the effects of exercise in all forms of indigestion, I have found that all the bending and twisting exercises but serve to help the condition, with the exception of the exercise of lying on the back and attempting to sit up. This latter exercise has aggravated the condition in three or four cases.

For indigestion, particularly where there is the

pain from the pressure of gas, Sandow's Rock (Fig. 7, Calisthenics) is particularly valuable. Where this is due to poor teeth, or lack of chewing of the food, these conditions should be corrected. Exercises with the wand (Figs. 15, 16 and 17, Calisthenics) are likewise useful. Circumducting the body to right and left (Exercise No. 12 in the Freehand Drill) is also valuable. These exercises are excellent for constipation. In addition to the exercises, a glass of cold water on rising, and one at eleven or four o'clock is a valuable adjunct.

*Weak Back.*—This is due in most instances simply to weakness of the muscles in the lower back, and can be corrected by the exercises given above to develop the lower back. Weak abdominal muscles, allowing abdomen to sag, also put a strain on the back.

*To Increase Weight.*—This depends on the individual, his temperament, occupation, and manner of eating. The usual regime is about as follows: There should be regular, daily, light, systematic exercise. There should be regular hours for sleeping at night, ten hours if possible, and a sleep throughout the day helps a great deal. Bathing should be regular, but the water should neither be very hot nor very cold. Very hot water reduces flesh and lowers the vitality. Very cold water is a strain on the nervous system, and there is too much animal heat lost. There should be an absence of any severe mental or physical effort, thus ensuring serenity of mind—a most essential condition. The Diet is most important. Eating should be very regular, with the meals at least five hours apart. Eating should be done slowly, the food being thoroughly masticated before going to the stomach. Extra meals are permissible, four meals being quite proper. Although, as above, the meals should be five hours apart, a raw egg, or a glass of water may be taken an hour or two before the next meal.

Sugar is especially good as an article of diet, good candies making an agreeable food.

Fats are also excellent. Many have the idea that if they eat fat, the fat they eat is stored directly in the body. This is not so. The fat eaten is the tissue that is used first for heat and energy, and thus the other foods, not being required for that purpose to the same extent, are available for building up the tissues of the body.

Milk is a valuable food in increasing weight. Eggs also give strength and increase weight. In building up the emaciated from any sickness, milk and eggs are the main articles of food used.

*To Reduce Weight.*—The first matter is the diet. Although there are individuals who seem to resist all efforts at weight reduction, as a matter of fact they are few in number. There is always some little essential overlooked. Sometimes it is too much sleep, sometimes an absence of serious employment, or, perhaps, exercising at the wrong period in the day.

The matter of diet is most important, and the indulgence in milk, cream, fats and starchy foods must be limited. Alcoholic drinks should be avoided absolutely. Lean meats and fish are the chief proteids that should be used.

The exercise should be plentiful and, if necessary, very severe, as a good perspiration should always be induced. Have the body covered with plenty of clothing during exercise, as many as three or four sweaters being often worn at one time. The exercise should begin slowly and continue for some time. It is a mistake to think you have taken sufficient and efficient exercise, because you are exhausted in a few minutes. The gradual exercise permits of a gradual but increasing perspiration, the exhaustion is further delayed, and more exercise is thus taken.

Baths should be frequent—a cold morning bath is no weight producer. Hot and steam baths also reduce weight. Drinking hot water every morning helps to carry off waste also, and is a factor in reducing weight. Employment requiring mental concentration is essential for best results.

## *GAMES FOR THE GYMNASIUM AND PLAY-GROUND.*

Win, if you can, by every means that's fair,
Play for the sport's sake, and always take good care
To be the best of losers, no matter when or where.

*Hang Tag.*—One person gives "it." The others scramble off to some piece of apparatus, and as long as they are suspending their weight by their arms they cannot be tagged. If "it" is near a player in distress who is about to let go, some of the other players attempt to draw him away by quitting their post momentarily. The tired one can then jump down and get a fresh start.

*Hop Jostle.*—Arms folded, hop. Try to make the opposing player lose his balance or put his foot to the floor.

*Follow the Leader.*—The instructor, or one of the class leads off on a smart walk or run, the others follow close behind in single file. The leader then hops, jumps, vaults over, or runs under apparatus, and the others do exactly the same. The game when used simply for exercise continues for a few minutes. If for competition, each player drops out when he is unable to follow the task set by the leader.

*Basket Ball.*—The rules for this game may be obtained at any book store. It is, perhaps, the best indoor game we have.

*Jump the Rope.*—A player lies on his back with a rope, at the other end of which is a bag of shot, or a bag of beans. He swings the rope around a few inches above the floor, and the other players try to avoid it as it comes around by jumping. The other players must keep within the circumference of the circle described by the rope. The player getting hit then exchanges places with the one swinging the rope.

