HEALTH AND HAPPINESS

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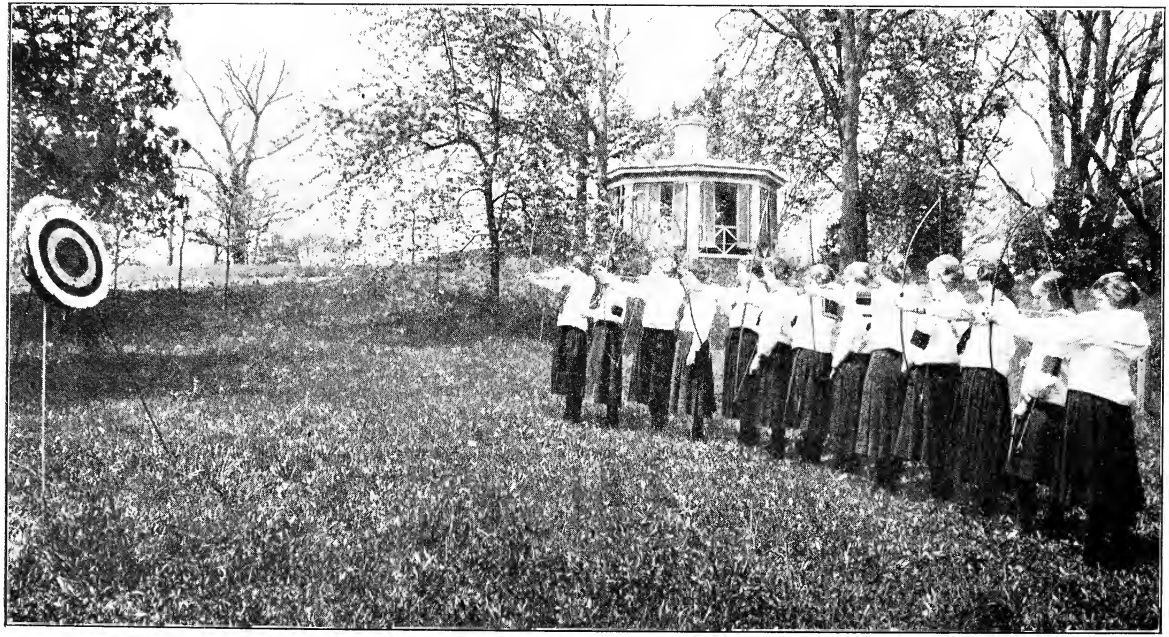

Archery Class at Georgetown Visitation Convent.

HEALTH AND HAPPINESS

An Elementary Text Book of Personal Hygiene and Physiology Based on Catholic Principles

BY THE REVEREND

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PREFACE

There have been many text-books written on the interesting subject of hygiene, but most of them emphasize so strongly the acquirement of health as the chief aim of life, without which happiness is impossible, that they tend to make the youthful readers too material, and to cause them to lose sight of the much more weighty spiritual interests of mankind. This book was written to try to indicate the close interweaving of science and religion, and to show how an unbiased study of the former naturally trains the mind in the knowledge and love of our First and Last End.

Acknowledgments are due to the encouragement and coöperation of a number of friends, and especially to the kindness of the Reverend John A. Brosnan, S. J., Professor of Biology at Woodstock College, without whose tireless industry many of the pictures in the book would not have been possible.

F. J. D.

Not in the world of light alone,
Where God has built His blazing Throne,
Nor yet alone on earth below
With belted seas that come and go,
And endless isles of sunlit green,
Is all thy Maker's glory seen—
Look in upon thy wondrous frame,
Eternal Wisdom still the same.

OLIVER WENDELL HOLMES.

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INTRODUCTION

1. Man is called a microcosm, from two Greek words, meaning a "little world," since he combines in himself the elements of all the rest of creation. His soul, in so far as it is spiritual, partakes of the nature of the angels. His body shares in all the elements which go to make up the three great kingdoms of this visible universe; namely, the mineral, the vegetable and the animal kingdoms.

2. Like the minerals, all human beings are subject to the laws of time and space; they are affected by heat and cold; they are influenced by gravity and the forces of attraction and repulsion. Thus, in ever so many ways, men show their kinship with the earth, from the soil of which God formed the first man, Adam, and on which man dwells for a time, while he prepares himself, by a loyal service of his Creator, for his true home in heaven. Like the members of the vegetable kingdom, the body of man develops cell by cell, grad-

ually enlarging in size until full growth is reached. While he lives on earth, a building-up, as well as a breaking-down process is always going on, just as in plants and flowers.

3. Like the animals, man eats, drinks, sleeps and wakes. He has similar faculties of taste, touch, sight, hearing and smell, though many of the lower animals have senses which are much more acute than those of man. His whole organic structure, however, is very much the same; so much so indeed, that this fact has led many people, who are educated only in a one-sided way, to conclude that man is an animal and nothing more. In the last century, this view was made public by an English scientist of prominence, named Charles Darwin, so that this very unworthy opinion of man is called "The Darwinian Theory." According to its followers, man is simply a highly developed animal, more so than the dog, cat or horse, or any of our domestic animals. Many of these misnamed scientists say that man's remote ancestor was a monkey, and this was the view adopted by Darwin. But some of the modern ones now hold that man has descended from a lizard, others say it was a scallop, others a jellyfish. In fact, there is no limit to the absurdities into which people fall when they once reject the safe guidance of the

infallible Church of Christ, which teaches that man is created by God with a definite purpose and a definite work to do; and if man is only faithful and obedient here on earth, he will be rewarded by his Creator with everlasting happiness in heaven.

4. Dr. Thomas Dwight, who was an anatomist of the first rank, as well as a splendid Catholic, used to begin the course of lectures which he gave at a certain medical school every year, with this sentence: "Man is a creature composed of body and soul," which you will remember from the first page of your catechism. But then he added: "With the soul we have nothing to do here, as our work lies altogether with the body"; and in the myriad wonders of the latter some of his hearers became so interested that they forgot the existence of the former.

5. We shall try to avoid their mistake, but must bear it in mind; since the human body is a very absorbing subject, and its marvellous construction and its wonderful mechanism, even though we shall penetrate their mysteries but very slightly, are so enticing, that unless we are on our guard, we may forget what our Catholic Religion tells us about the close association of the soul with the body, and that the body must never be allowed to do anything which will bring damage to the soul

or stain its whiteness with sin. It is also helpful to remember that the soul is so dependent upon the body here in this life that the condition of one affects the other, and that frequently a weak and unpleasant character is the result of an undeveloped and badly trained body. Dr. Charles Eliot, until recently the President of Harvard University, once said: "To attain success and length of service in any of the learned professions, a vigorous body is well-nigh essential. A busy lawyer, editor, minister, physician or teacher, has need of greater physical endurance than a farmer, trader, manufacturer or mechanic. All professional biography teaches that to attain lasting distinction in sedentary indoor occupations which tax the brain and the nervous system, extraordinary toughness of body must accompany the extraordinary mental powers."

6. Most men who have been forces that really counted in shaping the history of the world, were as strong in body as in mind. Napoleon was called a "man of iron," and his favorite saying was that "The first requisite of good generalship is good health." George Washington, the Father of our Country, was a man of wonderful strength and endurance, and we read that he never thought of asking his soldiers to stand the privations and

hardships which he himself bore without complaint.

7. Of Garcia Moreno, the gallant President of Ecuador, was written: "Nature had given him all the eminent qualities that formed the man of action. Tall and upright, with a robust constitution, everything revealed a man of untiring energy. In troublous times, he was on horseback from morning till night, and his iron constitution resisted all fatigue."

8. Gladstone was the Prime Minister of England at the age of eighty-four, when most men are unable to do very arduous work. His biographer writes of him: "He had enormous driving power and physical energy. His famed habits of felling trees and taking extremely long walks are pointed out as causes of his rare staying power and surpassing accomplishments."

9. These are but a few of many examples that might be cited to show that the leaders among men and women have been, generally speaking, those whose health of body equalled that of the intellect. You see, therefore, how necessary it is to foster and preserve your bodies in order to do your share of work in this world and help to spread the kingdom of God.

10. It is quite necessary to know the right way

to set about a work of such importance, and therefore we shall try to learn some of the simpler and more important facts connected with the teaching of bodily health, and to explain some easy methods of keeping well and strong.

11. This book, however, deals with bodily, not with spiritual hygiene, so that it is not to be expected that any formal treatment of the development of the soul will be included within these pages. Although every Christian knows whether more care should be given to the soul or the body, stress is here laid on the fact that neither should be neglected.

12. In the case of the younger readers, the technical terminology of the book may well be omitted; but some knowledge of physiology is absolutely essential to proper instruction in the subject of hygiene.

HEALTH AND HAPPINESS

CHAPTER I

THE SKELETON

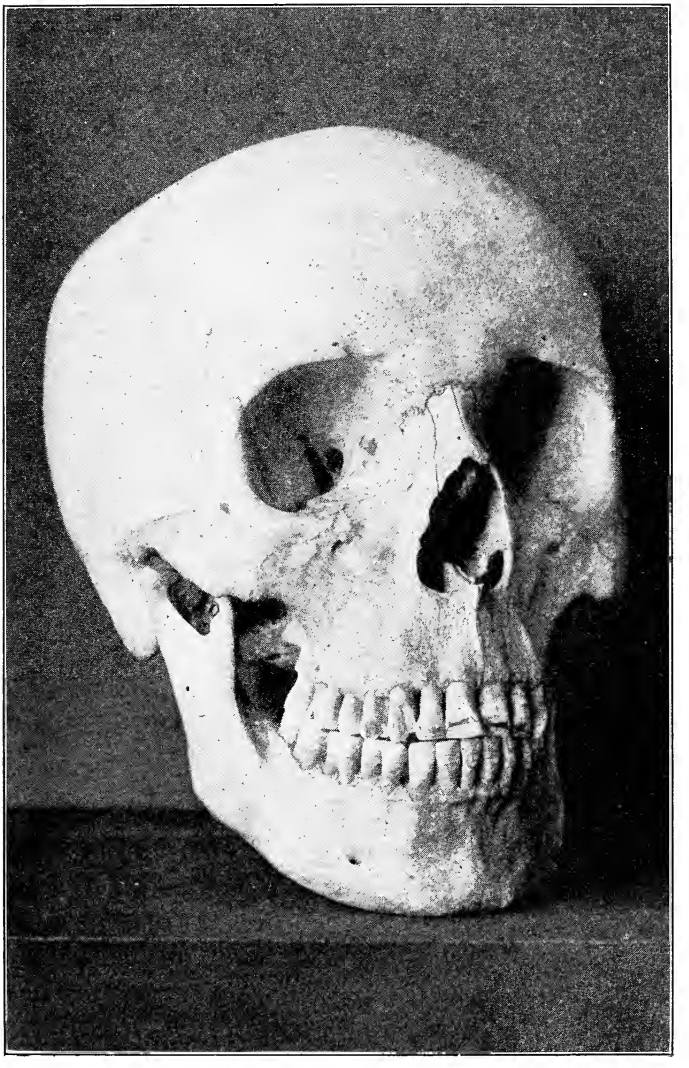
"Knowest thou the nature of the human frame,
That world of wonders, more than we can name?
Say, has thy busy, curious eye surveyed
The proofs of infinite wisdom here displayed?"

1. Biology is the name of the science which discusses living things; in botany, we learn about flowers and plants; in zoology, we study the animals; and in anatomy and physiology, we try to find out the various parts of the body and the functions of these parts. The *function* of any one of the bodily organs means the particular part it plays in maintaining the life of the organism. After we have obtained some idea of our bodies and the working of the parts of which they are made up, we shall endeavor to discover what are the things we ought to know in order to keep our

bodies in a constant state of good health; and this is what is meant by the science of Hygiene.

2. Man is called a rational or reasoning *animal,* an animal because his body is like the body of a brute animal in many respects, but *rational,* because he has something very important which the brute animals have not; namely, a mind, and therefore is able to reason and judge, and to use his free will, which makes man the king of all the rest of creation. God made all other things for man's use, and made man for His honor and glory; and man wins his eternal reward by employing his body, his mind and his will, and all other creatures, in serving and praising God. It is necessary to bear this in mind, since, if we do not know how to use our bodies, we shall not be putting them to the use God intended when He gave them to us.

3. There are three main divisions of man's body; the head, the trunk and the extremities. The bony part of the head is called the skull, and is composed of twenty-two bones, fourteen of which are in the face. There are three little bones in each inner ear. The lower jaw is the most interesting of the face bones, because it is separated from all the rest, and moves up and down and sideways in the actions of talking and eating; whereas



A Human Skull.

the upper jaw is firmly fixed to the top of the skull, and has no distinct movements. Attached to the two jaw bones are the teeth, of which the number in an adult is thirty-two, sixteen in each jaw. The four front teeth of the upper and lower jaws are called the incisors, and are sharp for the purpose of cutting and dividing the food as it enters the mouth. Next to these are the canines or cuspids, one on each side of both jaws; beside each of these four teeth are two bicuspids, or eight altogether. Behind them are three molars on each side, six in each jaw. The last are the grinders, and they reduce the food to the fine condition in which it may be safely swallowed. In the child there are only twenty teeth, of which the first to appear are the incisors, usually the upper ones, which cut through the gum when the baby is about one year old. The teeth require *daily* attention, and should be cared for by a dentist at least once a year.

4. The bones of the skull are generally broad and flat, as also are the ribs and the breastbone. Look at the picture of the skeleton, and notice the different shapes of the bones to suit particular purposes of the various parts of the body. Some people are frightened at the sight of a skeleton, but if they had no bones under their flesh, they could not walk or move. Besides, the skeleton

protects and guards from injury the brain and spinal cord, the heart and lungs, and other organs necessary to life, which we shall study later.

5. All the four-footed animals, called quadrupeds, the birds and the fishes, are like man in having a long backbone, which is called the spinal column. This is not one bone, but is made up of a number of small bones, called vertebræ, and it is on this account that man and all animals that have this backbone are named vertebrates. As you see in the picture, there is a big hole in each vertebra, through which runs the spinal cord, and this cord connects with the brain through a hole in the bottom of the skull.

6. In the old mythology of the Greeks, the earth was supposed to be held in space by a giant whose name was Atlas; and so the top vertebra, on which the skull rests, is called the atlas. The second one is named the axis, because it is on this one that the head and the atlas rotate. The spinal column is divided into several parts, according to the location in the body. The upper part is called the cervical part; since it is in the neck. Between the shoulders is the dorsal part; below that is the lumbar, and underneath is the sacral. All the vertebræ are strongly bound together by ligaments, which are composed of thick fibrous tissue;

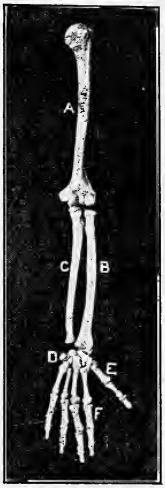
and by this means they are able to move on each other. If the spine were one bone only, we should not be able to bend our backs, and should have great difficulty in walking and moving about.

7. The back of the chest is formed by the dorsal part of the spine, and is composed of twelve vertebræ, to which the ribs are joined. In front, seven ribs are joined to the breastbone, and these are called true ribs. The lower five ribs are called false ribs, because they are not directly connected to the breastbone, but each to the one above it, by ligaments.

8. The shoulder is formed by the collar-bone in front, and the shoulder-blade behind. The collar-bones are the nearest to the surface of the body, and therefore are often broken in games, such as football, unless they are protected by thick pads.

9. Between the head and the chest there is a small bone, shaped like the letter U, which can be felt on each side of the throat, and to which the tongue is attached. There are thirty bones in each extremity. From shoulder to elbow is one bone; from elbow to wrist, two bones; the wrist has eight; and the hand, including the fingers, nineteen. On account of the number and location of the bones in the hand, it is capable of almost unlimited motions. Just think of the movements

made in playing the piano or any other musical instrument. The hand has been called, "the only machine truly godlike." There is no piece of apparatus made by the most skilful mechanic that can in any way perform the actions of even the smallest hand which has been designed by God.



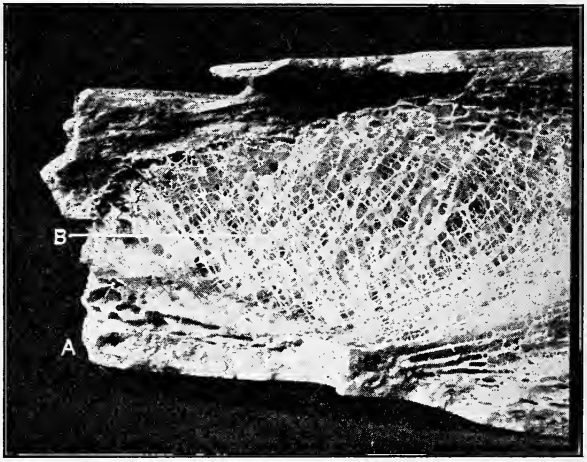
ARM BONES.

A, Humerus; *B*, Radius; *C*, Ulnar; *D*, Wrist Bones; *E*, Thumd; *F*, Fingers.

10. The thigh is one bone, and is the largest in the body. From the knee to the ankle are two bones, the ankle and foot have twenty-six bones. There is also a round bone in front between the thigh and the leg, which is the knee-cap. The ligament in which this bone is sheathed is stretched when we genuflect. The hip bones are very irregular in shape, and were called nameless by the old anatomists. They are joined together in front by a very strong ligament, but in the back they are separated by the sacrum. Enclosed between the hip bones is a cavity called the pelvis, which contains the lowest part of the abdominal organs.

THE STRUCTURE OF THE BONES

11. We are so accustomed to see dead bones, which are dull white in appearance, that we are apt to forget that within the living body the bones are filled with blood vessels and nerves. If we cut a dead bone open we find the center is hollow, but



PORTION OF LONG BONE NEAR ITS HEAD.
A, Compact Bone; *B*, Cancellous Bone.

in life this is filled with marrow, which is a source of nourishment when the body is deprived of other food. The hardness of the bone comes from mineral substances, principally phosphate of lime. We can burn out the animal matter and leave the mineral matter, so that the bone becomes brittle and porous, but it keeps its shape. If, however,

we put the bone in acid for some time, the mineral matter is dissolved out, and the remaining animal matter can be tied in a knot. When bones break easily, as in the case of old people, it shows that they have too much mineral matter. Children's bones, on the contrary, have an abundant supply of animal matter, and, therefore, bend more easily than they break. In the condition of rickets, which is a disease occurring in poorly nourished children, there is so small an amount of mineral matter in the bones that they are soft and yield to the least pressure, with the result that deformities occur.

12. During one's younger years, the bones are assuming the shape which they will bear all through life, and, therefore, it is wise to avoid all habits of attitude or attire which will tend to cause interference with the appearance of the body which the great Designer had in mind when He planned the best shape for man. Consequently, we should not sit or stand with the shoulders bent forward or the back curved. We should try to keep the spine straight, and not act as if it were made of rubber. We should keep the knees stiff when standing; otherwise a slouching attitude is acquired. The body should be free in every part, and all clothing which binds the waist or chest is to be avoided. The most abused member of the

body is the foot. We wonder at some of the Oriental nations, on account of the manner in which they destroy the shape of the foot by binding it up; and yet many supposedly fully civilized people in this country treat their feet in a worse fashion, by wearing shoes that are too short or too tight. This causes corns on the toes, bunions at the joints and ingrowing nails. The heel of the shoe should be broad and low and under the heel of the foot. The sole should be broader and longer than the foot itself. A national campaign should be started against the modern high heels of women's shoes, which are responsible for many of the physical ills which women endure. In the selection of your footwear let nature rather than fashion be your guide, and you will save yourself much pain and trouble later in life.

THE JOINTS

13. A joint is any region of the skeleton where motion is possible. There are three kinds of joints in the body; *viz.,* ball-and-socket, hinge and irregular.

14. The hinge joint permits motion in one direction only, as in the elbow. The ball-and-socket joint allows motion in all directions, forward, backward and rotary, as in the shoulder. The irregular joint is one in which the end of one bone

is received into the small groove of another, or of others, as in the wrist.

15. Between the ends of the bones there are pads of cartilage which serve as cushions, and these are bathed in a fluid, which prevents friction. The joints of all other machines require constant greasing by the mechanician. But the wonderful Mechanic, who fashioned ours, made them in such a way that they furnish their own grease by this fluid, whenever it is needed. Joints may become enlarged and stiffened from injury or disease, and then they are very painful.

16. Holding the ends of the bones together are strong bands of tissue, called ligaments. A dislocation occurs when the ends of bones are forced apart at the joint. Usually this causes some tearing of the ligaments also, and a pouring out of the fluid into the surrounding tissues.

17. Contortionists are people who are able to bend their joints in almost any manner. They have acquired this facility by stretching the ligaments gradually, while they were young. Many foolish young people, however, injure themselves permanently by trying to imitate their performances.

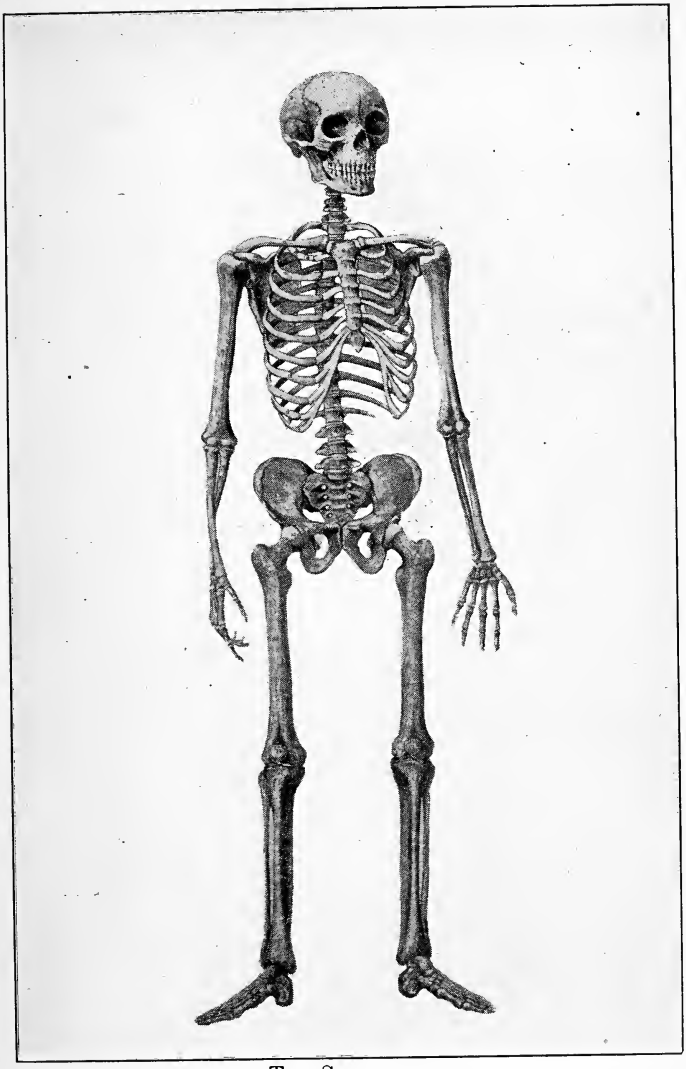
18. A sprain means the twisting or tearing of the ligaments in the region of a joint, without any dislocation of the bones.

19. A fracture is a break of a bone; the most common ones are of the collar-bone, the wrist or the ankle. Those who play baseball frequently break some of the bones of the hand.

THE BONES OF THE BODY

20. Number of bones in the skeleton..... 206

Head 28	Skull	8
	Face	14
	Ears (3 in each)	6
Trunk 52	Neck (to which tongue is attached)	1
	Spine	26
	Ribs	24
	Breastbone	1
Shoulders 4	Shoulder-blades (Scapula)	2
	Collar-bones (Clavicle)	2
Upper Extremities 60	Upper arm—each one	2
	Forearm—each two	4
	Wrist—each eight	16
	Hand—each five	10
	Fingers—each fourteen	28
Lower Extremities 60	Thigh—each one	2
	Leg—each two	4
	Knee-cap—each one	2
	Ankle—each seven	14
	Foot—each five	10
	Toes—each fourteen	28
Hips 2	Hips—each one	2
		206



The Skeleton.

(The thigh is the part of the body from the hip to the knee. The leg extends from the knee to the ankle. Each hip is really composed of three bones, but as they are firmly welded together, they are counted as one.)

QUESTIONS

1. Define biology, botany, zoology, anatomy, physiology.
   What is meant by the "function" of an organ?
   What is Hygiene?
2. Why is man called a "rational animal"?
   How is man to win an eternal reward?
3. What are the main divisions of the body?
   How many bones are in the head? In the ear?
   What is peculiar about the lower jaw?
   How many teeth are there in the mouth of an adult?
   What are the incisors? the molars? the cuspids? the bicuspids?
4. What is the shape of the bones?
   Of what importance is the bony part of the body?
5. What is the name of the backbone?
   Of what is it composed?
   What name is given to animals with a backbone? Why?
6. Name the top bone of the backbone, and why is it so called?
   What is the second bone? Why so called?
   Of what advantage is it to have the spinal column made up of a number of bones? What is that number?
   Name the various parts of the spinal column.
7. What forms the chest?
   How are true ribs distinguished from false ribs?
8. What forms the shoulder?
   Which shoulder bone is often broken and why?
9. How many bones are in the arm? the hand? the fingers?
10. Where is the thigh? How many bones has it? Compare its size to other bones in the body.

How many bones are in the leg?
What bone moves when we genuflect?
Describe the hip bones.

11. Of what is bone made?
What does it signify when bones break easily?
12. Why should we be careful of the position of the body during our younger years?
What have you to say about shoes?
13. What is a joint?
How many kinds of joints are there?
14. Describe the various kinds of joints.
15. Of what use is cartilage? Where is it found?
16. What is a ligament? a dislocation?
17. What is to be said about contortionists?
18. What is a sprain?
19. What is a fracture?
20. What is the number of bones in the head, trunk, extremities, hips?

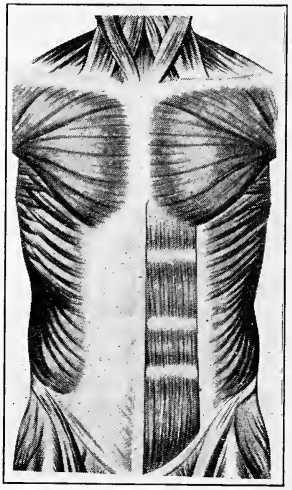
Chapter II

THE MUSCLES

1. The bony framework serves to give shape and firmness of outline to the body, and to protect the vital organs from injury. We have learned that motion occurs at the joints, where bones are hinged together by ligaments. But if we had nothing more than bones and ligaments, we could not move; and so God provided muscles, which cover the bones and are attached to them. There are over five hundred muscles in the body. Every kind of movement that we make is due to them, as well as our erect posture, which is one of the things that separate us from the brute beasts.

2. Look at the picture and you will see that muscles are of all shapes. Some are flat, like the ones which cover the back. Some are very short, as those attached to the fingers. Some are round and fat, others are long and thin. The longest muscle we have is the sartorius, or tailor muscle, in the thigh, which is about two feet long. The shortest is in the ear, and is called the stapedius.

3. The diaphragm is a broad muscle which runs right through the body from front to back, and is attached to the lowest ribs. It thus divides the trunk into two cavities. The upper one is the chest; the lower is called the abdomen. We know that the chest is enclosed by bones. But the abdomen is not, in order that we may bend our bodies. Besides, if there were a bony cage around that part, we should feel very uncomfortable after meals.



Muscles of the Trunk.

4. The body has been compared to a ship. The bones are like the masts and the spars, and the muscles are like the sails and ropes. It has also been compared to a machine, in which the bones and joints are like the columns and pulleys, and the muscles take the place of the belts and springs and cords.

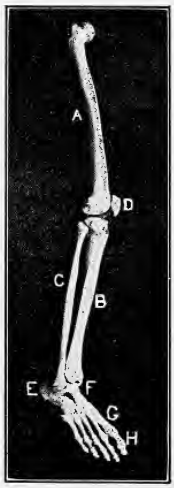
5. You have not, perhaps, realized that the meat you eat at table is nothing but some portion of the muscular system of an animal, and is called

beef or pork or mutton, according to the kind of animal from which it has come. (Only a cannibal eats human flesh.) The same muscles which help the animal to move and work serve as food for us, after it is killed. But is it right to kill animals so that we may eat? Yes, indeed; that is one of the wise purposes which God had in view when He made the animals. He made them for our help and needs.

