ECLECTIC EDUCATION SERIES

Guide to Health

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THE

ECLECTIC PHYSIOLOGY

OR

GUIDE TO HEALTH

With Special Reference to the Nature of Alcoholic Drinks and Narcotics and their Effects upon the Human System

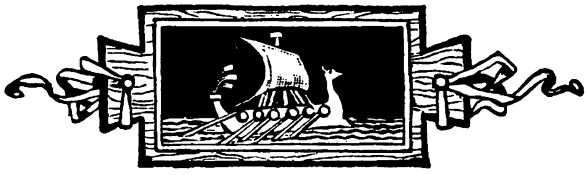

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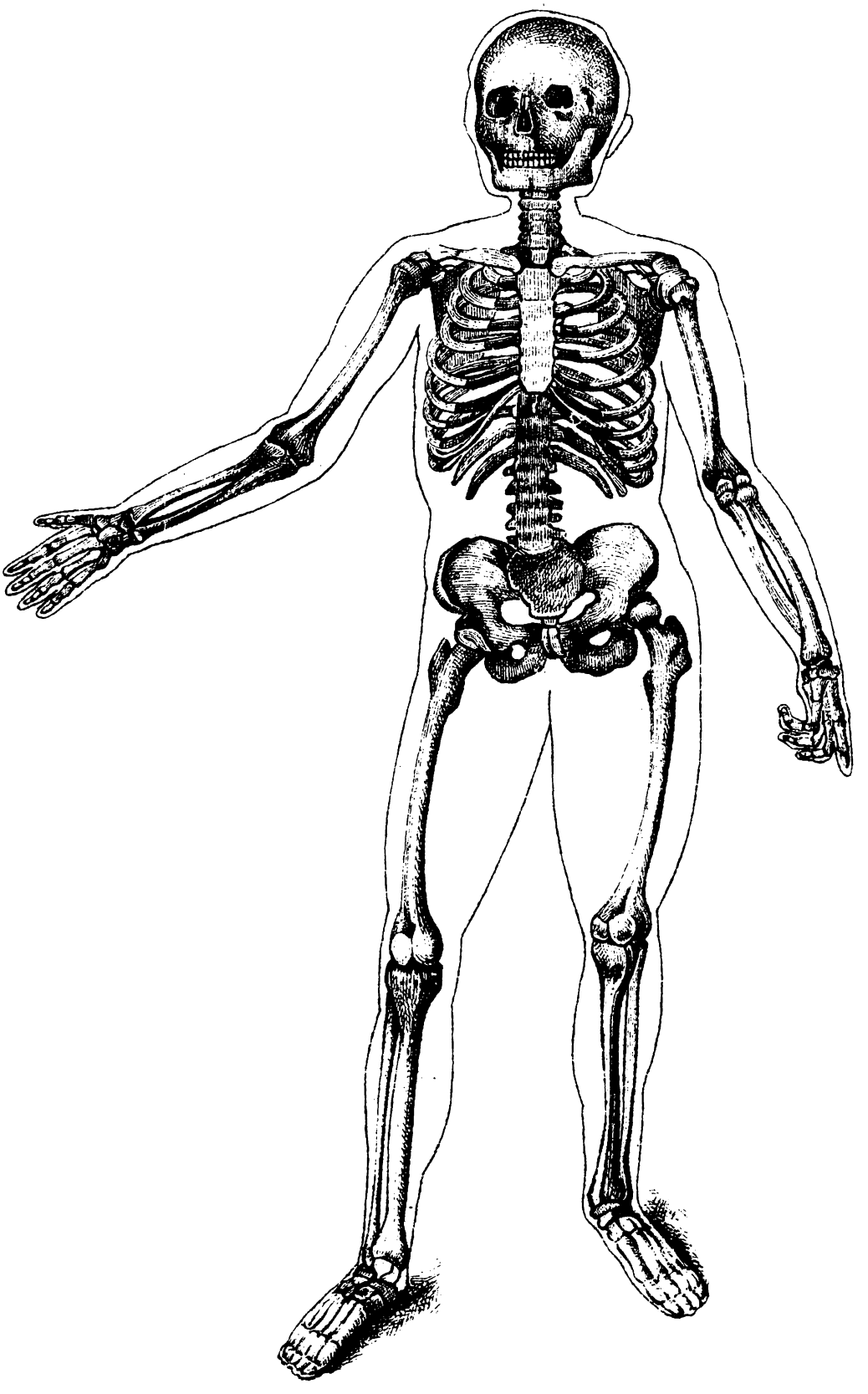
Plate I.



BONES.

PREFACE.