*Indian Club Dance.*—Each player sets up an Indian club on the floor in a ring about one foot interval between the clubs. The players join hands,

forming a ring around the clubs. They then endeavour to make one another knock down a club by pulling a portion of the ring across the clubs. A player knocking down a club with any part of his person, drops out. The game then continues until but one player is left.

*Volley Ball.*—A net is stretched across the room at a height of about eight feet. The sides are equal in numbers. Any number can play. The ball is about the consistency of a tennis ball, but about six inches in diameter. The idea is to keep the ball in the air by batting it with the hand or fist over the net. If it touches the floor on one side it gives a point to the other side. The scoring may be done as in tennis.

*Three Deep.*—A circle of players is formed facing toward the centre with an interval of six feet between them. Immediately behind each player another player stands, thus forming a double circle. To begin the game two players remain out of the circles, one who is "it," and one whom "it" tries to tag. They begin to run around the outside of the circle, when the one who is in advance steps in front of one of the pairs of players. This makes three in that row, which is not allowed. The third or rear player must try to escape "it," who pursues him now. If a player is tagged before he can get in front of one of the pairs, he must give "it," and endeavour to tag the one who has just caught him. The idea, then, is to step in front of a couple, thus compelling the third player to run. The running must be around the outside of the circle.

*"Tom, Tom, Pull Away."*—One player stands in the centre of the floor and the rest of the players at one end. The player in the centre who is "it" then cries, "Tom, Tom, come away; if you don't come, I'll pull you away." The players then run to the opposite end. "It" tries to catch one, whom he must hold while he says, "Tom, Tom, pull away," three times. This one in turn helps him to catch

the others, and so on until all are caught. The one caught first is "it" for the next game.

*Drop the Handkerchief.*—A child holding a handkerchief runs around the outside of the circle and drops the handkerchief behind someone. The child behind whom the handkerchief is dropped tries to catch the first child before he gets to the vacant place in the circle. If caught, he must be "it" again; if not, the second child is "it."

*Water Sprite.*—Players stand in two lines facing each other with a large open space, representing a river between. The water sprite stands between and beckons to one to cross. This one signals to one on the opposite side, and they run across to exchange places. If tagged by the water sprite, the water sprite and the one tagged exchange places.

*Arch Ball.*—Players stand in two or more lines, single file, players about two feet apart. The leader throws the ball backward overhead to the player behind. If the ball falls to the ground, the one who failed to catch it must pick it up and return to his position in the line, before throwing it. The last one in the line runs to the front with the ball, takes his place at the head of the line, and begins over again. The line wins whose leader first gets back to the front.

*Skipaway.*—The children stand in a circle, taking hold of hands. One child, who is "it," runs around the outside of the circle, and tags another as he runs. The child tagged runs in the opposite direction to the first runner. The child who first reaches the place in the circle left vacant by the one tagged, wins. The one left out becomes runner.

*Cat and Rat.*—The players form a circle with hands clasped. One is chosen for cat, who stands outside of the circle and tries to catch another in the centre, who is the rat. The children forming the circle try to help the rat by raising their hands to let him run under them, but try to keep the cat from breaking through the circle. When the rat is caught he joins the circle, the cat becomes rat, and a new cat is chosen.

*Have You Seen My Sheep?*—The players form a circle. One player walks around the outside, and touching someone on the back, says, "Have you seen my sheep?" The one questioned answers, "How was he dressed?" The dress of some player is then described, who, when he recognizes himself, must run around the outside of the circle and try to reach his own place before he is tagged by the questioner. If tagged, he is "it," and the questioner takes his place in the circle.

*Japanese Tag.*—This is like ordinary tag, except that a player who is tagged must place his left hand on the spot touched, whether it be his back, elbow or ankle, and in that position must chase the other players. He is relieved of his position only when he succeeds in tagging someone else. Several players may be "it" at one time.

*Circle Catch Ball.*—Form a circle with six to eight feet between the players. Toss the ball in one direction from one player to the next. The first player who fails to catch the ball steps into the centre and throws it to someone in the circle. It is then tossed promiscuously from one to another, so as to elude the one in the centre, who tries to catch it. If he is successful, the one toward whom it was aimed takes his place in the centre.

*Step.*—The ground is marked off by two parallel lines, a wide distance apart. One player, who is "it," stands on one of these lines, with his back to the other players, who start at the other line. The one who is "it" counts ten rapidly, during which time the other players approach his line. As he says "Ten," they stand still in whatever attitude they may be at the moment; he turns his head quickly and calls the name of any player or players whom he sees moving. Any thus caught moving have to go back to the starting line and begin over, while the counter repeats the count of ten and the players again move forward. The object of the game is to cross the counter's line without being seen in motion by him. The last one over changes places with the counter.