6. Foolish people who refuse to admit the existence of God and of our souls, and who say that the life in us is the same life as the animals and the plants have, would refrain from eating, if they were consistent, unless they admit the wrong principle that "might makes right." The fact is that the muscles of most of the animals are much bigger than ours, and the animals themselves very much stronger; so that unless we had an intelligence which God placed as a faculty in the human soul we should never be able to force them to serve our needs and obey our commands.

7. In general, there are two kinds of muscles, voluntary and involuntary. The first kind are those we know best, and are on the outside of the body. These act when we desire them to act, though on account of the habit we have acquired, we do not need to think directly of them at the

time. For instance, when you walk, you rest your weight on one leg, and the muscles of the other thigh shorten and lift the foot from the ground, carrying it forward until it rests on the ground in advance of the other. Then the muscles of the calf of the leg, which is behind, shorten and lift that heel from the ground, and the weight of the body is thrown forward on the foot ahead. Then the muscles of the backward thigh contract and lift the foot up, when it swings forward, just like a pendulum, till it again strikes the ground ahead of the other. Now you do not have to consider all these motions every time you start to walk; they follow your impulse without further deliberate intention, after you have once acquired the ability to walk.



LEG BONES.

A, Thigh (Femur); *B*, Tibia (Shinbone); *C*, Fibula; *D*, Patella (Kneecap); *E*, Heelbone; *F*, Anklebone; *G*, Instep; *H*, Toes.

8. We sometimes stand in wonder before a splendid statue of a horse rearing away back on his hind legs, and marvel at the skill of the sculptor who could make the charger rear so far, without letting him fall over back-

wards. It is really astonishing, and takes our breath away. Yet it is not nearly so wonderful as the act of walking. But we are so accustomed to this action that it fails to make any impression. To step forward, backward, to the right, to the left, to run, to hop, to jump, to dance, yet preserve our balance, and not even be mindful of the working of the various muscles called into action,—all this implies a power given by God to man, which immeasurably surpasses any changeless pose given to a statue by a sculptor.

9. There are other muscles over which you never acquire any control whatever, and these are called involuntary muscles. Examples of these are the heart and the muscles which assist in the digestion of food. Your heart begins to beat long before you are capable of thinking about it; it works all through the night while you are asleep; and no matter how much you might desire, you could never stop its steady beating. In the same way, after you have once swallowed your food, it is acted upon and moved along by the involuntary muscles, without any necessity of your bothering about it in the least. We can exist without using the voluntary muscles, but if the involuntary ones stopped working, we could not live; and on this account our Father in heaven arranged to have

them do their work under His wise direction without troubling us with the care of them. It gives us some idea of the magnificent providence of God to remember that the operations of the body, on which our life depends, are due to His constant and loving assistance, and not to us.

10. The muscles constitute forty-one per cent of the entire weight of the body; and in them is found one-quarter of all the blood. In the old Roman Empire, magistrates used to be preceded, when they went about, by servants who bore on their shoulders bundles of rods called fasces. These rods indicated the power of the magistrates to punish any persons who failed to observe the law. Many of the early Christians were flogged with these rods when they refused to adore the pagan idols. Now if we should examine muscles under the microscope, we should find that they are made up of bundles of small fibres. On account of a fancied resemblance between them and the Roman sign of authority, these fibres are called fasciculi, or little fasces.

11. Most muscles end in a strong, tough, white band of tissue, called a tendon, by which the muscle is attached to the bone. You have all probably seen tendons on Thanksgiving Day in the drumstick of the family turkey. You can feel

them in your own wrists by closing your fists. The largest tendon in the body is the tendon of Achilles, which is the end of the calf muscle, and is inserted into the heel. When the calf shortens, the tendon is pulled up, and this lifts the heel. It got its name from a fabled Greek warrior, whose mother dipped him in the mythical river Styx. This was the stream supposed to flow between time and eternity, and it was said that any mortal who was dipped in its waters would be rendered proof against all wounds. The mother held her child by this tendon while she immersed his body, and thus her hand prevented the water from touching that part; and that was the very place where he received a wound which proved fatal to him. Of course it is only a fable, but it gave rise to the name. The names of most of the muscles and tendons are derived from Greek and Latin words, which are too long for us to try to remember.

12. Every boy, however, is familiar with the biceps muscle on the front of the upper arm, which is so called because it arises from two heads. The tendon of this muscle is inserted into the bones of the fore-arm, and when the muscle is shortened, it forces the tendon to lift these bones, and thus the elbow is bent.

13. The process by which the muscle is shortened is exceedingly interesting. When we look at a piece of meat, we notice that the flesh is firm and solid, but the muscle in the living body is not solid. Most of its substance is semi-fluid, and is held in its position by innumerable tiny strands of delicate tissue. All muscles are supplied with nerves, and when the message travels along the nerve from the brain (where we form the wish to make some movement), it causes the muscle to contract, or in other words, to shorten and thicken.

SOME ARM MUSCLES.
A, Triceps; *B*, Biceps; *C*, Tendons (cords); *D*, Ligament.

14. But also, apart from the contraction, which is due to the nerves, there is an elastic power in the muscles themselves. This extraordinary power is called its irritability, and by means of it the muscle may contract even when the nerve is severed. After death occurs, the muscles become rigid and opaque, due to the fact that the semi-fluid part solidifies; and this condition of the corpse is known as *rigor mortis*.

QUESTIONS

1. Of what use are the bones? the muscles?
2. Of what shape are the muscles?
   Which is the longest muscle, and why is it so named?
   Which is the shortest muscle, and why is it so called?
3. Where is the diaphragm? How does it divide the trunk?
4. Compare the body to (*a*) a ship; (*b*) a machine.
5. What is meat? Who eats human flesh?
   Why is it right to kill animals for food?
6. Why should those who deny the existence of God refrain from eating?
7. How, in general, are muscles divided?
   Describe the voluntary part of walking.
8. Compare the act of walking with an equestrian statue.
9. What are the involuntary muscles? Which are the more important, the voluntary or the involuntary? Why?
10. How much of the body is muscular?
    How much blood is found in the muscles?
    What are the fasciculi?
11. Describe a tendon. Where can tendons be felt?
    Why is the tendon of Achilles so called?
12. How do you bend your elbow?
13. Is a muscle solid? How does it shorten?
14. What is *rigor mortis?*

Chapter III

WHAT EXERCISE DOES

1. God always has some definite end in view when He makes anything. Otherwise He would not be the infinitely wise God He is. But the only way that anything may obtain its end is by doing the work planned for it by its Maker. Otherwise it becomes abnormal, which means unhealthy, and dwindles away further and further from its real goal till failure and ruin overtake it. This is true of the man who neglects the end for which he was placed on this earth, and uses the means, which were given to him by God to help him reach his end, for the sake of this world, or for his own pleasure. It is true also of each part of the body of man that it must do its allotted work in order to be healthy. Each part is living, and therefore it cannot remain idle and inactive, as if it were a part of a marble statue. Life implies action and motion; and consequently the brain must have images, the lungs must expand with fresh air, the stomach must digest food, and the muscles must have exercise, if they are to remain alive.

2. This law, which is universal, applies especially to young people. When full growth is reached, and the body has become strong, it can stand lack of care better than in the growing period. But even then, if a leg is broken and forced to remain still and bandaged up, after a little time it will be found to be a good deal smaller than its fellow. The same thing is seen in children who stay much in the house, and who play very little. They are pale and thin and look unhealthy, in comparison to those who spend a large amount of time in the open air, romping and running about.

3. The muscles are penetrated everywhere by blood vessels, and exercise helps the circulation in this way. When the muscle contracts, the fibres shut down on the veins so that the blood cannot flow forward. At the same time there are valves in the veins which prevent the backward flow; and as the heart is always pumping the blood onwards, the veins become swollen and distended. Now as soon as the muscle ceases to contract, the pent-up blood rushes on, just like a river breaking through a dam. When an action takes place which requires the use of many muscles in rapid succession, the whole circulation is affected. This makes the heart work faster in order to supply the blood

demanded by the exercising muscles. It makes the lungs work more quickly in order to supply the oxygen needed by the greater quantity of blood sent to them. For you must know that it is the oxygen in the blood which supplies the muscle with the energy needed for the work it performs.

4. Muscles are warmer when they are working than when they are quiet. This comes from the fact that the muscular contraction always causes the combustion, or burning up, of the food supply which is stored up in the semi-fluid part of the muscles. This is why a person looks and feels hot after any vigorous exercise.

5. Why do you suppose that a person gets out of breath from taking exercise, as playing base-ball, or football? Well, it is due to the fact that the tightening and loosening of the muscles during exercise force into the blood, which is flowing through them, a quantity of carbonic acid gas. This gas is formed in the process of the combustion of which we were just speaking, and would be a poison to the body, if it were allowed to remain. So the blood carries it as quickly as possible to the lungs, and they hasten to get rid of it by working as fast as they can. We shall see how they work later on.

6. Another interesting question is why we get

tired when we exercise, or use our muscles. The answer to this has been found in the physiological laboratory, where the muscles of an animal or a frog are studied. The muscle of a frog keeps its vitality for some time after it has been removed from the frog's body. So first it is dissected, then

Knocking a High Fly.

placed on a glass plate, and connected with a smoked paper by slender electric wires. When contractions occur in the muscle, the wires make marks on the paper, and in this way the slightest change is recorded and can be observed.

7. When an electric current is applied to such a dissected muscle, it is found that while the first

contractions show increased strength up to a certain point, after a while they begin to decrease, and gradually slow down until they stop altogether. When this happens, if such a muscle is washed with some blood (or with a salt solution, which is the equivalent of the blood), it regains its power of contraction almost at once.

8. It is also noticed that if the washings from the muscle which has lost its power to work are at once injected into a fresh muscle, this muscle also loses its ability to perform any work. This fact demonstrates that some poisonous things have been produced by the exercise; that is, that some change has occurred in the materials that were in the muscular tissue when it was at rest, and which were required in order that the muscle might work.

9. The muscle is like a machine which carries its own supply of fuel. The fuel of the muscle is a substance called glycogen, which is animal starch, and this gradually is changed to sugar. During exercise, this sugar is converted into other substances called lactic acid and carbon dioxide, which are poison for the body; and as more and more work is done, these two poisons are heaped up and hinder the muscular fibres from stirring as they should in response to the stimulation. The stim-

ulation continues, and the muscle is not able to respond; this causes the feeling which we call "fatigue." It is like the situation that would occur in an automobile which was forced to run while its engine was being choked with dust and dirt.

10. Work may be continued until death is the result, as when slaves were made to run long distances, or soldiers fought on for days without any periods of rest. Horses have dropped dead at the end of a day's hard journey; and carrier pigeons sometimes drop down to the earth during a flight. In all such cases, death is usually caused by the overpowering amount of poisons heaped up in the body, which are formed so quickly that the blood has not the time to get rid of them. This explains also why exercising merely one part for a long time causes the whole body to feel fatigued. It makes clear the danger of over-exercising, and that is an important thing to bear in mind. Exercise is very necessary, as has been said, to keep the muscles healthy and to help our growth, but it is prudent to use caution, and to exercise under direction, as otherwise much harm may be done.

11. The voluntary muscles are, for the most part, arranged in pairs, which have an antagonistic effect. Otherwise, when one muscle con-

tracted, and thus moved a bone at a joint, there would not be anything to straighten the joint out again. For instance, the biceps pulls up the fore-

Wide World Photos

A Close Race.

arm at the elbow when it shortens, but it cannot replace it in position. It has to be pulled back by another muscle, the action of which just opposes that of the biceps. After you have bent your arm,

put your other hand on the back of the upper arm while you make it straight again. You will feel a muscle tighten, which is called the triceps. It gets its name from the fact that it arises from three heads, just as the biceps arises from two. The triceps is inserted into the back of the arm bones, and so when it contracts, it pulls them together in a straight line. This is an example of what happens in all parts of the body, all the muscles acting always in the order given them by the Master-worker, whose knowledge is without measure.

12. After hard work or exercise, it is natural to feel tired, and one needs to take a rest. The harder the work, the longer is the rest required. The rest provides the opportunity for the blood to wash out the accumulation of poisonous materials from the tissues, and to replace them with the necessary oxygen and glycogen. Fatigue is therefore recovered from sooner in a room where there is a good supply of fresh air than in a stuffy place. Why?

13. A hot bath also usually helps to make one feel rested after laborious exercise, by increasing the circulation and thus removing the waste matters more quickly. Sometimes a quick cold shower may have the same good effect. It is also possible

to ward off fatigue to some extent by taking a cool shower before beginning to exercise.

14. After unusual exercise, especially if prolonged, one will find the muscles somewhat stiff and sore. In some cases, this feeling does not arise until some hours after the exercise is finished. But do not be dismayed by this nor prevented from ever again attempting that form of exercise. Far from being a bad sign, it is really an indication that the body is preparing for such work in the future, by increasing the strength of the muscles and storing up in them a greater amount of energy.

15. Thus all the various muscles work together and help each other, and all the blood vessels and nerves and the organs of the entire body coöperate with the most unremitting constancy and faithfulness to assist the muscles in their work of carrying out our will. If we reflect on this it will teach us that, in like manner, we should all work together too, and try to help each other, since we are all members of the mystical body of Christ, our Lord, and loyally and steadily strive with all our power for the accomplishment of the holy will of God, and for the establishment of the kingdom of His Divine Son here on earth.

QUESTIONS

1. What does life imply? Why must each part of the body have some exercise?
2. What happens to bodies, or parts of bodies, which have no exercise?
3. Why do the heart and lungs work harder when muscles are contracting?
4. Why do we get hot when exercising?
5. Why do we get out of breath?
6. Why do we feel tired?
7. What happens to a tired muscle when treated with salt solution?
8. How is it shown that exercise has produced a poison in the muscle?
9. What is the fuel of the muscle? What happens to the fuel during exercise?
10. How does death result from over-exercising? What caution should be used?
11. What is meant by saying that muscles are antagonistic? Give examples.
12. What is the best way to recover from fatigue?
13. How does a hot bath help?
14. Is stiffness or soreness a good sign, or a bad one? Why?
15. What may we learn from the mutual coöperation of the different parts of the body?

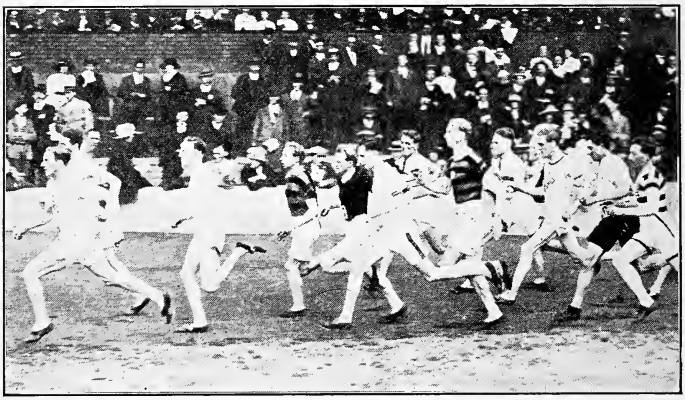
Chapter IV

HOW TO EXERCISE

1. In the matter of exercise, there are two extremes to be avoided; too little and too much. One is quite as bad as the other. But we have seen that some exercise is necessary, as otherwise the muscles cannot grow, and the whole body cannot remain healthy and strong. Exercise that is looked upon as a task or a hardship will not produce half the benefit as will the same exercise regarded as a game. It is like what happens in regard to eating. If a child sits down to dinner with a frown on his face, and grumbles at the lamb because he wanted beef, his food will not do him half the good received by his brother and sister, who ask God's blessing before they take their place at table, and remember thankfully that God has provided it for them out of His bountiful mercy.

2. In the same way, the boy who runs to the store on an errand for his mother with a merry whistle on his lips, will get the same, or even more

beneficial exercise, as if he ran a race at school amid the plaudits of his companions. For a girl, the same thing holds true. If she wears a cheerful smile, and looks upon her work as a privilege, when helping in her mother's household cares, she is doing at least the same amount of good for her body, and probably much more for her soul, than



Wide World Photos

A Marathon Race.

if she were skipping the rope or dancing. General housework, as it is called, furnishes the best kind of exercise, as it brings into action almost all the muscles of the body. Just contrast the appearance of the average housemaid, who really likes her place, with a shop-girl who stands behind a counter all day in a stuffy store. Boys who enter heartily into their share of the work

around the house, and are glad to be called upon when coal is needed from the bin, or wood has to be chopped, or apples or cherries are to be picked, are not only gaining strength by invigorating exercise, but are making themselves beloved by all at home, and also are piling up treasures in heaven.

3. We have said that oxygen is necessary for muscular energy, and therefore working in the fresh air is of much more benefit than working in air that is not fresh. Outdoor exercise brings better results than exercise taken in a gymnasium. When playing baseball one exercises a very large number of muscles—while throwing to home plate from left field, stooping to catch a grounder, jumping to reach a high fly or swinging the bat and knocking a home run. At the same time, the player is training himself in precision and coolness and obedience. If those who play ball will only avoid the use of improper language, and refuse to have anything to do with gambling, the game will do much to make them men in every sense of the word.

4. Swimming is another splendid form of exercise; moreover, it is an accomplishment that every boy and girl should possess. It is not hard to learn when one is young; once acquired the art is

never lost. Knowing how to swim may mean the saving of your life some day, or the life of some one else, which you prize dearer than your own. The breast stroke is the one most frequently used; it consists simply in lying on the front of the body in the water, bringing the hands together and then separating them as far as possible with a backward and downward motion; at the same time, the legs are drawn up to the body and then thrown back and away from it. The main point is to get accustomed to the feel of the water in the face, and not to become alarmed at a little splashing. Some never learn to swim, because they are afraid when a wave dashes some spray over their heads, even though they do not feel any fear when they fling the water all over themselves and the floor at their morning ablutions. Remember that the water will hold you up, if you just lie quietly on your back with your arms stretched out. Once you acquire confidence, the rest will be easy. However, do not be reckless. Do not jump into deep water before you have really learned the art, and never go in swimming alone. Do not stay in the water until you are chilled, and come out when you are tired. Otherwise you may get a cramp. A cramp means that a muscle has contracted and refuses to relax. Even if that should happen, do

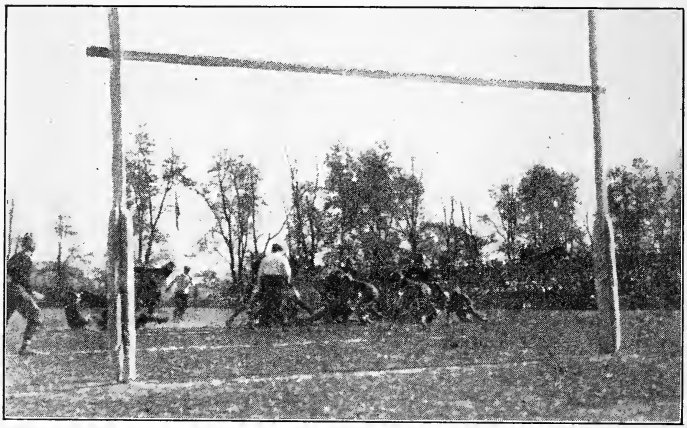
not get frightened. When it does occur, remember that you can still float on the back by simply keeping quiet; whereas if you lose your presence of mind and jump and toss about, you will only succeed in getting your head under the water. When you get ashore, rub the muscle until it relaxes.

5. Confidence and calmness, then, are two essentials for successful swimming. Almost equally, if not more important, is natural and deep breathing. Do not try to hold the breath. That would tire you very soon, and the lungs need to be supplied constantly with fresh air, which mainly supports your weight in the water. Lying out as flat as possible is also a great help in floating, as well as keeping the feet under, and the nose out of the water. If you have not yet learned to swim, take advantage of the very first opportunity to do so. After a swim, do not sit around in a wet suit, unless the day is very warm; use a rough towel and rub vigorously before dressing.

6. Wrestling is another good form of exercise, as also is boxing; the latter is a very useful accomplishment for a boy to have. While football provides vigorous exercise, it is rather too strenuous for little folks, and severe injuries are often received in that game.

7. In the winter, the cold snappy air causes one

to take some sort of exercise, consequently climates that have cold weather at some time during the year are generally much more healthful than those where the temperature never approaches the freezing point. The winter is a glorious season for such sports as skating, coasting, building



A Football Game.

snow-forts and having sham battles. Skating is another art everyone should strive to acquire; for, like swimming, once learned, it is never lost.

8. There is one reason or another why this game or that, or this form of exercise or that, fails to attract various people. It may be the season of the year, it may be the weather, it may be the place or the crowd. But there is one exercise which can

be relished by all, by old as well as young, at nearly all times, and in nearly all places. It combines in itself almost all the good points which are to be found in all other games. The number enjoying this exercise may be small or quite large, or the individual may indulge in it alone. It is the very first thing taught to the baby, and the oldest old lady never forgets it. Have you guessed it? Of course; it is walking. But to get real results, one must *walk*. A good, lively stride at a fairly rapid pace on a cool, bracing day is worth ever so much more than a mere stroll, or lazy saunter. It helps also to have some definite objective towards which you walk, rather than to walk nowhere in particular. The youth who gets up in the morning of a beautiful autumn day, takes a brisk walk to church, then back after Mass and Holy Communion, will have a much better appetite at table, as well as a much better start for the day, than one who is dragged from the pillow at the very last call for breakfast.

9. For walking, as for all other forms of exercise, the clothing must be loose and comfortable. Shoes in particular must be of the proper size; high heels and narrow toes, no matter how fashionable they may appear, are always to be avoided. It is a fact that serious internal injuries, as well

as interference with many muscles of the thigh and the leg and changes in the shape of the foot are often due directly to footgear which is absolutely ill-suited to the anatomy of the unfortunate foot, whose welfare is sacrificed to the vanity of the wearer.

10. Another important thing connected with the muscles is the poise or bearing of the body. It is evident, on a little observation, that a great many people do not know how to carry their own bodies. They do not stand, they do not sit, they do not walk correctly. The abdomen is allowed to sag forward, the shoulders are permitted to droop, the head hangs down on the chest, the knees are loosely bent, the chest is flat, the spine is curved or twisted. One, and sometimes all, of these deformities are not uncommon. It is a good thing to remember that your height may be affected by your habitual pose of body. Just look around you and observe how various people stand and sit, and then ask a candid friend how you hold yourself. As will be seen from the illustration, the face, the chest and the toes should be in a line when standing; the heels should be separated by the length of the foot, and the toes turned slightly outward. That same attitude should, as far as possible, be sustained while walking, swinging the arms at the

WHICH IS STANDING CORRECTLY?

sides, and taking an average stride. Naturally the girl will cultivate a shorter step than the boy, but it should not be a mincing gait. The former willowy glide has changed for the more athletic pace to the improvement in the health, as well as the appearance, of the gentler sex.

11. We live in an age of such a constant state of rush that we try to cover distances in the shortest space of time, and, consequently, jump on a car when we should walk, use the elevator when the climbing of stairs is just what we need, and generally we strive to avoid all unnecessary exertion. Climbing steps is only second best to climbing hills; and the trolley, and especially the automobile, are largely responsible for faulty attitudes and shiftless poses.

12. In order to develop the body equally on both sides, be on your guard against using right-handed movements only. A physician whose practice was very large, and who could ill afford any long period of idleness, got a bad wound in his right hand. He had always worked with it and his practice suffered considerably and his own health deteriorated from worry and inaction, before he had acquired any proficiency in using the left arm and hand. The same caution is, of course, needed

for those who are left-handed; this is something that they should immediately remedy.

13. As a supplement to activity in the open air, and when the state of the weather renders this inadvisable, some form of indoor gymnastic exercise may be undertaken with profit. But this should be done always under the direction of an instructor, who will prevent strain in the first bursts of enthusiasm, and make the training symmetrical. The question of an instructor is an important one. There are instructors who do not know the rudiments of gymnastics as well as their pupils. The daily drill, which is a matter of routine in many classes, is often a pathetic sight; it is worse than a waste of time. To be of any benefit, there must be a feeling of exhilaration during the calisthenics, combined with an intelligent realization of what the exercise is intended to produce. Attention must be paid to correct position and deep breathing, and real earnestness should be put into each movement.

14. Formal exercises are for the purpose of bringing into play the muscles which our ordinary actions do not employ. People whose occupations are of such a nature that they commonly make use of all their muscles do not need any other exercise than their work. But only professional acrobats

fulfil this condition. However, the main thing is not the exercise itself, but the management of the body between the times for the exercise. The effect of a daily drill is nullified if before and after it no attempt is made to hold oneself correctly when sitting and standing.

15. A few general hints in regard to exercise:

1. A little each day is better than much one day followed by none for several days.
2. Correctness in position is of utmost importance during exercise and after it.
3. Exercise will do more for the appearance and beauty of the body than any amount of face-washes and creams.
4. Exercise is just as necessary for girls as for boys.
5. It should never be taken immediately after meals. The digestive organs need an extra supply of blood at that time.
6. All parts of the body were made to be used; therefore none should be left without exercise.
7. Clothing should be loose and comfortable.
8. Shoes must be large enough, with broad toes and low heels.

9. Avoid excesses. Do not try things above your strength.

10. Exercise out of doors as much as possible.

16. There are very important muscles in the face, which are constantly being used. Every word, every thought writes its impress there. Our inmost feelings are reflected in the facial expression. Sorrow causes one set of muscles to contract, joy another. This is so natural that it is very difficult to conceal from an observer what is passing in one's mind. We learn the character of the person from looking at the face. If we desire to have a cheerful and happy expression, we must banish from our hearts all habitual ill-will, and anything that is opposed to kindliness and geniality.

17. So strongly are our facial muscles influenced by our thoughts and feelings, that people who are not blood relations acquire a striking resemblance, if they have a strong affection for each other. This is often seen in the case of a loving husband and wife, who have borne the trials and shared the joys of a long domestic life with ever-increasing mutual love. Since this rule is universal, it must also apply to our relations with our Blessed Lord; and those who love Him very much, and try to imitate Him as much as possible

here on earth, will be surprised, when they reach their true home in heaven, to find how much like Him they have become.

QUESTIONS

1. Why is exercise necessary?
   What caution is to be observed?
2. Is the spirit in which exercise is taken of any importance?
   Does housework provide good exercise?
3. Why is outdoor exercise of more benefit than indoor?
   What is your opinion of baseball?
4. What do you think of swimming as a form of exercise?
   How may it be learned? What is meant by a cramp?
5. What qualities are needed by a swimmer?
   Why is it best not to hold the breath?
6. What are some good forms of exercise? Name the good points of each.
7. What kind of climate is the most healthful?
8. What is the exercise which all may take with profit?
   How is it best performed?
9. What are the requirements in regard to apparel?
10. Apart from the matter of exercise, of how much importance are the muscles?
11. What is largely responsible for improper positions of the body?
12. What precautions are to be taken in the matter of bodily development?
13. When outdoor exercise is inadvisable, what may serve as a substitute? How should this be done?
14. How is the effect of exercise destroyed?
15. Name a few hints in regard to exercise.
16. How do muscles affect facial expression?
17. Apply this to our Blessed Lord.