LEGISLATION, largely due to the earnest work of the Woman's Christian Temperance Union, is now in force throughout most of the states of the Union, requiring that all the pupils in the public school shall be taught the laws of health with particular reference to the effects of alcoholic drinks and other narcotics upon the human system. Since the laws state that all the pupils must receive instruction in this subject, it follows that the younger pupils who can not yet read a text-book must be taught orally, and that the more advanced pupils must have a simple text-book treating of those matters which directly affect the health of the body, without any attempt to explain the reasons dependent upon the laws of physics, chemistry, and biology; the higher grades must have a book which, while conforming to the intent of the law in making instruction as to the harmful effects of alcoholic drinks and narcotics the direct aim of instruction, shall also give a knowledge of the elements of physiology and hygiene.

The succession of topics adopted is such as long experience has determined is the best. The simplest parts are studied first; the most complex portions are considered last. The succession of topics is based on a plain order of dependence. Each subject is presented methodically. Simple topical outlines are annexed to the chapters to guide the pupils and teacher in systematic study and recitation.

PHYSIOLOGY.

CHAPTER I.

INTRODUCTORY.

Article 1. Kinds of bodies.—The separate things we know about us are called bodies. By noticing these bodies we may see that there are two kinds: (1) bodies that do not live, (2) bodies that do live. The stones, the soil, the water, the air, pieces of iron, and such things, do not live and do not grow; while the trees, the grass, the corn, the birds, the flies, the people, and such things, do live and grow.

2. Contrast of non-living and living things.—Non-living bodies are formed and become larger by the addition of substance to the outside. Living things grow by taking food into themselves, which food they change so that, finally, it becomes a part of them.[1]*

Non-living bodies are not inclined to change, but usually endure for a long time in the same condition. Living bodies originate from parent bodies, they live and grow for

*These numerals throughout the book refer to the corresponding notes at the end of the chapter.

a short time, and then die. No living thing can exist long as an individual. If we examine a non-living body we shall find that all of its parts are much alike. For instance, the pieces of a stone are of the same kind, and are like the whole stone. The parts of a living thing are often very different. The roots of plants are not like the leaves. The bones of animals are not like the flesh.

3. **Organs.**—The parts of a living thing are for different uses in the life and growth of the body. The roots of the plant absorb food from the soil. The leaves take food from the air, and change the food till it is prepared to become a part of the plant. The bones of animals support the body, the lean flesh moves the body, the eyes aid in seeing, the ears give hearing, and many other parts perform other uses.

The different parts of a living body which perform the many kinds of work in the body are called *organs*. Thus the mouth is the organ for chewing, the heart is the organ for sending the blood through the body, the eye is the organ of sight, the lungs are the organs for breathing.

4. **Plants and Animals.** — Living things are of two kinds: (1) plants, and (2) animals. Plants take their food from the air and water; they have roots for the soil and leaves for the air and sunshine. Animals must have food that has been prepared for them by plants. Thus the horses and sheep feed on grass, the bees on the sweets of flowers, and men eat grains and fruits.

A plant can not feel and is fixed to the soil by roots. Animals feel, they move freely, and show by their actions that they are intelligent. The lowest kinds of animals have very little feeling, and show scarcely any intelligence; they are much like plants. The higher animals are quick to move, acute in feeling, strong in action, and possess much intelligence. Man is the most highly developed animal.[2]

5. **Human Body.**—The human body is the only erect animal body. The average adult male Caucasian is five

feet eight and one half inches in height. The weight is one hundred and fifty pounds. The circumference of the chest is thirty-six inches.

6. Systems of Organs.—The body is extremely complex in the systems of organs that operate in it.[3]

The chief systems of organs are as follows: (1) The bones, (2) the muscles, (3) the digestive apparatus, (4) the circulatory system, (5) the respiratory organs, and (6) the nervous system.

The bones support, the muscles move, the digestive apparatus changes the food, the circulatory system distributes the blood, the respiratory organs perform breathing, and the nervous system enables us to feel and to control the whole body.

7. Parts.—The parts of the body are quite simple. They are as follows: (1) the head and neck, (2) the trunk, (3) extremities. The head consists of two parts,—the face and skull. The trunk consists of two parts,—the upper portion, called the chest, and the lower part, called the abdomen. The extremities are known as the upper and lower.

8. Self-study.—In the study of the human body, we should bear in mind that we are learning about our own body. We need to examine it, and to find in it illustrations of what we learn. We can feel our own bones, muscles, joints, and skin. We can feel our own heart beat. We can observe our own breathing. Our own nerves tell us what feeling is. We know what hunger is. We know what health and sickness are.