*Last Pair Pass.*—Players stand in twos, one behind the other. One, who is catcher, stands in front, with his back to the others, and calls, "Last couple out!" when the last two in the line run around to the front and endeavor to join hands before they are tagged by the catcher. They must run up on opposite sides of the line, and must join hands beyond the catcher. The one tagged becomes catcher; his partner joins the previous catcher and they take their places as first couple in the line. The catcher must not look behind him when the last couple run out.

*Relay Race—Single.*—The children stand in two or more lines at one end of the ground. The first one of each line, carrying a flag or handkerchief, races to the opposite end of the ground, touches the fence or wall with the flag, and runs back, handing the flag to number two, and passing to the rear of the line. Number two starts immediately, and upon returning hands the flag to number three, etc., until all have run. The line whose last man returns first wins the race.

Those at the head of the line whose turn it is to run next must stand with the toe on the line, but not beyond it. They cannot advance to meet the returning racer.

If the flag is dropped, the one dropping it must return and pick it up before continuing the race. Anyone not touching the terminal wall, must go back and touch it before finishing the race.

It is well for each line to have a captain to see that rules are observed, and there should be an umpire to decide which line wins.

*Lame Goose.*—One of the players, the lame goose, retires to a space marked off as den; the others tease him to come out, saying, "Lame goose, lame goose, can't catch anybody." Lame goose runs out, but can only take three steps, when he must hop on one foot, trying to tag the others while hopping. All tagged become lame geese. If a lame goose puts his foot down while outside the den, after the first three steps, the others drive him back. The player last tagged wins the

game and becomes the first lame goose of the next game. Care should be taken that the hopping is not always done on the same foot.

*Pass Ball.*—Form a circle with the feet in straddle position, touching the feet of the adjacent players, so as to form a barricade for the ball. One player stands in the centre and tries to roll the ball out of the circle, between the feet of the players; the latter roll it back with their hands. If it passes between a player's feet, or he moves his feet to stop it, he exchanges places with the one in the centre.

*Straddle Club.*—Players stand in two or more lines, one behind another, with the feet apart in the straddle position. At a signal the leaders of the lines each slide an Indian club between the feet from the front toward the rear of the lines; the last one in each line, when he receives the club, runs with it to the front, takes position at the head of the line, and starts it in his turn. The line wins whose leader returns first to the front. If the club stops on its way to the rear, the player next whom it stops starts it again. If the club is allowed to skip a player, it is counted a foul, and must be returned to the player skipped, who then starts it. This game can also be played with a ball.

# PART V.

## Athletics

### *TRAINING FOR ATHLETICS.*

While a great deal has and can be written regarding training, I believe about three or four general rules are quite sufficient.

A young man or boy who takes proper care of himself and is therefore always in "fair" condition needs but very few words of advice.

(1) Avoid alcohol.

(2) Avoid tobacco.

(3) Avoid pastry.

(4) Cut down the amount of liquids to the minimum.

(5) Always have a hot bath and rub after a workout.

Sleep is the essential thing, because it not only rests the body and brain, but also allows the circulation to get rid of the fatigue products that have accumulated.

It is almost impossible for an athlete to go "stale" who is getting a hot bath and rub after exercise, and plenty of sleep.

Food is an important factor, for strength comes from eating. Almost anything can be eaten except pastry and hot bread. The amount is, perhaps, more important. An athlete in training often over indulges himself at the table. In fact, a noted writer has recently stated that many a good baseball player has eaten himself out of the big league.

About two hours before a race a fair sized meal should be eaten, consisting of a steak or a couple of eggs, a baked potato and a glass of water. If these seem to be too much, a couple of raw or soft boiled

eggs will give the strength required with the least amount of work to be done by the digestive apparatus.

A sprinter doing one or two heats only in an afternoon can do his best work often on a cup of tea or cocoa and a slice of bread.

## *SPRINTING.*

*The Crouch Start.*—Two holes are dug behind the starting line, one about four inches behind the line for the left foot, and one about a foot behind and a little to the right for the right foot. The hole for the right foot should be deep enough to allow the full ball of the foot to be pressed against the back of the hole.

When the runner is ordered to "get on his mark," he places his feet in the holes, his fingers on the mark, and kneels with right knee opposite left instep.

When the word "set" is given, the runner raises his hips, straightens his arms and leans forward as far as possible without losing his balance, and takes a breath. Back should be flat and parallel to the ground, head up.

