

CHAPTER X

ALCOHOL AND DIGESTION

137. Summary of the action of alcohol. — The action of strong alcohol outside of the body is threefold. First, it takes away water from substances which it touches; second, it hardens and coagulates albumin; third, as a result of the first and second actions, it impairs or destroys the life of cells and of ferments with which it comes in contact. Alcohol harms the body in these ways and also has special effects upon parts which it does not touch.

138. Effects upon food. — Alcohol produces changes in food in direct proportion to its strength and amount. If the alcohol be strong, and large enough in amount to saturate the food, then it may harden the albumin and render it more difficult of digestion. It may also prevent the pepsin of the stomach from acting. The habitual drunkard may take strong drink in sufficient amount and strength to produce this change in his food.

139. Effects upon the mouth. — In the mouth alcohol may take water from the epithelial cells, and give rise to a sense of thirst. Although the alcohol may be mixed with enough water to satisfy natural thirst, yet it causes a false thirst to arise, which demands another drink.

140. Effects upon the gastric juice. — When it reaches the stomach, a very strong alcoholic drink has a marked effect upon the gastric juice. The essential digestive agent in the gastric juice is pepsin, which is a lifeless albuminous ferment. The alcohol in any common form

of strong drink is in sufficient quantity to hinder or to stop the digestive action of the pepsin. But when the alcohol is absorbed or diluted, the pepsin can act as well as ever.

141. Effects upon the mucous membrane. — Alcohol irritates the mucous membrane of the stomach. Then more gastric juice is produced in order to dilute the irritating alcohol. Thus the effect of the alcohol may be somewhat overcome by the increased quantity of the digestive fluid. But the alcohol may cause an increased flow of mucus also, just as a cold causes the pharynx to produce more mucus. The mucus may coat the particles of food, and prevent the gastric juice from acting on them. This is especially apt to happen when strong drink is taken continuously in small amounts, and for long periods. In such conditions both the quality and quantity of the gastric juice may be impaired.

A drink, such as even a moderate drinker often takes, may produce redness, swelling, and inflammation of the stomach. The effect is far greater when the drink is swallowed upon an empty stomach, for then there is no food to protect the mucous membrane from the direct action of the strong drink.

142. Effects upon peristalsis. — The irritation of the alcohol at first causes an increased action of the stomach walls, so as to force the harmful substance away. Continuous use of strong drink is likely to weaken the muscles and to make peristalsis much less. Then the food is less perfectly mixed with the gastric juice and is not ground to pieces, but remains too long in the stomach undigested. The water and mucus poured out diminish the strength of the alcohol, and this, together with the poor quality of the gastric juice and the long stay of food in the stomach,

permits fermentation to take place. Thus alcohol disturbs every action of the stomach, and often produces the worst forms of indigestion.

It is true that a little weak alcoholic drink will not produce all these evil effects at once. Herein lies the danger. Alcohol is a deceitful thing. Though the stomach gives notice that it is abused by the drink, yet the mysterious thirst demands still more alcohol, and bribes its victim with the memory of its pleasant sensation. So the poor stomach suffers time after time, and before long becomes permanently crippled.

143. Protection against alcohol. — When an alcoholic drink is taken into the mouth, it irritates the mucous membrane. This causes the saliva to flow and dilute the alcohol, so that at any one time it can do very little direct harm. In the stomach it causes the gastric juice to flow in the same way, and thus it soon becomes dilute and has little direct effect. Even if the pepsin should separate from the gastric juice, in a little while the ferment will dissolve in the increased quantity of juice and perform its work well again. Nature may thus protect the body for some time, but it cannot remove the danger.

144. Effects of alcohol upon the intestine. — By the time alcohol reaches the intestine, it is usually too dilute to produce much direct harm. But if it has deranged stomach digestion, the work of digesting the food falls upon the intestine. Thus intestinal digestion may be imperfect. Alcohol itself is probably not changed by digestion. In its diluted form it is quickly absorbed. Even when a large amount is absorbed, little or none can be found in any of the tissues or blood tubes. The only probable way of its disappearance is by oxidation before it can pass beyond the liver.

145. Effects of alcohol upon the liver. — Alcohol affects the liver in three ways. In the first place strong drink is apt to induce stomach and intestinal indigestion. Then the liver must do an extra amount of work in completing the imperfect digestion. Thus biliousness is often produced.

If drinking is continued, the liver trouble is likely to persist.