9. Why study Physiology?—We study the human body so that we may learn how to take care of it. Good health is one of the choicest blessings. It is hoped that the pupil will learn such lessons about the uses and care of his body that he may avoid disease, and make of his body a fit abiding place for the soul.

NOTES.

1. Structure of Stones.—The stones do not grow. They are formed. We may think of a tiny grain of stone, and, as matter of the same kind adheres to it on the outside, the grain becomes larger. Or the reverse may be true. A very large stone may wear away by the action of air, water, or other substance, and finally, by losing bits of itself, it becomes a tiny pebble or grains of sand. We can not tell how old the stones are. Many of the quartz pebbles that we step upon may have been formed in the early stages of the earth's development.

2. Plants and Animals.—Many plants move upon being touched. Many of them move as freely as do some of the lowest animals. Some plants feed, in part, at least, on animal food. The "Venus Flytrap," and the "Sun Dew," are the most remarkable of the sensitive plants. Many of the lowest animals are like plants. They are fixed to a base, and do not move from place to place. Their parts resemble leaves and flowers. They have but little feeling, and show no intelligence.

3. Cells.—Microscopic examination shows that every portion of the body is made up of minute sack-like forms, called cells. These cells are held together by various kinds of substance placed between the cells. The cells are the living, growing parts of the body.

The cells are composed of an outer membrane and the contents of the membrane. The contents are usually fluid. The body grows by the increase in the number and size of the cells.

The cells are formed into tissues. Thus, we have bony tissue, in which there is lime deposited among the cells, and cartilaginous tissue, in which there is elastic matter between the cells.

The various tissues are as follows:

1. Bony tissue, which is hard.
2. Muscular tissue, which has the property of contraction.
3. Connective tissue, which is tough.
4. Cartilaginous tissue, which is elastic.
5. Adipose tissue, which is fatty.
6. Nervous tissue, which is sensitive.

SUGGESTIVE QUESTIONS.

What is a body? What are non-living bodies? What are living bodies? What are organs? What are some of the organs of a

plant? What are some of the organs of an animal? How do plants differ from animals? What are the dimensions of the average white man? What systems of organs are there in the human body? What are bones for? What are muscles for? What are the parts of the body? What use may the pupil make of his own body in the study of physiology? Why should we study physiology? Of what value is good health?

Topical Outline.

- Bodies.
  - Definition.
  - Kinds.
    - Non-living.
      - Formed by addition to outside.
      - Not disposed to change.
      - All parts alike.
      - Have no organs.
    - Living.
      - Grow by taking food inside.
      - Originate from parent bodies.
      - Have a season of life.
      - Die.
      - The parts are unlike.
      - Have organs.
  - Kinds of Living Bodies.
    - Plants.
      - Food, from air and water.
      - Have roots and leaves.
      - Fixed by roots.
      - No feeling.
      - No intelligence.
    - Animals.
      - Food taken from plants.
      - Have no roots or leaves.
      - Move.
      - Feel.
      - Intelligent.
- The Human Body.
  - Position.
  - Height.
  - Weight.
  - Circumference.
- Systems of Organs.
  - Bones.
  - Muscles.
  - Digestive.
  - Circulatory.
  - Respiratory.
  - Nervous.
- Parts.
  - Head.
    - Skull.
    - Face.
  - Trunk.
    - Chest.
    - Abdomen.
  - Extremities.
    - Upper.
      - Right.
      - Left.
    - Lower.
      - Right.
      - Left.
- Self-study.
- Purposes of the study of Physiology.

CHAPTER II.

THE OSSEOUS SYSTEM.

10. By pressing on the arm, we find the outer parts are soft and the deeper portions are hard. These hard portions are the bones. They form the frame-work known as the skeleton.[1]

11. Uses of the Skeleton.—The skeleton gives: (1) general shape and permanency of form to the body; (2) by the aid of the fleshy portions that are attached to the bones, the skeleton supports the body in any desired position; (3) the skeleton, by the aid of these soft parts, enables us to move and extend the limbs, as in walking and in reaching out the arms; (4) the skeleton protects many of the more delicate organs by furnishing bony cavities for their safe lodgment. For instance, the unyielding skull shields the brain, the cage formed by the ribs incloses the lungs and heart, and deep sockets protect the eyes.

12. The number of bones that unite to form the skeleton is somewhat variable: anatomists usually recognize 206, besides the teeth.[2] The bones are divided into four great groups: (1) the bones of the head; (2) the bones of the trunk; (3) the bones of the upper extremities; (4) the bones of the lower extremities.