When the pistol sounds, shoot ahead with all the force of both legs in a slanting position, getting a very strong push with the right leg, coming to the correct running position at the end of about fifteen yards.

Don't try to beat the pistol. It can be done once in a while, but it is a dangerous practice. If the "set" has been done properly, a "fair" start can always be accomplished.

*Sprinting.*—In sprinting the arms should be swung naturally, body inclined forward and head and chin bent forward. Legs travel in a straight line, knees well up, toes pointing straight, and hit the ground with a hard tap, almost a "pawing" motion.

The idea of some of our old-time runners, that a sprinter should always run 110 yards in practice is, to my mind, a splendid one. The majority of sprint races are won in the last 20 yards, and it is most frequently the man with the strong finish who wins the race.

Also, the little preliminary "canter" before a race is a wise procedure, as it often prevents a strained tendon or muscle.

The 220 and 440 yards races are both sprints, and the runner is at full speed all the way.

The half mile and mile do not call for the same degree of speed. Endurance and a long stride are essential factors.

Most mile runners try to cultivate a strong, speedy finish for the last 100 to 150 yards.

Middle Distance.—Any distance over the mile up to three miles is usually spoken of as "middle distance" events.

In events over the mile most runners, including Alf. Shrubb, advise a short stride. This is advisable, because the effort required to raise the body high enough in the air to ensure a long stride makes a tremendous call on the heart and lungs, and the runner becomes breathless and fatigued much sooner. [See chapter on Fatigue and Breathlessness.]

### *THE RUNNING BROAD JUMP.*

Spring and speed are the essentials in this event. Before practising for the season, a week or two of running and short sprinting should be done to prevent stiffness and strain. Even when in good condition, a broad jumper should "loosen up" before his event by running with knees high up in front, for a few yards.

There are four parts to this event, and the observance of them will add feet to the distance a beginner will be able to accomplish.

1st. Speed to the mark or take-off. The regular natural stride of the competitor should be used as he runs to the mark. He should start slowly and gradually increase this speed until he is at his top speed at the take-off. Without halting in the slightest, his last stride should be a little shorter to allow for the crouch. The crouch should not be too low, as it might interfere with the speed. The jumping foot should be brought down hard, toe pointing to the front.

2nd. Leaving the mark. The take-off should be struck hard from a crouch position and the leg and back should be straightened as the body is propelled high in the air. Arms forward and upward.

Fig. 1.

3rd. Position of body in the air. The head and back are bent forward and the knees "tucked" up well under the chin.

4th. Position of body on alighting. Just as the body is about to land the legs are shot forward, which adds at least a foot to the jump. The jumper lands in a sitting position, but with sufficient impetus to prevent him sitting right down.

*SHOT PUT.*

The body is turned sideways, with the right foot touching the back line. The shot is sometimes held high in the fingers, sometimes well down in "heel" of the palm, and kept close to right ear, elbow close to body. The weight of the body is all on the right leg,

Fig 11.

which is slightly bent. The left leg is then swung clear of the ground a few times to attain a balance, and the body leans further over on the right foot. When the balance is just right a short, quick hop is taken, but the weight of the body is still on the right

leg at the end of the hop. The moment the right foot hits the ground the weight of the body is then flung on left toe, a spring in the air is taken, the body and arm are straightened and the shoulders flung around swiftly, and the shot shoved upward and forward, the putter landing on his right foot, close to the front of the circle. At the conclusion of the put, the left leg should be well up behind the body to make a perfect balance.

### *THE RUNNING HIGH JUMP.*

Beginners make the mistake in this event of running hard at the bar. The run should be only a few

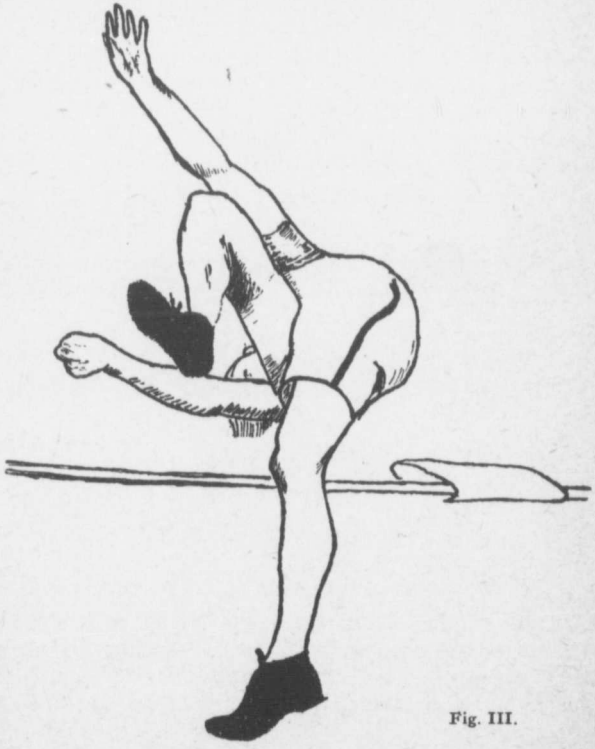


Fig. III.

paces and should be a series of springs or bounds. The last stride should be short, to allow for a crouch.

