heating of coal with certain ores, such as those of iron and zinc. It is always prepared in an ordinary coal fire. The air entering through the grate produces at first CO_2, which, on coming in contact with the glowing coals above, is reduced to this lower oxide: $2CO_2 + C_2 = 4CO$.

This gas is the one which is frequently seen burning with a blue flickering flame at the surface of the coals in an open grate fire. The gas may be prepared for experimental purposes by passing carbon dioxide through an iron tube loosely filled with charcoal, heated to redness, or by heating in a flask a mixture of oxalic and suphuric acids. In the last method the gas is mixed with an equal volume of CO_2, which may be absorbed by passing it through wash bottles containing milk of lime.

Properties.—Carbon monoxide is a colorless, transparent, odorless, tasteless gas, which may be liquefied by a pressure of 35.5 atmospheres at −139° C. (−282° F.), or at ordinary pressures at a temperature of −190° C. (−374° F.).

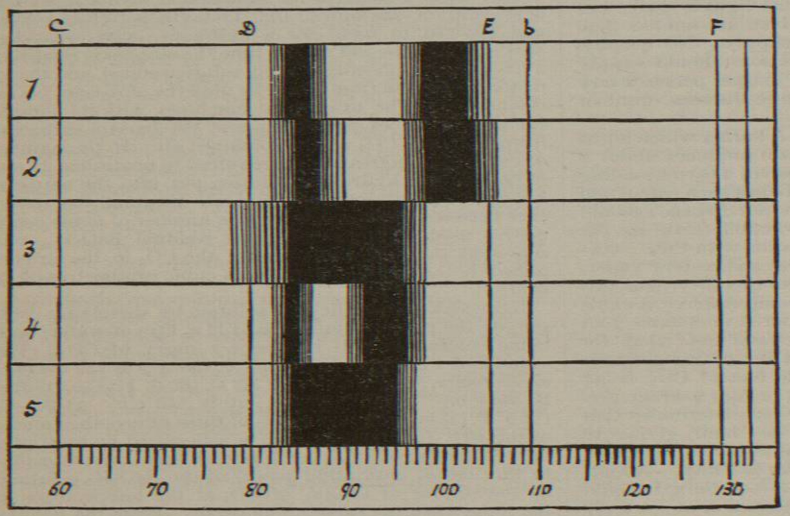

FIG. 1116.—1, Absorption bands of oxyhæmoglobin (Hoppe); 2, absorption bands of CO hæmoglobin, showing displacement of the bands (Hoppe). The same appearance is seen in the blood of persons poisoned by charcoal fumes or coal gas. 3, absorption band of reduced hæmoglobin, *i.e.*, it is No. 1, with a drop of ammonium sulphide added (Hoppe); 4 and 5, the same as Nos. 1 and 3, according to Hensen.

The density of the gas is 14 (H=1), and the specific gravity, .9678 (air =1), or nearly that of air.

It is but slightly soluble in water or alcohol. It dissolves in hot caustic potash (KOH) solutions, with the formation of potassium formate (KOCOH). It also unites directly with potassium, oxygen, and chlorine.

It dissolves readily in a solution of a cuprous salt in ammonium hydroxide; consequently, ammonio-cuprous chloride is used in the analysis of mixtures of gases to absorb the CO when present.

It burns readily in air, with a blue non-luminous flame, the sole product of the combustion being carbon dioxide. At high temperatures it has a very strong affinity for oxygen, and will take it from many of the metallic oxides. It is by its agency that iron ores are reduced to the metallic state in the blast furnace. The diffusive power of the gas is much greater than that of carbon dioxide, CO_2, and cast-iron plates, when red hot, allow it to diffuse through them with comparative ease. In this way a small quantity of the gas finds its way into the air of rooms heated by stoves, and especially by ordinary hot-air furnaces.