13. The bones of the head are divided into the bones of the skull and the bones of the face. The bones of the skull are eight in number. They are broad and curved, so that when joined at their edges they form the walls of an oval cavity. This cavity contains the brain. Their edges interlock in strong, irregular seams called sutures, which hold the bones firmly together. A thin packing of cartilage is placed in the sutures. This cartilage has two uses: (1) it permits very slight motion in the suture; (2) it renders the shock from blows less severe to the brain, and the skull less liable to fracture.[3]

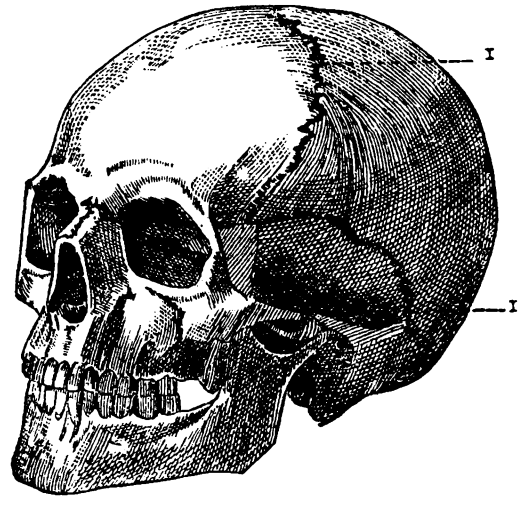


Fig. 1.

THE SKULL.—1. Sutures.

There are fourteen bones of the face. They are firmly fastened upon the front and lower portions of the skull. They are rigidly united with one another, excepting the lower jaw, which is free to move in opening and closing the mouth. These bones are extremely irregular in shape. They form the sockets of the eyes, the bridge of the nose, the prominence of the cheeks, the roof of the mouth, and the jaws.

There is a U-shaped bone at the base of the tongue, called the hyoid bone, that aids in moving the throat in swallowing and in speaking.

14. The bones of the trunk are divided into: (1) the bones of the spinal column; (2) the bones of the chest; (3) the bones of the pelvis. The spinal column, or "back bone," extends from the head along the back, and supports the upper part of the body on the pelvis. This column is formed of twenty-four pieces, called vertebræ. These vertebræ are placed one upon another, with layers of car-

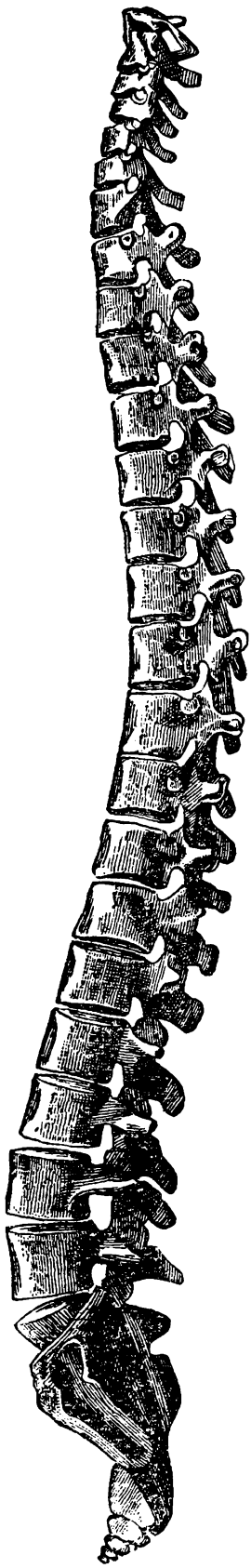


Fig. 2.
THE SPINAL COLUMN.

tilage between. This cartilage allows each vertebra to move a little.[4] The combined motion of the vertebræ enables the spinal column to bend readily in any direction. The column is exceedingly strong. An opening extends lengthwise through the center of this column, for holding the spinal cord.

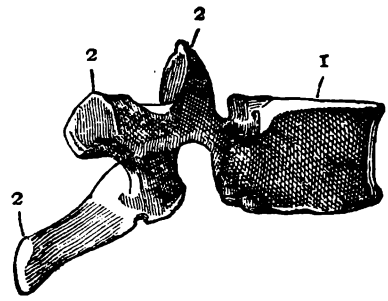


Fig. 3.
VERTEBRA, Side View.—1. Body. 2. Processes.

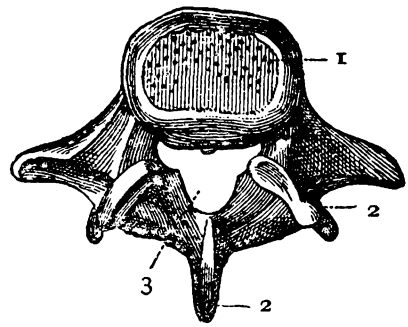


Fig. 4.
VERTEBRA, Top View.—1. Body. 2. Processes. 3. Opening for Spinal Cord.