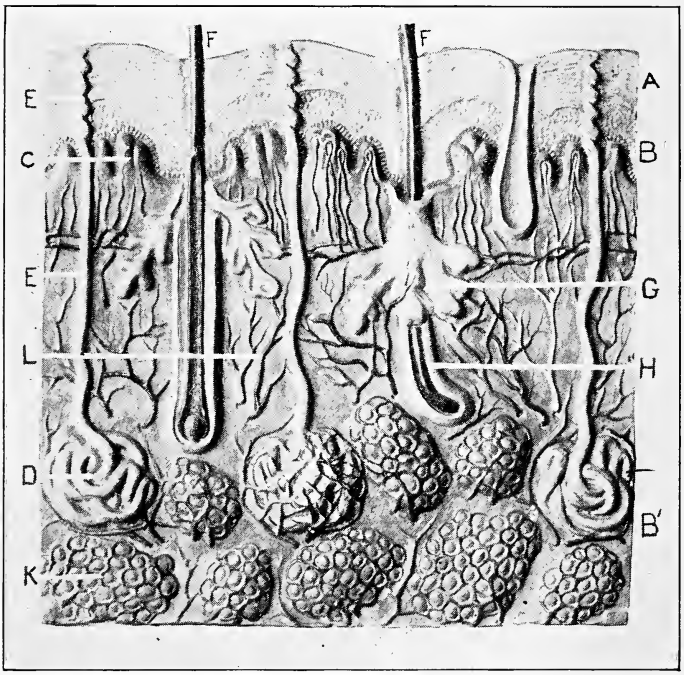
Chapter V

THE COVERING OF THE BODY

THE SKIN

1. The skin is not a muscle, but on account of the muscles attached to it, it is capable of contracting and relaxing. It is not a single covering, but is composed of two coats. The upper one is the epidermis, the lower is the dermis. You may have burned your finger at some time, and a blister formed, containing fluid, or serum, as it is called. The part of the blister over the serum was the epidermis; when it broke, and the fluid was drained away, the muscle was not exposed (unless the burn was very severe); but you saw a thin pink tissue, the dermis. In the dermis are the nerves, the blood vessels, and the glands. The blood vessels bring the necessary nourishment to the skin. Through the nerves we have the sense of touch, which is so wonderful a gift of God, that through it alone, children who are born blind and deaf and dumb, may acquire a knowledge of literature, and

a skill in music, that some children who are blessed with all five senses never obtain. The most remarkable examples of this in recent years are Tommy Stringer and Helen Keller.



SECTION THROUGH THE SKIN, FROM MODEL.

A, Epidermis; *B* to *B'*, Dermis or True Skin; *C*, Papillae; *D*, Sweat Glands; *E*, Duct from Sweat Gland; *F*, Hair; *G*, Sebaceous Gland; *H*, Hair Follicle; *K*, Fat Globules; *L*, Small Blood Vessels.

2. The blood vessels break up into such fine divisions, and are distributed so generally through the skin that no matter where a cut is made, blood

will flow. If one is healthy, and the blood is pure, almost as soon as a wound occurs, repair begins, and in a very short time, the skin is healed by the formation of new tissue.

3. The epidermis is intended to afford protection to the delicate parts beneath; consequently it is thickest where there is apt to be most pressure, for instance, in the palm of the hands and on the soles of the feet. Undue pressure at any spot causes a great increase of epidermal cells there; and so a corn on a toe is simply the piled up cells pressing down on the sensitive nerves in the dermis below. Removal of the growth does not cure the corn, unless the pressure is also removed by changing the shape of the shoe. Calluses on the hands come from the same cause, and are due to the demands of one's employment, or arise in the course of some sport. Every boy who plays baseball finds them on his palms after he indulges in a few games.

THE NAILS

4. The nails are for the purpose of protecting the surfaces over which they grow. They also increase the delicacy of the sense of touch, and help the fingers in picking up things. They grow from folds of the skin. Can you tell the parts of ani-

mals and birds which bear some resemblance to our nails? If there is a curvature in the nail, it is called a parrot-back nail. If there is a depression, it is known as a spoon-nail. A hang-nail is a shred of the epidermis at the edge of the nail, and should be clipped off, not pulled out. A felon is an abscess of the structures about the nail. When it forms, it should be poulticed. If neglected it may become deep-seated and involve the finger-bone.

5. Great care should be given to the nails and they must receive daily attention, if they are to look neat. Biting them ruins their shape and appearance; and it generally shows an undesirable nervousness. They should be filed, rather than cut; a knife must never be used on them. The nails on the toes should always be cut, or better, filed, straight across, not rounded at the corners. If this simple rule is followed, ingrowing nails will be avoided.

THE HAIR

6. The hair is to man what fur is to animals, or feathers to birds. Animals and birds need their covering in order to keep warm. We do not need hair for this purpose, for God has endowed us with the intelligence which enables us to provide

What are Her Striking Features?

ourselves with other means of warmth. On the greater portion of the body, the hairs are short and very fine. In the picture (p. 50) you can see the root of a hair, as the microscope shows it. It lies in the dermis, at the bottom of a tube called a hair follicle. Around this follicle is a tiny muscle, and when this contracts, it pulls up the skin all around the hair, making it project. An external influence, like cold, may make these follicle-muscles contract; or an internal influence, like fear, has the same effect. This is what happens when the hair stands on end, the flesh creeps, and goose-flesh arises.

7. How often we must wash the hair depends on how often it gets dirty. It is impossible to avoid dirt and dust from flying into the scalp, especially in the city; therefore these should be removed by a plentiful use of warm water and soap. Begin the process by brushing the hair well, and use your fingers which have been dipped in water, to knead the scalp in a rotary fashion. It is better to make a lather with the hand than to rub the soap directly into the hair. Afterwards, wash the soap out well with several rinsings before drying.

8. The hair needs air and sunshine, and therefore it is wise not to keep it too much covered. However, caution is required in winter weather in

order to avoid colds. Not only the hair, but hair-brushes also require attention; they should be kept covered and away from the dust. An easy way to clean them is to dip them in a bowl of warm water, into which a little ammonia has been poured. Have only enough water in the bowl so that the bristles may strike the bottom vigorously without wetting the back of the brush.

9. Besides the hair follicles, there are two kinds of glands in the skin, which are constantly pouring out secretions. These are sweat glands and oil glands. The latter are also called sebaceous glands, and lie beside the hair follicles. They produce an oily substance, consisting chiefly of fatty acids, which protect the skin and keep it supple. It also gives a gloss to the hair, which becomes dry and brittle when the glands do not function properly. When the tiny muscle at the base of the hair follicle contracts, it squeezes out some of the oil upon the surface of the skin.

10. Sweat is a clear, colorless fluid, composed almost entirely of water. We do not see any moisture on the skin when we are not hot, but nevertheless some is always being poured out from the sweat glands, of which there are two and a half millions in the body. In the palm of the hand there are twenty-eight hundred in each square

inch. As soon as the fluid strikes the air, it evaporates, and so is called insensible perspiration. As much as from a pint up to two quarts may in this way be lost from the body every day. Heat or exercise may increase the amount so that it may be seen and felt, in which case it is called sensible perspiration, or sweat.

11. The chief effect of the perspiration is the cooling of the body, and keeping it at an even temperature. On account of the combustion always taking place in the body and the energy being produced, the heat resulting would become so great as to destroy the tissues, unless there was some process to regulate it. This is what the evaporation of the moisture does. When the skin is cold and clammy, and perspiration is scanty, the heat is lost through the lungs by rapid breathing. Dogs which have thick furry coats, and therefore few sweat glands, lose heat by panting when they are too hot.

12. The sweat glands have also the duty of discharging through their pores some of the waste products of the body. When the watery part evaporates, the waste matter remains on the surface and becomes mixed with the excretion of the oil glands. If this is allowed to remain, it creates a bad odor, and interferes with the perspiratory

work. Therefore, it should be removed by friction and by bathing. Besides being unpleasant, it is also dangerous to permit it to remain, as it would become thicker all the time, and would attract dust and germs which are always in the air. If the person is not in good physical condition, the germs

International

WHO WINS?

would multiply and choke up the glands and follicles, producing boils, abscesses and pimples.

13. Bathing, then, is a necessity as well as a luxury, and should be indulged in by every one every day. For removing dirt and dust, warm water is the most efficacious agent. Soap is also needed as well as a flesh brush for the hands and nails. One should not be niggardly in regard to the number of times for bathing, but should per-

form the function whenever it is necessary. The hands should always be washed before meals.

14. A cold bath is an excellent tonic, as it drives the blood away from the surface of the body towards the brain and internal organs, thus helping to give them fresh energy and vigor. Cold water also strengthens the skin, and makes one less liable to take "cold." Bathing the neck and chest with cold water, the first thing in the morning, may keep one free from respiratory difficulties all through the winter. It is not necessary to have any expensive apparatus in order to get all the good effects of a cool shower. A large bowl, filled with water, and a couple of large coarse towels, will be all that is needed. Wring one of the towels nearly dry, and use it on the back and other parts, where it is impossible to reach with the hands. It is best to wet, and then dry, one area of the body, before proceeding to another. Do the face and hands first.

15. There are a few points to bear in mind about the cold bath:

1. Never bathe when chilly. The cold bath is, therefore, best when one rises from a warm bed.
2. The room in which one bathes should be warm.

3. A cold or cool bath should be short, always followed by a brisk rub.
4. If you feel cold after a bath, it is a sign that it was too long; or the water was too cool. Exercise vigorously until you get warm, and take a hot drink.
5. Do not bathe directly after eating.
6. Do not take a cold bath when overheated from play. Wait until you become cooler.
7. If it should be impossible to take a cold water bath, exposure of portions of the body to the cold air is advised. If the sun is pouring into the room, stand in the sunshine for a few minutes, and then rub each part of the body vigorously and thoroughly with a rough towel until the skin glows. Indians are able to bear much exposure to the cold on account of their custom of not overburdening the body with too much clothing. You may have heard the story of the white man, who shivered under his heavy coat, staring in amazement at the Indian, who seemed quite warm, though he was working on a winter day without any more covering than a loose pair of pantaloons. "Why," said the white man, "are you not freezing?" The Indian grunted and

shook his head. "Is your face frozen? No? Well, an Indian's body is all face."

16. There are various cautions about the warm bath also which should be borne in mind:

1. Bathe the whole body in warm soapy water two or three times a week, even in cold weather.
2. The best time for such a bath is just at bedtime.
3. The water should not be too hot; *i.e.*, over 100°.
4. Do not remain in the bath long, as the warmth is weakening and makes the skin sensitive.
5. At the end of a warm bath, always use a spray or shower of cold water, unless one is going directly to bed.
6. An incipient cold may be cut short often by immersing the legs up to the knees in a hot mustard bath for ten minutes. Cover the rest of the body with a big, warm blanket, and get into bed immediately afterwards. Sometimes it is helpful to remain wholly immersed in a hot bath for ten minutes, and then, without drying, put on a thick flannel nightrobe and jump into bed. This also has the effect of stopping a cold at the very beginning.

17. Do not use towels that any others have used at school or elsewhere. If paper towels are not provided, it is better to bring your towel from home. Diseases are sometimes taken from towels used by others in public places. It is important to bear this in mind.

18. If the whole body of an animal were to be coated with paint, it could not live long, as the paint would prevent the skin from doing its work, which is necessary for life. Putting paint and powder on the face is wrong and foolish, therefore, as it interferes with nature's processes. Some girls think that they are making themselves attractive by turning themselves into good imitations of china dolls. But what they are really doing is ruining their skin, while giving public manifestation of their coquetry and vanity. Fresh air and sunshine and the frequent application of cold water will do more for their complexion than any artificial cosmetics. Nature is not to be trifled with, and if abused, will inevitably demand her revenge.

19. Cleanliness, therefore, is absolutely necessary for the health and beauty of the skin; and cleanliness is just as necessary for the health and beauty of the soul. One is often an index of the other. A blotched, diseased skin only too fre-

quently covers a foul, sin-stained soul, while a shining soul makes the face positively glow. "Cleanliness is next to godliness"; and unless one keeps the soul clean, God cannot take up His abode in the heart. Doctors have found, by frequent experience in dealing with patients, how greatly the spiritual influences the physical part of man, and, therefore, try to effect a moral improvement before they begin a medical treatment. A good confession is sometimes a startling preliminary to a person's rapid restoration to health.

QUESTIONS

1. Of what is the skin composed?
   Of what purpose is the upper? What is contained in the lower?
2. How generally are the blood vessels distributed in the skin?
3. What happens to the upper skin when there is any pressure? Examples.
4. Of what use are the nails? Name a few curious kinds. What is a felon, and how should it be treated?
5. How do you care for the nails?
6. Of what use is the hair? How does it grow? What is goose-flesh?
7. How do you take care of the hair?
8. What do you know about hair-brushes?
9. What are the glands in the skin? Of what use are they?
10. How many sweat glands are there in the skin? the palm? How much sweat is evaporated from the skin each day?
11. Of what use is perspiration?
12. How are its ill effects removed?

13. Give some rules for bathing.
14. Name some good effects of cold baths.
15. What precautions are to be taken in regard to bathing?
16. What precautions are to be taken in regard to warm baths?
17. What precautions are to be taken in regard to towels?
18. What is to be said about putting paint and powder on the face?
19. Contrast cleanliness of skin and soul.

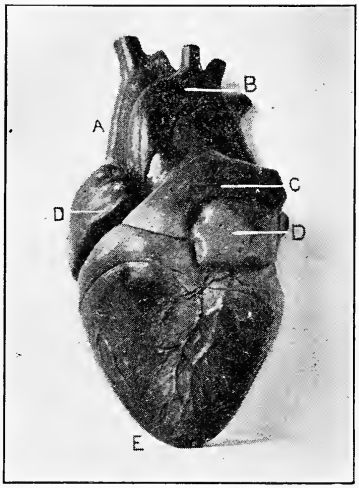
Chapter VI

THE CIRCULATION

1. The trunk is divided into two main parts by the diaphragm, which is sometimes called the midriff. The upper division is the chest, called the thorax, the lower is the abdomen. The chest is enclosed by the ribs and the dorsal portion of the spinal column. In the chest are the heart, the lungs, the trachea or windpipe, the esophagus, blood vessels, entering and leaving the heart, and important nerves.

2. The more we know about the human body the greater is our admiring reverence for the power and wisdom of its great Constructor. All its parts are so ingeniously contrived, each one so well fitted to do its work, and all working so harmoniously together, that there is nothing like it to be found anywhere on the earth with which it can be compared. For the most part, it is bilateral, its two sides being perfectly symmetrical. Thus we have two arms, two legs, two eyes, two ears, two lungs, two kidneys, etc., one of which is the exact

counterpart of its mate; and where there is only one thing of its kind, its two halves are generally reproductions of each other. This state of things has this tremendous advantage, that if a thing on one side happens to be injured, its work is taken



THE HEART FROM A MODEL.
A, Vena Cava; *B*, Arch of Aorta; *C*, Pulmonary Artery; *D*, Auricles; *E*, Apex

up by its partner; and if it cannot do the work of both as it is, it begins to develop in size so that alone it can attempt the task previously done by the two.

But there is only one heart, which is the organ of circulation, whereby the blood is distributed through the body. An organ may have meant to

most of us a wind instrument, consisting of a collection of pipes, which thrills us when played by a skilful musician in church. But the word is also used to designate any part of the body that has a special task. The smallest unit in the body is the cell. This is a very small, more or less enclosed body, containing a substance called protoplasm. By a tissue is meant a group of similar cells that do a similar work. An organ is a group of tissues that perform a similar function, so that the function of an organ is the particular part the organ plays in maintaining the life of the whole body.

4. If any one of the various organs can be said to have the most necessary or important function, that privilege certainly can be claimed by the heart. It is the first one that begins to functionate, and when it stops, all others must cease activity also. The others have periods of partial tranquillity, but the heart never can rest for even a few minutes. The actual labor of others varies from time to time; but the heart goes on its way steadily, ceaselessly, unwaveringly, from the time God places it in our body, until we are finally worn out by the service of a well spent life, striving steadily, ceaselessly, unwearyingly to "love the Lord, our God, with our whole heart, and our whole soul, and our whole mind, and all our strength," and

then at last when the faithful heart-beats pause, we close our eyes in death, and go to heaven to receive the reward of that service.

5. In studying the muscles, we have learned that there are two kinds of muscular tissue in the body, the voluntary and involuntary. The voluntary are also called striped muscles, on account of the appearance of the fibres. What is called a muscle is an organ, composed of thousands of muscular fibres, which are bound together by connective tissue and surrounded by a sheath of the same tissue. Each fibre is a complete structure in itself; a very minute, fine end of a nerve comes to it, causing the fibre to contract when we send the expression of our will down along the nerve from our brain. The amount of contraction of these muscles depends upon ourselves; we can move them as much or as little as we desire.

6. The heart is an organ made up of cross-striped fibres, but it has these striking differences from all the other striped muscles of the body. We had nothing to do with starting it in motion. It does not stop beating because we will that it should. It contracts and relaxes regularly without any desire on our part. When it contracts, it does so to its fullest extent: in scientific language we would say of it, "The contractions of the heart

muscle are always maximal." In all other muscles the amount of contraction depends on the amount of the stimulus; and we realize varying degrees in the strength of the contractions. But this is not the case with the heart. Whenever it contracts, it does so to the greatest extent of the power of its muscle at the time. This does not mean, of course, that the heart-beats never vary. They do vary frequently, depending upon the condition of the body, whether the individual is young or old, in good health or ill, well fed or poorly nourished, exercising or in a state of rest. But at the moment it is beating, it could not be made to contract more strongly by any stimulus.

7. In the case of the other muscles, if a mild stimulus is applied, they contract somewhat. If a stronger stimulus is used, they contract still more. But if a stimulus is applied to the heart when it is already in a state of contraction it produces absolutely no effect. This is called the refractory period of the heart-beat.

8. But the chief thing that distinguishes the heart from all other muscular tissue is the fact that it is automatic; that is, that its contractions arise from a stimulus within the tissue itself, and are not brought to it through extrinsic nerves. This stimulus is called the inner stimulus, and although

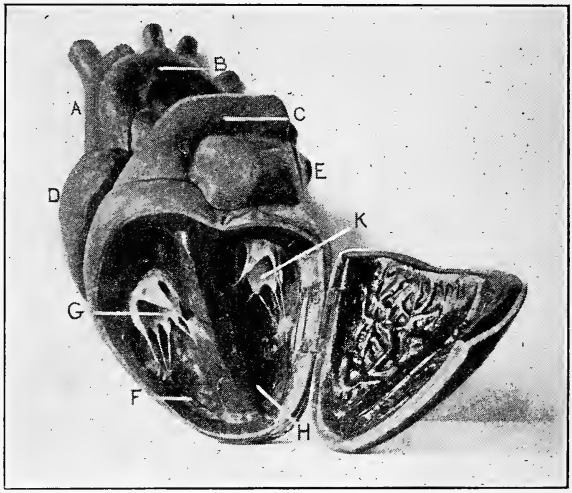
various theories have been given from time to time to explain its mysterious power, there is no adequate explanation to be found, except in the infinite power of the One from whom alone all power comes. Since He is infinite, men must realize that He can make things, the composition of which they cannot fully understand, and endow things with wondrous qualities, which are finite reflexes of His wondrous infinity.

9. So deeply is this automatic rhythm implanted in the heart muscle that in the case of the frog, for example, the heart may be made to contract for several hours even when removed from the body, by being kept moist with the proper kind of salt solution.

10. Everyone is familiar with the conical shape of the heart. It is about the size of the fist, and is divided into four compartments. The two upper ones are called auricles, from the fancied resemblance to a dog's ears; the blood is received into these. The two lower ones, which are much the larger, are called ventricles; they pump the blood out. As in all pumps, there are valves which prevent the blood from coming back, when it has once been pumped through any of the compartments. Generally, when people are said to have heart trouble, it means that one of the valves

does not shut tight, and the blood trickles back, thus causing disturbance to the circulation.

11. The blood comes from the body to the right upper compartment, or the right auricle. It passes through a valve into the right ventricle. This



Heart from Model, Showing the Lower Valves.

A, Vena Cava; *B*, Aorta; *C*, Pulmonary Artery; *D*, Right Auricle; *E*, Left Auricle; *F*, Right Ventricle; *G*, Tricuspid Valve; *H*, Left Ventricle; *K*, Mitral Valve.

valve is called the tricuspid valve, because it has three pockets. From the right ventricle, the blood goes to the lungs to be purified by the air there. From the lungs it returns to the heart, entering the left auricle. From there it enters the left ventricle through the mitral valve, so called because

it looks like the mitre of a bishop; and thence it flows out through the body.

12. The circulation of the blood is an uninterrupted flow through a chain of vessels which are continuous. The vessels which bring the blood from the heart are called arteries. Those which return the blood to the heart are called veins. The two are connected by smaller vessels which are called capillaries.

13. The biggest artery is the one which carries the blood out from the left ventricle; it is called the aorta. Over the heart it forms a loop which is called the arch, and then descends along the spinal column. On a level with the hip bones, it divides into two branches which supply the lower limbs. In the thigh, these two are called the femoral arteries; in the leg, they are called the tibial arteries. From the arch branch the arteries which bring the blood to the head and arms. Those going to the head pass up on each side of the neck, and their throbbing can sometimes be seen and felt. These are the carotid arteries.

14. The brachial arteries run from the shoulder to the elbow, where they are divided into the radial and the ulnar. The radial runs down the thumb-side of the forearm, and is the one where the pulse is usually taken as it passes along the wrist. The

ulnar passes down the little finger side. The heart beats about seventy-two times a minute in an adult, rather oftener in a child.

15. The large arteries lie very deep in the flesh. The veins are nearer the skin, and can be traced for a considerable distance. The blood flows fastest in the big arteries; less quickly in the veins; and least rapidly of all in the capillaries, which join the arteries and the veins. But nowhere can the flow be called slow, since a volume of blood passes through the heart every minute which is equal to twice the amount contained in the whole body. This amount is about six quarts in a healthy man.

16. If a condition in the body is just what it should be, it is called normal. If an organ behaves in the manner best suited for the health of the whole body, it is said to be acting normally. If anything is out of order it is called abnormal; that is, not normal, not as it should be. To have, then, the normal rhythm of the heart-beat, is to have the auricles contract first and force the blood into the ventricles; then, when the ventricles are filled, to have these contract, and force the blood from the right side to the lungs, and from the left side into the aorta. While the ventricles are expelling the blood, the auricles are being refilled. If you

should put your ear to the chest of someone at about the fifth rib, to the left of the breastbone, you could hear the noise which the heart makes when it contracts. It sounds something like this, "lub-dub, lub-dub." By listening to the sounds, the doctor can determine whether the condition of the heart is normal or not; if not, just where the trouble lies.

17. The life of the muscles, the nerves, the bones, all the various parts of the body, depends on their receiving a constant supply of blood, which conveys to them a proper amount of food material and oxygen, and at the same time removes from them all the waste products and poisonous or worn-out matters. In order to have this important function carried out properly, the heart and the blood vessels furnish the pump and the channels by means of which the circulation is kept up; and the central nervous system acts as a control over the activities of the blood vessels, so that the ever-changing demands of the body as a whole, or of its many parts, may be attended to on the instant.

QUESTIONS

1. How is the trunk divided? What is contained in each division?
2. What is the general arrangement of the bodily structures?

3. What is meant by an organ of the body? a cell? a tissue? What is the function of an organ?
4. What is the most important organ? Why?
5. Describe the structure of a muscle.
6. Tell the different ways in which the heart is distinguished from the muscles.
7. Name some other differences.
8. What is the chief difference? How is it explained?
9. How can a heart be made to beat when separated from the body?
10. Describe the shape, the size and the divisions of the heart.
11. How does the blood flow through the heart?
12. What are the various kinds of blood vessels?
13. What is the biggest artery in the body? What are its divisions?
14. What arteries are in the arm?
15. What is the difference between arteries and veins?
16. What does "normal" mean? Describe the normal rhythm of the heart.
17. How are the various parts of the body kept in good condition?

Chapter VII

THE BLOOD

1. The heart is made of muscles, as has been said; there is muscular tissue in the walls of the blood vessels, a great deal in the arteries, less in the veins and very little in the capillaries. These last are hardly anything more than single layers of cells, through which the dissolved food may easily pass out into the surrounding tissues. On account of the thickness of the arterial walls, the arteries retain their shape when they are cut open; and when this occurs in the living body, the blood spurts from them in jets which correspond to the beats of the heart. The veins are much thinner and contain less elastic tissue, so that they collapse when cut; and consequently the blood oozes from them in a steady stream. This is a means of distinguishing between an injured artery and a vein, when blood flows after an accident. Also, the arterial blood is red; the venous blood is purple. Since the artery is bringing blood from the heart, the way to stop the bleeding is to tie a

bandage above the cut, when the blood issues forth in spurts, below the cut, when the fact that a vein is damaged is shown by the oozing of purplish blood. The treatment is to wash the wound in clear cold water and cover it, when the bleeding stops, with the inside of a freshly laundered handkerchief.

2. The fact that the blood is not merely a watery fluid is seen when the bleeding stops, by the formation of a clot. This clot is composed of little round bodies, which are red blood cells and white blood cells. These cells are caught and entangled in string-like material called fibrin, which forms a meshwork of spidery threads, as soon as the blood leaves the blood vessel. The formation of the clot is the means of saving a person from bleeding to death. If blood had not this property, we should be staring death constantly in the face, and it would not be safe to have even a tooth extracted, no matter how much it ached.

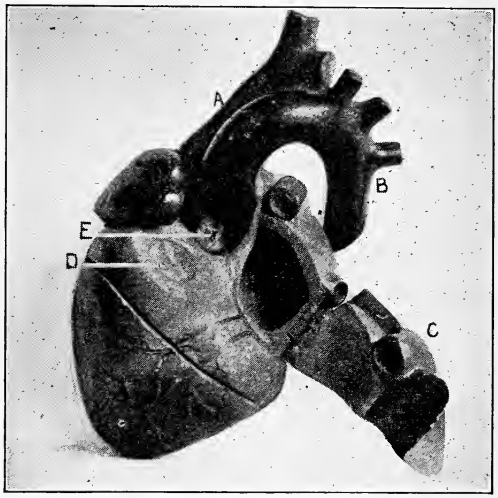
3. But why does not the blood clot in the blood vessels, just as well as outside? Scientists cannot tell exactly; the air has something to do with it, but we know that the real reason is because God is our Preserver, and being infinitely wise, is able

to bestow upon blood that quality so necessary for the existence of us all.

4. The watery part constitutes about four-fifths of the blood, and is called plasma. It carries dissolved in it the nourishment which has been digested in the alimentary canal and passes out through the thin walls of the capillaries into the needy tissues.

5. Besides food for rebuilding tissue, every smallest part of the body needs oxygen. The red blood cells pick this up when the blood leaves the right side of the heart and goes to the lungs, so that they are well stored with it when they start off on their trip round the body from the left side of the heart. These cells are so small that we cannot see them except through the microscope, though the blood is simply swarming with them. There are several millions in every drop, and in the whole body there are many millions. If the red cells of a single individual boy or girl were laid out in a line, they would stretch around the earth over four times. This will give you some idea of their number, also of the wonderful body which can manufacture them; as, of course, they are made in the body by its master, the soul. As they are so small, and are given such an important work to do, they wear out very quickly, and

constantly have to be replaced by new ones; so that to keep the supply up to the need, over four hundred million cells must be manufactured every minute. Do you think any such marvellous factory could be built by anyone except Almighty God?



THE HEART FROM MODEL, SHOWING THE UPPER (SEMILUNAR) VALVES.

A, Vena Cava; *B*, Aorta; *C*, Pulmonary Artery; *D*, Valve to Pulmonary Artery; *E*, Valve to Aorta.

6. The white cells are not so numerous as the red, nor are they of such uniform size or shape. Besides moving in the blood stream, they have an independent movement of their own, which they accomplish by changing their form. First they stretch out a finger-like process which

becomes bigger and bigger, until the whole cell has gradually pushed itself into the projection. In this way they squeeze through the walls of capillaries without leaving any trace of an opening. Here again, science halts before an explanation; and we can simply say that it is another proof to those who are not wilfully blind, that there is some superhuman force controlling our existence, and that that force can only come from the One who first gave us existence.