Sources.—The most frequent sources of carbon monoxide, likely to produce it in poisonous or dangerous quantities, are open charcoal or stove coal fires, defective stove pipes or furnace flues, and the escape of illuminating gas, especially the variety known as *water gas.*

A frequent cause of fatal poisoning by this gas is an open charcoal fire. This is sometimes used with suicidal intent, especially in some European countries. Leblanc gives the following analysis of the air of a confined space in which charcoal was burnt, and which proved rapidly fatal to a dog: Oxygen, 19.19 per cent.; nitrogen, 76.62 per cent.; carbon dioxide, 4.61 per cent.; carbon monoxide, .54 per cent.; marsh gas, .04 per cent.

In this case, however, the poisonous effects might not be due alone to the carbon monoxide, for 4.6 per cent. of carbon dioxide in an air containing 1.4 per cent. less oxygen than normal air would form a poisonous atmosphere.

Another source of carbon monoxide, and one which is frequently overlooked, is from escape of the gas through defective flues, or even through the red-hot walls of the flues or pipes of stoves and hot-air furnaces. The gas thus finding its way into rooms frequently gives rise to headache, dizziness, loss of appetite, nausea, debility, and bronchial irritation, which last effect is sometimes very severe. Indeed, severe cases of capillary bronchitis in children have been traced to an escape of poisonous gases from a defective flue. The ordinary hot-air furnace, in common use at the present day, is the cause of a considerable and undetermined amount of chronic poisoning, and is on this account open to very serious objection. From ordinary stoves, when the draught is rendered imperfect by the downward direction of the pipe before entering the chimney, carbon monoxide and other gases frequently escape into the room.

Perhaps the most frequent source of fatal quantities of this gas in the air, especially in large cities, is the escape of illuminating gas. From thoughtlessly blowing out the gas, or accidentally turning the stopcock, or having it turned by children, as occurred to a number of persons coming under the care of the writer, or from accidental leakage of pipes, the gas may find its way into a room in sufficient quantities to give fatal results. Even in waking hours, when the gas escapes slowly, the odor does not seem to be a perfect safeguard. (For a further discussion of this subject, see the section that treats of coal gas.)

Physiological Action.—Carbon monoxide is a very poisonous gas, entering the blood and combining with the hæmoglobin of the red corpuscles and expelling the oxygen. When the blood is pretty thoroughly saturated with this gas, death is usually, if not always, the result.

The blood of persons poisoned with this gas retains its bright cherry-red color for a long time after death, both in the body and out of it, and in the veins as well as in the arteries.

Properly diluted, the blood shows in the spectroscope two absorption bands situated between the lines *D* and *E*, but slightly nearer *E* than the similar bands of oxyhæmoglobin (see Fig. 1116).

These bands do not readily disappear when the blood is treated with ammonium sulphydrate, *i.e.*, the blood resists the action of reducing agents. In ordinary arterial blood, reducing agents change the spectrum, so that the two bands seen in 1 disappear, and one broad band, represented in 3, makes its appearance. Vogel has proposed to employ this peculiar behavior of hæmoglobin as a means of detecting CO in the air.

The process consists in shaking the mixture of gases with a drop of blood diluted with 2 or 3 c.c. of distilled water, and observing the spectrum of this blood solution. This method is said to detect 2.5 to 4 parts per 1,000, of this gas in the air.

Blood charged with carbon monoxide, in the absence of oxygen, resists the action of putrefaction for a long time. The CO may be expelled from blood by allowing any inert gas to bubble through it, or by placing it in a vacuum. The very poisonous character of CO is explained by the behavior of the hæmoglobin of the blood toward it.

Toxicology.—The poisonous action of carbon monoxide has been known since 1802, when Guyton Morveau first observed it. Leblanc and Dumas' experiments show that air containing 1 per cent. of the gas will kill a dog in one minute and a half. Dr. Letheby found that air containing .5 per cent. killed birds in three minutes. One per cent. of the gas in air renders it fatal to most animals, and .5 per cent. to some, even if the oxygen is normal or in excess of normal.

