CHAPTER XVII

DRUGS AND POISONS

250. Nature of disease. — Disease is due to some derangement of the action of the cells of the body. The derangement is almost always produced by overwork of some kind, for the cells are able to protect the body against all ordinary causes of disease. Few people who are exposed to epidemic diseases take them, because the cells are able to destroy the germs as fast as they enter the body. If men would eat, breathe, and in all things live as physiology and hygiene show that nature intended them to live, the cells would be strong enough to resist almost any disease.

251. Action of drugs. — Each drug has a special influence upon certain cells of the body, and is able either to stimulate or to restrain their action. Under the influence of the proper drug, each deranged cell takes in nourishment and performs its duties more perfectly, and soon overcomes the sickness. Thus the cells themselves, and not the drug, cure the disease.

252. Action of a few common drugs. — When the liver is deranged, *calomel* or *podophyllin* will usually stimulate it to action. In stomach indigestion *muriatic acid* and *pepsin* supply the missing digestive agents. When the heart is weak, *digitalis* or *strychnine* cause it to act more strongly, while if it is excited, *aconite* will quiet it. A fever is often lowered by *aconite* or *phenacetine*. When there is pain, *opium* will generally relieve it. When the brain is excited and the person is

nervous or delirious, *chloral* or *bromide of potash* will quiet the cells. These are a few examples of the actions of drugs which physicians prescribe.

253. Quack medicines. — Drugs should never be given except by a physician. The country is flooded with medicines advertised to cure various diseases. People who take them generally get well, but they forget that the cells of the body themselves tend to overcome all diseases, and that in all probability they had no disease at all, but were only feeling bad because of improper eating, or of overwork.

254. Poisons. — All narcotics and drugs are poisons and cause sickness or death when taken in overdoses. The signs of poisoning are much alike in all cases. A person previously well suddenly feels very sick and weak, or becomes unconscious. Vomiting often occurs, and pain is often present.

255. Treatment of poisoning. — The first thing to do whenever a poison is swallowed is to empty the stomach as quickly as possible. Almost anybody can be made to vomit by tickling the throat with a finger, or with a feather passed through the nose if the mouth cannot be opened. A tablespoonful of mustard in a cup of warm water will generally cause vomiting and is always safe. A teaspoonful of alum in water will act in the same way. Water or soft food of any kind should then be swallowed and vomiting continued, so as to remove all traces of the poison.

The second thing is to give castor oil or salts, so as to remove any poison which may have entered the intestine.

The third thing is to give something, called an *antidote*, which will destroy the poison in the body.

The fourth thing is to give a *stimulant*, for the person will be very weak. Strong coffee should be given by the cupful, without sugar or milk.

256. Poisoning by acids or alkalies. — If the lips and mouth are covered with a white film or are raw, some

acid or alkali has probably been swallowed. If it is an alkali, a drink of weak *vinegar* should be given at once as an antidote. If it is an acid, soda, soapsuds, or limewater should be given as an antidote.

Also give water, or flour and water, or the white of an egg, or milk, so as to dilute the substance as soon as possible.

257. Carbolic acid. — When swallowed, pure carbolic acid produces great weakness and rapid death. In small doses, or even applied to the skin in surgical dressings, it may produce headache and weakness, which may result in death.

In treating its poisonous effects, a stomach pump will generally have to be used to remove the poison, because the stomach will be paralyzed by the burning to which it is subjected. The antidote is *Epsom salts*.

258. Narcotic poisoning. — If the person poisoned is sleepy, it shows that a narcotic like opium or chloral has been taken. Care should be taken not to mistake a fainting spell for the drowsiness of poisoning. In faintness, the face is of a deathly pale color, and no pulse can be felt, and breathing ceases, while in drowsiness the face is of a natural or even deeper red color, the pulse can be felt, and breathing will continue.

259. Strychnine poisoning. — Strychnine produces violent convulsions, like lockjaw, within half an hour after it has been taken. Vomiting should be induced at once. Chloral and bromide of potash are its antidotes, and should be given as soon as possible, to quiet the convulsions. In an emergency tobacco may be used.