It is best to run straight at the bar rather than obliquely, although it is a little harder to learn.

The distance from the bar at which the jump is made varies. The old saying, "You can't do a broad jump and a good high jump at the same attempt" is true. Too many beginners attempt to jump at too great a distance from the bar.

On the last stride the body should be in a crouch with the weight over the jumping foot. Give the off-leg a powerful swing upwards at the instant of take-off and follow it up with a "bending-the-crab-movement" just at the instant when the hips and back would appear to take the bar off the pegs. The body should clear the bar with a "wiggle" movement. As the legs clear the bar they should be snapped downward and the head and arms carried forward, thus allowing the upper part of the body to clear the bar.

## *HURDLES.*

This is one of the most popular events from the spectators' standpoint.

Very few athletes specialize in it, and yet the main points can be drilled into a willing student in a very short time.

The main idea is to get over the hurdle as quickly as possible and with the least possible check to the speed.

In leaping, extend the leg going over first straight to the front; bend the body forward from the hips, the arms being extended out to the sides in line with the shoulders, as a sort of balance. Bring the rear leg, with knee well bent, up close to the body and gradually draw it over the bar, and be ready to shoot it forward for the next stride after landing. A hurdle always

takes the same number of strides between the jumps, some taking three, others five.

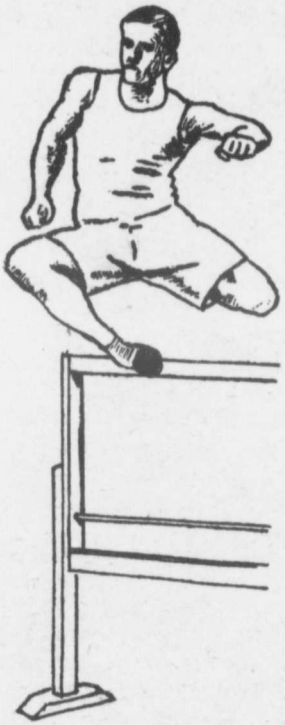


Fig. IV.

# ATHLETIC RULES

## Of the Canadian Intercollegiate Athletic Union. In Affiliation with the Amateur Athletic Union of Canada.

### RULE I.

*Officials.*

The officers of an Athletic Meeting shall be:—

One Referee.
One or more Inspectors.
Three Track Judges.
Three or more Field-judges or Measurers.
Three Timekeepers.
One Starter.
One Clerk of the Course, with Assistants if necessary.
One Scorer, with Assistants if necessary.
One Announcer.

### RULE II.

*The Referee*

shall decide all questions relating to the actual conduct of the meeting, whose final settlement is not otherwise covered by these rules.

He alone shall have the power to change the order of events as laid down in the official programme, and to add to or alter the announced arrangement of heats in any event. A referee has no authority, after heats have been duly drawn and published in a programme, to transfer a contestant from one heat to another.

When in any but the final heat of a race, a claim of foul or interference is made, he shall have the power to disqualify the competitor who was at fault, if he considers the foul intentional or due to culpable carelessness, and shall also have the power to allow the hindered competitor to start in the next round of heats, just as if he had been placed in his trial.

When, in a final heat, a claim of foul or interference is made, he shall have the power to disqualify the competitor who was at fault, if he considers the foul intentional or due to culpable carelessness, and he shall also have the power to order a new race between such of the competitors as he thinks entitled to such a privilege.

RULE III.

*The Inspectors*

shall stand at such points as the Referee may designate to watch the competitors closely, and in case of a claim of foul to report to the Referee what they saw of the incident.

The Inspectors are merely assistants to the Referee, to whom they shall report, but in no case shall they give decisions.

RULE IV.

*The Judges at Finish*

shall determine the order of finishing of contestants and shall arrange among themselves as to noting the winner, second, third, fourth, etc., as the case may require.

In case of disagreement the majority shall decide.

Their decision as to the order in which the men finish shall be final and without appeal.

RULE V.

*The Field Judges or Measurers*

shall measure each trial of each competitor in all games whose record is one of distance or height.

They shall act as judges of these events, and their decisions as to facts shall likewise be without appeal. In case of disagreement a majority shall govern.

RULE VI.