Symptoms of Acute CO Poisoning.—The symptoms of carbonic-oxide poisoning are singularly persistent. The first subjective symptoms are dizziness, excruciating headache, debility, and a feeling of prostration; nausea and vomiting are not uncommon; convulsions are frequently seen in experiments upon lower animals, as well as in human beings poisoned by it. This gas seems to act as a narcotic poison, death usually occurring by coma. The face is usually, though not always, livid, and the pupils are dilated. When the quantity of gas is not sufficient to produce such pronounced results as those above mentioned, and when this small quantity is breathed for days or weeks, the symptoms are those of malaise, debility, anæmia, anorexia, and usually headache. There is frequently a dry, irritative cough. These symptoms are sometimes mistaken for those of malaria, and probably are benefited by the tonic effect of quinine. When the severer symptoms are well marked, the chances of recovery decrease with the length of time the patient has been exposed to the gas. When the time of exposure has exceeded eight hours, and coma has set in, the prognosis is very unfavorable. If the time is less than eight hours, and the coma is not too profound, there is reason to hope for recovery. This statement is based upon experiments upon the lower animals, and the histories of a number of recorded cases. Much will depend upon the amount of gas breathed; but, other things being equal, the longer the blood is exposed to the gas, and the more thoroughly it becomes saturated with CO, the more permanent is the injury, and the less chance there is for recovery. The characteristic *post-mortem appearances* are: the bright red color and persistent fluidity of the blood, and hyperæmia of the brain and meninges. The heart is usually nearly empty and flaccid.

Chronic Poisoning.—The symptoms of chronic poisoning with carbon monoxide are somewhat different from those of acute poisoning. In this case the amount of gas is small and the time of exposure is long. The hæmoglobin absorbs the CO very slowly, while it also absorbs oxygen freely. Under these circumstances, a part of the CO-hæmoglobin is decomposed, but a part of it remains in the blood. The symptoms are generally vague, inconstant, and very often overlooked or attributed to other causes. The chief symptoms are malaise, anæmia, anorexia, and disorders of digestion. The person never feels well, but he seems better when in the open air. Indeed, fresh air and change of residence are the best and only treatment. The symptoms are such as to suggest chronic malarial infection. The origin of this form of poisoning is usually from leaking gas pipes either in the house or in the ground near the house, whence the gas reaches the dwelling by diffusion through the soil.

The *treatment* of cases of poisoning by CO are, briefly, fresh air, cold affusions, stimulants, and artificial respiration when demanded. Even with all these, death will result in those cases in which the exposure has been of long duration, and the coma pronounced, *i.e.*, when the blood has become well-nigh saturated with the gas. In such cases transfusion, or displacing the poisonous with pure blood, or even with normal salt solution, seems more likely to succeed. Good results have followed this method of treatment in a number of cases.

Illuminating Gas, Fuel Gas, or Coal Gas.—These names are applied to complex mixtures of gases, made from coal, wood, oils, resin, petroleum, shales, etc., by a process of destructive distillation. The most of these gases contain more or less of the oxides of carbon, especially of CO, and in this country they are the most frequent sources of poisoning by carbon monoxide. Much of what has been said as to the effects of this gas applies to illuminating gas.

Coal gas was first used for house lighting by William Murdock in London in 1792. It was first used for street lighting in London in 1812, and in Paris in 1815. In this country, especially in the larger cities and in some towns, the so-called *water gas* enriched with naphtha has nearly replaced coal gas. The complete apparatus for its preparation consists of: 1. A set of semi-cylindrical iron or clay retorts, set horizontally in a furnace. 2. A series of horizontal and upright iron pipes acting as condensers, in which the liquid products of the distillation are condensed and separated from each other, and from the gases. 3. One or more purifiers, which consist of upright stacks, containing moistened coke, freshly slaked lime, ferric hydrate, or mixtures of these with sawdust. The object of these purifiers is to absorb the most of the carbon dioxide, sulphuretted hydrogen, etc., before the gas is stored for use. 4. A gasometer or gas-holder, which consists of an inverted iron tub of large size floated in a well of water. The gas is conducted into this gasometer by a pipe leading from below and terminating above the water, where it is stored ready for use.