Each vertebra is broad in front. This broad part sustains the pressure of the column. On the sides and back portion, there are many irregular processes, by which the vertebra attaches to the various parts that surround it.[5]

15. The bones of the chest form a conical, bony cage. The bones that form the chest are a portion of the spinal column behind, the sternum or "breast bone" in front, and the ribs at the side. The sternum is a flat bone, to which the cartilages of the ribs join in front. In a young person, the sternum is composed of three parts, but in later life these parts join firmly into one bone.

16. The ribs are twenty-four in number, twelve on each side. They are long and curved to form the walls of the chest. They are all fastened firmly to the vertebræ behind. In front, the seven upper, called the true ribs, are joined by cartilages to the sternum. The next three are united by cartilages to the true ribs. The lowest two have no front attachment. By this arrangement, the chest is more yielding in its lower portion than in the upper region.

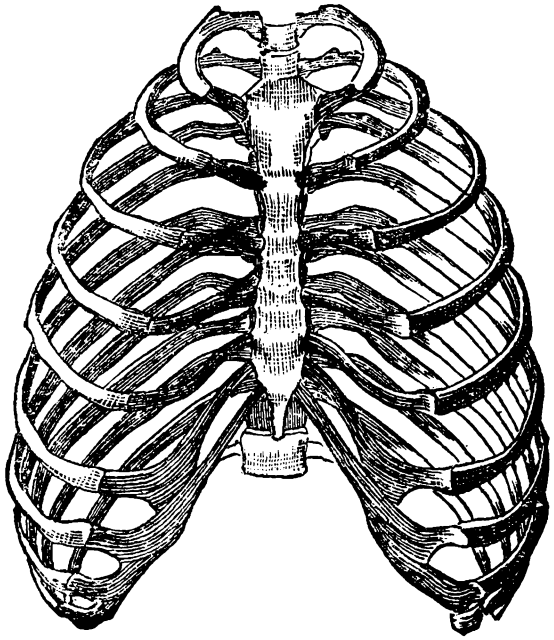


Fig. 5.
THE CHEST.

17. The pelvis is composed of large bones, that form a stout, basin-like frame. This frame bears the weight of the parts above, and supports the trunk upon the lower extremities.

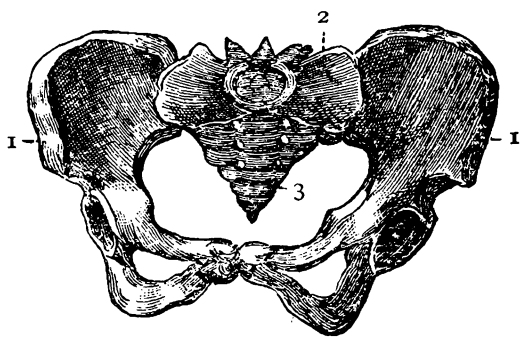


Fig. 6.
THE PELVIS.—1. Hip Bones. 2. Sacrum. 3. Coccyx.

18. The Bones of the Upper Extremities. — The clavicle, or "collar bone," is braced against the sternum in front, and the scapula, or "shoulder-blade," is placed on the back. These two bones unite to form the prominence of the shoulder and a shallow socket in which the head of the humerus is held. This makes the shoulder-joint. The humerus is the long bone of the arm. The ulna, the inner bone of the fore-arm, joins with the humerus to form the elbow. The radius is placed by the side of the ulna, in the

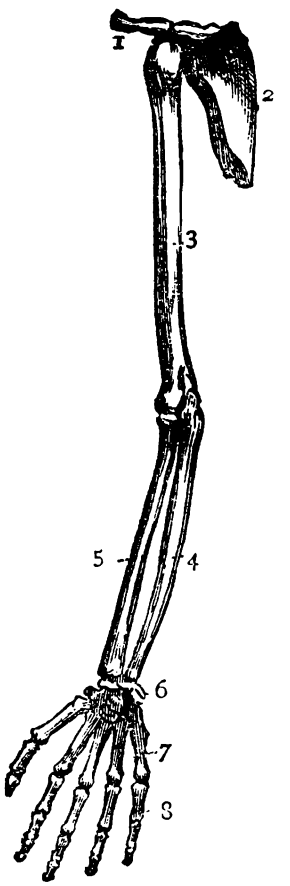


Fig. 7.

UPPER EXTREMITY.—1. Clavicle. 2. Scapula. 3. Humerus. 4. Ulna. 5. Radius. 6. Carpus. 7. Metacarpal. 8. Phalanges.

fore-arm. These two bones twist about each other in turning the hand over.[6] At the wrist there are eight pebble-shaped carpal bones, so united as to give great freedom of motion to the hand. The five metacarpal bones form the palm of the hand, and the fourteen phalanges form the fingers and thumb.