*The Timekeepers*

shall be not less than three in number. They shall individually time all events where time record is re-

quired, and determine among themselves and announce the official time of each heat or race.

Should two of the three watches mark the same time and the third disagree, the time marked by the two watches shall be accepted. Should all three disagree, the time marked by the intermediate watch shall be accepted.

The flash of the pistol shall denote the actual time of starting.

If, for any reason, only two watches record the time of an event, and they fail to agree, the longer time of the two shall be accepted.

For record, however, three watches must be held on an event and record the time.

RULE VII.

*The Starter*

shall have sole jurisdiction over the competitors after the Clerk of the Course has properly placed them in their positions for the start.

The method of starting shall be by pistol report, except that in time handicap races the word "go" shall be used.

The actual start shall not be effected until the pistol has been purposely discharged after the competitors have been warned to get ready. In case the pistol was not purposely discharged the competitors shall be called back by the Starter by pistol shot.

When any part of the person of a competitor shall touch the ground in front of his mark before the starting signal is given, it should be considered a false start.

Penalties for false starting shall be inflicted by the Starter as follows:

In all races up to and including 125 yards the competitor shall be put back one yard for the first and another yard for the second attempt; in races over 125 yards and including 300 yards, two yards for the first and two more for the second attempt; in races over 300 yards and including 600 yards, three yards for the

first and three more for the second attempt; in races over 600 yards and including 1,000 yards, four yards for the first and four more for the second attempt; in races over 1,000 yards and including one mile, five yards for the first and five more for the second attempt; in all races over one mile, ten yards for the first and ten more for the second attempt. In all cases the third false start shall disqualify the offender from that event.

The Starter shall also rule out of that event any competitor who attempts to advance himself from his mark, as prescribed in the official programme, after the Starter has given the warning to "get ready."

RULE VIII.

*The Clerk of the Course*

shall be provided with the names and the numbers of all entered competitors; shall record the names of all competitors who shall report to him; shall give them their numbers for each game in which they are entered, and he shall notify them to appear at the starting line before the start in each event in which they are entered.

RULE IX.

*The Scorer*

shall record the order in which each competitor finishes his event, together with the time furnished him by the Timekeepers. He shall keep a tally of the laps made by each competitor in races covering more than one lap, and shall announce by means of a bell, or otherwise, when the leading man enters the last lap. He shall control his assistants, and assign to them such of his duties as he may deem proper.

RULE X.

*The Announcer*

shall receive from the Scorers the result of each event, and announce the same by voice, or by means of a bulletin board.

RULE XI.

*Competitors*

shall report to the Clerk of the Course immediately upon their arrival at the place of meeting, and shall be provided by that official with their proper numbers, which must be worn conspicuously by the competitors when competing, and without which they shall not be allowed to start.

Each competitor shall inform himself of the time of starting, and shall be promptly at the starting point of each competition in which he is entered, and there report to the Clerk of the Course.

Under no condition shall any attendants be allowed to accompany competitors at the start or during any competition.

Trainers and handlers shall not be allowed within the centre field or inner circle, or on the track immediately prior to or during competitions at championship meetings, except in distance races exceeding one mile.

All entries must be made in the real name of the competitor.

Every competitor must wear complete clothing from shoulder to the knees (*e.g.*), jerseys and loose drawers.

RULE XII.

*Protests*

against any entered competitor may be made verbally or in writing to the Referee before the meeting, or during the meeting. If possible, the Referee shall decide such protests at once. If the nature of the protest or the necessity of obtaining testimony prevents an immediate decision, the competitor shall be allowed to compete under protest, and the protest shall be decided by the Referee within one week.

RULE XIII.

*Ties.*

In all contests whose results are determined by

measurement of height or distance, ties shall be decided as follows:

In case of a tie in a scratch contest at high jumping, the tieing competitors shall have three additional trials at the height last tried, and if still undecided, the bar shall be lowered to the height next below, and three trials taken at that height. If no one clears it, the bar shall be lowered again and again until one of the competitors clears it. In case of a second tie, the award shall be given to the competitor who cleared the bar with the least number of trials.

In case of a tie in the pole vault the officials shall raise or lower the bar at their discretion, and those competitors who have tied shall be allowed one trial at each height.

RULE XIV.

*The Course.*

Each competitor shall keep in his respective position from start to finish in all races on straightaway tracks, and in all races on tracks with one or more turns he shall not cross to the inner edge of the track except when he is at least six feet in advance of his nearest competitor. After turning the last corner into the straight in any race, each competitor must keep a straight course to the finish line, and not cross, either to the outside or the inside, in front of any of his opponents.