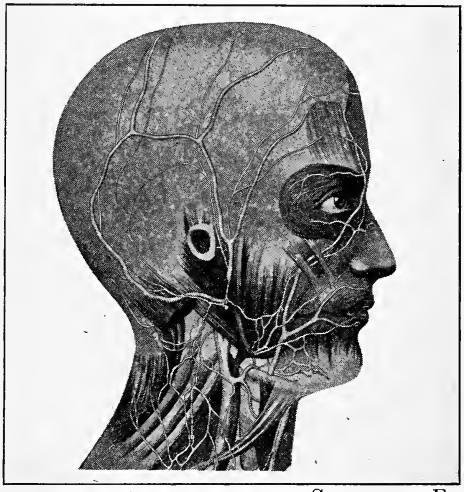
7. These white cells are the defenders of the body against disease. They are much more expert in detecting and warding off danger than the most experienced soldiers. They never rest, but are always going about, and hardly has a danger threatened, than they rush to the spot and begin their attack. In war, we honor the brave heroes who seem to forget all fear in their eagerness to slay the foe. But no hero was ever so daring as these white cells, nor so eager to lay down his life. Penetrating the capillaries in the vicinity of the enemy,—*i.e.*, the disease germ, they surround it and try to enclose it. If they have difficulty in winning the battle, more and more recruits arrive on the scene, and many of them give up their lives in defense. This causes a swelling at the place of conflict, and an abscess is formed; the pus

which comes from the abscess consists of thousands of these white cells which have died as martyrs to duty.

8. The white blood cells teach a striking lesson. They fight and die to preserve life in us. "Greater love no one hath than this, that he lay down his life for his friend." So we should fight, and if need be, die too, to preserve the life in our souls, which is sanctifying grace. Thus we follow the example of One who laid down His precious life for us, "becoming obedient unto death, even to the death of the cross."

9. But the energy of these white cells is not confined to military manœuvres. They are also builders, like ants or bees, and much resemble these little creatures in their habits. As soon as an injury happens anywhere, whether it be a bruise, a fracture or a torn ligament, they at once come swarming about the lacerated spot. First, some of them engulf the broken and damaged tissues and carry them away. Others then cover the area with new tissue, so cunningly constructed that it attracts tiny offshoots from nearby capillaries, which spread out in all directions. Very soon the injury is repaired with new tissues exactly similar to those which were damaged. This is very striking, because we would like to know

how the same kind of white cells can rebuild flesh here, skin there; can replace a fracture with new bone; can also, and even at the same time, restore the cut ends of nerves and blood vessels. There can only be one answer; Catholics are able to find it easily.



Arteries and Muscles of the Scalp and Face.

10. The blood supply is not always the same to the same part of the body. There are no gates in the arteries which can be opened or shut on demand, but there are nerves which go to these vessels and narrow or enlarge them, and thus regulate the blood supply within them, according to the necessity of the occasion. Thus during sleep,

the blood vessels going to the brain are contracted, because as large a supply of blood is not needed then as when the mind is active. After a meal, the vessels connected with the alimentary tract are enlarged, as the digestive apparatus is then in full operation. When the muscles are being used, they require more blood than when they are resting. The muscles that control these movements of the blood vessels are involuntary, therefore not under the direction of the will. It is on account of these same nerves, which report externally all impulses in the brain, that a blush follows a feeling of shame, or the face blanches from fright.

11. Emotion affects as well the heart itself. Anger has stopped its beating in extreme cases. Joy also may quicken its rate until the person feels suffocated. The expression, "nearly died of joy," is literally true. Self-control means the power of the will to put the brakes on the emotions, so that we are not overcome by them, but remain masters of ourselves in any and every circumstance.

12. One cannot begin too early to acquire this self-control. We can never obtain complete possession, but we can do much, if we are willing to make earnest efforts, and we should try very hard.

So much depends upon it. It is a necessary factor in making any success in this world, no matter where our sphere of action may be placed. This is important, for no one wants to be a failure in life. But much more important still, is its influence in combating temptation; for without it the imagination yields readily to the insistence of the senses, and sin is often committed by the individual who has failed to cultivate it, lacking, as a consequence, the force of will to say, "no."

13. All the organs of the body are enclosed for their protection in a covering, or sac. The sac does not fit tightly; consequently movement is possible inside it. Its lining is kept moist with a fluid which it manufactures; thus friction is avoided.

14. The sac which envelops the heart is called the pericardium (meaning "around the heart"). It was most probably this sac around Our Lord's Sacred Heart which was pierced by the lance of Longinus, the centurion, on Calvary, after our Saviour had died upon the cross. From the simple account of that faithful eye-witness, St. John, we may with all reverence, try to ascertain what was the actual physical cause of our Blessed Redeemer's death. Of course, He died because He willed; He was a willing victim for sin; He died in obedi-

ence to the command of His heavenly Father, who asked such a sacrifice as the price of our eternal redemption.

15. We know that when, in the Garden of Olives, the Precious Blood burst the barriers of the veins, and escaped, like sweat, through the pores of the skin, His agony was due to His dreadful vision of the sins of men, whose brother He had become, rather than to the anticipation of the coming Passion. So, as He hung, nailed upon the cross, the sight of the sins of the world came rushing again before His mind. He saw their awful malice, which He alone could comprehend, in all its enormity. He realized how much He had done for men, and foreknew how many of them would turn their faces towards hell, despite His death of expiation. Knowing how hateful sin is in God's pure sight, He understood how He, God's only Son, must appear covered with the sins of all mankind. Reduced in strength as He was by all His previous torments, the vision was too dreadful to be borne by flesh and blood, and as the Sacred Heart broke with grief and sorrow, the Precious Blood within it poured out into the pericardium.

16. We know now that blood clots, when removed from its proper channels. So the Precious

Blood, though it was divine, followed God's laws for human nature, since Christ was Man as well as God; therefore, as soon as it escaped through the broken heart muscle, it clotted within the pericardium. When the centurion's lance pierced Our Lord's Sacred Side, its point penetrated into this sac, and through this opening immediately flowed "Blood and Water," the Blood being the solid elements which form the clot, the Water the thin, watery fluid.

17. Of course, this is merely a point of view, by no means a certain fact. But if the Sacred Heart of Jesus had not broken from sorrow, and had been opened by the tip of the spear it would seem that the Gospel would not have stated that "One of the soldiers with a spear opened His side, and immediately there came out blood and water" (John xix. 34); but merely that blood came out. Of course it might have been a miracle. Some hold that it was. This explanation is, however, a natural and a plausible one, and may help our devotion to our crucified King, now that we understand something about the heart and the circulation. Holy writers, moreover, teach us that the Blood signified the Blessed Sacrament, and the Water the Sacrament of Baptism.

QUESTIONS

1. How can you tell whether an artery or a vein has been cut? How would you treat a wounded blood vessel?
2. What is meant by a clot?
3. Why does not the blood clot in the vessels?
4. What is the plasma?
5. Of what uses are the red cells? How many are there?
6. How do the white cells act?
7. Of what use are the white cells of the body?
8. What is the lesson of the cells?
9. How do they repair tissue?
10. How is the blood supply limited?
11. Do emotions affect the heart?
12. Of how much use is self-control?
13. With what is each organ covered, and why?
14. What is the name of the covering of the heart?
15. What have you to say of the death of Our Divine Lord? Can you defend such a theory?

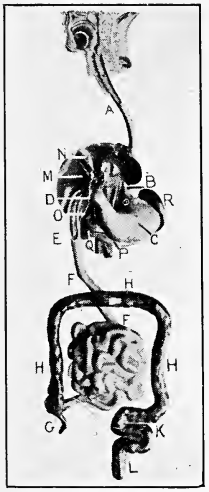
Chapter VIII

THE ALIMENTARY TRACT

1. The alimentary tract is the canal through which the food passes, and where it is digested and absorbed. It is made up of the mouth, the esophagus (or gullet), the stomach and the intestines. We have spoken of the use of the teeth in cutting and grinding and separating the food; they should be employed for this purpose. Human beings do not gulp their food as dogs do. The human stomach was not intended by its wise Maker to receive food until it had been prepared for its descent from the mouth by the process which is called mastication. This process includes not alone the dental work, but also the mixing of the food with the saliva.

2. A secretion is the separation from the blood of a substance which is necessary for some one of the vital processes, and is poured out on the free surfaces of the body, whether internal or external. Examples of those poured out on the

external surfaces are tears and perspiration; of those on the internal surfaces, saliva and the gastric juice.



ALIMENTARY CANAL WITH APPENDAGES, PARTS SOMEWHAT SEPARATED.

A, Esophagus; *B*, Cardia; *C*, Stomach; *D*, Pylorus; *E*, Duodenum opened (beginning of Small Intestine); *F*, Rest of Small Intestine; *G*, Vermiform Appendix; *H*, Colon (Large Intestine); *K*, Sigmoid Flexure; *L*, Rectum; *M*, Liver (turned upwards); *N*, Gall Bladder; *O*, Bile Duct to Duodenum; *P*, Pancreas; *Q*, Pancreatic Duct to Duodenum; *R*, Spleen.

3. An action occurring within the body, which is necessary for its well-being and the preservation of its life, which involves something different from any chemical, physical or mechanical process, is called a vital process. There are seven such processes; *viz.*, sensation, locomotion, digestion, assimilation, respiration, excretion, reproduction.

4. (*a*) Sensation is a vital process by which the living organism comes to know of things outside itself, or of one part of itself by other parts.

(*b*) Locomotion is a vital process by which a living thing moves itself, or any of its parts.

(*c*) Digestion is a vital process by which food is prepared by the body to become some part of itself.

(*d*) Assimilation is a vital process by which the digested food is changed into body tissue.

(*e*) Respiration is the vital process by which oxygen is drawn into the lungs, where it is absorbed by the blood and carried by little cells, called corpuscles, through the arteries to all parts of the body.

(*f*) Excretion is the vital process by which the waste products of the body are cast off.

(*g*) Reproduction is the vital process by which new organisms are brought into existence.

5. The vital processes are found in all living things, as well as in man, and mark off life from death, as they all cease when death occurs. Despite this striking fact there are some individuals, whose minds, though trained in science, are so filled with prejudice against the Catholic doctrines of a Creator who gave us a soul distinct from the body, that they declare that "the differences between life and death are rapidly being done away with"; and again, that "the difference between a living and a dead body is simply the difference between the building-up and the breaking-down processes that are going on." Their fancied wisdom, which is really folly, is an apt illustration of what our divine Master warned us against when He said that "unless you become as little children you shall not enter into the king-

dom of heaven''; and also of those who ''having eyes to see, see not, and having ears to hear, hear not; and again (in Luke x. 21): ''Thou hast hidden these things from the wise and prudent, and hast revealed them to little ones.'' For the truth which seems to be hidden from these re-

Just Before He Caught the Ball.

nowned men of science is instinctively grasped by the smallest Catholic child, who can tell at once the immense difference between a living and a dead dog in the streets.

6. Some of the operations of these vital processes may be reproduced in the laboratories of a chemist, but the whole process cannot be repeated;

and in the small part which he is able to perform, he deliberately takes the place of the mysterious, inward principle, which is our life, and which does the same work, that causes him such time and care, without any trouble to us, or indeed, without our even adverting to what is going on within us.

7. For example, he is able to produce changes in food, which are similar to the changes that occur in the stomach during digestion. But no chemist has ever been able, nor ever will be able, to convert that changed food into flesh and blood. Many have been trying to do that for years, but all have failed; and the most honest, as well as the most skilful among them, now acknowledge that there is some wondrous agent working for us in our bodies, which cannot be found in their laboratories.

8. Do you ever stop to think how the simple processes of changing food into our bodily tissues show unmistakably, to those who are not wilfully blind, the constant care of the master Builder, whose wisdom not only made us, but ever preserves us in existence? A great many non-Catholics look upon members of the one Church of Christ as foolish, because we believe that miracles occur. Yet every day, in fact, every meal,

they know that the food which they eat is converted into the various tissues that compose their bodies. How can men who see that their eyes, their ears, their tongues, their teeth, their hair, their skin, their muscles and all the rest of what they fancy is themselves, are being constantly built up and kept in good condition by such substances as meat and potatoes, due to the vital processes which God alone controls, yet refuse to believe that the same Wonder-worker can easily restore a sick person to health, or instantly heal a broken bone? It is clear that faith must be a gift of God, and we, to whom that gift has been given, cannot be too thankful, nor take too much care not to weaken it, nor endanger it in the least.

QUESTIONS

1. What is meant by the alimentary tract? Of what is it composed? Is it necessary to chew the food well? What is the process called?
2. What is a secretion? Give examples.
3. What are vital processes? How many can you name?
4. Define each vital process.
5. What do vital processes show? Do all admit them? Do all admit what they imply?
6. What difference exists between a laboratory process and a vital process?
7. What is generally acknowledged by honest chemists?
8. What does the process of body-building show?

Chapter IX

DIGESTION—PART I

1. Digestion is one of the vital processes about which we have been speaking; it begins in the mouth, not in the stomach, as you might suppose. The act of moving the jaws, while chewing food, causes saliva to be squeezed out into the mouth from the salivary glands. Sometimes the mere thought of appetitizing food has this effect. The smell of a steak broiling on the fire "makes the mouth water." This water, or saliva, as it is called, begins the change in the food, which is continued in the stomach, and which is necessary in order that it may be assimilated, or changed into our flesh. The glands from which it flows are situated, one in each cheek, and two on each side of the floor of the mouth, six in all. The two in the cheeks are under the ears, and when they are choked up and become swollen, they produce the condition called "mumps." If you should examine one of these glands under the microscope, you would find that it is made up of bundles of

little tubes, to which smaller sacs are attached, looking something like a bunch of grapes. All around the sacs are tiny blood vessels; and the vital principle, which is our life, causes these sacs to abstract the fluid part from the blood and to store it up within their walls. When a supply

Transporting American Troops in French Trucks, Driven by Chinese.

is needed, it flows from the sacs through the tubes into larger ones, called ducts, which open directly into the mouth. The saliva is flowing while we talk, as well as when we eat. Otherwise the mouth would become dry and speech would be difficult.

2. While the food is being ground up into fine pieces by our teeth, it is also being moistened

by the saliva, which has two effects on it; first, it converts it to a soft, pulpy mass; secondly, it begins to digest some of the food. We should be sure to take enough time to chew our food well. Later on in life, people have serious trouble in the stomach, because they force it to do the work that God intended to have accomplished in the mouth, when He placed the teeth and the salivary glands there.

3. The food being thoroughly masticated, the tongue seizes it and forces it into the throat, where by the contraction of the muscles it is pushed down the gullet (or esophagus), into the stomach. The stomach is a large pouch, capable of holding about three pints. It is about twelve inches long, and four or five inches wide. The food generally remains in the stomach for some hours, thus obviating the necessity of eating very often. If we had to do so, we should not have time for the other important things in life.

4. The stomach lies in the portion of the trunk called the abdomen, just under the heart and lungs, and separated from them by the diaphragm. On its right side, behind the ribs, lies the liver; on its left, the spleen. It has two openings; the one which joins the esophagus is named the cardiac orifice, since the word *cardiac* refers to the

heart, near which this opening lies. The lower opening is called the pylorus (meaning "a gate-keeper"), and joins the stomach to the bowels, or the intestines.

THE WORK OF THE STOMACH

5. In the stomach, the main work of digestion occurs. The stomach is composed of strong muscles, and as soon as food enters, these muscles contract about it and squeeze and knead it thoroughly, rolling it back and forth from one end to the other. The food mass has a peculiar motion, travelling down from the cardiac orifice along the two sides of the stomach, and when it finds the pylorus closed, it goes back through the middle.

6. Just as in the mouth there are glands which manufacture saliva, so in the stomach there are gastric glands which furnish gastric juice, which is mixed with the food as it is pushed around, and continues the process of digestion. It used to be thought that the contact of the food with the stomach wall mechanically caused the flow of gastric juice. But in the last century, a Canadian hunter, named St. Martin, was terribly wounded in the abdomen, and the wound healed in such a peculiar

way that a hole was left in the skin into the stomach. Through this hole food could be passed, and the processes that take place within could be studied.

7. Experiments have also been made on different animals, in the course of which food was given them, but before it reached the stomach was made to pass out through an artificial opening below the mouth. In these various ways, it has been learned that the mere smell and sight of food, and, in the case of the man, the mere thought of it, when he was hungry, were quite sufficient to start the action of the gastric glands.

8. These facts show the great value of palatable and attractively prepared food. They also prove the presence of some very important factor within us, which is higher and more powerful than any mere mechanical or chemical stimulus to digestion, and altogether distinct from the latter. This goes by the name of the "psychic influence," and it can never be satisfactorily explained except by admitting in our body the existence of a living principle, which we know to be the soul.

9. When any portion of the food is properly prepared, the pylorus opens to let it pass into the bowels, and then shuts quickly again until another portion is ready to leave. To completely empty

the stomach takes four or five hours. By the "bowels" is meant the intestines, which are from twenty to thirty feet long, and are divided into two parts, the small intestine and the large intestine. The former is called small on account of its size, not its length, as it is very much the longer; it lies coiled up in innumerable twists and curves within the three divisions of the large intestine, which are called the ascending, the transverse and the descending colon, from their position in the abdomen.

10. Where the small intestine joins the large is a valve, called the ileo-cæcal valve, which has a function for the small intestine similar to that of the pylorus for the stomach. Just below this valve a thin narrow pocket opens from the large intestine. This is the "appendix," the inflammation of which is the cause of many operations in recent years. Some people suppose that "appendicitis" is a modern disease. This is not the case, of course. Appendicitis is simply the modern name for the condition formerly called "inflammation of the bowels," which caused the death of many people. Now that operations have become very frequent, and their technique perfect, lives are saved every day by means of them; hence foolish fears of hospitals and of surgeons should be

set aside when the family physician makes the diagnosis of appendicitis, urging an immediate operation. It is quite remarkable to notice the attitude of mind towards the hospital, of a child, when he is brought in, shrinking and crying, and to compare his timidity and repugnance at entrance with his reluctance to leave, after he has been there for several weeks, being petted by doctors and nurses and constantly receiving the kind ministrations of devoted Sisters.

QUESTIONS

1. What is digestion? Where does it start?
   What is saliva? Where is it made? How is it made to flow?
   What is mumps? Describe the salivary glands. Is the saliva needed for any other purpose than eating?
2. How many effects does saliva produce? What are they?
3. After mastication, what occurs to food?
   How big is the stomach? How long does food remain there?
4. What is the position of the stomach? How many openings has it?
   What are they called and why?
5. What happens to food in the stomach.
6. What are gastric glands?
7. What starts the action of these glands?
8. What does this show?
9. How does the pylorus act? How long are the intestines? What are its divisions?
10. What is the valve at the junction of the small and large intestines? What is its function? What is appendicitis?

Chapter X

DIGESTION—PART II

1. In the mouth the saliva has been acting upon certain parts of the food. Other parts have been subjected to the influence of the gastric juice in the stomach. Now, in the intestine, there are three other fluids which aid the digestion of the food. One of these comes from glands situated in the walls of the intestine itself, and this is called the succus entericus, or intestinal juice. The other two come from two large organs in the abdomen, the liver and the pancreas.

2. The pancreas is what is called sweetbread in calves. It lies across the abdomen behind the stomach, and is about six or seven inches long. It furnishes a secretion which is poured out through a duct on to the food in the intestine. This secretion is more important as an agent in digestion than all the other digestive fluids put together. Most of our knowledge about this organ comes from a great French Catholic scientist, Claude Bernard.

3. The wonderful way in which one part of the body coöperates with the other parts is shown by the pancreatic secretion. When the gastric juice leaves the stomach, it strikes the walls of the first portion of the small intestine and causes a certain

Right and Wrong Posture.

substance which develops there to be changed in such a way that the blood may take it up and carry it to the pancreas, where it at once stimulates the flow of the pancreatic juice. Moreover, the action of the saliva ceases as soon as the food enters the stomach, but when it enters the small intestine anything the saliva has left undone is set to rights

by the pancreatic juice. In like manner, the gastric juice loses its effect when the food leaves the stomach, but what it may have failed to accomplish is finished by the pancreatic juice. Then it assists the liver in the work of digesting fats and oils. Since its task is so important and diverse in the preparation of food for absorption, it may readily be surmised that if it is out of order or becomes diseased, serious defects ensue in the proper nutrition of the body, as a result.

4. The secretions of pancreatic, as well as of gastric juice, and saliva, are vital actions; that is, they are manufactured by the living force of the soul and do not occur where life does not exist. But the action of these different secretions on the food is a chemical action which can be made to take place outside the body in a glass tube, almost as well as in the alimentary canal. It is necessary to remember this distinction, as it is lost sight of by those who speak only of the chemical effect of these digestive fluids, not of their production, thus eliminating any reference to the soul.

5. The last of the five secretions which aid digestion comes from the liver, and is called bile. The liver is a large organ, situated in the abdomen to the right of the stomach, just under the dia-

phragm, behind the lowest ribs. The functions of the liver are manifold, but the one which interests us here is the manufacture of bile. This liquid is not only a digestive secretion, playing an important part in the digestion of fats, but is also an excretion carrying off some of the waste products of the body. The bile is constantly being formed, but until it is needed for digestion, it is stored up in the gall-bladder, which is a pouch attached to the under surface of the liver. The bile contains salts which sometimes form crystals, these may increase in size, or become very numerous, so that they block up the passage leading from the gall-bladder to the intestines and cause a great deal of pain in trying to force their way through. These are called gallstones. They are found in varying numbers up to thousands, usually requiring surgical interference for their removal.

6. The passage from the gall-bladder is called the bile duct. If this becomes inflamed from any cause, it becomes swollen. The swelling prevents the bile from getting into the intestines and forces it back into the gall-bladder, where the blood takes it up and tries to get rid of it through the skin. The bile contains a yellow pigment; when this is deposited in the skin, it causes the condition known as jaundice.

7. The chief action of bile is to break up fats into glycerine and fatty acids, so that they may be absorbed; because fat, as such, cannot pass through the membrane of the intestinal walls. After passing through in this divided state, by some mysterious power which is unexplainable if the vital action is eliminated, the divided substances reunite and are deposited as fat in the tissues. The bile has also a marked laxative action.

8. The liver is one of the most important organs of the body, so important, in fact, that one could not live if it should be removed. It acts as a storehouse where various substances are kept until they are required by the needs of the tissues. All the foods, except the fats, are carried there from the intestines by the blood. What is not immediately needed is changed into a substance called glycogen. When no food has been ingested for some time and the body is craving for it, or when a particular need is felt at some special place, the blood travels down to the liver, picks up a little glycogen and carries it where it is required to supply the want. During the winter months, hibernating animals, such as the bear and the frog, live upon this glycogen, as well as on the fat which they have stored in their bodies. Snakes also live

in this way. In early springtime colonies of flies are sometimes found clinging to southern windows. They have been there from the preceding summer; the little nourishment they required during the winter must also have been furnished by the liver.

QUESTIONS

1. How many fluids aid the digestion in the intestines?
2. What and where is the pancreas?
   Who first described it?
3. How is the juice of the pancreas stimulated? What is its action?
4. What is the meaning of the vital and the chemical action of the glands?
5. Where is the liver? What is bile? Where is it stored?
   How are gall-stones formed?
6. What is jaundice?
7. What is the chief action of bile?
8. Of how much importance is the liver?
   How do hibernating animals live in the winter?

Chapter XI

ASSIMILATION OF FOOD

1. The food which has been eaten is now much changed by the action of the five digestive juices, and is ready to be absorbed. This process of absorption is called assimilation. Very little of this occurs in the mouth, though some substances, like poisons, may seem to be absorbed there in a sufficient quantity to cause death. There is not much absorption in the stomach either, though alcohol is absorbed there. Water, if taken alone, passes directly through. The absorption of food takes place mainly in the small intestine, and is effected by the *vital activity* of the membrane that lines it. It is again necessary to insist on this point, as some physiologists have claimed that assimilation of food within the body is due merely to the physical phenomena of filtration, or osmosis, or diffusion. Filtration and osmosis both mean the passage of fluids through a piece of membrane, such as a parchment; and diffusion is the tendency that vapors have to spread, due to the fact that

the materials of which gases are composed have the power of locomotion. This is observed when a bottle of cologne is opened; the vapor escapes and begins to penetrate all through the room, showing its presence by the pleasant odor.

2. All these phenomena are paralleled by what takes place during assimilation; but in this latter process there is an evident selection of materials to supply needs, such as is never found anywhere outside the bodily membrane which is endowed with life. Given the same conditions outside the body; for instance, the same materials, the same weight, the same heat, the same filter, etc., the same results may confidently be expected. But the results that occur in assimilation do not depend upon the conditions of the materials so much as upon the bodily needs, so that now one kind of food is taken up, now another, some here, some there, according to whether or not the tissues should be built up or repaired, in this part or that, or demands arise suddenly from exercise, illness, a wound or any other cause.

3. The length of the intestine is about thirty feet, as has been said; but the length of the assimilating surface is much increased by the fact that the lining membrane is not smooth, but is filled with tiny projections, which give it a velvety ap-

pearance. These projections are called villi. They dip down into the digested food as its passes along the food-canal, very much as roots of plants dip down into the earth and suck up moisture and sustenance.

4. In the centre of each villus is a small tube, called the central lacteal, into which the living membrane covering the villus absorbs the dissolved fatty substance. Each lacteal joins with the others, forming a chain of vessels, known as the lymphatic system, which terminates in a large tube in the chest, called the thoracic duct. This duct empties directly into a large vein which goes to the heart.

5. Besides the lacteals, in each villus there are also tiny blood vessels, which pick up all the rest of the food materials, and send it along through the abdomen until it is poured into a large vein, the portal vein, which brings it to the liver. To this organ, therefore, is carried all the food which is ingested, except the fats. As soon as the portal vein enters the liver, it breaks up into innumerable tiny branches, which penetrate every part of the liver substance; this at once sets to work, changing the food particles still further into the form in which they may later become part of the body tissues. What is not required immediately, it stores

up. The remainder is sent to the right side of the heart, and is pumped into the lungs, where it probably undergoes more changes by being brought in contact with the oxygen in the air. From the lungs it comes back to the left side of the heart; through a big artery, called the aorta,

International

A Race in the Harvard–Yale–Oxford–Cambridge International Meet.

it is then pumped to all parts of the body, as has been seen.

6. The aorta sends off many branches—up to the brain, off to the arms, out to all the various organs and down to the legs. Each branch divides and subdivides, until no portion of the body is left unprovided for. Wherever a cut is made, you

know that blood oozes forth; and remember that the blood has not been lying loose in the tissues, but is contained in the tiny blood vessels, which are called capillaries (from the Latin word, *capillus,* meaning hair), because they are so fine and hairlike.

FOODS

7. Our food is derived from (1) the animal kingdom, (2) the vegetable kingdom (plants). We should desire and make an effort to obtain fresh, clean and wholesome foods. Legislation has done much in the past few years to improve matters in this regard, but each one should be vigilant in his own interests, and those of his family, to ward off infection. This is much more likely to come from the animal than the vegetable kingdom, especially from meat and milk.

8. Food affects our health in many ways:

(1) It may itself be poisonous, as certain mushrooms, or some kinds of fish.

(2) It may contain poisons or chemical substances, added as adulterants; for example, lead, arsenic or copper.

(3) Poison may develop in the food, either before eating or afterwards, as the result of the action of certain germs.

(4) Food may contain worms or germs, as the germs of typhoid fever in oysters.

(5) Some people are unable to digest certain kinds of foods which are usually harmless to others, as strawberries, eggs, tomatoes.

(6) Too much food causes diseases of the liver, kidneys and heart, and obesity (which means a state of being too fat).

(7) Not enough food, or not the right kind, brings about ill health.

(8) Lack of certain lime salts or acids, produces disease of the bones, resulting in deformity.

(9) Eating when tired, or eating too fast, will induce indigestion.

(10) Most people drink too little water, especially between meals.

(11) The chewing of gum is a most undesirable habit from every possible point of view. Do not indulge in it.

9. Food is the fuel for the body-engine; oxygen in the air that is breathed is the fan that makes the fire flame. Active breathing of fresh air is, therefore, a great aid to assimilation. Probably you all have noticed how life in the open air helps digestion and increases the appetite.

10. Food has two uses; *viz.*, (1) for growth and repair of the tissue, and (2) to supply energy for

motion and heat of the body. More than four-fifths of the total energy that comes from our food is expended in the production of heat, less than one-fifth in motion. As we are moving in some way almost all the time, we can form some idea of the amount of heat production that is going on in the body furnace. The temperature of the body ought to be about 98.6 degrees. If it rises above that point, the person is said to have a fever.