260. Arsenic and other metals. — Rat poison and Paris green contain arsenic. Arsenic is a metal, and its poisoning is much like poisoning by *mercury*, *lead*, *copper*, *silver*,

or *antimony*. *Sugar of lead* and *white lead* paint are the common forms of lead which poison the body. Copper is seldom dangerous. Some forms of *silver* are very poisonous.

Antimony is poisonous in the form of *tartar emetic* and *wine of antimony*, both of which are used in treating colds.

All forms of metallic poisoning are much alike. Vomiting usually comes on within half an hour, followed by great weakness, cramps in the abdomen, and burning thirst. If vomiting has not freely occurred, it should be induced by tickling the throat or by giving mustard in water.

Afterwards the white of eggs, flour paste, or milk should be given as an antidote. The albumin of these substances forms a chemical union with the metal, producing a harmless compound which should be vomited and more of the antidote given.

The special antidote for *arsenic* is *oxide of iron*. The settlings which form in a mixture of tincture of iron and baking soda may be used in an emergency. The special antidote for *lead* is *Epsom salts*; for *silver*, *common salt*; and for *antimony*, *tannin*, which is found in a strong tea made of almost any bark.

261. Phosphorus. — Phosphorus poisoning may occur from sucking the ends of matches. It produces vomiting and violent cramps in the abdomen for two or three days, and then jaundice appears, with delirium and death. It resembles a slow poisoning by a metal.

Phosphorus poisoning is treated by giving something to cause vomiting and to expel the poison from the intestine. Always avoid castor oil or other fat, for phosphorus is dissolved by fat. A small pinch of sulphate of copper (blue vitriol) given every few minutes will destroy the poison and also cause vomiting.

262. Aconite. — Aconite produces extreme weakness of the whole body. A tingling in the throat is the only distinguishing sign of the poison.

A poisoned person should be kept absolutely quiet, and strong coffee should be given as a stimulant.

263. Belladonna. — Belladonna, or its active principle, *atropine*, is used to enlarge the pupil in examinations of the eye. In overdoses it produces redness of the face, dryness of the throat, enlargement of the pupil of the eye, delirium, and great weakness. The enlarged pupil is its distinguishing sign. Its treatment consists in giving an emetic, stimulating by coffee, and giving tannin or strong bark tea.

264. Mushroom poisoning. — Poisonous mushrooms produce violent cramps in the abdomen, with vomiting and great weakness. One form produces symptoms within an hour or two, and is seldom fatal, for the poison is thrown off. The other, and by far the more dangerous, form of poisoning does not come on for ten or twelve hours, or until the poison has entered the intestine. In poisoning by mushrooms, vomiting should be induced, and castor oil given to remove the poison from the intestine. Strong coffee should be given as a stimulant.

265. Decayed food. — All forms of decayed food, especially fish, eels, and crabs, may produce vomiting, cramps, and weakness, like mushroom poisoning. The symptoms usually come on within six hours after eating, and are seldom fatal. The treatment is to empty the stomach and intestine.

266. Alkaloids. — The active principles of many vegetable drugs can be separated from the crude drugs. They are called *alkaloids*. Nicotine, morphine, strychnine, atropine, and quinine are alkaloids. Over one hundred in all are known. A single grain of almost any alkaloid except quinine can produce violent poisoning.

267. Leucomaines. — As a result of the imperfect oxidation of albumin within the body, compounds resembling

alkaloids are formed. They are called *leucomaines*. They circulate in the blood and produce headaches, drowsiness, and other mild forms of poisoning which may become severe and produce death when, as in Bright's disease, the kidneys and skin do not remove the poisons. At least sixteen leucomaines are known.

268. Ptomaines. — As a result of decay and other changes after death, another set of poisons like alkaloids and leucomaines are produced. They are called *ptomaines*. They cause most of the symptoms produced by eating decayed meat. A special kind of the poison, called *tyrotoxicon*, sometimes forms in milk and ice cream which has been kept for some time. Ptomaines and leucomaines can always be found in the bodies of dead persons.

269. Hypodermic injections. — When injected beneath the skin by means of a hypodermic needle, drugs and poisons reach the blood at once and produce much more powerful and rapid results than when absorbed from the stomach. Alkaloids are well fitted for this use.