19. The bones of the lower extremities join the sides of the pelvis by the insertion of the head of the femur, or "thigh bone," in a deep socket of the pelvis. This forms the hip joint. The femur joins at the knee with the tibia, or "shin bone," of the leg. The patella, or "knee-pan," fits into the hollow of the knee in front. The tibia and fibula are placed side by side in the leg. At the ankle, these two unite with the seven tarsal bones to form the ankle joint. The tarsal and five metatarsal bones form the arch of the instep, and the phalanges form the toes.

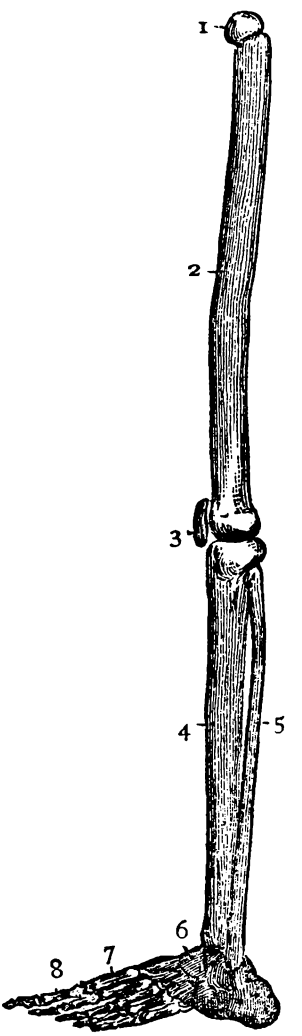


Fig. 8.

LOWER EXTREMITY. — 1. Head of Femur. 2. Femur. 3. Patella. 4. Tibia. 5. Fibula. 6. Tarsus. 7. Metatarsus. 8. Phalanges.

20. The Composition of the Bones.—The bones are composed of two kinds of matter: (1) a jelly-like substance, known as the animal matter, and (2) a hard substance, known as the mineral part. The bones of very

young persons contain much animal matter, and the bones of old persons consist largely of the mineral substance. It is by the combination of these two kinds of matter that the bones possess their great strength. The mineral part makes them hard, and the animal portion preserves their toughness and elasticity.[7] By burning a bone, the animal part is driven off by the heat, and the mineral portion is left in the form of a white, brittle body, resembling chalk. By placing a fresh bone in weak acid for a few hours, the mineral part will be dissolved, and the animal part will remain. The animal part thus left will have the shape and size of the original bone, but will be so soft that it may be tied in a knot.

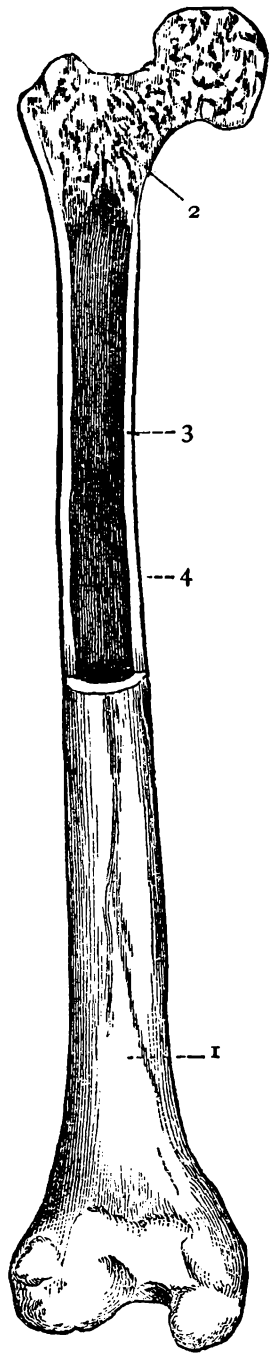


Fig. 9.

SECTION OF FEMUR.—1. External view. 2. Cellular portion at end. 3. Hollow in middle. 4. Thick shell of middle.

21. The Structure of the Bones.—The long bones are so formed that they are hollow cylinders. This shape gives them great strength without the use of much matter, and makes them sufficiently large without their being heavy. The outer part is a dense, hard shell, but toward the center the matter becomes more porous, and the middle is a hollow, filled with a fatty substance, called marrow. The ends are large, to render the joints strong. The outer shell of the end is thin, and the whole inner portion of the end is composed of numerous tiny cavities, separated by thin, bony partitions. These cavities are filled with fluid. By this means, the ends, though large, are not so heavy as if they were solid bone. Between the ends, the

shell of the bone is much thicker, so that these smaller parts may be strong also.

