able errors of his manual operations, and authorize him to eliminate from the essential elements of a compound those products of an analysis whose quantity cannot be reduced to any admissible proportion, and may therefore be considered as extraneous.

The author, at the close of his paper, controverts the opinion of those who think that crystallization requires a previous state of solution in the matter crystallized; and contends, that as long as any quantity of fluid is present in a solution, no crystallization can possibly take place.

Experiments on the Quantity of Gases absorbed by Water, at different Temperatures, and under different Pressures. *By Mr.* William Henry. *Communicated by the Right Hon. Sir* Joseph Banks, *K.B. P.R.S.* Read December 23, 1802. [*Phil. Trans.* 1803, *p.* 29.]

After a short recapitulation of what has of late been done by Mr. Cavendish, Dr. Priestley, Dr. Nooth, and others, respecting the impregnation of water with different gases, our author observes, that the circumstance of the different degrees of temperature and pressure had not been as yet sufficiently attended to. Dr. Priestley, indeed, had long since remarked, that, in an exhausted receiver, Pyrmont water will actually boil at a common temperature, by the copious discharge of its air; and that hence it is very probable, that by means of a condensing engine, water might be much more highly impregnated with the virtues of the Pyrmont spring: but this conjecture remained as yet to be proved by experiments; and this is the task our author has undertaken in the present paper.

This paper consists of two sections; the first treating of the quantities of gases absorbed by water under the usual pressure of the atmosphere; and the second, of the influence of pressure in promoting the absorption of gases. The apparatus contrived for these experiments may be described as a siphon, of which one side, or leg, is a glass vessel of comparatively a considerable diameter, and the other a long glass tube of about a quarter of an inch bore; the junction of these two parts at the bottom being a short pipe of India rubber, well secured by proper integuments of leather, thus forming a joint, which admits of the vessel being briskly agitated. This vessel has a stop-cock both at top and bottom, in order to insert and emit fluids and gases; and both the vessel and tube are accurately graduated. It may now be understood, that a known quantity of water and of a certain gas being put in the vessel, and the tube being filled to a certain extent with mercury, the absorption of the gas will be accurately measured by the column of mercury in the tube. Those who are particularly interested in this inquiry will find in the paper various precautions and additional contrivances, all tending to insure the success and accuracy of the investigation.

The first experiments were made on the absorption of carbonic acid gas by water: and here a singular disagreement was observed in the first trials made under exactly the same circumstances. It

soon occurred that this might be owing to the variable amount of the residua of the gas, after the absorption; and this was actually confirmed by the observation, that, of a greater quantity of gas, more would be absorbed than of a smaller, though both quantities were sufficient for saturation of equal quantities of water. This was found to be owing to the quantity of common air, which will ever be extricated from the water, though it be ever so pure, and which will form a greater proportion of the smaller than of the greater dose of the residuary gas.

A table of nine experiments is next given, in which are entered the temperature, the quantities of water and gas, the quantities of gas absorbed, the residua, and the quantities absorbed by 100 inches of water. The two extreme results are, that, at the temperature of 55°, 13 measures of water, exposed to 32 measures of gas, absorbed 14 measures, leaving a residuum of 18 measures; so that the absorption of 100 measures of water would be 108 measures of gas. In the temperature of 110°, 20 measures of water, exposed to 20 measures of gas, absorbed 9 and left 11; so that 45 in 100 was the total of the absorption.

A series of experiments on other less absorbable gases have afforded for one temperature, viz. 60°, and in 100 cubic inches of water, the following results:—nitrous gas 5 inches, oxygenous gas 2·63, phosphorated hydrogen gas 2·14, azotic gas 1·20, and hydrogen gas 1·08. Some experiments are next described on the quantity of atmospherical air that may be extricated from water; the general result of which is, that 100 cubic inches of common spring water will yield 4·76 of gas; which, being analysed, was found to consist of 3·38 carbonic acid, and 1·38 atmospherical air.

The object of the second section being to ascertain the ratio between the addition of pressure and the increased absorption of gases by water, Mr. Henry made some alteration in his apparatus, which consisted chiefly in lengthening the tube, so that, by the addition of mercury, any required addition of pressure might be obtained on the water and gases.

The results of a series of at least fifty experiments on a variety of gases were, that under equal circumstances of temperature, water takes up, in all cases, the same volume of condensed gas as of gas under ordinary pressure; but that as the spaces occupied by every gas are inversely as the compressing force, it follows that water takes up of gas, condensed by one, two, or three additional atmospheres, a quantity which, ordinarily compressed, would be equal to twice, thrice, &c. the volume absorbed under the common pressure of the atmosphere.