270. Snake bites. — In the upper jaw of a poisonous snake is a sharp, hollow tooth, which is the outlet for a bag of poison. When the snake bites, the pressure of the flesh against the bag forces some poison through the tooth, which thus acts as a hypodermic needle. The poison is a kind of leucomaine. It produces pain and swelling at the point of injection, great weakness of the whole body, and sometimes death.

The treatment of snake bites must be prompt. A handkerchief should be tied very tightly round the limb, above the wound, so as to prevent the poison from reaching the whole body. Then the wound should be sucked for some time, so as to remove as much as possible of the poison. No harm can come to the person who sucks the wound if the blood is spit out at once. If bleeding does

not take place freely, the wound should be cut open. Active stimulation with such substances as strong coffee or ammonia is also necessary.

271. Insect stings and bites. — Bees, wasps, and hornets possess a hollow sting through which the insect injects poison into the flesh. This poison produces swelling and pain, and if there are a great number of stings, there will also be a considerable weakness of the whole body. Usually the swelling begins to decrease within an hour. To allay the smarting, a lump of cold mud is an effective remedy. Carbolic acid in water sopped on with a cloth is also good. If the insect has left its sting in the flesh, it should be removed by pressing over the sting with the open end of a watch key, or by picking it out with the point of a sharp knife.

The bites of mosquitoes and of flies produce swelling and pain or itching in some people. Ammonia water or carbolic acid in water usually gives relief.

SUMMARY

1. Disease is a derangement in the action of some of the cells of the body. Drugs either stimulate or retard the action of the cells.
2. All narcotics and drugs are poisons.
3. In every case of poisoning the stomach and intestine should be emptied at once, and a stimulant with an *antidote* to destroy the poison should be given.
4. Spoiled or poisonous food produces stomach and intestinal disturbance. It should be expelled from the body as soon as possible.
5. The active principles of many vegetable drugs are called *alkaloids*.
6. Leucomaines and ptomaines are substances resembling alkaloids, but are produced in the bodies of animals.
7. The poisons of snakes and insects are substances like leucomaines, and are injected into the flesh by means of a hollow tooth or sting.

REVIEW TOPICS

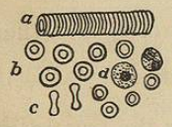
1. Describe the nature of *disease* and how drugs tend to restore health.
2. Describe the general signs and treatment of *poisoning*.
3. Describe the treatment of poisoning by *acids*, and by *alkalies*.
4. Describe *carbolic acid* poisoning and its treatment.
5. Distinguish between the drowsiness due to narcotic poisoning and a fainting spell.
6. Describe *strychnine* poisoning and its treatment.
7. Describe poisoning by *arsenic* and give its treatment.
8. Give the signs and treatment of poisoning by *metals* in general.
9. Describe *phosphorus* poisoning and give its treatment.
10. Describe poisoning by *aconite*; by *belladonna*.
11. Describe poisoning by *mushrooms*, and by decayed food.
12. Describe *alkaloids*, *leucomaines*, *ptomaines*, and their poisonous effects.
13. Describe hypodermic injections.
14. Describe *snake* and *insect bites* and give the treatment.

CHAPTER XVIII

THE BLOOD

272. The circulatory system. — Nature has provided an intricate arrangement of tubes to conduct food to each cell of the body, and to wash away its waste matter. These two objects are accomplished by the *blood*. The conducting tubes and the blood which they contain make the *circulatory system*.

273. The blood. — About one thirteenth of the body is a red liquid called *blood*. It consists of a multitude of circular flat red plates, called the *red blood corpuscles* or *cells*, floating in a colorless liquid, which also contains a few round colorless cells, called *white blood corpuscles* or *cells*.



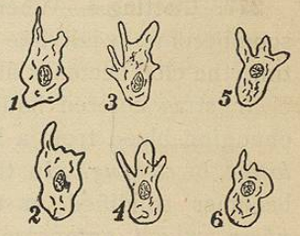
Blood corpuscles (× 400).

a a pile of red blood cells.
b red blood cells, seen flatwise.
c red blood cells, seen edgewise.
d white blood cells.