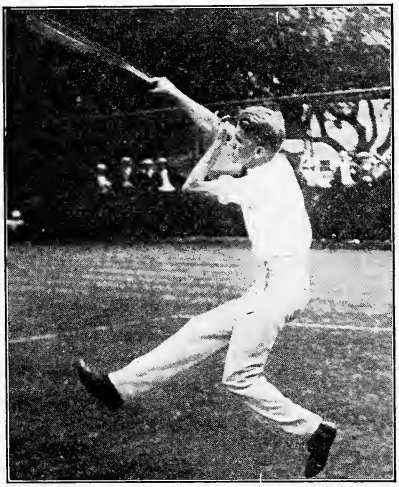
11. As for exercise, so for food—too little or too much may be taken. The latter fault is much the more common. Gluttony is one of the seven deadly sins; it causes the speedy wearing out of all the organs of the digestive apparatus, also serious heart trouble. Headache, weariness, dizziness and coated tongue sometimes spring from nothing but an engorged stomach and intestines. In order to keep well there should be a movement of the bowels once or twice each day, and nothing should be allowed to interfere with this most important duty.

12. One way to bring God's blessing upon our food is to say grace properly before and after meals. We should try to say it with reverence, remembering that the food we eat has really been provided for our needs out of the bounty and

watchfulness of Him to whom we pray for "our daily bread."

VITAMINES

13. Nowadays we hear a great deal of talk about certain qualities of food which are spoken of as



Central News
VINCENT RICHARDS OF FORDHAM PLAYING TENNIS.

vitamines, meaning "life-giving," from the Latin word *vita,* life. They get their name from a Polish chemist, Dr. Casimir Funk, who made extracts of the polishings of rice, and after many trials got a crystalline substance, the chemical nature of which is a puzzle. Polished rice is nothing more mysteri-

ous than the kind you buy at your grocer's, but from which the hulls have been completely removed. It has been found on experiment that the feeding of such rice to birds causes them to suffer from various nervous disorders; but the strange point is that if this extract from the polishings is given to the birds, they rapidly recover from their disorders.

14. Following Dr. Funk, other observers noticed that there was evidently some quality in the yolk of egg and the fat of butter, which not only helped growth, but was quite essential for any growth. Other oils and fats were found not to possess this quality, or if they did, not in the state useful for the bird to which they were fed. Other men made further experiments, until to-day we know that there are at least three kinds of vitamines, which are found in different foods. They are so necessary that if absent, the food, although perfectly good in every other respect, fails to nourish.

15. Despite all the investigations, not much that is actually definite has yet been discovered, but it is certain that all the necessary vitamines are found in milk and green vegetables, so that if you only drink plenty of good milk and eat some fresh salad every day, you will have all the vitamines in your food that you need.

16. Years ago, people thought that they knew all there was to know about such simple things as foodstuffs. Now they are just beginning to realize that they actually know very little of the real qualities which make foods nourishing. Yet some people presume to assert that they know all about such a complex array of substances as make up the human body. "Where ignorance is bliss, 'tis folly to be wise"; but one cannot help pitying their blindness. The fool thinks that he knows everything; the wise man realizes how extremely small is the amount of his knowledge.

QUESTIONS

1. What is assimilation? How is it obtained?
2. What is the difference between assimilation and other processes?
3. What are villi? What is their purpose?
4. Describe the lymphatic system.
5. What is the portal vein? What does it carry? How does it divide?
6. Why does blood issue wherever a cut is made in the flesh?
7. Where do our foods come from? What is infection?
8. How may food affect health?
9. How does breathing fresh air help assimilation?
10. Of what use is food? How much is needed for heating the body?
    What is a fever?
11. What care should be taken in regard to food?
12. What is the importance of saying grace?

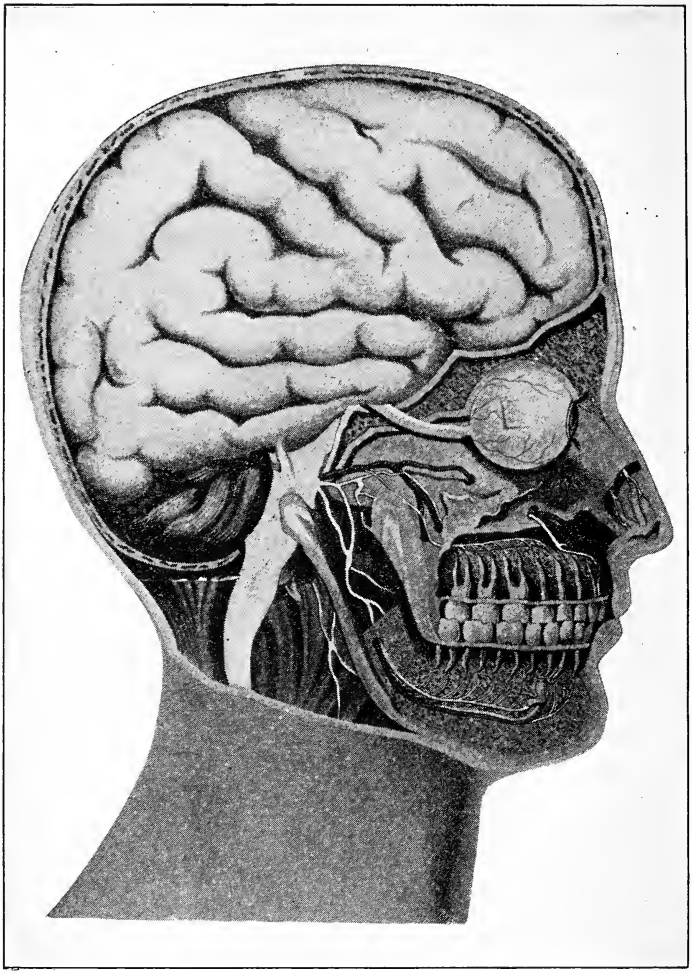
13. What are vitamines? How were they discovered?
14. How many kinds of vitamines are there? Of how much importance are they?
15. Where are the necessary ones to be found?
16. What is the lesson they teach?

Chapter XII

THE WONDERFUL EYE

1. The possession of a camera has become so common nowadays that it is probable that many readers of this chapter call one their own. Taking pictures is an agreeable pastime; unless it develops into a mania, it is a very good means of preserving for us scenes and persons with whom pleasant memories will always be associated.

2. There are many parts to a camera; modern inventions have made them so perfect that clear and distinct pictures may be taken even of rapidly moving people or objects; for example, of runners, or of a ball on its way towards the bat from a pitcher's hands. High-priced cameras, however, are often far beyond the reach of many a wistful girl or boy who gazes with envy at the owners of such treasures. But though the girl and boy may not possess a kodak, they have for their very own, as a free gift from their Creator, not merely one, but two cameras, each far more wonderful than any which can be purchased with money.



Section Through the Head.

3. A camera left to itself can do nothing. It might face a landscape all day long without reproducing a single tree. The owner must know how to adjust it properly, or his pictures will be blurred. He must provide it with a film or plate, a new one for each picture. He must treat the film later with various chemical solutions; the result obtained depends upon the amount of care he takes.

4. But our wondrous eyes do all these things themselves, without bothering their owners at all. You do not need to open or shut the pupil for a distant or near object, nor for a dim or strong light. You do not concern yourself about lengthening or widening the lens in order to bring the scene into proper focus. No care is required to remove the film from the back of the eye, and to put a fresh one in place for each picture.

5. Instead, then, of fretting, if you cannot have an expensive camera, thank God for His gift of your two eyes; and try to learn something about them, so that you may understand how to take better pictures than the highest priced photographer in town. Just try some experiments on yourself. Shut your eyes for ten minutes, then imagine what it must mean to be blind. Let someone blindfold you, and after the first thrill of fun has subsided,

try to walk about without bumping into things; try to eat your dinner in that condition. You will find that you hardly know the way to your mouth.

6. Then suppose that, through some terrible mistake, the handkerchief had been so placed that it was found absolutely impossible to remove it. What do you think would be your feelings when you realized that never again could you see your dear father and mother, your brothers and sisters, your home and all its pleasant rooms? What would you do if told that the sun and the stars, all the glory of the winter sky, the trees, the grass, the beautiful flowers, the mighty ocean, the flowing rivers, the hills and mountains, all the beloved, familiar sights which are the joy of your life, a very big part of it—that all these things on which you had been accustomed to gaze as a matter of course, were to be hidden forevermore from your view?

7. Reflect for a moment how helpless you would be, if you should forget all that you have learned through the means of your eyes. Imagine what it would actually mean never to be able to read again, to be obliged to depend entirely upon your other senses for all information about current news, to be shut off from any further acquaintance with the literature of the world's best authors,

except at the cost of the untiring devotion of your friends.

8. Yet we take it so much for granted that these twin servants, our eyes, should teach us to know and enjoy all these things, without interruption, without complaint or fatigue, without our thinking about them in the least. We do not need to give them any commands. We do not need to care that they are oiled and greased when our constant use of them has worn out their delicate parts. Without a word from us, without assistance from any other part of the body, they repair their own damages, they keep themselves in good condition, if only we do not abuse them.

9. But is anybody so foolish as to abuse these faithful servants? Yes, indeed; perhaps you are guilty. You abuse your eyes by rubbing them, thus making them inflamed, and by pushing into their outer, fine coverings dirt and germs from your fingers. You also hurt them by reading in a dim light, such as twilight, or when the light is unsteady or flickering, as when riding on trains or trolleys. You wrong your eyes by washing them in a public wash basin, or by wiping them with a common towel, because you may introduce in this manner foreign substances which cause disease, that leaves the eyes weak and inflamed ever

afterwards. You maltreat your eyes by applying to them any washes or salves, except on the advice of a physician.

10. You may strain your eyes by not providing them with glasses, when you find that you are obliged to hold the book close to your face in order to read, or when you cannot see from your desk all the writing on the blackboard. Some people imagine that they will outgrow their eye trouble by refusing to get glasses; whereas, if they need them, they are only increasing the trouble the longer they remain without them.

11. Young people sometimes carry their head to one side, or are forced into a disfiguring squint, because they will not visit an oculist who would correct their faulty vision. Many cases of nervousness, indigestion and headache are cured merely by wearing suitable glasses. From repeated examinations in schools, it has been estimated that at least a quarter of a million of the children of the United States ought to be wearing glasses, but through ignorance or carelessness are not doing so. If you hold the book nearer than one foot to your face, then you need glasses to correct shortsightedness. If you can read comfortably, but cannot see well at a distance, then glasses are required to remedy farsightedness.

When objects are blurred at all distances, then the outer shape of the eyes ought to be helped by properly fitting glasses.

12. The lining of the back of the eye is called the retina, and it is here that the image of the object that we see is formed. In shortsightedness, this image falls short and in front of the retina; in farsightedness, it comes to a focus behind the retina; in the third case, which is called astigmatism, it may fall on the retina, but its outlines are not clearly defined, therefore the picture is blurred.

13. The image is always upside down on the retina, just as it is on the film in the camera. When you have taken a picture with your kodak, you must remove the film, and then wait to see the result until the photographer can have it developed. But when the image is pictured on the retina of the eye, immediately it sends a message along the track of the optic nerves to the brain, and you at once see the object. The development is instantaneous.

14. What is really the thing that goes from the object into the interior of the eye? Certainly the object itself does not leave its position and pierce the eye through the pupil. No, but light does. Light is reflected from the object upon the retina. There it starts into activity the cells, which are

called, from their shape, rods and cones. These cells are connected with the optic nerves, and the stimulus is flashed along their course to the back of the brain, where we appreciate the colors, shapes and sizes of the objects from which the light was reflected.

15. Light travels very rapidly, about 186,000 miles per second. It gives us some idea of the enormous distance of the universe, in which the almighty Creator placed our planet, to be told by astronomers that the light is now travelling through space towards the earth from stars which have possibly ceased to exist. They also tell us that some stars are so far away that the light from them has not yet reached us.

16. There is a lens in every camera. There is also a lens in the eye, only the latter is a living substance and, therefore, can shorten and widen itself in order to bring a near object to an exact focus on the retina. In like manner, it can lengthen and flatten itself for the same purpose, if the object is at a distance. You will learn more about a lens and a focus in your study of physics. The lens of the eye is called crystalline. It divides the eye into two chambers, the one in front being very much the smaller. Each is filled with fluid,

which helps the lens to focus the object properly upon the retina.

17. Sometimes old people are said to have a cataract. This means that the lens has lost its power of shortening and lengthening and has become opaque. In this condition, it can no longer do its work of focusing, so it is removed through a little slit which the surgeon makes in the upper part of the eye. After the eye becomes accustomed to its loss, it settles down to its work again with the aid of very thick glasses which take the place of the lens.

Central News

A Jump Like This Requires Good Sight.
(12 ft. ¼ in.)

18. The colored portion of the eye is the iris, the hole in its centre is the pupil, through which light is reflected. The iris is a muscle; therefore it makes the pupil small or big by contracting or expanding. The eyes are set into a bony cavity of the skull which is called the orbit. They are protected by the eyebrows, the eyelids and eyelashes. They are kept free from dust, while the lids are kept moist, by the

tears. These come from a small tear "factory," called the lachrymal glands, which are placed in the outer corner of each eye, behind the upper eyelid. The tears pass across the outside of the eyes, and keep them moist and clear. They drain into the nose through a little duct at the inner corner of each eye. When we are affected by emotion, the tears are manufactured in such abundance that the ducts are unable to carry them all away, and so they overflow the lids and run down the cheeks.

19. Each eye is moved by six small muscles, which turn the pupil in all directions. When a person squints, some of the muscles are not working properly. This defect should be corrected by consulting a physician, who may be obliged to cut one of these muscles. Sometimes it may be remedied by wearing glasses. It may happen that a foreign body, such as a small gnat or a cinder, gets into your eye. In such a case, do not rub the eye. Rubbing will only increase the difficulty. Instead of rubbing, if blowing the nose does not help, use an eye-cup. This is a little cup, made of glass in such a shape that it fits tightly over the eye. Fill the cup with clean water, then open and shut the eyelids, while holding the cup closely against

the eye. It is a good thing to have an eye-cup ready for emergencies in every home.

20. Do not face a strong light when reading or studying. Try to place yourself, especially when writing, so that the light comes from your left side, for then the shadows from the hand will not fall on your work. Do not insist on sewing or reading in a dark room. Use daylight for sewing with any black material. When there is a choice, do not choose a book which is printed on shiny, glazed paper. Remember that your eyes are one of your most precious possessions. By means of them you have acquired knowledge of most of the things that make life worth living for you. Ordinary prudence then will suggest that you make use of the hints contained in this chapter in order to take care of them. Never insult the Giver of them by using them for anything your conscience warns you to avoid.

QUESTIONS

1. How many persons of your acquaintance wear glasses? Just why do they wear them?
2. Do you own any camera of your own, which was not bought?
3. What amount of care does the usual camera require? Is it expensive?
4. Compare the taking of pictures by means of a kodak with what is required in order to see.

5. Describe what your impressions would be, if blindfolded.
6. If suddenly made blind, what do you suppose would be the state of your feelings?
7. Can you tell some of the things your eyes have helped you to know, and which you could not know in any other way?
8. How are the repairs needed in the eye cared for?
9. How may eyes be injured? How may you rest them?
10. How can you tell when glasses are needed? Why is it wise to consult an oculist as soon as eye difficulty is noticed?
11. What defects may be remedied by wearing glasses?
12. What is meant by the retina? What is the difference between short-sightedness and its opposite? What is astigmatism?
13. Can you explain why the image is upside down on the retina? How long a time does the eye picture require for its development?
14. What happens when we see something?
15. Name some remarkable facts about sight.
16. Of what use is the lens?
17. What is meant by a cataract? How is it corrected?
18. What is the iris? the pupil? the orbit? Where do tears come from? How do they leave the eyes? Of what use are they?
19. How many muscles move the eye? Explain a squint. Of what practical use is an eye-cup?
20. Give some rules for preserving good sight.
    In order not to abuse the eyes, what is the most important thing to avoid?

Chapter XIII

THE MARVELLOUS EAR

1. If there is anything in the world more wonderful than the eye, it is the ear. As a piece of mechanism, it cannot be duplicated by anything man-made. In olden cruel times, men were punished by having one of their ears, or in extreme cases both of them, cut off. It was considered that the amputation produced a great and ludicrous disfigurement. Nowadays, it would not be thought such a heavy penalty, as the modern young woman has for some time been trying to conceal all evidence of her ears by hiding them under ugly bunches of hair.

2. The ear has three principal parts: according to position, they are called the outer, the middle and the inner ear. The outer ear is again divided into two parts, the auditory canal and the auricle. This latter is the part usually called the ear, but actually it is the least important part. No matter how huge the disfiguring bobs of hair which conceal it, and even if it is really amputated, hearing

is not destroyed, though it may be impaired. But if anything happens to any other portion, hearing is at once affected.

3. Sometimes insects find their way into the auditory canal. The best and simplest manner to dislodge them is to pour into the canal a teaspoonful of warm water, which will drown them, when they will float to the surface. Never poke any-

Students of the Ateneo, Manila, P. I.

thing into the auditory canal. It is an old adage, which is worth observing, that nothing smaller than the point of the elbow should be put into the ear. Both ears should be washed thoroughly during the morning and evening ablutions in order to remove the dirt and wax, then dried with a corner of the towel. But neither pin nor toothpick should ever be inserted, as these have often caused much trouble by tearing the delicate skin

within the ear, thus opening the path to an infection, or by piercing the eardrum, thus incurring the danger of resulting deafness.

4. The eardrum is at the inner end of the auditory canal. The latter is about an inch long, somewhat curved. The drum is a thin, tense membrane, placed between the outer and the middle ear. By vibrating, it sets in motion the three little bones of the middle ear which, in turn, transmit the vibrations to the inner ear, where the ends of the auditory nerves are. The names of the three little bones are the hammer, the anvil and the stirrup, on account of their resemblance to these articles.

5. When the eardrum is damaged, the injury usually affects the middle ear also; or, at least, an entrance is forced, through which germs may intrude and set up an infection. This is what occurs in many cases of so-called abscess of the ear. The drum may be ruptured by violent coughing, as in whooping cough, and also by a blow on the head. Parents given to anger should remember this fact, and refrain from such a form of expressing their wrath. It may be injured during any of the children's diseases, such as measles or scarlet fever.

6. The middle ear is connected with the throat by a small canal, called the Eustachian tube. This allows air to enter, thus keeping the pressure the

same on both sides of the eardrum. It also drains off the moisture from the lining membrane of the middle ear. When your head feels "stuffy," it is because this tube has become clogged. Yawning and swallowing, and gargling especially, tend to open up this tube and relieve the discomfort. The most common cause of earache is the inability of this moisture to escape from the middle ear. Sometimes it becomes necessary for the doctor to make a tiny puncture in the eardrum, through which the gathering moisture may find an escape into the auditory canal. When the gathering has drained off, the tiny hole heals with scar tissue, just like a wound anywhere in the skin.

7. Do not put oil or laudanum or anything else into the ear, except on the advice of your physician. Do not try any patent medicines. Sometimes a remedy is recommended by a friend, who credits it with a cure, simply because it happened to be the last thing tried. The ear is too important to trifle with. "Safety first" will save you from unwise experiments.

8. Some children are classed as mental defectives, when the real reason why they are behind their classmates is because they are deprived, by unnoticed deafness, of one of the most helpful sources of information. Their ears are at fault,

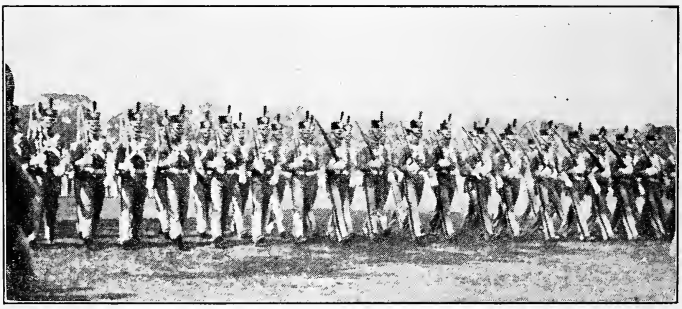
not their minds. Sometimes the cause is nothing more serious than adenoids, which choke the throat end of the Eustachian tubes. When the adenoids are removed, the deafness disappears and the mental condition at once improves. There is usually no cure for complete loss of hearing, as this implies interior trouble in the ear, which cannot be reached except by such a destructive operation that "the cure would be worse than the disease."

9. The inner ear is placed well inside the head, and consists of two parts: the cochlea, so called because it is like a snail's shell; the other part is the labyrinth, which has small bony spaces and tubes, placed in different planes. In these tubes is a fluid, one use of which is to help in preserving our balance. The inside of the body labyrinth is lined with a membrane, in which lie the cells which are connected to the brain by the fibres of the auditory nerve.

10. This is what happens when we hear any sound. You have all seen a violin string vibrate when the bow was drawn across it to produce a thrilling note. The vibrations of the string set up waves in the air, and these strike against the ear-drum. The variety of vibrations for the human ear range in number from sixteen to forty thou-

sand per second. The more vibrations, the higher the note; the fewer the vibrations, the lower the note. If the vibrations are large, the note is loud; if they are small, the note is soft.

11. Anything that makes a sound in our ears makes it in this way; that is, by vibrating, thus setting up air currents. It is somewhat the same as when you toss a pebble into the still waters of



West Point Cadets.

a pond. From the spot where the pebble enters, ripples start off across the smooth surface, widening and enlarging until they strike the shore. This is the explanation of a bell. It is true of all musical instruments. It is the secret of the wireless telegraph and telephone. But all human inventions vibrate clearly to one sound only at a time. No device has ever been made which will record a single tone out of a complex sound. The tiny

drumhead at the inner end of the auditory canal, however, vibrates in such a magical manner that it conveys many things, near and far, to our hearing at the same time. We are able to recognize our own breathing, the voice of one reading in the next room, a piano being played in the room beyond, a person walking on the floor above, a train rumbling by the station at the foot of the hill, a motor horn sounding warning in the street outside, all in the same moment; and we appreciate immediately just what each sound signifies. How do we do this?

12. The delicate vibrating drumhead sets in motion the three little bones of the middle ear. These at once pass along the vibrations to the fluid of the inner ear, like the ripples in the pond, and these ripples strike against the fine endings of the nerves which lie among the cells of the membranous labyrinth. Passing along the nerve fibres, the stimulus reaches the brain cells, where, if these are in a normal state, it is transformed for us into a sensation of sound.

13. Like all our sensations, hearing is made up of the sense organ, the nerves which carry the outside stimulus to the brain and the soul, which furnishes the vital energy without which the first two would be entirely useless. The sweetest music

might resound in the room where a corpse lies, but not a note would be heard in the absence of the soul, even though the ear, the nerves and the brain cells were all physically perfect. Perhaps you may ask: "But how does the soul bridge the gap from the changes in our bodily organs to the various sensations which we feel?" That is a mystery, which, if we could unravel it, would enable us to tell the secret of life which God has not yet revealed to man.

QUESTIONS

1. What is to be said of the ear as a mechanical device? What impression of its appearance is evident from current fashion?
2. How many parts has the ear? Which part is most prominent and the least important? Which is most often affected by changes in the weather?
3. Is it prudent to poke anything into the ear? Why? What daily care should the ear receive?
4. What is the auditory canal? In what structure does it end? How does this act? What are the bones of the middle ear?
5. What is meant by an abscess of the ear? How may the eardrum be injured?
6. What connects the ear with the throat? Of what use is this? What occurs when this is closed? How is the condition relieved?
7. Why is it unwise to put things in the ear? What sort of things should the ear not be forced to hear?
8. What is the explanation of the condition of some children who are mentally deficient?

9. How many parts has the inner ear? What important structures are in the labyrinth? What gives the cochlea its name?
11. What is the difference between the eardrum and anything else which vibrates?
12. How is the motion of the air currents passed along to the brain?
13. What is the difference between the senses and sensation?

Chapter XIV

THE AIR WE BREATHE

1. The air we breathe is our most important concern. We exist in the air, and cannot live without it. If we were deprived of air, we should die, like people who choke to death when air is shut out from their lungs. Animals and plants need air too, and the marvellous way God has disposed His creatures is shown by the striking fact that what we cast off as harmful is just what the plants need to keep them in health.

2. We cannot see the air, but we can see what it does, when we stand on the seashore on a fine summer day, and watch a trim sailboat scudding along before a stiff breeze. We can feel it as it blows inland upon our eager faces, and even taste the salty brine it carries in from the ocean, as well as smell the sweet odors with which it becomes laden after recrossing the flower-strewn meadow.

3. Although it is invisible, it is really not a spiritual substance, such as an angel or the human soul, which cannot be seen by bodily eyes. It is a

material substance, like the matter of which the earth or our bodies is composed, but in a gaseous state. There are a number of gases in the air; the important ones for us are three: oxygen, nitrogen and carbon dioxide.

4. Oxygen is the life-giving element; it constitutes about one-fifth of the atmosphere. It is taken into the body when we inhale, carbon dioxide is given off when we exhale. Plants act in just the opposite way; they retain the carbon dioxide and expel the oxygen.

5. Carbon dioxide is the chemical result of the various processes which go on in the body, such as digestion, assimilation, combustion, breathing, fermentation. Fires add to the amount, as well as all decaying animal and vegetable matters. There is a greater amount in the city than in the country, more also in the house than outdoors; burning coal gives off large amounts. The soil also produces a great deal, but there are usually present in the atmosphere, nevertheless, only about three parts in every ten thousand parts of air. When ten parts to ten thousand are present, an uncomfortable feeling results, and health is injured if this proportion is continued. Headache, dizziness, etc., come on when the amount becomes as large as fifteen parts to ten thousand.

6. Carbon dioxide is not, however, itself a poison; but is harmful because it deprives the body of the oxygen needed. Oxygen is the most wonderful of all elements. Water is largely made up of it, at least three-quarters of the material of which our bodies are formed is composed of it, and it is more than half the weight of many other substances. We could live for some time without food, and all our lives could be spent without many of the other things for which large sums of money are spent by foolish people who forget that money is a gift of God, to be used for His glory, not for their folly and luxury. But the most precious thing of all, oxygen, is to be had by all without any necessity of buying it or working for it, for the loving Creator would not have any one of His creatures deprived of it, not the poorest nor even the most wicked.

7. Nitrogen gas constitutes almost seventy-nine parts, or four-fifths of the air, but is not used either by animals or man. Its purpose is to dilute the oxygen, so that we may breathe this in the proper strength. If the proportion of oxygen were too high, it would be almost impossible to put out a fire when once it got started, and there would be too much combustion occurring within our bodies.

8. Some water is always present in the air, the amount constantly varying, as it is being formed by evaporation from the lungs and the skin of man, as well as from the ocean and rivers, from the leaves of trees and plants, etc. The warmer the air, the greater is the amount contained in it. If the heat is increased, the percentage of water the air can hold is also increased. The air nearest the earth is warmest; the temperature falls one degree each three hundred feet above the surface.

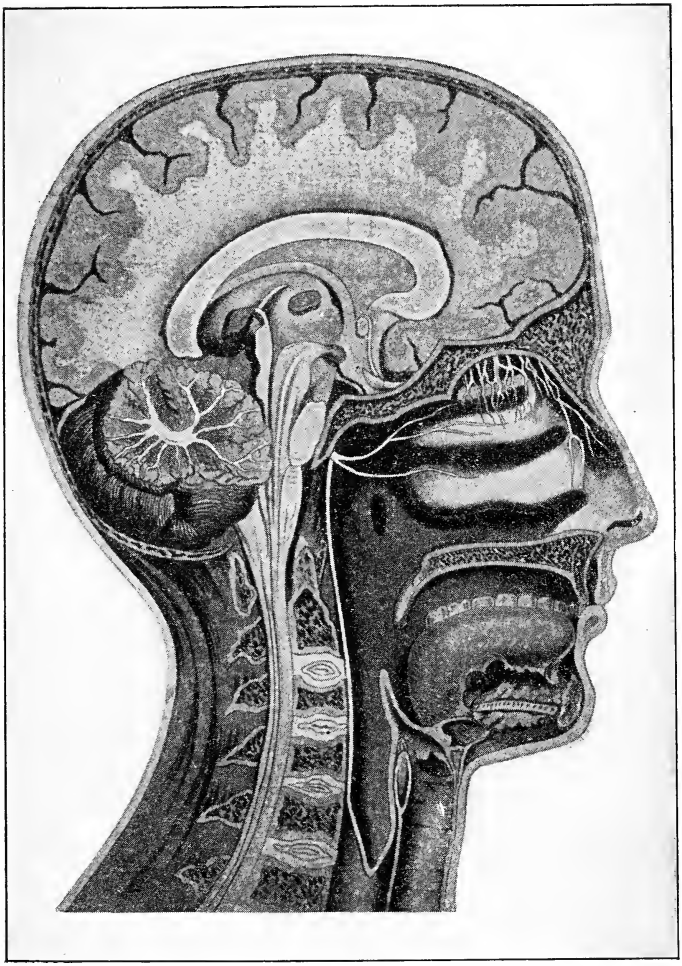
9. If the air holds as much moisture as it can at a certain degree of temperature, it is said to be saturated, and evaporation cannot occur. In such an atmosphere moisture from plants is deposited as dew on their surface, from man and animals as perspiration. Air saturated with vapor is very uncomfortable, whether it be hot or cold. A humid day is one on which the perspiration cannot pass off into the air, resulting in a disagreeable, sticky feeling. Most deaths from lung diseases occur on a moist day, on account of the lack of evaporation from the lungs, which increases, consequently, the difficulty in breathing.