The coal is heated in the retorts to a cherry-red heat, or about 1,500° F. This temperature breaks it up into coke (which remains in the retort), liquid and volatile products, and gases. Ordinary bituminous coals yield about ten thousand cubic feet of rather poor gas per ton. It is a common practice to mix with these coals about five to ten per cent. of a rich boghead or cannel coal, to improve the illuminating power of the gas produced.

COMPOSITION.—The gas ordinarily used is a mechanical mixture of various gases, some of which are illuminating agents, while others have no value in this respect, but are combustibles furnishing considerable heat, while there are usually some present which are inert either as combustibles or as illuminants. Besides the true gases, there are present vapors of certain hydrocarbons, which are of value as illuminating agents. The chemical composition of the gas varies with the coal used, and the temperature to which it is subjected. The chief constituents of coal gas, with the quantities of each, are given in the following table from Letheby:

	Volume per cent.
1. Hydrogen	25 to 50
2. Marsh gas	35 to 52
3. Condensible hydrocarbons: Oleflant gas(C_2H_4), propylene (C_3H_6), butylene (C_4H_8)	3 to 20
4. Benzol and its series	(?)
5. Acetylene (C_2H_2)	(?)
6. Naphthalene ($C_{10}H_8$)	(?)
7. Carbon dioxide (CO_2)	0 to 2
8. Carbon monoxide (CO)	5 to 9
9. Cyanogen (CNCN)	Traces.
10. Ammonia (NH_3)	0 to .06
11. Bisulphide of carbon (CS_2)	.004 to .05
12. Aqueous vapor (H_2O)	.6 to 2.5
13. Oxygen	0 to 10
14. Nitrogen	0 to 8
15. Sulphocyanogen	traces.

It will be seen that this table presents wide variations as to the percentage of the various gases. The illuminating power of the gas varies with the proportion of ethane, C_2H_6, ethylene (ethene), C_2H_4, acetylene, C_2H_2, and benzene, C_6H_6, and their homologues, and the heating value with the hydrogen, marsh gas, and carbon monoxide present. The specific gravity of coal gas is about from .400 to .650, air being taken as 1.

The illuminating power of gas is measured by comparison with a standard spermaceti candle of six to the pound, and consuming, as near as may be, one hundred and twenty grains of spermaceti per hour. It is assumed that the light given off is in direct proportion to the sperm consumed. The gas to be tested is to be burned at the rate of five feet per hour. Such a burner should give as much light as sixteen or eighteen standard candles. It may reach as high as twenty-five or thirty candle-power.

WATER GAS may be referred to here as a gas manufactured and sold for the same purposes as coal gas. Its manufacture is conducted on a large scale in most cities, and to a large extent it has taken the place of coal gas.

This gas is manufactured as follows: Steam from a boiler is forced through a bed of glowing anthracite coals, previously heated to a very high temperature by an air blast. The steam from the boiler is passed through pipes or flues over the fire box, so as to superheat it to a temperature of 800° to 900° F. In passing this hot steam through the coals the water is decomposed, the oxygen combines with the carbon of the coal to form carbon dioxide, which is reduced, by the heated coal above, to the monoxide: $C + 2H_2O = CO_2 + 2H_2$. $(CO_2 + C = 2CO)$. The hydrogen of the steam remains in a free state. After the steam has passed through the coal for about six minutes, the latter cools off and the process stops. The air blast is now turned on until the coal is again heated to the required degree—*i.e.*, for about eight minutes—when the steam is again passed into it. It is, therefore, an alternating process. The gas thus produced has very little illuminating power, but answers well for heating purposes. To give illuminating power it must be charged with hydrocarbons. This is accomplished as follows: Naphtha, or light benzin, is placed upon shelves in a carburetter, and the gas passed through the apparatus. A small quantity of the vapor of the naphtha is taken up by the gas. This mixture is now passed through retorts heated to bright redness, by which process the vapors are decomposed and converted into permanent gases instead of condensible vapors. This is the Tessie-du-Motay process. By the Lowe process the carburetted gas is made in one operation instead of in two, as above described. Water gas is cheaper and usually of higher illuminating power than coal gas, and is consequently superseding the latter.