274. Red blood corpuscles. — The red corpuscles of the blood form about 45 per cent of its weight. Each one is a circular flat plate, with rounded edges, and with a depression in the center of each face. Each cell is about $\frac{1}{3500}$ of an inch in diameter and $\frac{1}{12000}$ of an inch in thickness. Each one is of a reddish yellow color, but when great numbers are piled together they appear bright red. Each corpuscle is composed of a jellylike albuminous substance, four fifths of which is a reddish substance called *hemoglobin*. Hemo-

globin is the essential part of the red corpuscle. It contains a small amount of iron, which gives to it the property of carrying oxygen without itself being oxidized. By means of the hemoglobin the red corpuscles are able to carry oxygen from the lungs to all parts of the body. When the hemoglobin contains a large amount of oxygen the blood is of a bright red color, but as the oxygen is used up it becomes darker, or almost purple. Bright red blood, called *arterial* blood, is continually flowing toward the cells of the body; while that returning from the cells, called *venous* blood, is purple in color, from the lack of oxygen.

275. White corpuscles. — White corpuscles are each about $\frac{1}{3000}$ of an inch in diameter, and are about $\frac{1}{500}$ as numerous as the red corpuscles. They are round and colorless, and each contains a nucleus. They have the power of changing their shape, and of adhering to the sides of a blood tube, and of passing through its wall, and of moving about between the cells of the body as though endowed with a will of their own. They have important duties to perform in preventing foreign substances from entering the circulation and in the healing of wounds. (See p. 393.)



A white blood cell of a frog, sketched at intervals of two or three minutes, showing its changes in form (× 300).

276. Plasma. — The liquid part of the blood is called the *plasma*. It is composed of ninety parts of water, holding in solution about eight parts of albumin and two parts of mineral matter. The mineral matter is mostly soda and potash. This alkaline property of the blood plasma aids it in dissolving carbonic acid gas, and in carrying it to

the lungs, where it is breathed out from the body. Some of the mineral matter of the blood enters into the composition of the cells of the body, especially of bone cells.

The albumin is the substance out of which all of the cells of the body are mainly built. It is formed by the liver out of the peptone which was absorbed from the intestine. A little pressure causes the solution of albumin and minerals to flow through the sides of the capillaries; and thus it reaches the separate cells of the body. Waste matters are continually being poured into the plasma, but they are removed as fast as they enter, so that carbonic acid is the only one to be found except by the most delicate tests.

277. Clotting. — When blood is drawn from the body it soon becomes a jellylike mass, called a *clot*. After a longer time the clot becomes firmer and smaller, squeezing out a clear, straw-colored liquid, called *serum*. The process of changing blood from a liquid to a jellylike form is *coagulation*, or *clotting*. In the process a part of the albumin becomes solidified in small interlacing strings, called *fibrin*, which entangles the rest of the blood into its meshes. The network soon contracts, squeezing out the serum, and retaining the corpuscles. The serum is composed of all the materials of the plasma, excepting the fibrin. The process may be represented thus:

$$\left.\begin{array}{l}\text{Plasma or}\\ +\\ \text{Corpuscles}\end{array}\right\}\begin{array}{l}\text{albumin}\\ +\\ \text{mineral matter}\\ +\\ \text{water}\\ \text{. . . . . .}\end{array}\Bigg\} = \left\{\begin{array}{l}\text{Serum, or}\\ +\\ \text{Clot, or}\end{array}\right.\begin{array}{l}\left.\begin{array}{l}\text{albumin}\\ +\\ \text{mineral matter}\\ +\\ \text{water}\end{array}\right\}\\ \\ \left\{\begin{array}{l}\text{fibrin}\\ +\\ \text{corpuscles}\end{array}\right.\end{array}$$

While the blood is in motion within a healthy blood tube, no clotting occurs, but as soon as blood is drawn, it clots, or if a blood vessel is wounded, a clot forms at the wounded spot. The use of clotting is to stop bleeding. Sometimes no clot will form, but a wound will keep on bleeding until it is healed. This is a disease called *hemophilia*, and may cause death.

278. Anemia. — Sometimes there are too few red corpuscles in the blood. Then the skin appears pale and there is shortness of breath, because too little oxygen is carried by the diminished number of red blood cells. The disease is called *anemia*, meaning lack of blood. It is mainly a lack of red corpuscles.

