decomposes bromide, iodide and ferro-cyanide of potassium, and acts upon the metals.

He regarded it as constituting the base of nitrogen, which he supposed to be a compound of ozone and hydrogen, analagous to the chloride of hydrogen. He supposed it to be a secondary product of the electrolysis, and formed by the reaction of the nascent oxygen on the nitrogen of the atmospheric air dissolved in the water.

M. Schonbein was subsequently enabled to produce this body by purely chemical means; when phosphorus, at ordinary temperatures, is exposed to *moist air*, ozone is always generated.* This reaction is best observed by introducing into a large glass vessel, a piece of phosphorus one or two inches long, and sufficient water to partially cover it; the whole may now be exposed for 24 hours to a temperature of 68° to 75° F., when the air will be found very highly charged with ozone.

From its supposed nature as the base of nitrogen, this body has attracted considerable attention from chemists, and has been made the subject of much experimental research, as well as a great deal of theorising and speculation. It has been particularly examined by M. Marignac and Mr. Williamson.

The former chemist has shown that ozone is generated by the electrolysis of dilute sulphuric acid, independently of the presence of nitrogen; it being produced equally well in a vessel exhausted of air.† M. Marignac also instituted a series of experiments on ozone produced by chemical means; air was made to pass through a long tube containing phosphorus, and thus it became sufficiently charged with ozone for the purposes of experiment. He found that perfectly dry air is incapable of generating this substance, and also that air freed from oxygen by passing over ignited copper, produced no trace of it; but if a very little oxygen (insufficient to support combustion for a moment,) is present, ozone is produced with the same ease as in ordinary air. Pure oxygen, nitrogen or hydrogen alone, do not produce it, but if a small quantity of oxygen is mixed with hydrogen, ozone is formed with great rapidity, on passing the mixture over phosphorus.

Air impregnated with ozone looses entirely its characteristic properties, if passed through a tube heated between 570° and 750° F. This principle is absorbed by water, but not by oil of vitriol, ammonia or chloride of calcium. If the air is passed through a solution of iodide of potassium, it loses its odor, and the salt is decomposed with the liberation of free iodine. Some iodate of potassa is also found in the solution.

Ozone is readily absorbed by the metals. If the ozonized air is passed through a glass tube containing silver in a porous form, (from the decomposition of the acetate by heat,) it loses its peculiar odor, and the silver is converted into a blackish brown substance which when thrown into water, gives off oxygen gas with effervescence, and the remaining substance has all the characters of ordinary oxide of silver.

These curious results, many of which were previously obtained by Schonbein, prove that nitrogen is not concerned in the formation of this substance, and seem to show that these peculiar reactions are owing to oxygen in a loosely combined state.

Mr. Williamson's experiments confirm these observations, and go to prove that it is a compound of oxygen and hydrogen. In his experiments, the oxygen from the electrolysis of dilute sulphuric acid, was thoroughly dried by passing it over chloride of calcium; the gas thus dried, was passed through a glass tube containing metallic copper, and heated to redness; water was formed abundantly and condensed in the cool part of the tube, and this formation of water continued as long as the process lasted. From this it appears that water is formed by the reducing power of the metal. To remove all sources of error, the oxygen was evolved from the electrolysis of a solution of sulphate of copper, in whose decomposition no hydrogen is set free, the oxygen thus obtained possessed strongly the peculiar ozone odor. It was now passed over copper (obtained by decomposing the oxide by carbonic oxide,) heated to redness, and water was immediately formed as in the last experiment.

In subsequent experiments, the ozonized oxygen previously dried, was passed through a glass tube heated to redness, by which the peculiar odor was completely destroyed: to this an accurately weighed chloride of calcium tube was fixed, after the gas had been passed a short time, the tube was found to have increased perceptibly in weight.

When the ozonized oxygen is passed through water, it communicates to it the peculiar odor. If this solution is added to a mixture of starch paste and iodide of potassium, a blue color is produced; and when mixed with ferro-cyanide of potassium, this salt gives a blue precipitate with proto-salts of iron. Solutions of lime and baryta give, with a solution of ozone, a heavy and apparently crystalline precipitate.

Mr. Williamson states as the result of his experiments, that ozone is not produced by the action of air on phosphorus, but we cannot admit this, for several reasons. The results of M. Marignac were obtained by the substance formed in this manner, and many of the results obtained by him are precisely the same with those of Mr. Williamson; and these as well as others obtained, cannot be referred to the action of phosphoric acid.

Mr. Williamson's arrangement, which consisted of a tube containing asbestos, on which the phosphorus was deposited by sublimation, was such as completely to defeat the object in view; for although ozone is generated by the action of phosphorus on air, yet it is itself absorbed or decomposed, when brought in contact with a large surface of phosphorus; and this result would especially occur when the phosphorus was heated, as it must have been from the exposure of so large a surface. Our own observations also have shown that something distinct from phosphoric or phosphorous acids, is generated by this process, for after the air enclosed in the globe had been thoroughly agitated and allowed to stand some hours, in contact with a mixture of carbonate of lime and water, it still retained the peculiar odor, and the power of decomposing iodide and ferro-cyanide of potassium.

The conclusion which these gentlemen deduced from their experiments was, that the substance which presents these curious reactions is a compound of oxygen and hydrogen, containing more oxygen than water, and perhaps isomeric with the deut-oxide of Thenard. This view was certainly consonant with their results, and indeed they appeared to be inexplicable by any other hypothesis. The oxidation of silver to such a degree, and the conversion of iodide of potassium into iodate of potassa, evince the existence of oxygen in a feebly combined and very active state, while the formation of water by passing it through an ignited glass tube or over heated copper, show that hydrogen is also present. More recently, however, we have a memoir on this subject by MM. Louis Rivier, and Professor L. R. de Fellenberg,* which contains many interesting facts.

In their experiments they passed for two hours a series of electrical sparks through a glass vessel containing humid air, and whose sides were moistened with a solution of carbonate of potassa. The air acquired strongly the peculiar odor of ozone; which, by standing some time, disappeared, and the liquid was found to contain *nitrate of potassa*. They then proceeded to examine the ozone produced by chemical means. The arrangement consisted of a tube about three feet in length, in which were placed several pieces of phosphorus moistened with a little distilled water: to one end was adapted a recurved tube, dipping in a bottle which contained milk of lime; by means of an aspirator connected with the other tube; the air was made to pass slowly over the phosphorus and through the milk of lime, at the rate of 10 litres in 24 hours. The ozone thus formed was absorbed by the alkaline fluid, which after 24 hours was removed. After filtration, it was evaporated to dryness, redissolved in distilled water, decomposed by carbonate of ammonia, and the resulting salt again decomposed by a solution of strontia, when it afforded a salt in beautiful needles, which gave the following reactions: with sulphuric acid and brucine, a reddish yellow, and with narcotine a red color; it destroyed the color of sulphate of indigo; rendered brownish-black the protosulphate of iron; its solution in water with pure hydrochloric acid, readily dissolved gold leaf, and from the solution, chloride of tin threw down the purple precipitate of Cassius; some of the salt mixed with bisulphate of potassa, and heated in a glass tube, gave off abundant red vapors, which promptly blanched indigo paper held in the tube.

* The peculiar odor of phosphorus is probably due entirely to the formation of this new substance.

† In one experiment, water acidulated by sulphuric acid was decomposed in a vessel, from which the air was completely excluded. After the decomposition had been continued for two or three days, and when more than one fourth of the liquid had been driven off in the form of gas, the oxygen was found to be as strongly impregnated with ozone as at the commencement of the experiment.

*Archives de l'Electricité, No. 17, Tome v. 1845.