10. Dust is always in the air, a certain amount is very necessary; otherwise we should not have any rain. The clouds are simply collections of dust particles to which moisture is clinging. They

are able to hold only a certain amount at a certain temperature; when the temperature changes the moisture condenses, and the rain falls to the earth. When the air is cold enough we have a snowstorm. The dust is made up of organic matters from animals and vegetables, threads of mildew, bits of cork, starch granules, fibres of silk, cotton, linen, wool, feathers, etc.

11. "Bad odors" used to be considered dangerous to health, but they are more disagreeable than harmful. Sewer gas may affect the digestive tract to some extent, and cause nausea. Odors in the living room come from decaying teeth, bad breath, decomposing matters on skin or clothes, gas from the stomach, unclean mouths, sweat glands, nasal troubles. Therefore, it is necessary to exercise care in the matter of cleanliness, for we are social beings, not hermits, and must have regard for the comfort of others.

12. Odors are perceived much more readily when the air is moist than when it is dry. The membrane lining of the nose, in which lie the nerves of smell, must be wet in order to appreciate any odor. The nerves soon tire in any case, and after a while the odors are not noticed by those in the room, while newcomers are at once made aware of them.



Cross-section Through the Head and Neck.

13. An unpleasant odor causes us to breathe less deeply, whereas a pleasant one has the opposite effect, just as pleasant sights and pleasant sounds help us physically as well as mentally. In the plan of God for His creatures, there would have been nothing to hurt or harm us, all things would have "worked together unto good." But sin came and marred God's scheme, bringing with it a whole train of disagreeable and unpleasant things. Indeed "the wages of sin is death."

14. Ordinary ventilation does not remove vapors which have been absorbed by surfaces of surrounding objects. Hence the great need of opening the windows and doors frequently in order to insure a wholesome stream of fresh air. Most people have a very erroneous notion about the dangers of draughts. They are really the best thing for driving out bad odors, as well as something much more dangerous; namely, disease germs, with which the air is often laden.

15. Most diseases are brought about by minute organisms called germs, and they begin their career of trouble as soon as they enter the body. A draught will effectively blow such mischief-makers out of the room. It is not, however, wise to sit or sleep in a draught when one is perspiring, as the rush of air causes the sweat to evaporate

too rapidly, thus chilling the body by lowering the temperature.

16. Germs are breathed out by sick people. It is not well, therefore, to come very close to them. Tuberculosis, or as it is commonly called, consumption, is a very infectious disease, which means that it is contracted from some one who already has it. Hence, the best manner of avoiding it is to breathe fresh air; that is also the best way to cure the disease. In this illness some of the lung tissue is damaged, and cannot, therefore, do the work of supplying the blood with the proper amount of oxygen. The purer the air that is breathed by the rest of the lungs, therefore, the larger is the amount of oxygen that will be received into the tissues.

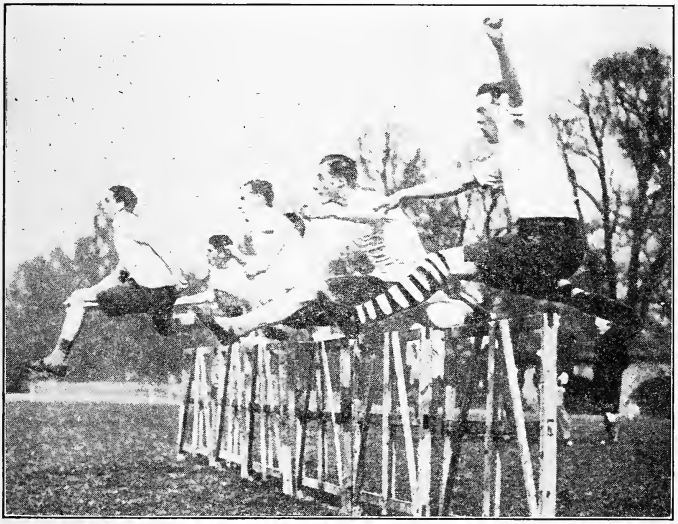
17. It is good, then, to get all the fresh air possible out of doors; but is also necessary to have fresh air indoors. When the Indians were given houses by the United States Government, a great many of them developed tuberculosis, because they were deprived of the fresh air to which they had been accustomed. The only way to help them was to let them live their own wild life. Remember also that this rule of ventilation is just as necessary for our sleeping, as well as our waking hours.

18. In some tenement houses there are frequently several rooms without any windows. There should be a penalty for such a condition fixed by law, serious enough to deter any landlord who would force his tenants to dwell in such a place. Light and cleanliness usually accompany air, while misery and disease lurk where fresh air is not to be found. If you put a flower in a vase, but do not change the water, it will die; if you put a fish in a bowl, but do not change the water, it will die. If you make people live in surroundings where the air is not changed, they will die also. There is a famous case in history, called the "Black Hole of Calcutta," where a hundred and forty-six men were in a small hut which contained only six thousand cubic feet of air, with the result that all but twenty-three of them were dead when relief came. The same law holds true of animals. Especial care is given to provide them with plenty of fresh air in all circuses and zoological parks; it has been found that they do not thrive in captivity otherwise.

19. When houses used to be heated with fireplaces, there was always a plenteous supply of fresh air, since the overheated air went rushing up the chimney, while fresh air was always coming into the room to take its place through every

crack. But in our modern steam-heated houses, the same stale air is being constantly raised to a higher heat; there is no chance for it to escape, nor is any loophole left for fresh air to enter.

20. It is not necessary, however, to have fresh



Wide World Photos

Racing Requires Proper Breathing.

cold air. In fact, very cold air is harmful, unless one is sufficiently clothed. Fresh warm air is what is best in the house, as the still, chilly air of indoors predisposes to colds and coughs. Cold, damp air is injurious, especially in infancy and old age, where the vital forces are at a low ebb. The cold dampness throws extra work on the heat

mechanism of the body to preserve the proper temperature, consequently the strain falls on the circulation. On a cold, misty day a person will shiver and his face turn blue, especially when out in the wind. The reason is that the moisture interferes with the exchange of gases in the lungs, so that the breathing becomes shallow.

21. In warm moist air, both physical and mental activity are reduced, because an undue supply of blood is brought to the surface of the body, resulting in a general feeling of depression. People are overcome by the heat when the temperature of the air is above 88 degrees, and the air then becomes saturated. In this condition the body temperature rises rapidly, and unless precautions are immediately taken, heat stroke will result. While awaiting the doctor, you may help the patient by applying cold water to the body, after removing the clothing, and by fanning the face. Once I saw a poor man who had been sunstruck, being treated by misguided relatives. They had put his feet into a tub of boiling water and covered him all over with thick blankets. They said that the idea was to draw off the heat from his body, but they were only helping to raise his temperature. They would have killed the victim of their ignorance, if the doctor had not most opportunely arrived

on the scene and reversed the whole treatment, afterwards berating them for their stupidity.

22. A cool, dry air in motion is the most bracing. It causes all the bodily functions to become more active, the breathing deeper and more frequent, the circulation to be increased and the digestion stimulated. Deodorants are things which remove bad odors. Disinfectants are things which kill germs. The best deodorants and the best disinfectants are cleanliness, ventilation and sunlight, which are at the disposal of every one.

23. God has placed the sun in the universe in such a position that it furnishes us not only the proper heat but also light and energy. If it were nearer, we should be burned from its excessive rays; if it were further away, we should be frozen. If it gave more light, we should be blinded; if it furnished greater energy, we should be killed, in the same way that germs are slain now. Who but an all-wise Creator could have arranged this planet in such a manner that everything tends to our benefit? What great love for His creatures is shown by such a magnificent arrangement and care for each detail that concerns our well-being. Even the disagreeable things that sin has brought in its foul company may, if used aright, be profitable unto us in God's wondrous mercy, through

the divine merits of His Son, our Lord Jesus Christ. "To those who love God, all things work together unto good."

QUESTIONS

1. Of how great importance is air? How do animals and man differ from plants in regard to it?
2. How many senses detect the presence of air?
3. Is air spiritual? What gases does it contain?
4. What percentage of the air is oxygen?
5. What is carbon dioxide? Where is it found in greater amount?
6. How is carbon dioxide harmful? What have you to say of oxygen? Where is it obtained?
7. Of what use is the nitrogen in the air?
8. Where does the water in the air come from?
9. Explain what is meant by saturation of the air. Why do deaths from lung diseases usually occur on a damp day?
10. Is dust usually found in the air? Why? What are clouds? Of what is the dust composed?
11. Are bad odors dangerous?
12. Why are odors perceived more readily in moist atmosphere?
13. What is the effect of a bad odor? Of a good odor?
14. What do you know about "draughts"?
15. How are most diseases caused? How do these act?
16. What happens in cases of tuberculosis?
17. Is fresh air needed indoors? When sleeping?
18. Are windows necessary? Why?
19. What are the defects of steam heat?
20. Why does a person shiver on a cold, misty day?
21. What happens in warm, moist air? Why?
22. Which air is most bracing? What are the best disinfectants and deodorants?
23. How is the sun placed for our comfort?

Chapter XV

THE PATH OF THE AIR

1. Our food mechanism begins at the mouth. The apparatus of the body for utilizing the air, however, starts, not at the mouth, but at the nose. This particular organ was specially constructed by that infinite Designer, whose wisdom you must by this time have recognized. He would not have made it, if he had considered the same opening sufficient for both food and air. There are children who are called "mouth-breathers," on account of their faulty habits of breathing; their faces have a strange, characteristic expression. This condition is usually due to an overgrowth of tissue behind the nose, which is known as adenoids, and requires surgical interference. The operation is not serious, however, and no one should be deterred from having it performed, or postpone it any longer than is necessary.

2. The nostrils are lined with little fine hairs for the purpose of catching dust before it enters the lungs. You remember that the tube which

conveys food from the back of the mouth to the stomach is called the esophagus. There is another tube to bring the air from the throat to the lungs, called the trachea, or windpipe. It is placed in front of the esophagus, so that the food passes over it on its journey downwards. The top is covered with a valve, called the epiglottis, which opens to receive air, and closes as if it had intelligence, whenever food is swallowed. It is dangerous, as well as impolite, to try to talk and eat at the same time, because if one does, the valve may not be able to shut. The food will then enter the wrong passage and cause choking. Coughing is nature's way of freeing the air passages of something which does not belong there, or is irritating to the membrane.

3. The upper portion of the windpipe is the larynx, where the voice-box is situated. It is rather wider than the rest of the trachea, and projects into the throat, thus making the "Adam's apple." Across it are stretched the vocal cords, which are bands of strong membrane running along each side. In ordinary breathing no sound is produced; but when we wish to speak the throat muscles tighten and loosen these cords; as air is expelled from the lungs, it makes the cords vibrate when passing by. The cheeks, the teeth, the

tongue, the lips, the nose, the throat, the larynx, the trachea and the lungs all have their part to play in producing sound, and a change in any one of them will bring about a corresponding alteration in the tones; but while the deficiency of any of the others may be partially overcome, defects in the vocal cords cause serious derangement in speaking. It would be like trying to play a violin with broken strings, though everything else was perfect. Our voices were given to speak and sing the praises of God. They should never be used to tell untruths, or to use improper language, or to abuse our neighbor. "Thou shalt love thy neighbor as thyself," Our Divine Lord told us.

4. When goods are manufactured in a factory, no matter how big the factory may be, they are of the same identical pattern, one is just like the rest. Theologians tell us that the angels differ from each other; though there are countless millions of them, each one is in a class by himself. This gives us some idea of the infinite mind of God, their Creator. In a similar way, you must have noticed how great is the diversity in human beings. They differ in appearance, tastes, ideas, habits, even in their manner of walking. In every school-room you are able to recognize

each child from all the others. In the same family, with the same parents, living under the same roof, eating the same food, how distinctly each member of the household is separated from the rest. We know each as soon as we see him. It shows us something of the wonderful construction of the eye, which reports to our vision even the smallest differences between people.

5. But in no way is this difference in people more marked than in the tone of the voice. Before we even catch a glimpse of a person, we know who it is from the sound of his voice. And remember that the voice depends on the vibration of some very small bits of cartilaginous membrane stretched along the larynx. It would seem well-nigh impossible to make any diversion here where the space is so tiny, the membranes all of exactly the same variety of tissue, placed in exactly the same way in the throat. Yet not only does one voice differ from another, but in the same throat high tones differ from low tones, and one high or low tone from all the others, enabling man to elicit the wondrous music which enraptures us when listening to a great singer, like McCormack or Caruso, who recently died. Is not our God, who made us, wonderful and mighty beyond the power of words!

6. All should try to become good speakers. A man or woman who can talk well in public is able to wield a great power for good. But everything worth while costs effort. We should be willing to make the effort, since so much depends upon it. Do not be discouraged if you have not a pleasing voice. Very much may be accomplished by proper training and cultivation, both in regard to singing and to speaking. Some do not take the trouble to speak distinctly, as a consequence their enunciation is always poor. Demosthenes was one of the greatest orators of Greece; he became such through continued efforts, despite the great handicap of stammering, which he had as a youth.

7. Reading aloud in school or at home is one of the best ways to improve the voice, if you are careful to acquire the correct pronunciation of each vowel. We should all learn to breathe properly: "To breathe well is to live well, to live longer and better," someone has said. Many people never use their lung capacity, because they have never been obliged to take deep and full breaths. All vigorous forms of exercise help to develop the chest and to enlarge the lung space, and thus to increase power and endurance in speaking. Swimming is said to be one of the best kinds of exercise for this purpose. Running is

also splendid, for all runners are forced to use their "second wind," which means that all the air is renewed in the lungs as they run, not merely the surface air at the top of the chest, as happens in the case of those who never take exercise, nor even practice deep breathing.

Using Their Second Wind at Fordham "Prep."

8. Proper breathing always expands the abdomen on account of the fact that when the lungs are full, the diaphragm is pressed down upon the abdominal organs and pushes them out. In this way it acts as a form of massage for these organs, especially for the stomach and liver, and thus is also an effective aid to the circulation. It is an-

other example of the way one part helps another, and of the wonderful harmony and coördination which exist everywhere in the body.

9. When we breathe, the chest is enlarged, not only by the descent of the diaphragm, which forms its floor, but also by the elevation of the ribs and breastbone. The ribs, you will remember, are joined to the vertebræ in the back, and are connected with the breastbone in the front by cartilages, which have the power of bending. Two sets of muscles are attached to the ribs, the inspiratory and the expiratory. The inspiratory muscles raise the ribs, the expiratory muscles lower them, thus tending to enlarge the chest cavity during inspiration, and decrease it during expiration. We do not have to think about all these movements; they take place during sleep as well as when we are awake. The process of breathing is, therefore, somewhat like the automatic beating of the heart.

10. The trachea extends from about the fifth vertebra in the neck to the fifth in the chest. It has throughout its length from sixteen to twenty rings of cartilage, which hold it open. These rings do not join in the back, however, and so furnish no obstruction to the passage of food down the esophagus, which is directly behind.

11. The trachea divides into two tubes, which are smaller editions of itself, called bronchi. The inflammation of the tubes brings about the condition called bronchitis. When these tubes enter the lungs they divide again and again, until they end in little bunches of air sacs. The tissue of the lungs is itself elastic, stretching as the air enters, till it fills all the space in the chest, except that occupied by the heart.

12. The lungs are connected to the chest-wall by a double sac, the pleura, one layer of which covers the lungs, the other is attached to the chest-wall. The insides of these sacs produce a small amount of fluid, which prevents friction between the lungs and the ribs, allowing one layer to move upon the other without any difficulty. Dry pleurisy is the condition in which these two layers are inflamed here or there, causing pain. In wet pleurisy the fluid increases to such a degree that it partially fills up the sac and prevents the expansion of the lung. It often is drawn off by tapping, when it seriously interferes with breathing.

13. There is always a certain amount of pressure in air, just as there is in water. If you put an empty glass or bottle under water, the pressure immediately fills it with the liquid. In the same way, wherever there is any space, the air pres-

sure at once fills it with air. "Nature abhors a vacuum." That is how we breathe. During inspiration, the chest-wall is lifted and broadened and the diaphragm is flattened. Into the enlarged space the air pushes the lungs, and as they are elastic, they expand without difficulty. When we

Columbus Day at Fordham University.

breathe forcibly, we stretch them still more, and the air penetrates into the smallest sac.

14. We have learned that the blood from the right side of the heart goes to the lungs through a large artery, called the pulmonary artery. Just as the bronchi divide and sub-divide in the lungs, so the artery branches into innumerable capillaries, and these form a fine network all over the

surface of the air sacs. If you picture the trachea as a mighty oak, spreading its branches in all directions, you may consider the capillaries as vines which climb the tree, growing around the limbs and even the smallest twigs.

15. In the small sub-divisions of the lungs, the tissue is thinned out to the finest degree; in the same way the capillaries which cluster over them are so tiny that their walls are not more than one cell thick. The blood does not actually leave the capillaries, but the red cells within them have the power of attracting through the walls the oxygen in the air, and as this is a gas, it passes through without causing any damage to the fine tissue of the lung or the blood vessel. Is not that power of attraction a wonderful thing? We cannot even see the difference in the gases which are in the air; yet the red cells would seem to be more clever than we, for they are able to subtract from the air just the amount of oxygen which is needed for the repair of some part of the body, while we are not even conscious of the process, despite our boasted wisdom. The more we know, the more we realize how small is our knowledge, compared with His, whose wisdom formed us from clay and keeps us ever from destruction. When Pasteur, the "Father of Modern

Medicine," was an old man, he said: "The more I learn, the nearer I approach the faith of a Breton peasant. If I had only studied more, I should be able to approach the faith of the Breton peasant's wife."

16. Remember also, the process is never-ending. As soon as the blood takes the life-giving oxygen to some worn-out cell, it picks up what the tissue gives up as useless, and hurries it back through the veins to the heart, to be pumped again to the lungs, there to continue without losing a second. What should we say to those people who abuse their bodies in any foolish way, forcing these tireless messengers in the blood to do more than their allotted share of toil, in order to ward off feebleness and disease from those who really do not deserve such condescension on God's part?

QUESTIONS

1. What are "mouth-breathers"? Why is the name given them?
2. What is the name of the tube that brings air to the lungs? Where is it placed? What is the epiglottis? Why is it dangerous to talk and eat at once?
   What does a cough mean?
3. What is the larynx? What does it contain? Why were voices given to us? For what purpose should they not be used?
4. What have you noticed about differences in people?

5. What have you noticed about voices? What does this show?
6. Is it well to learn to speak? Why so? Who became a great orator, though handicapped by stammering?
7. What is a good way to improve the voice? What exercises are helpful?
8. How does the diaphragm affect the abdomen?
9. Describe the movements of the chest during breathing. What do the inspiratory muscles effect? The expiratory?
10. What do you know about the trachea? About its rings of cartilage?
11. What are the bronchi? How do they divide?
12. What are the pleura? Distinguish between wet and dry pleurisy.
13. How do we breathe?
14. How do the blood vessels reach the air sacs?
15. How does the oxygen in the air get into the blood?
16. How often does this process occur in a day?

Chapter XVI

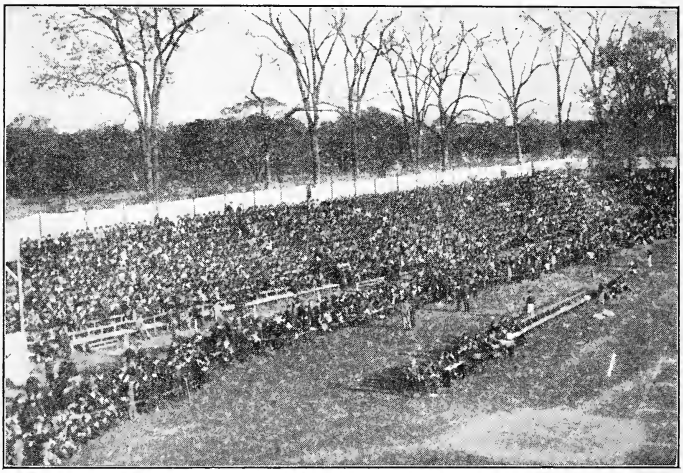
ARTIFICIAL BREATHING

1. Resuscitation, or artificial respiration, is the process of restoring breathing, when once it has stopped for any reason. The reason may be drowning, gas asphyxiation, drugging, an electrical shock or a blow (concussion). But whatever the cause, the individual ceases to draw fresh air into the lungs, therefore the blood is deprived of the life-giving oxygen which the tissues need. There are three methods of resuscitation, in all of which the procedure is just the opposite of natural breathing, that is, the lungs are filled with air by positive pressure.

2. The method advocated by Hall consists of placing the person face downward and rolling the body from side to side, at the same time pressing upon the chest with the hands.

In the Sylvester method the person is placed on the back, with a small cushion or a coat under the shoulders. The one who is to undertake resuscitation kneels behind the patient's head, and

grasping his arms, brings them up above the head, then downward, pressing them forcibly against the sides of the chest. These movements should be made slowly, not more than twelve times a minute. This number is important, as most



Viewing a Fordham-Georgetown Football Game.

people in their eagerness to serve, will be over-anxious.

3. Another method, which seems the simplest as well as the safest, is described by Schaefer: "It consists in putting the subject on the ground face downward, with a thick folded garment underneath the chest and stomach. The operator puts himself athwart or at the side of the patient, fac-

ing his head, and places his hands on each side over the lower ribs at the back. He then slowly throws the weight of his body forward to bear upon his own arms, and thus presses upon the chest of the subject, and forces the air out of the lungs. This being effected, he gradually relaxes the pressure by bringing his own body up again to a more erect position, but without moving his hands. These movements should be repeated regularly twelve or fifteen times a minute, until the person begins to breathe, or the prospect of restoration is abandoned. A half hour or more may be required before success is obtained."

4. Do not give up too soon. People who were given up for dead have been restored by a continuation of the process by some one else. While respiration is being established, the patient should be freed of his garments, if they are wet, and the circulation assisted by vigorous rubbing of the extremities by other assistants. After breathing becomes regular, give the patient hot coffee and cover him with blankets

5. If the case seems hopeless, and you are not sure that the person was baptized the Sacrament of Baptism should be administered by any one of those present who knows the simple formula. If you do not know it, look it up in your catechism,

as you may at some time or other be the means of sending some soul to heaven under such circumstances. In any case, send for a priest, if possible.

QUESTIONS

1. What is resuscitation? What may cause one to attempt it?
2. What are the methods of resuscitation?
3. What is Schaefer's method?
4. How long should it be continued? Is there any other remedy?
5. What should be done, if a case seems hopeless?

Chapter XVII

THE NERVOUS SYSTEM

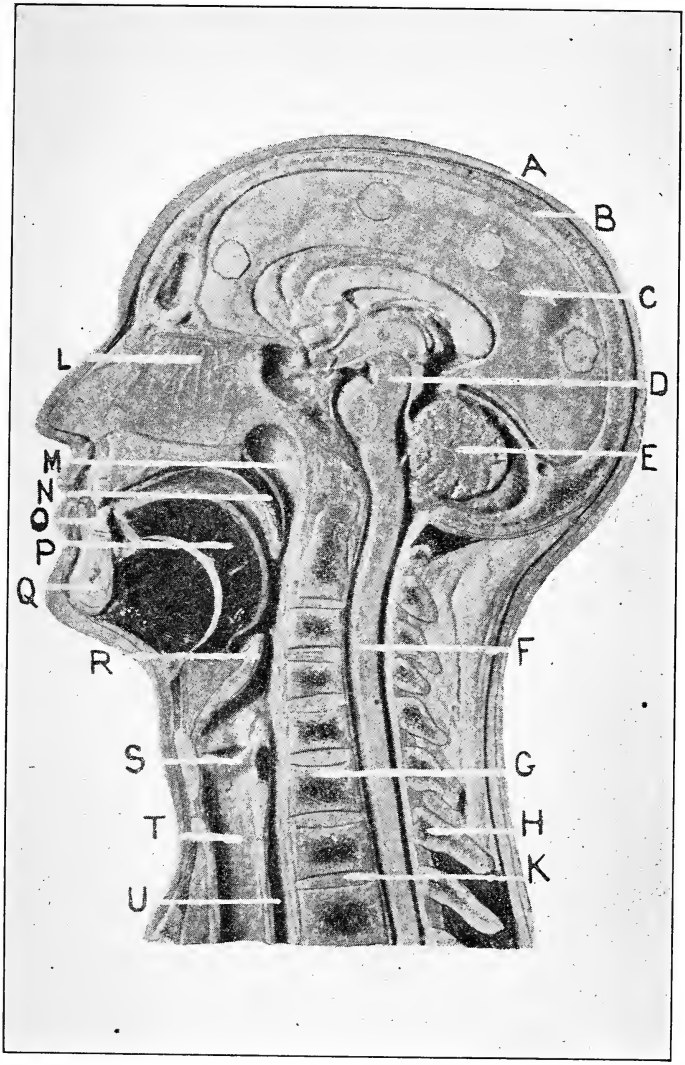
1. Have you ever been in a central telephone office, and watched the numerous clerks receiving and sending messages near and far across the wires? Have you marvelled at their speed, and thought what a wizard Mr. Edison must have been to perfect the telephone to such an extent that we may speak from New York to a friend in Chicago almost as clearly as if he were in the same room at home? What a revolution in the business world has been produced by the introduction of the telephone! How slow and strange life would seem now, if we were suddenly deprived of the use of this instrument!

2. But wonderful as the telephone is, there must be intelligent clerks, alert at their posts, to connect the wires before the message can be sent. A large force of men must be employed to keep watch and restore anything broken or frayed. The smallest part of the myriad workings of this vast system must be kept in order or defects and

annoying delays will result. "Eternal vigilance is the price of success," and though money is ever pouring into the coffers of the company which controls the system, it also requires the constant expenditure of much money, labor and thought to bring satisfaction to owner and user of the telephone.

3. There is something like a complicated telephone system within the bodies of all of us, only it is far more amazing than the most perfect telephone ever invented. It is called the central nervous system, the chief station of which is within the skull. It is also known as the cerebro-spinal system, because its main line is made up of the brain and the spinal cord.

4. Like all the important parts of the body, the brain and spinal cord are enclosed in a delicate sac, which, in their case consists of a triple covering, called the meninges. The ending, "itis," always denotes inflammation, and so spinal meningitis means the disease in which the covering of the spinal portion of the nervous system is inflamed. Cerebro-spinal meningitis includes the covering of the brain also. This inflammation generally is due to some germ which penetrates through the body until it can attack these delicate membranes.



SAGITTAL SECTION THROUGH HEAD FROM MODEL.

A, Scalp; *B*, Skull Bone; *C*, Right Hemisphere of Brain; *D*, Medulla; *E*, Cerebellum; *F*, Spinal Cord; *G*, Spinal Vertebra; *H*, Spinal Process; *K*, Cartilage Packing; *L*, Nerves of Smell; *M*, Pharynx; *N*, Soft Palate (Uvula); *O*, Tooth; *P*, Tongue; *Q*, Lower Jaw Bone; *R*, Epiglottis; *S*, Larynx; *T*, Trachea; *U*, Esophagus.