In all races, at any distance under and including 220 yards, each competitor shall have a separate course, properly roped, staked and measured, whether the race be run on a straight path or around one or more curves.

The Referee shall disqualify from that event any competitor who wilfully pushes against, impedes, crosses the course of, or in any way interferes with another competitor.

The Referee shall disqualify from further participation in the games any contestant competing to lose, to coach, or to in any way impede the chances of another competitor either in a trial or final contest.

RULE XV.

*The Finish*

shall be represented by a line between two finishing posts, drawn across and at right angles to the sides of the track, and four feet above which line shall be placed a tape attached at either end to the finishing posts. A finish shall be counted when any part of the winner's body, except his hands or arms, shall touch the tape at the finish line.

The tape is to be considered the finishing line for the winner, but the order of finishing across the track line shall determine the position of the other competitors.

RULE XVI.

*Track Measurement*

All distances run or walked shall be measured upon a line eighteen inches outward from the inner edge of the track, except that in races on straightaway tracks the distance shall be measured in a direct line from the starting mark to the finishing line.

RULE XVII.

*Hurdles.*

In the 120 yards hurdle race, ten hurdles may be used; each hurdle to be three feet six inches high. They shall be placed ten yards apart, with the first hurdle fifteen yards distant from the starting point, and the last hurdle fifteen yards before the finishing line. In the 220 yards hurdle race ten hurdles shall be used, each hurdle to be two feet six inches high. They shall be placed twenty yards apart, with the first hurdle twenty yards distant from the starting mark, and the last hurdle twenty yards before the finishing line.

No record shall be made in a hurdle race unless each of the hurdles, at the time the competitor jumps the same, is standing, and is not knocked down by such competitor.

RULE XVIII.

*Jumping.*

Sec. 1. A fair jump shall be one that is made without the assistance of weights, diving, somersaults or handsprings of any kind.

*The Running High Jump.*

Sec. 2. The Field Judges shall decide the height at which the jump shall commence, and shall regulate the succeeding elevations.

Each competitor shall be allowed three trial jumps at each height, and if on the third trial he shall fail, he shall be declared out of the competition.

At each successive height each competitor shall take one trial in his proper turn; then those failing, if any, shall have their second trial jump in a like order, after which those having failed twice shall make their third trial jump.

The jump shall be made over a bar resting on pins projecting not more than three inches from the uprights, and when this bar is removed from its place it shall be counted as a trial jump.

Running under the bar in making an attempt to jump shall be counted as a "balk," and three successive "balks" shall be counted as a trial jump.

The distance of the run before the jump shall be unlimited.

A competitor may decline to jump at any height in his turn, and by so doing, forfeit his right to jump again at the height declined.

*The Running Broad Jump.*

Sec. 3. When jumped on earth a joist five inches wide shall be sunk flush with it. The outer edge of this joist shall be called the scratch line, and the measurement of all jumps shall be made from it at right angles to the nearest break in the ground made by any part of the person of the competitor.

In front of the scratch line the ground shall be removed to the depth of three and the width of twelve inches outward.

A foul jump shall be one where the competitor in jumping off the scratch line makes a mark on the ground immediately in front of it, or runs over the line without jumping, and shall count as a trial jump without result.

Each competitor shall have three trial jumps, and in championship events the best three shall each have three more trial jumps.

The competition shall be decided by the best of all the trial jumps of the competitors.

The distance of the run before the scratch line shall be unlimited.

*The Pole Vault.*

Sec. 4. The height of the bar at starting and at each successive elevation shall be determined by the officials.

Three trials allowed at each height. Each competitor shall make an attempt in the order in which his name appears on the programme, then those who have failed shall have a second trial in regular order, and those failing on this trial shall take their final trial.

Displacing the bar counts as a try.

A line shall be drawn fifteen feet in front of the bar and parallel with it; crossing this line in an attempt shall be a balk. Two balks constitute a try.

Leaving the ground in an attempt shall constitute a try.

A competitor may omit his trials at any height, but if he fails at the next height he shall not be allowed to go back and try the height he omitted.

The poles shall have no assisting devices, except that they may be wound or wrapped with any substance for the purpose of affording a firmer grasp, and may have one spike at the lower end. No competitor shall, during his vault, raise the hand which was uppermost when he left the ground to a higher point

on the pole, nor shall he raise the hand which was undermost when he left the ground to any point on the pole above the other hand.

Poles shall be furnished by the club giving the games, but contestants may use their private poles if they so desire, and no contestant shall be allowed to use any of these private poles except by the consent of their owners. The poles shall be unlimited as to size and weight.

Any competitor shall be allowed to dig a hole not more than one foot in diameter at the take-off in which to plant his pole.