The principal differences in the chemical composition of coal gas and water gas are, that the latter, as usually manufactured, contains a larger percentage of illuminating agents and of carbon monoxide than the former.

The following analyses of the two gases, by Professor Remsen and Dr. Love, will serve to illustrate these differences:

Constituents.	REMSEN.		LOVE.
	Coal gas.	Water gas.	Water gas.
Carbon dioxide	0.0	0.3	0.0
Illuminants (ethylene, propylene, butylene, ethane, propane, butane)	4.3	12.85	15.75
Carbon monoxide	7.9	28.25	21.51
Hydrogen	50.2	30.30	46.49
Marsh gas (methane)	29.8	21.45	11.75
Nitrogen	7.8	6.85	4.30
Oxygen	....	....	.20

OIL GAS is now largely made by heating petroleum, tar, or shale oils in a retort to a temperature of about 1,000° C. This gas, especially that made by the Pintsch process, is much used in lighting cars. Oil gas is frequently used to enrich other gases of low illuminating power.

AIR GAS, so called, is produced by passing air through layers of very light petroleum distillates, known as gasolene, when it takes up enough of the light hydrocarbons to form a combustible mixture. Air gas is much used where other gas is not available. It cannot be stored long or piped a long distance because of the condensation of the illuminants.

ACETYLENE, C_2H_2, has recently become prominent, and is used as an illuminant in small lamps. It is prepared by treating calcium carbide with water, when the following reaction takes place:

$$CaC_2 + 2H_2O = Ca(OH)_2 + C_2H_2.$$

The calcium carbide is prepared by heating a mixture of powdered coke and lime in an electrical furnace. One ton of calcium carbide of eighty-per-cent. purity is said to produce 1,000 cubic feet of acetylene gas. Its illuminating power is very high, and when burned in an ordinary burner gives off considerable soot. When burned in a specially constructed burner it gives a light of great brilliancy. The cost of production prevents its general adoption for illuminating purposes. Acetylene combines with copper and silver, forming acetylids, which are explosive. It combines with the hæmoglobin of the blood, and thus acts as a poison. The gas has a pungent, suffocating, disagreeable odor, by which its presence in the air can usually be detected.

FUEL GAS AND FURNACE GASES.—Gases of more or less poisonous character are produced during various smelting and roasting processes and which may be the cause of serious accidental poisoning. The most commonly met with are arsine (arseniuretted hydrogen), stibine (antimoniuretted hydrogen), and sulphurous oxide, obtained by roasting ores containing arsenic, antimony, or sulphur, and CO_2 and CO obtained in smelting processes generally.

Carbon monoxide is an important constituent of *fuel gas* or *producer gas*. Producer gas is made by forcing air through a bed of incandescent coal or coke in specially constructed furnaces. It contains from twenty-five to thirty per cent. of CO, to which it owes its value as a fuel. It also contains some CO_2 and free nitrogen. In another form of furnace steam is forced through the heated coal, when CO and hydrogen are produced, as in making *water gas*. It is needless to say that both these gases are poisonous.

NATURAL GAS is so called because it exists already formed in the earth whence it issues spontaneously, or is obtained by boring wells. The gas is found chiefly in localities where petroleum is found. In this country this gas is found in western Pennsylvania, in eastern Ohio, in West Virginia, and in Fredonia, N. Y. At the last-named place it was used as an illuminating gas as early as 1821.