In the second place the destruction or oxidation of alcohol uses a large amount of oxygen which the liver should use in assimilating food. Thus food is imperfectly oxidized. While no products in the body can be traced directly to oxidized alcohol, yet when alcohol is used poisonous products of imperfectly oxidized albumin are always abundant. These products circulate through the whole body and produce far more harm than the original alcohol. (See p. 152.)

In the third place the liver cells are directly affected by these abnormal actions. Long-continued drinking often results in an incurable wasting away and hardening of the liver tissues.

146. Unintentional forms of drinking. — There is a form of alcohol which is used by many innocently and unintentionally. Many a well-meaning person habitually uses "Strengthening bitters" after meals, ignorant of the fact that they are only bitter herbs dissolved in alcohol and water. Each dose is equivalent to a large drink of whisky.

Essence of Jamaica ginger is only ginger dissolved in alcohol, and its effects are due mainly to the alcohol, and not to the ginger.

147. Intemperance in eating. — There is a common intemperance of eating too much starch and sugar. These substances can never be digested, absorbed, and oxidized with sufficient rapidity to produce the intoxicating effects of alcohol, but their excessive use deranges the liver in the same manner as alcohol. In the first place, starch and sugar are likely to ferment and produce a sour stomach and intestinal indigestion; this is probably the most common cause of biliousness.

In the second place, when too much sugar or other food is oxidized too little oxygen is left for the albumin

of the food, then the products of incomplete oxidation resemble those produced by alcohol; but they usually produce no more than a sick headache or an attack of biliousness, although under aggravated and repeated conditions they may endanger life. (See p. 34.)

In the third place, the effect of a continual excess of food is to injure the liver cells permanently. Even the wasting away and hardening called "gin drinker's liver" may be caused by intemperate eating. Intemperance in eating differs from the intemperance of strong drink in the *quantity* of effects produced rather than in their kind.

SUMMARY

1. Alcoholic drinks take water from the mucous membrane of the mouth and so increase the thirst, even if the body contains sufficient water.
2. In any considerable amount alcohol hardens the pepsin in the stomach, and so prevents its acting upon the food.
3. Alcohol irritates the mucous membrane of the stomach so that it becomes inflamed and unable to produce the gastric juice. Then the intestine is overworked in digesting what the stomach should have digested.
4. Alcohol is quickly absorbed by the intestine. It is quickly destroyed, probably by oxidation, before it passes the liver.
5. Because oxygen is used in the destruction of alcohol, incomplete and poisonous products of the oxidation of albumin are formed. These go through the whole body and greatly increase the harm done by alcohol.
6. Bitters, and essence of ginger contain much alcohol.
7. When starch and sugar are eaten in large amounts, they use oxygen which should oxidize the albumin.

So they can produce slowly the same kind of effects as alcohol.

DEMONSTRATIONS

50. Hold some common salt in the mouth, and at once saliva flows to dilute it. In a moment it can be held with comfort. Explain that this is a provision of nature to protect the body from any irritating substance. The stomach may pour out an excess of gastric juice in the same manner so as to protect the body against alcohol and other irritating substances. Call attention to other similar ways in which nature protects the body, as in the flow of tears to wash away a speck of dirt from the eyes.

51. Prepare two bottles to show artificial digestion (see demonstration No. 40). In the second one replace a quarter of the water with alcohol and notice that no digestion takes place in this bottle. Explain that this experiment may be misleading, for in the stomach more gastric juice will flow to dilute the alcohol until the pepsin can act as well as before. Explain that alcohol does not destroy the pepsin, but when the alcohol is diluted, the pepsin is as good as ever.

REVIEW TOPICS

1. Give the three characteristic actions of alcohol outside the body.
2. Give the action of alcoholic drinks upon the mouth.
3. Give the action of alcoholic drinks upon the mucous membrane of the stomach; upon its secretions; and upon the peristalsis of the stomach.
4. Tell why alcoholic drinks have but little direct action upon the intestine and upon the villi.
5. Give the action of alcoholic drinks upon the liver.
6. Explain why bitters and essence of Jamaica ginger are both harmful.
7. Explain the effects of intemperate eating.

CHAPTER XI

DIGESTION IN LOWER ANIMALS

148. **Digestion in dogs.** — All four-footed animals have essentially the same digestive organs, secreting the same juices as man. Their food, also, is absorbed and assimilated in the same way, but there are slight modifications according to the kind of food eaten. A dog's stomach and intestine have thicker walls, and their juices have far more digestive power; so dogs can digest even bones, which form one of their regular articles of diet.