5. When a telephone company has established itself in a neighborhood, another organization sometimes obtrudes itself, endeavoring to draw business away from the company that was first in the field. In the body there is also a second nervous system, lying outside the spinal column instead of inside, but it is a good friend and auxiliary to the other, rather than a rival or antagonist. This second system is the sympathetic system, and, together with some branches of the other (which are concerned with the heart and digestive organs), is also called the autonomic system, because it controls the involuntary muscles, or those not under the control of the will.

6. The central nervous system governs the organs of sense. The voluntary muscles, which are generally those muscles attached to the bones of the skeleton, are called skeletal muscles. When, for instance, we wish to move a hand, the brain flashes the signal down through the cord and out along the nerve of the arm, till it reaches those particular muscles which move the hand in the direction desired. But when food is passing along the alimentary tract, it is the nerves from the autonomic system that assist it on its journey and urge on the various parts properly to perform their digestive functions.

7. The brain, or cerebrum, is the organ of the higher faculties and feelings, such as the intellect and will, which, however, being faculties of the soul, are entirely distinct from the brain, even though they use it as their instrument. If the cerebrum is not developed sufficiently, or if it has been injured, the individual becomes foolish or idiotic, cannot reason or make up his mind to do things easily within his powers. Does not this seem to show that there really is no soul; because if there were, it could not be damaged by any injury or deformity of the brain, since we claim that it is spiritual? We do indeed claim that the soul is spiritual or immaterial; that is, not made of matter, such as that which composes the body; but we do not say that it is a pure spirit, as an angel is, who in no way depends on matter. God made us a compound of soul and body in such a manner that the body is held in life by the soul, and the soul depends on the body for its operations. When a part is injured, therefore, the soul cannot act through it, just as a boy cannot use a broken hammer to drive a nail, though he knows well how to use tools; or a girl, though an expert seamstress, cannot do good work with a bent or blunt needle.

8. The two halves of the brain and the spinal

cord are exactly alike, and nerves cross over from one side to the other, so that there is constant intercommunication between the two: one helps the other; one takes up where the other leaves off; what one is unable to do, for any special

Keystone View Co.

EVERY NERVE IN FORM.

reason, the other does; an impulse started in one is transmitted through the other to a whole series of connecting links. On account of this wonderful system's arrangement, when endowed with life, we are able to appreciate at once that the little finger which is cut belongs to *our* body, that it is *our* foot which has been hurt, etc. Perhaps this

is the first time you have thought of this fact; but it shows us clearly that there is some principle within us that is the same in all parts of the body. It is that thing which makes the foot something entirely different from the shoe. It lets the owner of the body know clearly that the hand belongs to *it* as an integral part of the same individual, whereas the glove is merely an exterior addition. We say, "my shoe," "my glove," etc.; but we are well aware of the enormous difference that exists between what we own, and what is actually part and parcel of ourselves.

9. Some of the so-called scientists of modern days have claimed that there are hundreds of thousands of individualities inside us; that, in fact, each cell has its own personality. But they are saying such things merely in order to deny the unity of the soul. Their lack of faith blinds them to the fact of which Catholics are so vividly aware. Catholics realize and acknowledge that within us there are indeed different portions of the body, many diverse cells (as many as 25,000,000,000,000,000), varied moods, myriad thoughts and changing physical conditions. We are quite unlike a jellyfish or a microbe. But we are even more certain that it is not "a stream of consciousness" which holds us together; nor the mere

"proximity of parts" which makes us one; but that there is a central governing force which unifies all parts, making them one and the same individual.

10. It is the nervous system which God arranged should be used by the soul as its chief instrument to accomplish this astonishing fact, and by means of it we work out our eternal salvation. You sometimes see the triplet:

> "Sow a thought, and reap an act.
> Sow an act, and reap a habit.
> Sow a habit, and reap a character."

But seldom is the fourth and most important line added, which runs thus:

> "Sow a character, and reap a destiny."

11. Without any doubt, we do form habits by the succession of acts, and we become so accustomed to their repetition that we cease to take any notice of them. Thus the beginner's performances on the piano consist of slow and painful placing of each finger on the white and black notes of the keyboard. But after long practice the hands of the musician sweep from end to end of the instrument, slip from one delicious chord into

another, without the necessity of glancing at them, or even of thinking of them.

12. In similar fashion, we perform daily acts of kindness until they occur spontaneously. We keep on overcoming temptation, until what was difficult becomes easy and pleasant and seems the natural, as well as the supernatural thing to do. Sometimes we become discouraged when we think of the many things we must accomplish before we can reach heaven; but we ought to remember that when we are well advanced on the way, it is really easier to continue straight forward, than to turn around and deliberately face the open jaws of hell.

13. We may have envied the ability of a Saint Aloysius to pray for hours without a distraction. But he accomplished this by repeated efforts every day, until he acquired such splendid control over his nervous system, that it resisted, rather than welcomed, any outside influence, while his mind was fixed on God and holy things. It is similar to learning to skate. You receive a fine pair of skates for Christmas, and rejoice that the weather is cold enough to freeze the pond nearby. With your best friend you run down to the shore, then sit down to put on the skates, amid an admiring group of the neighbor's children, who look

as if they wished Santa Claus had been equally generous to them. The skates are buckled on; you stand up, striving to conceal the unexpected trembling of your heart. Your instructor tells you to "strike out." You do not dare to disobey with all those eyes upon you. You do strike out; immediately you fall down. You are picked up and told to try again. You try again; once more you assume a sitting posture. If you are cowardly, you will then give up and retire to the safe shelter of the hearth. If you have the normal share of pluck, however, you are not deterred by your falls, but keep on trying until you are spoken of as the most graceful skater of your age by your flattering relations, who frequently come to the scene to witness your prowess on the ice.

14. In obtaining facility in spiritual things, much the same tactics are pursued. We daily do pious things, until we become pious. We perform humble things until we become humble. We keep on obeying, until we become obedient. So of other things; and having thus formed habits by repeated good actions, and having moulded sterling characters by the attainment of many good habits, death finds us at last with the characteristics of saints and bears us away from this earth to be saints forever with God in His home in heaven.

15. Though the acquirement of any habit, bodily or spiritual, involves the daily use of the nerves, and the control of at least parts of the nervous system, there is this important distinction between what is natural and what is supernatural. In the weaving of our destinies, we do

A Happy Group on May-day.

not depend wholly on our own unaided efforts. We know that God is everywhere; He sees all our struggles; He knows every one of our difficulties. He not only has made us, but constantly supports us in existence. There is nothing which we attempt, for which He does not supply aid. We cannot so much as move a hand without His assistance. But when we do good and holy things,

when we strive to avoid evil and to act in the way which pleases God, when we endeavor to cultivate virtues by being kind, truthful, generous and charitable,—in a word, when we try to imitate our Model, who was "meek and humble of heart," then we have not only His ordinary coöperation in the nervous system which He gave us, but also those special helps and favors about which we are taught in our catechism classes.

QUESTIONS

1, 2. What is necessary to make the telephone system a success?
3. Is there a system within us which corresponds to the telephone system? What is its name?
4. What is the covering of the brain called? What is cerebro-spinal meningitis?
5. What is the second nervous system? Where is it?
6. What are the differences between the two nervous systems?
7. How much do the intellect and the will depend on the brain? Are they identified with it? If the soul is distinct from the body, how is it that our mental state seems to correspond to the condition of the brain?
8. What is the arrangement of the brain and the spinal cord? Of what help is this arrangement to us?
9. How many cells are there in the body? Is our life a mere stream of consciousness? How can you tell?
10. What part of the body does the soul use chiefly?
11. How do we learn?
12. What should this method tell us?
13. Give an example of what practice can do.
14. How are habits formed?
15. Is there any distinction between acquiring what is natural and what is supernatural? What is the meaning of "supernatural"?

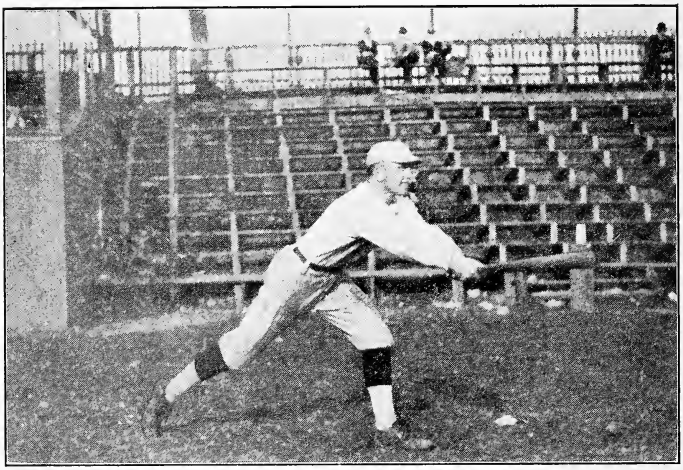
Chapter XVIII

THE CENTRAL STATION

1. In proportion to his size, man has the biggest brain known. He alone has intelligence and will-power. Animals have senses, feeling and instinct to guide them, but not an intelligent soul with its faculties, for they are not destined by the Creator for the immortal existence which He has granted to us.

2. The outside of the brain is called the cortex, which is divided up into many ridges and furrows, known as fissures and convolutions. It has been found by experiments on animals, also from necessary operations in the case of man, that various localities in the brain are concerned with the movements of various parts of the head and body. Thus the area included within a few convolutions or fissures on the side of the head is connected with taste, those above with hearing, the ones behind with seeing; the area on the top of the brain is concerned with the trunk, just be-

low this is the area for the legs, underneath for the arms, in the centre for the face, etc., as is observed in a paralysis. One portion may be injured and a deformity result, without any defect necessarily occurring in any other part. Thus the blood vessels, which supply the particular place



A Striking Pose.

where the nerves which control the motions of one of the fingers originate, may be diseased for some reason, with the result that the blood escapes into the surrounding tissue and blocks it up. This will prevent the movements of that finger, but leave all the others undamaged. A hand area may be involved without any injury

to the wrist or arm. A foot area may be unsound, but no other deformity necessarily follows in the leg.

3. If the damage is slight, the tissue may be capable of being repaired; the area may recover its usefulness, if not wholly, at least to some extent. Sometimes curious effects follow injuries to small regions. After attacks of influenza some patients are unable for a time to understand the meaning of words which are spoken, while they readily grasp their sense if written or printed. This shows that the nerves of the hearing centre were disturbed, while those of the seeing area remained intact.

4. We often hear that old people suffer "shock" or a "stroke." This signifies that the brain tissue in some area has been injured, generally by the escape of blood from some break in a blood vessel. It is often called, "a clot of blood on the brain." If it is the part which controls movements of the arm or leg, the person loses power over that extremity, and is said to be paralyzed, the extent of paralysis depending upon the amount of damage.

5. The injury need not be in the brain itself to produce such a result. It may also occur in the cord. Thus in the disease called infantile paraly-

sis, only that special part of the spinal cord from which the nerves run to the leg or foot is affected, with consequent inability to use that member. On account of the crossing of the nerves from one side to the other, it is the right side of the brain which controls the left side of the body. After a shock it has happened that the area itself recovers, while the nerves lose some of their connecting links, and the person makes peculiar slips in speech as a consequence. Thus if he wishes to say a word, like "tree," for example, he may say "house," or something else far removed from what he intended. This shows what an intricate machine the nervous system is, and how delicate is its adjustment.

6. The speech-controlling centre is on the left side of the brain on the under surface, in a convolution called the convolution of Broca, after the man who described it. Mr. Edison has lately placed the location of the soul here, as if talkativeness were a sign of great spirituality. The interesting thing to note is that if the left side is injured, and the person is, therefore, unable to speak as a result, after a while the right side takes up the duty, restoring the power of speech.

7. Another interesting fact, which helps to refute the doctrine of those who hold that man is

descended from the monkey, is that in the monkey's brain there is a convolution just like the convolution of Broca; yet the monkey has never been able to say one word, though men have wasted years trying to teach it. On the other hand, the cortex of the parrot's brain is quite smooth, without a vestige of this convolution, yet it can be taught to pronounce words.

8. The theory which Darwin taught, of man's descent from apedom, is being discarded nowadays, and other follies are substituted. For example, a gorilla died recently in a circus in New York; the following is taken from one of the accounts of his death, written by a writer usually very sagacious on other matters: "You will be told that his brain is like that of man in structure and operation. For every bone in the human skeleton, the gorilla's skeleton will show a bone almost exactly similar. Some will say that this proves that man descended from a monkey. But it does not. Man grew up alongside the monkey, and passed the monkey. He is constructed like the monkey, because both had to fight the law of gravitation." (But if man grew up with the monkey and both had the same laws to fight, why should man surpass the monkey?) The writer makes the statement, but offers no proof to support it. It is a sample of the absurd assertions

made without any foundation by those who reject the Biblical account of creation which, even from the mere viewpoint of history, stands as sound evidence. The article continues to scatter more of the same kind of valueless foolishness. "Your ear was once the gill on a fish, letting out the water. Your five fingers come from the five-toed foot of the salamander that lived millions of years ago under the fern trees that produced the coal beds." (And we are counted behind the times if we refuse to accept this sort of wisdom which has not a shred of proof to support it, preferring to believe the inspired Word of God and the teaching of His infallible Church. It only proves that faith is a gift of God, and fortunate are we to whom that gift has been given.)

QUESTIONS

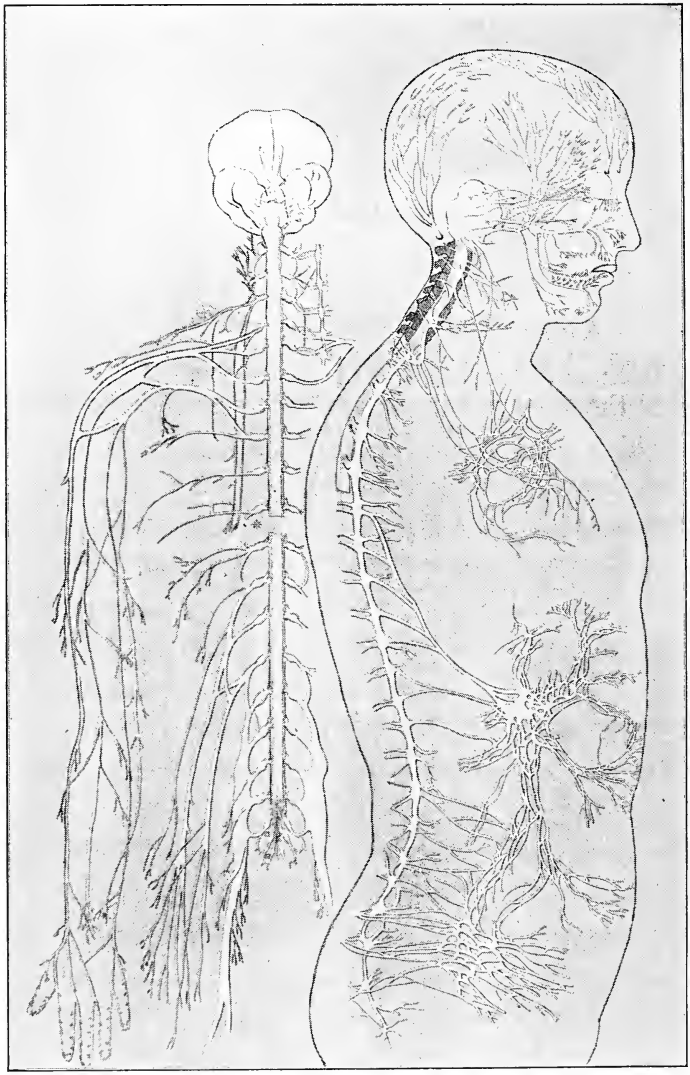
1. What are some differences between man and animals?
2. What is the cortex, and into what is it divided? Name a few areas of movement. If an injury occurs in the brain, what is the usual result?
3. Give an example of the results of brain damage.
4. What is a shock or stroke?
5. For deformity, need the injury exist in the brain?
6. What is the convolution of Broca? What does Edison attribute to it?
7. What can be cited as a refutation of the theory of man's descent from a monkey?
8. What do you think of the average proofs which are given to throw discredit upon the Biblical account of creation?

Chapter XIX

THE CARE OF THE NERVES

1. A very important part of the nervous system is that which connects the brain and the spinal cord. This is the medulla oblongata, where some of the vital functions are centred. It is this spot which the toreador strives to pierce with his rapier when he delivers the death-blow to the poor animal at the end of a bull-fight. Instant death results from any injury to it. On the other hand, large portions of brain or cord tissue may be damaged without loss of life or even serious disfigurement. In the museum of a certain medical school is exhibited the skull of a man, which shows where a crowbar passed through from front to back. The brain necessarily must have been terribly injured, but the man lived for some time afterward.

2. When a man falls from a height and breaks his neck, the vertebræ are fractured to such an extent that the spinal cord is severed. This does not produce death at once, but paralysis occurs



THE CEREBRO-SPINAL AND SYMPATHETIC NERVOUS SYSTEMS.

below the point of injury. No messages can travel from brain to arms or legs, consequently the person cannot move them when he wishes.

3. There are twelve principal pairs of nerves which come out from the brain. These are connected with the senses and the chief organs in the chest and abdomen. From the spinal cord thirty-one pairs of nerves run out to all parts of the body. The nerves are, for the most part, made up of two fibres, one sensory and one motor. Sensation travels in along the sensory track from some place on the outside of the body, and the answering impulse flies back along the other fibre and produces motion.

4. We learned that the flesh everywhere is filled with tiny branches of the arteries. The nerve endings likewise are so fine and so universally distributed that there is no spot anywhere in the body which you can touch without pressing on a nerve.

5. The nerve fibres are white, shining cords, varying in size, from those which can be seen only with the aid of a microscope to the large nerve which runs down the leg from the hip to the ankle, called the sciatic nerve, which is about a half inch wide. When this nerve is inflamed it gives rise to that extremely painful form of rheumatism

called sciatica. Everyone sooner or later strikes at the elbow the place called the funny bone, or the crazy bone, from the peculiar sensation produced when it is hit. It is not the striking of the bone there which causes the feeling, but the irritation of the nerve which is close to the surface at that point. This nerve is called the ulnar nerve, because it follows along the ulnar bone, which you will remember is one of the bones in the forearm. Is it on the thumb, or the little finger side?

6. The nerve fibres are covered by a thin sheath. When the covering of one of the larger nerves is attacked by some form of inflammation we have the trouble known as neuritis. Neuralgia is the word used to express irritation of finer bundles of nerves in certain regions or areas. By the common term, nervousness, is usually meant that state of the nerves in which trifles upset too easily that restful poise which most people possess, or that condition in which the ordinary amount of self-control is lost. The individual allows the imagination to have too great sway over the actions, so that he is ruled by feeling and emotion. This is more frequently the fault of the female sex; when it occurs in the sterner sex, the effects are more pronounced.

7. If you are naturally nervous, you should train yourself to overcome that habit while you are young, or it will be a difficulty all through life. It may be impossible to get rid of it completely, but do what you can to work against it on all occasions. If you will not try a thing just because

American Officers Coming from Church at Moreuil en Dole.

you feel afraid, you will never accomplish much for yourself or for God in this world, nor will you have a harvest of good deeds to bear to the next. Useless worries and needless fears are the only things which deter a great many people from making a success of life. If they had only made proper use of their opportunities they might have become great in the eyes of their fellows, they

might have done heroic things for the spread of Christ's kingdom on earth, and reached a high plane of holiness for themselves; instead they spend their days in idle inaction and fruitless desires. The real reason of their failure is that they have never acquired the amount of self-control that would have enabled them to act in spite of their fears. Strength, courage, endurance may come more easily to some than to others; but unsuspected depths of these virtues are at the disposal of any boy or girl who may wish to mould them into their characters by repeated acts until their nerves have acquired them as habits. Do what you know is right, no matter how you feel, or what you fear, and your life will be a constant ascent in happiness as well as in holiness.

8. Neurasthenia is the long word used to express a number of symptoms which indicate a serious breaking down of the force and energy which should naturally accompany the normal working of the nervous system. There is a break here or there, a lack of continuity, an interruption in the communication of the various branches of one system; or the two main systems, the cerebro-spinal and the autonomic, have lost their accustomed harmony and coöperation. Neurasthenia

means the depression of the nerves, just as debility means physical depression. It is usually the result of living at too rapid a rate, "of burning the candle at both ends," of striving too strenuously for things which are beyond one's mental or physical resources. Be on your guard against

Practice Gets the Nerves under Control.

it! It is a serious illness, known as the American disease, because in this, our country, life is lived by many at such a rapid pace that the nerves are not able to stand the strain. Have high ideals and strive to live up to noble standards, but not at the expense of the necessary share of sleep, food and recreation.

9. "Health is above riches." Therefore do not work too long; do not study too hard! Moderation should be practised in everything. You cannot have all the parts of the body working at top speed at the same time. After meals you should not try to study or to use the mind, because the nerves of the alimentary tract are then busy passing the food along and stirring up the digestive juices, while the blood is being sent to the same regions to assist the nerves in doing their duty. That means that the arteries going to the brain have not the full amount of blood; therefore the brain cells should not be called on to their utmost working capacity.

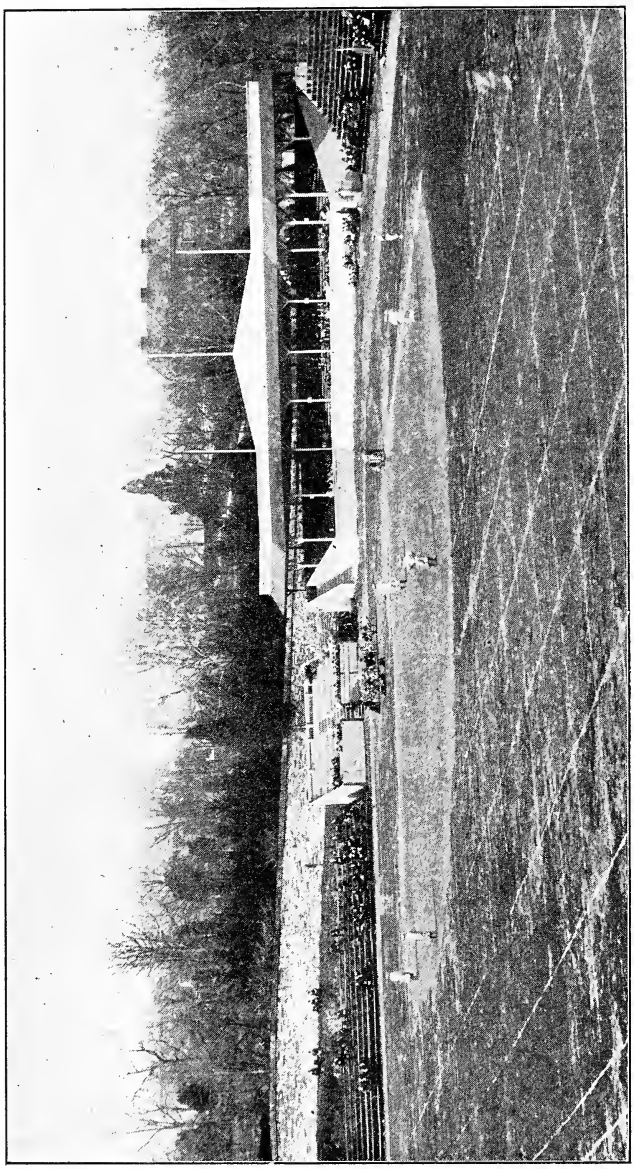
10. Sleep is needed to reconstruct the worn-out nerves, which are tired from the day's demands, and require rest and quiet. Of course, as we know, the heart goes on beating and the lungs continue to do their work, even in the soundest sleep; that means that some of the nerves are then vigilant. But with most of the body in repose, without too much effort the blood can show more care of the guardians of these vital functions, and take the opportunities between beats and between breaths to furnish nourishment and repair damages for these particular branches of the nervous tissue.

11. The amount of sleep required varies with age and with occupation. The young need more than the old. The infant does little more than wake up to be fed, to go to sleep again immediately. The growing child requires nine or ten hours' sleep; an adult should have at least six, better, seven or eight.

> "Early to bed, early to rise,
> Makes a man healthy, wealthy and wise,"

is an old adage, and contains advice much needed nowadays, when the "children's hour" has been put so far back that their parties and entertainments rival their elders' in unhealthy excitement and lateness in closing. Of course, those who do not go to bed until midnight or after, find it hard, or impossible, to get up for Mass in the morning. As a result their Holy Communions become infrequent, and their devotion toward the Blessed Sacrament gradually grows tepid and cold. They wear out their nerves in a whirl of gaiety, until there is nothing left in life by the time they reach the age when they should really enjoy it to the utmost.

12. Most leaders of men come from what is called the middle class, for this reason. The children of the rich have no incentive to labor, the



GEORGETOWN UNIVERSITY ATHLETIC FIELD.

brain and the nerves rust and lose their force through disuse. How often do we hear of a man who dies after a life of hard work, leaving an honorable name, as well as a large fortune, to his sons, whose brains and whose bodies have never been trained to endurance, so that their unearned wealth soon departs, and their health is also wasted in spending it.

QUESTIONS

1. What is the medulla oblongata? Why is it of importance?
2. What happens when a man breaks his neck?
3. What nerves come from the brain? from the spinal cord?
4. How widely distributed are the nerves?
5. Describe the appearance of nerves. How big are they? What is the "crazy bone"?
6. What is neuritis? neuralgia? nervousness?
7. What usually causes nervousness? How can one get rid of it?
8. What is neurasthenia? What causes this condition?
9. What precautions are to be taken in order to keep healthy?
10. What happens during sleep?
11. How much sleep is required?
12. Why do leaders usually come from the "middle class"?

Chapter XX

HOW DO NERVES ACT?

1. Precisely what the nature of a nervous impulse is, has always been a subject of discussion. This is naturally accounted for by what has been said, for we know now that the nervous system is the instrument for the expression of all the manifestations of life within us, but that God has not yet explained fully to man what life really is.

2. Before men knew much about the construction of the body, it used to be thought that the nerves were hollow tubes, through which flowed animal spirits in the form of a gas. There were four kinds of these spirits. The temperament or disposition of an individual depended upon the particular variety flowing through the fibres of the nervous system. The four spirits described were these:

1. Phlegmatic, *i.e.,* even-tempered, gentle, cool.
2. Melancholic, *i.e.,* sad, pessimistic, gloomy.
3. Irascible, *i.e.,* irritable, sensitive, impatient.
4. Sanguine, *i.e.,* ardent, optimistic, hopeful.

Can you pick your own character from such a list? When you do, you know that it does not come from any spirits in the nerves, though the nerves have much to do with character.

3. According to other writers, the nerve force was a fluid, somewhat similar to water. Later,

Fordham University Campus on July Fourth.

when electricity was discovered, many scientists held that it was of exactly the same nature as the nerve impulse. A noted French physiologist wrote a book, in which he expanded this view into a theory which was adopted by nearly all outside the infallible Church. Nowadays most scientific people have rejected this opinion, and have given up the attempt to solve the difficulty,

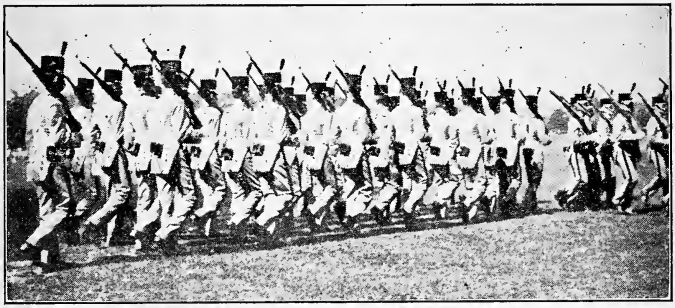
just as they have learned how to make use of electricity, without discovering what its nature is.

4. It would seem equally, or even more impossible to analyze the nerve impulse. Study a reflex action, for example. A reflex action is the nervous impulse which travels along a sensory fibre to some station inside the body, where it is transferred back along the motor fibre, causing motion, without any desire or even consciousness on our part. Such a station may be compared to a sub-station of the telephone system. The mind is located in the brain, the principal station; but we do not have to call on it to have mere local calls sent.

