The yellow colour renders the examination of its optical properties difficult, but, as far as has been hitherto tried, it is inactive. I have not been able to recognize fluorescence in its solutions.

Its taste is a peculiar bitter, very much less, both in intensity and permanence, than that of the other cinchona alkaloids.

I have not been able to find out whether this alkaloid is contained in all the species of cinchona, or, if not, to which it belongs, for the difficulty of the crystallisation of the impure salts makes it a matter of uncertainty to obtain it.

My uncle, Mr. J. E. Howard, when investigating the leaves of the *Cinchona Succirubra*, from India, found minute quantities of an alkaloid, soluble in ether, from which an alcoholic solution of oxalic acid precipitated it in a crystalline form; but the small quantities at his disposal prevented his examining it further than to show its analogy with quinine; his present conviction is that this substance is identical with the alkaloid I have been describing, and though the evidence is not yet sufficient to enable us to speak with certainty, it tends strongly to prove it. It seemed so desirable to settle this point, and to throw some light, if possible, on the order of formation, and possibly on the far more important and far more difficult question of the mode of formation of the alkaloids of the descending sap, that he has written to Mr. Broughton, and we hope shortly to receive a quantity of the leaves sufficient to enable us to investigate it.

VII.—On the Origin of Nitrates in Potable Waters.

By CHARLES EKIN, Bath.

I HAVE frequently been at a loss to account for the presence of considerable quantities of nitric acid in potable waters, where contamination by sewage or manured land was out of the question. To give but one instance, there is a hill near Bath, capped by the Great Oolite, which has not a single house upon it, no drainage near it, and on whose scanty herbage browse only a few sheep, and yet the springs rising at the junction of the Oolite with the Fuller's earth contain as much as 65 grains of nitric acid per gallon. Here, then, after making all due allowance for the combined nitrogen contained in rain water, which, according to the observations of Lawes, Gilbert, and Way, amounts to 24 parts nitrogen in 1,000,000, there still remains the large proportion of eight to one to be accounted for. And this proportion will be still further increased if we consider that much of the nitric acid and ammonia

present in rain water must be absorbed by vegetation in its passage through the soil.

It has, of course, long been known that water from artesian wells in the chalk contains nitrates which cannot possibly be referred to sewage or other impurity, but I am not aware that it has been suspected that other strata might also contain nitrates. It was to ascertain this in the absence, so far as I know, of any published experiment bearing on the subject, that the following experiments were made, and to ascertain, if possible, the origin of these nitrates which, according to Dr. Paul, in his comprehensive article on Water Analysis, in Watts's Dictionary of Chemistry, has not yet been done.

The rocks and fossils mentioned below were all most carefully collected by myself from situations where any accidental contamination seemed impossible, none of them having been exposed to the weather or to percolating impurity.

The method I pursued was to powder the fossils roughly, and macerate them for a few days in perfectly pure distilled water; to pour off the clear supernatant liquid; add an equal quantity of solution of pure sodium hydrate (1 to 10); transfer to a retort; dissolve in the liquid a piece of thin sheet aluminium; collect the ammonia by distillation; and estimate it by Nessler's test.

The utmost care was used to insure the purity of the water and solution of sodium hydrate, and perfectly negative results were obtained in each case by blank experiments.

Proceeding in this way, I found that grey chalk marl contained 1.1 part of combined nitrogen in 1,000,000 parts; Bath oolite, 1.3 parts; fossils from the Green-sand, 2.23 parts; fossils from the Lias, 3.6 parts; another sample of fossils from the Lias, 4 parts; fossils from the Fuller's earth, nearly 3 parts; a sample of Inferior Oolite rock, 7.6 parts; and another sample of the same, 6.9 parts. The samples of Inferior Oolite rock were entirely made up of fossils, and although I had every reason to trust the results given by my first experiment, yet the quantity of nitrogen present was so high that I obtained the second sample from a different locality, but it gave almost the same results. The high figure of combined nitrogen given by the Inferior Oolite caused me to look at my note-book, and I found that almost without exception the springs in this neighbourhood which I have examined, and which had percolated through the Inferior Oolite, rising at its junction with the Lias, contained a larger quantity of nitric acid, varying from $1\frac{1}{2}$ grain to 2 grains per gallon, than the springs rising at the junction of the Great Oolite with the Fuller's earth, and this I attribute to the one stratum being so much more fossiliferous than the other.

It is still the practice of many of our first analysts to look with great suspicion upon waters containing any appreciable amount of nitric acid,

but that this nitric acid is not necessarily due to the oxidation of excretal matter, I think the foregoing experiments sufficiently prove, and I venture to think in consequence that the "previous sewage contamination theory" ought to be considerably modified.

VIII.—*On the Development of Fungi in Potable Water.*

By E. FRANKLAND, Ph.D., D.C.L., F.R.S.

IN June, 1870, Mr. Heisch communicated to the Chemical Society the results of some very interesting observations on the development of cellular and fungoid growths, in various waters to which a small quantity of crystalline sugar had been added. Having observed this phenomenon in water to which sewage was strongly suspected to have gained access, he procured water from various sewers, and after allowing the suspended matters to settle, six drops of each sample of clarified liquid were mixed with 10,000 grains of West Middlesex and New River water, and to 6 oz. of each sample, thus polluted, 10 grains of pure sugar were added, a like quantity being mixed with 6 oz. of the water without the sewage. All the samples were placed in stoppered bottles in a window where plenty of light could reach them. It was found that the water and sugar remained clear and sweet, as did also the water and sewage without sugar; but the mixtures of water sewage, and sugar became turbid, and on being submitted to microscopic examination, were found to contain small spherical cells with, in most cases, a very bright nucleus. After the lapse of some days, these cells gradually grouped themselves together in bunches something like grapes; they next spread out into strings, with a wall surrounding and connecting the cells; the original cell-walls then seemed to break, and leave apparently tubular sort of threads branched together. Mr. Heisch then describes a number of other experiments which, taken together with the foregoing, led him to the conclusion, that the cells of these germs, when thus developed, are distinct evidence of sewage contamination, and that the germs producing these cells are not removed by filtration through the finest Swedish paper, neither are they destroyed by boiling for half-an-hour.

These remarkable results excited in myself, and doubtless in other chemists occupied in the investigation of potable waters, the liveliest interest. In connection with the most generally accepted hypothesis of the cause of the spread of epidemic disease through the agency of water, there was here discovered a much nearer approach to the supposed morbid matter in such water, than had before been attained. Another parallel was apparently opened, from which one of the strongholds of