The "Burning Springs" of Baku, on the Caspian Sea, have been known since the sixth century B.C. The composition of natural gas is fairly uniform, and it consists of about ninety per cent. of marsh gas (methane) with small quantities of ethane, C_2H_6, propane, C_3H_8, and other paraffin hydrocarbons, hydrogen, carbon monoxide, and carbon dioxide.

It is a valuable fuel, burning with a feebly luminous flame, but giving out an intense heat. In many localities it is the chief fuel. When heated in a suitable furnace with petroleum or the higher hydrocarbons, its illuminating power may be greatly increased and it is then used for illuminating purposes.

ACTION OF ILLUMINATING GASES ON THE ECONOMY.—All forms of illuminating gas are irrespirable and more or less poisonous.

They are irrespirable because they do not furnish oxygen. The chief poisonous agents are carbon monoxide and the heavier hydrocarbons mentioned above under the name of *illuminants*.

The physiological action of carbon monoxide has already been discussed in the section which treats of that subject.

The heavy hydrocarbons are more or less poisonous when mixed with air. The symptoms produced are dizziness, headache, nausea, and prostration. These compounds are more deleterious than is the lighter marsh gas, but their exact physiological action is not well understood. The physiological effects of illuminating gas are due not alone to the carbon monoxide, as some have supposed, but to the combined effect of this gas and the

heavier hydrocarbons, together with the loss of oxygen due to the displacement of air by the gas.

Symptoms.—The symptoms of acute poisoning by ordinary illuminating gas are: headache, dizziness, nausea, a staggering gait, great muscular weakness, prostration, loss of memory, and finally, unconsciousness and complete asphyxia. Convulsions frequently end the scene. There is usually little difficulty in making the diagnosis, as the circumstances under which the patient is found, the odor of the gas, etc., will prevent deception. The only diseases likely to be confounded with this form of poisoning are, cerebral apoplexy and uræmic coma. Should the physician not see the patient before the odor of the gas has escaped, such difficulty might arise. In both of these diseases the symptoms are pretty constant, while in *coal-gas* or *water-gas poisoning* they are apt to fluctuate; the patient will frequently rouse up for a time, and answer questions intelligently, and then lapse into unconsciousness, or be seized with convulsions.

A marked difference in the symptoms will be noted, dependent upon whether the gas is admitted into the air rapidly or slowly. In the first condition the person rapidly becomes unconscious, and recovers rapidly when removed into fresh air. When the gas is admitted to the air of a room slowly, the headache, dizziness, nausea, and muscular weakness are the prominent symptoms, and they are remarkably persistent. The condition of the patient often seems to remain constant for days after the accident; and when entire unconsciousness has occurred, recovery is very unusual. We should distinguish between asphyxia by illuminating gas and poisoning by carbon monoxide obtained by breathing the diluted gas. The first is produced by a rapid displacement of the air of the room with the gas, while the second results from a slower and very gradual admixture of gas with the air.

Fresh air and stimulation will usually suffice to restore the patient in the first case; but in the second, while these measures should not be neglected, they are much less useful, and, when the time of exposure has been considerable, of slight benefit. It may be well to name here some of the sources of coal-gas poisoning other than leakages directly from fixtures in the room.

The odor of the gas is so characteristic that this will in most cases give its warning. Repeated instances, however, prove that people may be killed by this gas without detecting the odor.

Cases of poisoning have occurred when the leak in the pipes occurred in an adjoining room, or in a cellar or other room underneath. Most of such accidents occur in the night while the victims are asleep, even though they were exposed to the same influences during the preceding day.

It should be known that these poisonous gases may diffuse themselves through walls, soil, and partitions. It should also be remembered that the odorous vapors may be almost entirely removed by diffusion through a thick wall or several feet of soil. The gas deprived of its odor may thus pervade the air of a sleeping- or sitting-room, and give no warning of its presence.