279. Good and bad blood. — The terms *good* and *bad blood* are remnants of the old idea that disease was caused by watery substances, called *humors*, in the blood. From their supposed influence on the mind the terms *good* and *bad humored* are derived.

For many years attempts have been made to inject healthy blood into the veins of sick persons. Injecting a liquid into the veins of a living person is *transfusion*. In bleeding, the loss of water is one of the greatest dangers, and to replace it water is sometimes injected into the veins. It answers better than blood itself.

280. The blood in lower animals. — All living beings possess some form of fluid circulating in their interior. In higher animals, birds, reptiles, and fishes, the fluid is red, and contains both red and white corpuscles. In insects the blood is usually white or colorless. In worms the blood is sometimes colorless and sometimes red or green. In shellfish the blood is colorless, and contains no corpuscles. In animals which are made up of a single microscopic speck of matter, there seems to be a continual motion of fluid within their bodies, although they are so extremely small that nothing definite can be seen.

281. The spleen. — The spleen or milt is a soft red organ, shaped like a tongue, lying just to the left of the stomach. It is composed of small cells and fibers, among which the blood circulates as through a sponge, without being held within firm walled tubes. The spleen is supposed to form the red blood cells, but they are also formed in the marrow of bones. The spleen can be removed with but little harm to the body. The pain in the side caused by running is often due to an excess of blood in the spleen.

SUMMARY

1. Blood is composed of a liquid called *plasma*, in which float great numbers of extremely small *red cells*, and fewer *white cells*.
2. The red cells carry oxygen from the lungs to the cells of the body.
3. The white cells repair injuries to the body.
4. The plasma contains albumin and mineral matters, both of which are food for the cells of the body.
5. The soda of the plasma carries carbonic acid gas to the lungs. The gas is there given off in the breath.
6. After standing outside of the body for a few minutes, some of the albumin hardens to a stringy mass and entangles the cells, forming a clot.
7. All animals possess a fluid somewhat like man's blood.
8. The spleen is a soft organ in which red blood cells are formed.

DEMONSTRATIONS

64. Set aside a spoonful of *chicken's blood* to clot. In a few hours the serum will begin to separate. Breathe on a slide and place a tiny drop of fresh chicken's blood upon it, cover it with a cover glass and examine it with a microscope magnifying at least 200 diameters to see the red blood cells. Notice their oblong shape and their nuclei.

65. *Human blood* may be obtained without pain by tying a string snugly around the finger. After a moment make a quick prick with a clean needle upon the back of the finger just behind the nail. Remove the string, and a drop of blood will flow which can be examined under the microscope. Notice the circular shape of the *red cells* and the absence of nuclei. Notice that they tend to arrange themselves in rows like piles of coins.

66. Place a drop of salt water on the slide by one edge of the cover glass, and notice that the cells become shrunken.

67. *White blood cells* are too few in number to be readily found within a specimen of blood, but they form most of the white matter of a pimple or boil. Prepare and examine a specimen, and notice the dark specks scattered through the cells, and the nuclei which may be three in number in each cell. Add a drop of vinegar and notice that each cell becomes transparent, only the nuclei remaining visible.

68. With a little care the movement of the white cells may be shown in frog's blood. Prepare a fresh specimen of frog's blood upon a slide slightly warmed. After a little search an irregularly shaped white blood cell can usually be found. Watch it carefully, and it will be seen slowly changing its shape exactly as an ameba changes, only more slowly. A magnifying power of at least 200 diameters will be necessary.

69. Prepare a specimen of blood for the microscope. (See demonstration No. 65.) At the edge of the cover glass drop a tiny bit of alcohol. Notice how the red blood cells shrivel and become irregular in form, because the alcohol takes away their water.

REVIEW TOPICS

1. Describe the blood.
2. Describe the red blood cells.
3. Describe the white blood cells.
4. Describe the blood plasma.
5. Describe the clotting of blood.
6. Show what was meant in olden times by the terms *good* and *bad blood* and *good* and *bad humored*.
7. Describe the blood in some of the lower forms of living beings.
8. Describe the spleen and its use.