The bones are covered with a tough membrane, called the periosteum. This membrane protects and nourishes them. This tough cover, together with the many prominences and roughnesses on the bones, gives attachment to the soft parts (muscles) that move the bones.

22. Minute Structure of the Bones.—The bones are filled with myriads of tiny chambers, passages and cells. These openings permit nourishment to pass through the bones. See figures 10 and 11.

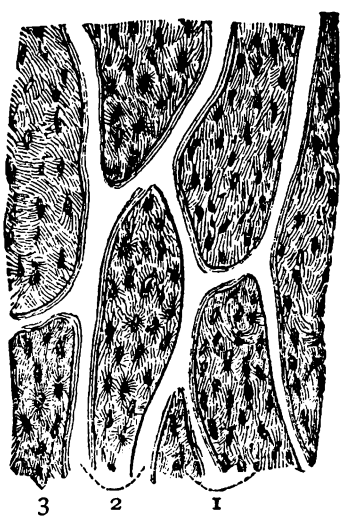


Fig. 10.

LONGITUDINAL SECTION OF BONE (microscopic).—1. Cells. 2. Canals. 3. Intercellular Substance.

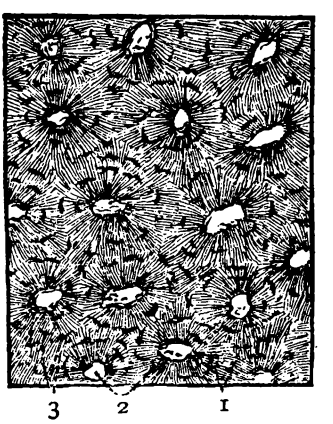


Fig. 11.

CROSS-SECTION OF BONE (microscopic).—1. Cells. 2. Canals. 3. Intercellular Substance.

23. Joints.—The union of two or more bones is a joint. A joint may be formed for the purpose of binding the bones together firmly, as in the case of the sutures of the skull, or a joint may be for the free movement of the parts, as with the joints of the fingers; such unions as the latter are called movable joints. Movable joints are classified into: (1) hinge-joints, such as the elbows and knees; (2) ball and socket joints, as in the case of the shoulder and hip joints; (3) compound joints, like the wrists; and (4)

pivot-joints, such as the rotation of the radius about the ulna, in the fore-arm.

In movable joints, the ends of the bones do not touch each other. The ends of the bones are covered with a

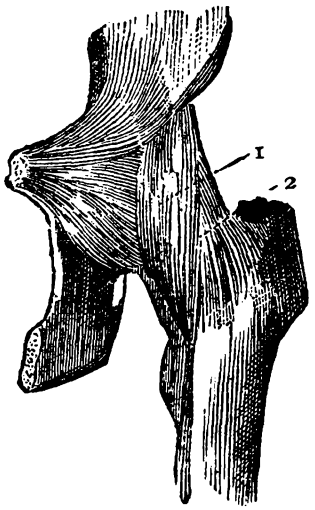


Fig. 12.

HIP JOINT.—1 and 2. Capsular Ligament.

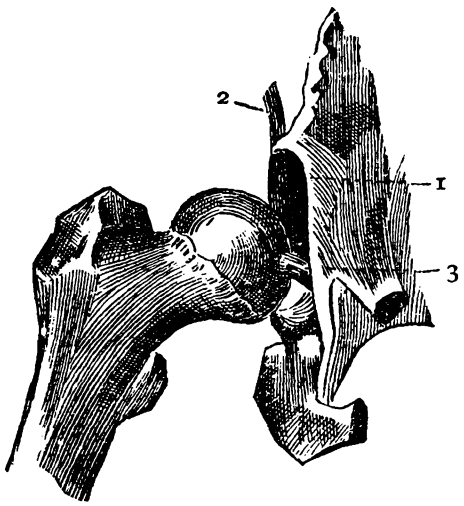


Fig. 13.

HIP JOINT, with Capsular Ligament cut away.—1. Margin of Socket. 2. Portion of Capsular Ligament. 3. Round Ligament.

layer of cartilage, which prevents the jar and wear that would occur if the ends of the bones rubbed together. The cartilage on each bone is covered with an exceedingly smooth membrane, called the synovial membrane. This membrane lines the whole inner surface of the joint. This membrane secretes a fluid between the surfaces that rub together, so that the joint moves with the greatest possible ease and smoothness.