In winter, when the ground is frozen, and the upper layers are impervious to the gas, this may diffuse itself several feet laterally from a broken street main, reach the cellar, pass thence to the rooms above, and so do its deadly work unperceived. That this accident has frequently occurred is shown by abundant evidence taken from the statistics of any large city. Aside from the fatal cases of poisoning from this source, we can easily see that there must be a much larger number of cases in which headache, dizziness, loss of appetite, general debility, anæmia, etc., may be dependent upon a smaller amount of the same gas continually finding its way into the air of houses.

It is evident, from the above, that cases of poisoning may occur in houses where gas is not used, and where the pipes do not even enter the house.

There has been, at various times, not a little discussion as to the relative poisonous effects of coal gas and water gas. This question has been made the subject of a great number of investigations. We may note that of Commissioner Raymond, of Brooklyn, N. Y., Health Department, 1883, and that of the Committee on Manufactures of the Massachusetts Legislature of 1884.

The weight of experimental evidence, however, goes to show that *water gas* is decidedly more dangerous than *coal gas*.

With a given amount of gas, the danger line is reached sooner with water gas; and, indeed, in many rooms it is not easy to get a fatal mixture of *coal gas* and air with the escape from a single burner jet, owing to natural ventilation through walls, floors, windows, etc. That is, dogs, cats, rabbits, and pigeons will endure almost indefinitely an atmosphere containing one per cent. of coal gas, while the same animals die in from five to eight hours when exposed to an atmosphere containing one per cent. of water gas.

The post-mortem appearances, in cases of poisoning by illuminating gas, are similar to those found after poisoning with carbon monoxide. There is generally an odor of the gas about the body, especially on compressing the chest, so as to expel the residual gas from the lungs.

The countenance may be pallid, pink, or purple, varying in different cases. Frequently more or less froth will be found issuing from the mouth, due probably to the nausea which precedes death, and which is one of the marked symptoms. Occasionally, rose-colored patches will be found on the thighs or other parts of the body.

When the body is opened the blood will generally be found everywhere in a fluid condition, and uniformly of a light red color on both sides of the heart. It shows the spectroscopic bands of carbon-monoxide hæmoglobin see Fig. 1116, p. 662). The lungs will usually have a brilliant red hue, while the bronchial tubes will be filled with a frothy mucus. The venous sinuses of the brain and the vertebral nervous system will be found engorged with blood.

The above appearances are not always found, however, for there is great variation in this form of poisoning, both as to the symptoms and as to the post-mortem appearances. These variations are probably explained by the fact that in some instances the cause of death is a true asphyxia, while in others it is CO poisoning. In the former we may expect a livid hue of skin, dark, clotted blood, and engorgement of the venous sinuses; while in the latter we may expect the light, fluid blood, the rose-colored spots upon the skin, a lingering death, etc. More careful observation is needed upon these points.

Treatment.—We have incidentally mentioned nearly all that can be said of the treatment of coal-gas poisoning. If the case is one of suffocation, and the time of exposure has not been too long, fresh air, stimulants, and rest will usually suffice to restore the patient to consciousness.

No antidote for poisoning by the gas is known. Transfusion of blood has been tried with apparent success.

In experiments upon the lower animals the introduction of normal salt solution into the veins has occasionally been successful in saving life.

Inhalations of oxygen have often been tried, with temporary benefit, but it does not seem to expel the carbon monoxide from the blood. If persisted in, it may save life when the blood is not too nearly saturated with the gas. *Elias H. Bartley.*

CARBON TETRACHLORIDE.—*Tetrachloromethane, Chloro-carbon:* CCl_4. This body is a colorless, thin, ethereal fluid, of a pleasant aromatic smell, insoluble in water but miscible freely with alcohol and ether. It has been tried as an anæsthetic and has been found to operate after the general manner of chloroform, but with such a depressing effect upon heart action that it is little likely ever to come into practical use. *Edward Curtis.*

CARBONIC-ACID WATER.—"*Soda water.*" Carbonic-acid water is the product of the solution of carbon dioxide (carbonic-acid gas) in water. In such solution there is a chemical union between the gas and the water, molecule for molecule, producing the body *carbonic acid* proper