149. **Digestive organs in cattle.** — A horse lives upon hay, which man cannot digest at all. Cattle have an arrangement which enables them to gather a large amount of food at once, and then to chew it at leisure. As grass is eaten, it is swallowed almost whole. It goes first to a small intermediate stomach, and then to a large pouch called the *paunch* or *rumen*, which in an ox holds about two bushels. When this is full, the animal lies down and proceeds to chew the food. It forces the food back into the mouth in small masses, called the *cud*, which it chews and swallows again. But this time the food is guided on to a third stomach, whence it soon passes into the fourth. The fourth stomach corresponds in size and shape to man's, and is the true digestive stomach, while the others are only storehouses and passageways for the food.

150. **Digestive organs in birds.** — Birds swallow their food whole, for they have no teeth or strong jaws for

chewing. It first enters a pouch called the *crop*, where it is soaked in a fluid secreted there. It slowly passes on to the stomach, where it is mixed with the gastric juice. Then it passes into a muscular bag called the *gizzard*.

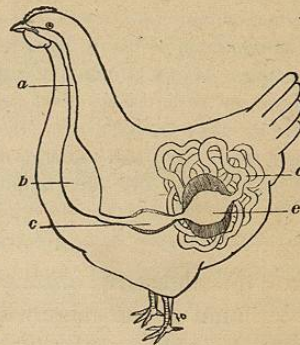
The walls of the gizzard are from one fourth to one half an inch in thickness, and its lining is a thick, tough membrane. It contains small stones which have been swallowed. Its thick walls roll the food about with the stones, so as to grind it to pieces and mix it with the gastric juice.

Then it passes into the intestine, where its digestion is completed, as in man.

151. **Digestive organs in insects and worms.** — Insects possess a stomach and intestine which secrete digestive juices. They also have organs like the liver and pancreas. Some insects masticate food, and others possess a gizzard, which grinds the food after it is swallowed.

Worms generally possess a digestive tube which extends straight through the body. Shellfish, as oysters and clams, possess a stomach and a coil of intestine, which passes through the heart. The large, dark-colored, rounded mass at the back end of the oyster and clam is the *liver*.

152. **Energy required in digestion.** — Man's food requires but little energy in its digestion, hence most of his energy can be applied to physical and mental effort. To digest dog's food requires



Digestive organs of a bird.

- a esophagus.
- b crop, or crop.
- c stomach.
- d small intestine.
- e gizzard.

more energy; to digest the food of cattle requires still more. The lower the form of life, the more time and energy is spent in digestion, and the less is the action of other parts, until the lowest forms of animals simply live to eat, and remain at rest except when eating food. A comparison of man's digestion with that of the lower animals is misleading. Man's alimentary canal is designed to deal with food upon which but little energy need be expended. More energy is thus available for his voluntary use. Because of his perfect food man can perform more labor and undergo more fatigue and exposure in proportion to his size than any other animal.

SUMMARY

1. The digestive organs of all animals are similar to man's, but modified according to the needs of the animal.
2. Cattle swallow grass whole, and then chew it at leisure. They have four stomachs.
3. Birds swallow food whole. It passes first into the crop, and later is ground in the gizzard.
4. Insects, worms, and shellfish each possess a simple stomach and intestine.
5. Man uses food which is more easily digested than the food of any lower animal. Thus he devotes less time to mere eating and digesting food.

REVIEW TOPICS

1. Show in what way and for what purpose a dog's digestive organs differ from those in man.
2. Show the use of four stomachs in cattle.
3. Show how birds digest their food.
4. Point out how the digestive organs are modified in worms; in insects; and in shellfish.
5. Show what advantage man's food gives him over the lower animals.

CHAPTER XII

ANIMAL FOOD

153. Food elements. — Anything which, taken inside of the body, supplies it with weight, heat, or energy is food. Man's food consists of a great variety of substances derived from the animal, vegetable, and mineral kingdoms. Yet all food consists of the proximate principles: water, mineral matter, albumin, fat, and starch or sugar. Neither alone makes a perfect food, but all must be present in proper proportions or else the body will suffer.

154. Water. — Water requires no digestion, but is continually entering and leaving the body unchanged in form. All solid food contains some water, and enough more is added in liquid food and in drink to supply the full needs of the body. Twelve or fifteen pints of fluid are used daily in the work of digestion, but it is absorbed back again to the blood and so little is lost. Within reasonable limits, water taken at meal times aids digestion. In order to digest food and wash away waste matter properly, two or three quarts must be swallowed daily. If the thirst is satisfied with pure water, there will be little danger of taking too much, and the indications of thirst will be the most reliable guide as to the times of drinking and of the quantity required.

155. Mineral matters. — Mineral matters are not changed during digestion, and they leave the body in the same form in which they enter. More than enough are found in all