In case of a tie the officials shall raise or lower the bar at their discretion, and those competitors who have tied shall be allowed one trial at each height.

The rule governing the "Running Broad Jump" shall also govern the "Pole Vault" for distance, except that when the man leaves the ground in an attempt, it shall be counted a trial.

RULE XIX.

*The Shot.*

The shot shall be a solid sphere, made of metal, and weighing at least sixteen pounds.

The shot shall be "put" with one hand, and in making the attempt it shall be above and not behind the shoulder.

The competitor shall stand in a circle seven feet in diameter, and it shall be divided into two halves by a line drawn through the centre. In the middle of the circumference of the front half shall be placed a stop-board four feet long, four inches high, and firmly fastened to the ground. In making his put, the feet of the competitor may rest against, but not on top of this board.

A fair put shall be one in which no part of the person of the competitor touches the top of the stop-board, the circle, or the ground outside the circle, and the competitor leaves the circle by its rear half, which

shall be the half directly opposite the stop-board. A put shall be foul if any part of the person of the competitor touch the ground outside the front half of the circle before the put is measured.

The measurement of each put shall be from the nearest mark made by the fall of the shot to the circumference of the circle on a line from the mark made by the shot to the centre of the circle.

Foul puts and letting go the shot in making an attempt shall be counted as trial puts without result.

The order of competing and number of trials shall be the same as for the "Running Broad Jump." Shots shall be furnished by the Games Committee. Any contestant may use his private shot, if correct in weight and shape; in which case the other contestants must also be allowed to use it if they wish.

RULE XX.

*Throwing the Hammer.*

The head and handle may be of any size, shape and material, provided that the length of the complete implement shall not be more than four feet and its weight not less than sixteen pounds.

The competitors may assume any position he chooses, and use either one or both hands.

All throws shall be made from a circle seven feet in diameter.

A fair throw shall be one when no part of the person of the competitor shall touch outside the circle in making the attempt.

A throw shall be counted foul if the competitor steps over the front half of the circle before his throw is measured.

Foul throws and letting go of the hammer in an attempt shall count as trial throws.

The measurement of each throw shall be from the nearest mark by the fall of the head of the hammer to the inside circumference of the circle, on a line from the mark to the centre of the circle.

The number of trials and methods of decision shall be the same as in the "Running Broad Jump."

Hammers shall be furnished by the Games Committee. Any contestant may use his private hammer, if correct in weight and length; in which case the other contestants must be allowed to use it if they wish.

RULE XXI.

*Throwing the Discus.*

The discus shall be of smooth, hardwood body without finger-holes, weighted in the centre with lead discs and capped with polished brass discs, with steel ring on the outside. The weight of the discus shall be four and one-half (4½) pounds; outside diameter, eight (8) inches; thickness in centre, two (2) inches.

All throws shall be made from a seven (7) foot circle, with four-foot stop-board, similar in all respects to the circle for putting the shot.

From the centre of this circle a straight line shall be drawn in the direction in which the competitors are to throw. At an angle of forty-five degrees on either side of this line shall be drawn side lines. To constitute a valid throw the discus must first strike the ground in the space between side lines.

In making his throws a competitor may assume any position he chooses. Foul throws and letting go the discus in attempts shall count as trials without result. A fair throw shall be one in which no part of the person of the competitor touches the ground outside the front half of the circle and the competitor leaves the circle by its rear half. A throw shall be foul if any part of the person touches the ground outside the front half of the circle before the throw is measured.

In making his throw the competitor may assume any position he pleases, and the rules governing a "fair throw" shall be the same as for the hammer.

A discus shall be furnished by the Games Committee. Any competitor may use his private discus if

it conforms to the rule, in which case other contestants shall be allowed to use it if they wish.

The measurements of each throw shall be made from the nearest mark made by the fall of the discus to the inside circumference of the circle on a line from the mark made by the discus to the centre of the circle.

### RULE XXII.

### *Relay Races.*

1. A line shall be drawn twenty feet in front of each starting line. Between these two lines each runner must touch the succeeding runner. Failure to do this shall disqualify the team in that event. There shall be judges of relay racing whose duties it shall be to see that all touches are properly made.

2. The same rules with reference to fouling, coaching or impeding a runner in any manner, apply to relay racing as to other running events.

3. No member of a relay team, in order to relieve his team mate, can run back of the line. No man can run two relays in any one team.

4. Only those are allowed to run in the final of a relay race who have competed in the trial heats.

5. The positions of the team must be drawn for.

6. In all relay races an announcement must be made as to what distance each man is to run in his relay. Any man failing to run the distance required shall cause his team to be disqualified. And the failing of any one man to run his full relay shall cause the team to be disqualified.

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