The great strength of a joint is due to the enlarged ends of the bones, and to the ligaments that bind the bones together.[8] These ligaments are formed of dense, inelastic, fibrous tissue. They are fastened from bone to bone, over the joint, so as to inclose the two ends of bone in one band, or capsule. Besides this capsular ligament that surrounds the joint, other short ligaments, within the joint,

fasten the ends of bone together. So strong are the joints that the limbs, in breaking, will usually break elsewhere than at the joint.

24. Injury to the Joints.—The joints are often injured by violent twist or pressure. If the joint is so violently bent as to tear or damage its ligaments, the injury is called a sprain. A sprain produces great pain, and often requires a long time for recovery. The ligaments are slow to mend. The joint is usually weak for a long time afterwards.

When one end of a bone slips from its proper place in the joint, it is said to be dislocated, or "out of joint." Such an injury is most likely to occur to the round head of the humerus, in the shallow socket of the shoulder. To return the bone to its place, requires skillful stretching of the joint, and pressure upon the dislocated bone. Dislocation weakens a joint, so that the same misfortune is likely to re-occur with a joint once injured in this manner.

25. Growth of Bones.—The young bones are soft, and are composed in some cases of cartilage and in others of fibrous tissue. These soft bones have the proper shape and size. They become hardened by the deposit of mineral matter within them, until they are rigid bones. During life, the bones, like all other parts, are constantly undergoing change of structure. The old material is being removed, and new matter is taking its place.

26. A broken bone is repaired in the same manner in which the bone grows. At first, a watery fluid is poured out about the broken ends; this fluid thickens day by day, until it is jelly-like and fibrous in composition. This matter hardens by the deposit of mineral matter, so that by the end of about six weeks the broken parts are quite firmly reunited. The union is frail, however, for several months. Finally the place of fracture becomes firm, and is even more strong, in some cases, than are the other parts of the bone. In order that the repair of the broken bones

may proceed properly, they need to be held in position by stiff bandages. It is necessary, too, that the broken limb be kept quiet.[9]

27. Hygiene of the Bones.—The healthfulness of the bones is affected by the food.[10] If children are fed on diet that is deficient in bone-making substances, the bones do not become rigid and firm. Exercise strengthens the bones by causing more blood to flow to them, and by forming the necessary deposit of matter in them for their growth. Great care needs to be taken not to deform the bones in early life by pressure and improper position. Injury is especially liable to occur to the bones of the chest by tight dressing, and to the spinal column by sitting or standing in stooped position. Habits and shapes acquired in this way in early life are scarcely to be remedied when the person grows older.

Broken bones and injured joints require patient care, and deserve the attention of a skillful physician.

Special Caution concerning Alcoholic Liquors and Narcotics.—In our study of Physiology and Hygiene we need to learn how to take good care of the body so that it may grow to be well-formed and of full size. There are very many ways in which we may injure the body and prevent its natural development. The growing frame-work is especially liable to injury. We may deform it by improper pressure and bad position. We may stunt the growth of the body by poor food and overwork. We may also stunt its growth by the use of such injurious substances as tobacco and alcoholic liquors. These substances are such powerful poisons that they injure every part of the body, especially the blood and nerves, and hinder the natural growth.

Young persons are easily injured by chewing or smoking tobacco, and by drinking beer, wine, and whisky. To use tobacco in any form, or to drink alcoholic liquors,

can not aid a boy in becoming a man. On the contrary, these substances so injure the digestive organs, the blood, and the nervous system as to prevent the boy from growing naturally, and from becoming a strong and healthy man.

While these substances are poisonous and injurious, it is true that the person who uses them may become so accustomed to their effects that he does not know how much they are hurting him. Sooner or later, however, he will find out how evil they are, and it may then be too late to remedy their bad effects. Young people need pure water and milk instead of wine, cider, and beer, and they need good food instead of tobacco.

As was stated before, the habits that are fixed in youth are difficult to correct in later years. The appetite for tobacco and alcoholic drinks usually grows stronger with advancing life, so that the man who has formed such habits continues to be a slave to them, however expensive and hurtful he may find them to be.

Let us remember that it is the bony frame-work that gives size and shape to the body, and let us be careful not to interfere with the growth of this frame-work. Proper food and healthful exercise can do more than any thing else to promote our growth, while tobacco and all kinds of intoxicating liquors are to be shunned as evil, and only evil, to us.

NOTES.

1. **Skeletons of Animals.**—There are two plans of skeleton among animals: (1) In the higher animals, the frame-work is internal, with the muscles arranged about it, the whole covered with a soft, pliable skin, as illustrated in all vertebrates, such as mammals, birds, reptiles, and fishes. Their skeletons are much like the human skeleton. (2) The animals below the vertebrates have the skeleton, or hard frame-work of the body, on the outside. Such is the case