5. Suppose you should accidentally put your hand in the steam from a kettle, merrily boiling on a red-hot stove. You do not need to look at the stove to observe that it is hot and that steam is coming from the kettle; then gaze at your hand, remark that it is being burned and decide to remove yourself from the vicinity of the fire before further injury occurs. If you were obliged to go through this process, serious damage, even loss of life, would often happen. Instead, the sensation caused by the heat travels along one nerve into the nearest sub-station; the answering impulse along its mate jerks the hand away from

the danger before you have any time to think about it.

6. Imagine this case: A window cleaner is standing on the ledge outside a window of the twentieth floor of a high building, using both hands at his work. Suddenly a puff of wind blows his cap off. He reaches for the cap, loses his



COLUMN RIGHT.

balance on the ledge and falls off, as one hand grabs the cap; but the other grasps the edge of the ledge, preventing his fall to the ground. How many reflex actions occur in such a situation, do you think? Do you suppose his guardian angel had anything to do with saving his life?

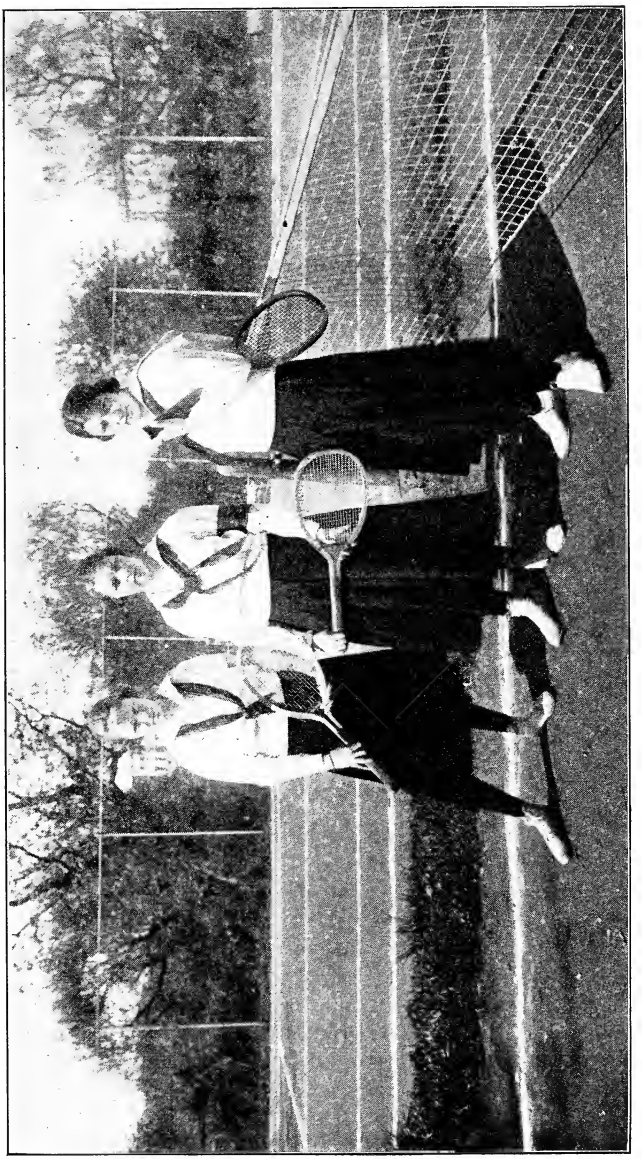
"He hath given His angels charge over thee . . . lest thou dash thy foot against a stone. (Ps. xc. 11, 12).

7. Place yourself in this situation: you are

crossing a thoroughfare; suddenly a horn shrieks and a chauffeur shouts at you, as you jump back out of the way of a motor car which flies past. As you jump, you turn your face towards the car with a look of mingled alarm and annoyance, which changes into a smile as you recognize the occupants, and your hand waves in return to their bow of friendly greeting, before you start forward again. How many reflex actions can you count here?

8. It is reflex action that accounts for digestion, circulation, respiration, winking, coughing, sneezing. Some acts begin as voluntary ones, and therefore originate in the brain; later, when the parts acquire the habit, lower sub-stations take care of them without troubling the higher centres. In this way occur such actions as walking, skating, swimming, dancing, bicycling, motoring, playing any game or instrument, in fact, most of the bodily movements that we are making continually every day.

9. The only explanation of all such actions can be the living principle which animates the body and which uses the nerves as its instrument. You may take a dead body, with all the structures perfectly preserved, and place it in any situation, but nothing happens. The only reason can



WAITING FOR THE FOURTH PLAYER AT THE GEORGETOWN VISITATION CONVENT.

be because life is absent. Now life is simply the manifestation of the soul, from which all vital actions proceed. We cannot, indeed, perceive the soul with any of the five senses, because the soul is spiritual; therefore, while we can see *what* it does, we cannot see *how* it acts. Those who deny the existence of the soul can offer no sufficient explanation for the many and varied acts with which our days are filled. Life implies action, self-orginating action betokens life, the acts of life show forth the soul.

PAIN

10. Pain is caused by the irritation of some nerve. Most people fear pain and try to escape it in every manner possible. Yet pain is a great benefit. Some of those who have done most for mankind, leaders in every sphere of life, have been sufferers in one form or another. Of the writers, there are Keats and Robert Louis Stevenson, both of whom were consumptive; Sir Walter Scott, who suffered for years from agonizing cramps; George Eliot, who was ill off and on during her entire life; Boyle, Descartes and Malebranche. There were Kepler, Saunderson, D'Alembert, all great scientists, though also great

sufferers from pain. Among the artists were Watteau, Beardsley, Navarette; of the musicians Chopin, Schubert, Beethoven, Schumann; of the physicians there were many, who, though themselves invalids, worked for the health of others, of whom the greatest was Louis Pasteur. So the list runs through every branch and profession.

11. We naturally expect to find many among the saints, and are not disappointed in our search. In fact, it is hard to find a saint who does not seem to desire to "suffer or to die," the daily prayer of St. Teresa. You will also remember St. Catherine, to whom was given the choice between two crowns, one of roses, the other of thorns, the latter of which she freely chose. Why?

12. Physically, pain helps us, by warning us of what would otherwise harm us. It is like a red flag, or an alarm bell, indicating danger. Morally, it is also good for us, as it supplies opportunities for cultivating virtues which can be developed in no other way. A person who never has any hard things to bear, remains weak, soft and unstable. Most of all, it provides a chance to resemble our Blessed Lord, who ennobled pain and glorified it forever, by the painful shedding of His Precious Blood as the price of our salvation.

QUESTIONS

1. Why is the nature of the nerve impulse a subject of frequent discussion?
2. What used to be thought of the nerves?
   How many spirits were thought to be in the body? Describe the various kinds.
3. What later views were held of the nerves?
4. What is a reflex action?
5. How important is such an action? Give some examples.
6. Cite some cases of reflex actions.
8. What other acts are explained in this way?
9. What is life? Why cannot the soul be perceived by the senses? How can we know it exists, if we cannot see it?
10. What is pain? Of what use? Name some sufferers who accomplished something noteworthy in spite of afflictions.
11. What is the practice of saints in this regard?
12. How does pain help us, physically and spiritually?

Chapter XXI

OVERWORKING THE NERVES

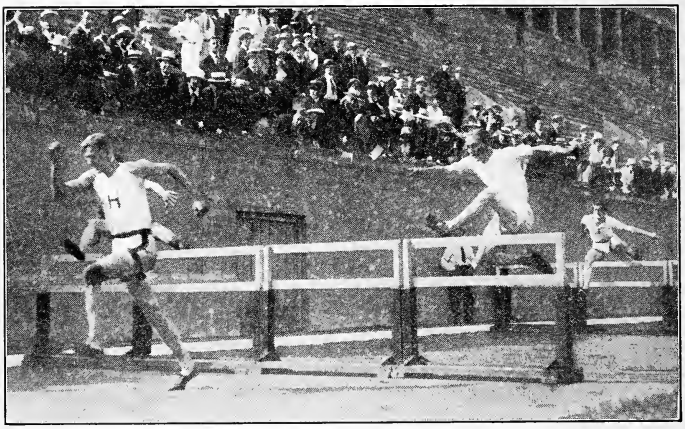
1. There are certain things which overstimulate the nerves and cause them to be overworked. Moderation is best in everything, in food, in clothing, in play, in study, in conversation, in work. Too much food is as bad as too little. The former taxes the digestive system beyond its capabilities, the latter starves it into uselessness. Excess in the matter of dress partakes of the spirit of paganism and detracts from Christian humility and modesty. It would be amusing, if it were not sad, to consider that the present feminine style of bunching the hair above each cheek came from a notorious Parisian dancer, who covered her ears in order to conceal their deformity.

2. If there is too much play, nothing is ever accomplished. Too much study results in ill-health. Too great prominence in conversation makes the talker undesirably conspicuous; and the continual interjection of slang phrases shows

a lamentable acquaintance with good language and grammar.

"All work and no play,
Makes Jack a dull boy,"

is an axiom that explains itself.



Keystone View Co.

OVER THE TOP.

3. So it is with the nerves. Lack of exercise makes them feeble. Overstimulation wears them out. Muscular exercise does not do this, because the sense of fatigue makes one stop and rest. But there are certain things which give a false sense of well-being, while actually causing degeneration. Such are alcohol, tobacco and drugs.

4. Alcohol is not a food, but a poison. Some-

times poisons are needed, as strychnine, when the heart is weak; but we do not take poison through choice. Over and over again, it has been proved that men are much stronger and able to do better work when they do not drink.

This does not mean that the use of wine in itself is sinful. It is wise to have clear ideas on this point. We know that at the marriage feast of Cana, our Blessed Lord changed water into wine for the pleasure of the guests. At "the Last, sad Supper with His own," He instituted the wondrous Sacrament of the Blessed Eucharist by changing bread into His Sacred Body and wine into His Precious Blood. Every morning's Mass, which is a commemoration of that stupendous event, and an unbloody repetition of the supreme sacrifice of the cross, requires the presence of both substances, wine as well as bread.

Moreover, alcoholic beverages are useful, even necessary, in cases of ill-health; so that many physicians deplore the pernicious results to the sick which prohibition has produced and are trying to bring about some modification in the legislation.

It is, however, undoubtedly true that the practice of excessive drinking has been productive of untold misery, and that, generally, people are

much better off when they do not use liquor in any form as a beverage. It is to guard against its possible evil effects, and to show what great harm it may produce in the opinion of some noted men that the quotations following are cited.

The Junior Campus at Georgetown University.

5. Mr. Taft, the former President, present Chief Justice of the Supreme Court of the United States, stated on one occasion: "He who drinks is disqualifying himself for any advancement in life. I refuse to take such a risk, and therefore do not drink." In the great European War recently, it was found that drinking impeded the efficiency of the soldiers very much, and so pro-

hibition became imperative in all our armies. A Doctor Williams, who made a careful investigation of this subject, has this to say to all those who use alcohol in any form: "I am bound to believe in the light of what science has revealed:

(1) That you are threatening the physical structures of your stomach, your liver, your kidneys, your heart, your blood vessels, your nerves, your brain;

(2) That you are decreasing your capacity for work in any field, be it physical, intellectual, or artistic;

(3) That you are in some measure lowering the grade of your mind, dulling your higher æsthetic sense, and taking the finer edge off your morals;

(4) That you are distinctly lessening your chances of maintaining health and attaining longevity; and

(5) That you may be entailing upon your descendants yet unborn a burden of incalculable misery."

6. Almost every boy, as soon as he reaches his teens, is apt to think it would be smart to smoke, whereas he would prove his real worth by refusing to do what he knows is wrong for him, and he shows his cowardice when he yields weakly to the ridicule of others. Judge Lindsey of the Juvenile

Court of Colorado, who is known as the "Boys' Friend," makes this remarkable statement about smoking: "I have been in the Juvenile Court nearly ten years, and in that time I have had to deal with thousands and thousands of boys who have disgraced their parents and themselves, and brought sorrow and misery into their lives; and I do not know of any one habit that is more responsible for the troubles of these boys than the vile cigarette habit." These are strong words, but they should be weighed well by every boy, and brought to mind when tempted to smoke or to drink by some companion who is foolish or vicious.

7. Wait until you are twenty-one before you begin to smoke, and then you are not so liable to develop "smoker's heart," which is a very serious affection of the heart, due to tobacco. Ask the men who have succeeded in breaking off the habit of years whether or not they would go back, and you will find in every instance that they feel like free men at last.

8. It certainly seems strange to say a word to girls on the subject of smoking, but unfortunately it is a practice which is becoming rather common among them. Just because some men smoke is no reason why women should. Men do many things

Wide World Photos

A Flying Leap With Every Nerve Taut.

which women do not do, just as women do many things which men do not. Remember that a gentleman regards a woman as belonging to an order higher than his own, and loses all respect for her, if she insists on losing her womanly charm by adopting the manners of the "fast set." Tobacco has an effect even worse on women than on men, and in most cases leads sooner or later to the adoption of the alcohol or the drug habit.

9. The drug habit is almost the worst thing possible that can happen to anyone. More than anything else, drugs destroy brain power, make the nerves unsteady and unreliable, weaken the heart and reduce the strength. But most of all, they kill all higher feelings and ruin the moral character. The drug addict will lie, steal and commit any crime, in order to obtain the drug for which his nervous system is clamoring. Many of the most hardened criminals admit that their downfall in life was due to the practice of taking drugs. Morphine, opium, heroin, cocaine,—these are the drugs usually taken; but of late years, heroin is the chief one used. Vile men will give this drug to boys until they acquire the craving, when they make the boys buy it at fabulous prices.

10. Some people acquire this dreadful habit through taking patent medicines, which contain

alcohol or some drug. Morphine fiends are sometimes the direct outcome of the prescription of the drug by a physician for some illness; the patient continues its use after he has recovered. Beware of all patent medicines. Remember that those who manufacture them are doing so in order to make money, not because they have such a love of their fellow men as their advertisements would lead one to suppose.

11. It may seem strange to class tea and coffee under the heading of drugs, but that is really where they belong. They both contain a drug which stimulates the nerves, and although grown people may take it without apparent harm, it is very inadvisable to give it to children, as it produces nervousness, irritability and frequently headaches. The drug has an effect similar to that of the whip upon a tired horse, and those who constantly whip their horses must expect them to become useless in a short time. Milk is the safest and most nourishing beverage for all young people.

QUESTIONS

1. Why is moderation in all things the best policy?
2. Give examples of moderation.
3. Why does not muscular exercise wear out the nerves?

4. What substances cause degeneration of the nerves?
5. Give your opinion of the use of alcohol.
   State the views of prominent men.
6. What do you think of smoking? Should the average boy or girl indulge in it? Why?
7. Is the drug habit harmful? Why?
8. How is it often acquired? What do you know of patent medicines?
9. Are tea and coffee safe beverages for all?

Chapter XXII

THE MASTERY OF THE NERVES

1. Nerve tissue is found in two forms, nerve fibres and nerve cells. The cells are like bodies from which the fibres run off like long, slender branches or arms, to a muscle or some other bodily structure. They frequently connect with the arms from other cells, and while they do not join the latter, come so close that the impulse travels from one to the other, almost as the spark jumps from one electric wire to another.

2. A cell with its branches is called a neuron. It consists of a clear, jelly-like substance, which is the most wonderful substance known. Protoplasm is its name; it looks simple, but it really is so complex that it cannot be analyzed by the most expert chemist. Nothing like it has ever been, and probably never will be, made by man.

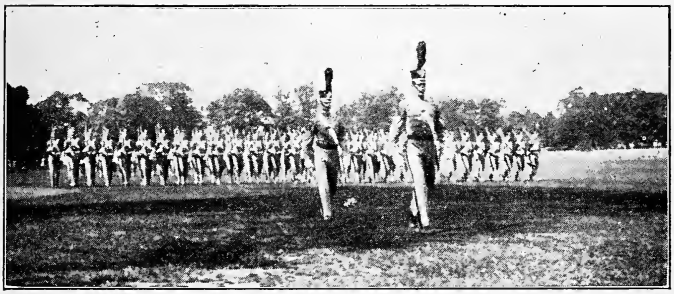
3. If a fibre is cut, the part no longer connected with the cell begins to degenerate, and the muscle to which it ran cannot move. This clearly shows that it is the nerve through which the motive

power is supplied, as everything else,—the skin, the muscular tissue, the blood vessels, all remain the same as before. If the two cut ends of the fibre are joined at once, they will usually grow together again. This may be seen at times in a bad cut in the wrist, in which the nerves going to the fingers are severed. All motion of the fingers is immediately lost; but if the surgeon is skilful, he may reunite the fragments and hold them in place with sutures. Then the tiny blood vessels begin their work of healing, and motion is soon restored. It has happened, after such an accident, that a careless surgeon has brought together the wrong ends of the fibres, with the result that after the cut has healed, the person may wish to move the little finger, for example; but the impulse travels down from the brain and out along the fibre to the place of union, then to the other finger to which the cut end has been joined by mistake, so that this is the finger moved, instead of the one desired.

4. A somewhat similar thing occurs not infrequently after one of the extremities has been removed in an accident or an operation. All the nerves have been cut, but the upper portions going to the spinal cord, have not, of course, been removed. The cut ends may become caught in the

healing of the scar, and the irritation causes the same sensation to the person which he formerly experienced when the amputated part was actually touched; so that he now thinks the pain is in his foot or arm, as the case may be, and he asks to have that part made comfortable, when it is no longer there.

5. Doctors made use of this fact after the Great



PERFECT FORM.

War in restoring usefulness to crippled soldiers. A soldier came to one of the big New York hospitals with his arm all shattered by a shell. It was absolutely useless and had to be removed. The only sound thing left was four inches of the bone, with the shoulder muscles covering it. An artificial arm was fitted to the stump in such a way that wires were put through holes made in the muscle, and connected to the artificial fingers.

The upper ends of the nerves which formerly had gone down the arm to the man's fingers had not all degenerated nor atrophied entirely, but were still in the cut muscles. These muscles are voluntary; when the soldier wished, the impulse traveled along the nerves to make the muscle fibres contract, and the contraction pulled upon the wires which connected with the fingers, making them move also. After some months of practice, the man was able to control these artificial fingers to such an extent that he could use a hammer and drive a nail. Many similar, amazing things were done in the various reconstruction hospitals, so that even those terribly maimed and mutilated were able to become self-supporting, in many instances.

6. This should give us an idea of how much we can accomplish, even if God has asked us to become like Him, "who having joy set before him, endured the cross, despising the shame" (Heb. xii. 2), and has visited us with some affliction. It is remarkable how much can be done, once we really make an effort. Some of us may have seen people who were deprived of both hands yet learned to play the violin and to paint and do other things, by training the nerves of the feet.

7. It also shows quite clearly how much is ex-

pected from those who are physically and mentally perfect. You remember the parable in Scripture, where our Divine Lord speaks of the stewards to whom were confided different numbers of talents. "To whom much has been given, much is expected." Unless we use all our gifts of mind and body for God, the evil one will help us to put them to a wrong use, for it is an old saying that "The devil finds work for idle hands to do."

8. To accomplish anything well, we must learn to concentrate. That means the ability to fasten the attention on one thing at a time, and thus prevent dissipation of nervous energy by scattering it uselessly in many directions. We do this unconsciously when we become interested in anything. When, for example, we are absorbed in the fascinating plot of a story, the noises outside in the street, the ringing of bells, the chatter of voices, even the imperious demands of hunger, may be altogether unnoticed. At such a time, however, there is nothing wrong with the nerves of the stomach or of the ears, but we have withdrawn our attention from them completely, so that we pay no heed to their stimulation.

9. In the same way, we may be able to hear one of the many instruments in an orchestra by neglecting the music of all the others. The proper

way to use the microscope is not to close one eye, and squint with the other, as most beginners do, but leaving both eyes wide open, to concentrate the interest so firmly on what the eye beholds in the field of the microscope, that what the other eye

X-Ray of a Hand.

records from outside is absolutely disregarded. In like manner, we may hear but one voice in a large choir, we may see but one face in a crowd, we may scent the sweet fragrance of one favorite flower in a bouquet.

10. Such concentration is practised by all successful men and women to a greater or less extent. It is necessary for the acquirement of any-

thing worth while. It enables a boy or girl who really wants to learn, to perform the assigned lessons, no matter how insistently the outdoors may clamor in the springtime, no matter how many voices are engaging others in the classroom, no matter how interesting are the storybooks lying in the immediate vicinity. It is a good thing to practise it while young, so as to be able to use it well in later life. "Practice makes perfect," and "if at first you don't succeed, try, try again."

11. It is mastery of this quality that enables the nun, kneeling in prayer before the Blessed Sacrament, to banish all the distractions of earth and breathe the very atmosphere of heaven. By the possession of this most valuable habit, and with the aid of God's grace, which He will never deny, you will be able to conquer all temptation, and remain calm and unruffled in the very midst of a surging sea of difficulties.

12. How is such a gift obtained? What does it mean? It consists of nerve control. The higher faculties rule, the lower are constrained to obey. The soul is master, as it should be; the body is the servant. Sense allurement, the siren's suggestions, the inducements of false friends, worldly advantage, feelings, hopes, ambitions, imagina-

tion's vivid play,—one and all are dominated and held in check by the nerves, which are directed and guided by the intellect and will, like reins in the hands of a man who drives a team of superb horses, harnessed to his fragile chariot, carefully, fearlessly, unerringly.

13. This is, of course, the ideal, and was realized perfectly in the case of our dear Lord, Jesus Christ. Our Blessed Lady was the only one who resembled her divine Son in this absolute dominion over self; but we all should do what we can by never-ending attempts and by daily prayers to approach that ideal as nearly as possible. If we have won the victory on our deathbeds, we shall thank God for all eternity.

QUESTIONS

1. In what forms is nerve tissue found?
2. What is a neuron? What is protoplasm?
3. What happens to a nerve fibre when it is cut? to the muscle to which it went? Can the cut ends be joined? What may happen when joining the ends?
4. What often happens after an amputation?
5. What can be done after amputation?
6. What lesson does this bear for all of us?
7. Why must we try to do our best?
8. What is concentration? How obtained?
9. Give examples of it.
10. Is concentration necessary? Why?
11. What can you say about temptation?
12. What does the possession of concentration imply?

Chapter XXIII

THE END AND THE BEGINNING

1. In an ordinary book on Hygiene it is not usual to treat of the subject of death, but we may be allowed to say a few words about it here, since for Catholics "right living" is merely the preparation for the great moment of our departure from this world, and "right dying" is a matter of supreme importance to us, for we know that our whole eternity depends upon it.

2. To many a modern scientist death is simply the cessation of all bodily activity, the complete stopping of the physical and chemical processes which are called life. The scientist's interest ceases at that point, which for him, who recognizes not the soul, means oblivion, annihilation,—the end of everything.

3. But for us death means the beginning of everything; it is the goal towards which all our endeavors in life have led. It is the end of a shadowy life, but the beginning of real life with

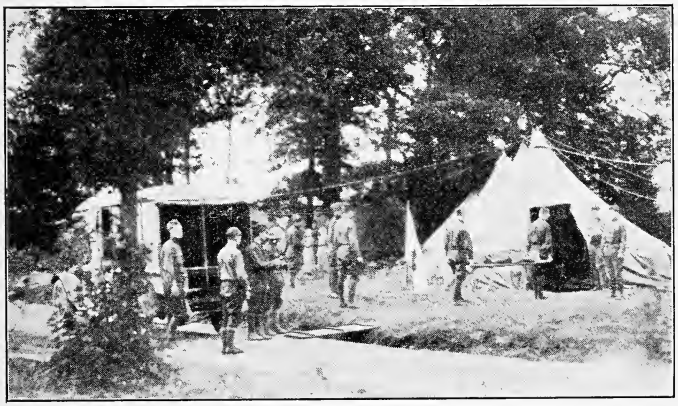
our God, "whom here we see but as in a glass darkly, but there face to face."

4. Death is the separation of the body from the soul which inhabited it, and which gave it life. Without the soul, the body was helpless and could do nothing; when the soul leaves it and thus deprives it of all sustaining and vital powers, it ceases to be a body and becomes a corpse. A corpse is merely a collection of various bony, muscular and nervous tissues and cells, held together for a time by the force of the position which the soul had stamped upon them, and by the chemical and physical laws which the Author of nature has arranged. But shortly these yield to the inevitable law of all matter, and the various organs and structures fall apart, decay and return to the earth from which they were made.

5. When the priest puts the ashes upon your forehead on Ash Wednesday morning, he says "Remember, man, that dust thou art, and unto dust, thou shalt return." As soon as life departs with the soul, therefore, the corpse begins to corrupt; and soon it has to be buried in the earth, there to await the trumpet-call of the Archangel on the last day of the world, when all bodies shall rise and be again united to the souls. The bodies of the just shall be glorious and shining with

light, and shall stand in the splendor of the right side of the Judge; the bodies of the wicked shall be frightful and hideous, and shall shrink to their place in the dark shadow of the left.

6. Cremation means the burning of the corpse. Crematories are frequently found attached to



Death on the Field of Honor.

Protestant cemeteries. Never are they found in Catholic grave-yards, which in olden times were always grouped around the church, and called affectionately "God's Acre." During life the church has been the strength of those whose bodies are lying there. It would be their protection after death, and a guarantee of respect and veneration for them. The practice of cremation has not been

tolerated by the Catholic Church, as it considers such a practice an unworthy method of treating the former habitation of the soul, which was stamped with the Precious Blood of Christ, and so often was the recipient of His sacraments. The Sacred Body of our Lord was also buried in the earth, and we place our dead there in imitation of His burial.

7. Without the body the soul could not act during life. The body was the instrument by which it worked out its salvation, or brought it to reprobation. The soul was not created with ideas and thoughts, but was endowed with intellect, memory and will, which had to be gradually developed by the use of the senses which belonged to the body. "It is appointed unto man once to die, and after death, judgment"; when the proper time comes, therefore, the soul leaves the companion of its earthly pilgrimage, and goes alone to render an account of the use it has made of that companion to the supreme Judge, "who can neither deceive nor be deceived."

8. The exact instant when the soul departs is one of the secrets God keeps to Himself. It seems as if the two partners could not bear to be torn apart. The soul clings to the innermost embraces of the body until it is forcibly driven

forth. The external surfaces, the sense impressions, visible breathing and the circulation of blood,—all may indicate apparent death, but at times persons in such a condition have been revived, showing that the soul had done nothing more than withdraw the usual outward manifestations of its presence. This is a point to bear in mind, and in all cases of sudden and unexpected death, the priest should be called to administer Extreme Unction, for if the soul is still present, the sacrament may mean its salvation.

9. Some ill informed Catholics think that "anointing" means that death will surely follow, and so delay to send for the priest until the person is dying. Such people do not understand that this sacrament has a twofold effect. By their foolish delay they deprive the patient of the "health and strength of the body," which Extreme Unction is intended to produce, for the anointing might have been the very means of saving life instead of hastening death. When, by waiting too long, the person is actually dead on the arrival of the priest, the sacrament cannot have any effect.

10. Do not be afraid of death. The devil will be on hand at our dying hour to make use of any advantage which our fear may give him. If we have received the Viaticum, we are sure that our Lord

will be there too; our guardian angel will have summoned our Blessed Mother, the Mother of Mercy, and all our patron saints, who will form a guard about us, and ward off all harm and danger. Have no fear therefore. Death means simply the going home to God, who is waiting to reward us for everything we have done for Him. Think of it often during life, prepare for it every night as you kneel beside your bed, then, when it comes, you will face it calmly and without any other longing than "to be dissolved, and be with Christ."

QUESTIONS

1. Why is it right to speak of death in a book on Hygiene?
2. Of what interest is death to the average scientist?
3. What does it mean to Catholics?
4. What is death? What is a corpse?
5. What happens to the body after death?
6. What is cremation? How does the Catholic Church regard it? Why does the Church take this stand?
7. How much does the soul depend on the body during life?
8. When does death occur? What follows it? How should we act, if a person dies without the last sacraments?
9. Why is such a practice recommended?
10. How should we prepare for a good death?

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