drogen under an inverted tumbler, when the hydrogen will combine with oxygen from the air, and the resulting water form as a mist on the sides of the tumbler. This process is called the synthesis of water as opposed to analysis.

Pure water, as thus prepared, is a colorless, odorless, tasteless liquid, with which you may think yourselves tolerably familiar, but it must be said that pure water, such as the sample before you, is not found in nature; no, not in that cool spring which you sought in boyhood days; not in that well to which the farmer points with such pride—every farmer's well is "the best well in the township"; not even in the raindrops which fall from the thunder-cloud, though this is nature's nearest approach to pure water.

Naturally occurring waters may be classed as—1, rain; 2, spring; 3, river; 4, sea water. Of these, the water which falls towards the end of a shower is nearly pure; that which falls earlier is contaminated with ammonia and dust. Spring water derives impurities such as lime, iron, sulphur, from the rocks or soil with which it has come in contact. Thus we have the various mineral waters, and the hard water so common in wells. River water necessarily contains the impurities of spring water, and in addition organic matter from decaying vegetation and animal refuse. I hardly need mention that sea water contains about 3½% of solid matter, mostly common salt.

The common impurities found in water may now be considered. One of the commonest of these is salt, and this, though harmless of itself, is a bad symptom for water to show, for it generally goes hand in hand with dangerous organic impurities. These are naturally regarded as menacing to health, and it should be borne in mind that a water may be clear and sparkling and yet be entirely unfit for domestic use. If the water contain a susdicious quantity of organic matter, it will in a few mintes bleach a solution of potassium permanganate. This may be shown by placing two glass cylinders on a sheet of paper, filling one with pure water and the other with the suspected water, then adding to each a quantity of the permanganate sufficient to impart a distinct pink color. If the second cylinder loses its color in a few minutes, the water should be condemned. From the decomposition of organic matter ammonia is produced (witness a manure pile), hence ammonia is usually present in impure water; its presence may be detected by the addition of a few drops of Nessler's solution. Even one part of ammonia in a million parts of water may be detected by this reagent.

Of particular interest to the engineer as well as to the hygienist is the existence of lime in water, producing so-called hard water. As is well known such water uses up a quantity of soap before a lather can be produced, and this property is made use of in estimating the degree of hardness of any water. Another convenient test for hard water consists in adding a few drops of solution of ammonium oxalate; if lime is present in the water a white cloudiness or precipitate is produced. Hardness is of two kinds—1, temporary; 2, permanent. Temporary hardness means that hardness which is removed by boiling, and is due to carbonates of lime or magnesia. We may illustrate its formation thus: Into some lime-water a current of carbon dioxide is led; the liquid becomes milky, but on continuing to pass in the gas the liquid clears up; it now contains carbonate of lime in solution, and is simply artificial hard water. When we boil some of it in a glass tube it turns turbid, and the lime deposits on the tube, off which it may be dissolved by a few drops of acid. We can now understand how hard water is formed in nature. From decaying leaves, etc., the water of a stream becomes charged with carbon dioxide; such water possesses the power of dissolving carbonate of lime, so it takes up the substance from the soil or from the limestone rock over which it may flow. When such water is boiled it loses the carbon dioxide, and the carbonate of lime falls to the bottom of the vessel, as fur in a tea-kettle or as scale in a boiler. The evil produced by such a deposit on a boiler is so great that it has been estimated that ¼ in. of scale wastes 60% of the fuel. Since in Toronto the water supply comes from Lake Ontario very little trouble from scale is experienced, but in localities such as Galt and Guelph, Ont., where limestone exposures are common, the water is quite unsuitable for use in boilers. Though the exact composition of scale varies according to the locality, it generally consists of carbonate of lime, or magnesia, or both; what can be done for it? As with most other maladies, treatment may be in the way of prevention or of cure. In households three methods of prevention are used: 1, boiling; 2, adding lime; 3, adding washing soda. Of these methods of softening water, the second seems, at first sight, altogether unreasonable, but an experiment shows that on adding lime-water to water containing lime, a precipitate of chalk falls to the bottom and the water is made pure. Such a method may be applied to a tank of hard water, the requisite quantity of lime being previously determined. In order to cure the scale numerous boiler compounds have been used; in many of these tannic acid is the active ingredient, hence the cure is about as bad as the disease, for the acid eats its way between iron and scale, loosening the latter by attacking the iron underneath the coating. What is wanted is a compound that will eat its way through the scale and not attack the iron.

Turning to permanent hardness, we may illustrate its cause by dissolving in water a little gypsum (plaster of Paris), chemically called sulphate of lime. This liquid responds to the oxalate test, but is in no degree softened