

LETTERS TO THE EDITOR.

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The Spectrum of Krypton.

PROF. RUNGE, in your last issue, points out that the wave-length of the bright green line of krypton is 5570.4 (Rowland's scale), while that of the auroral line is about 5571. In the paper presented to the Royal Society by Dr. Travers and myself on June 3, the wave-length is given as 5567.7. The wave-length was re-measured by Mr. Baly on June 7, and its value was found to be 5570.0. That of the feebler green was 5561.8, and of D₄, the yellow line, 5870.0. These values, read by means of a grating, are very close to those given by Prof. Runge. We hope to publish photographic measurements of the other lines shortly.

WILLIAM RAMSAY.

University College, London, November 15.

Stereochemistry and Vitalism.

ALTHOUGH Prof. Japp has already replied to the criticisms which have appeared in NATURE on his address to the Chemical Section of the British Association, we should be glad, in view of the interest taken in the matter, and also because we have been investigating externally compensated and optically active compounds for some years past, if you could find space in which we may continue the discussion and bring forward a few facts in support of our views.

In the first place, we will briefly summarise the main points on which there seems to be general agreement, as follows:—Compounds, optically inactive by external compensation, can be prepared under symmetric conditions—such compounds, under suitable and symmetric conditions may separate from solution in enantiomorphously related crystals; under symmetric conditions crystals of the two enantiomorphs are deposited in equal numbers, and the crystalline deposit as a whole, as well as the mother liquor, if separated, are both optically inactive.

Now Prof. Japp contended that, in order to obtain an optically active deposit or mother liquor from such an externally compensated compound (without the aid of some pre-existing asymmetric influence), an intelligently selective or vital force must be called into action, and consequently that vitalism determined the existence of optically active compounds in nature; in his reply he modifies his original contention by introducing the word "constantly"; but this modification makes very little, if any, difference to the arguments which we adduce. His critics, on the other hand, have attempted to show, with what success we do not venture to express an opinion, that chance alone, or other causes apart from vitalism, may have brought about the present occurrence of enantiomorphous compounds in organised nature.

Having frequently had occasion to study the spontaneous crystallisation of externally compensated substances, we had in mind various observations, especially some made during recent work, which led us, from the first, to doubt the validity of Prof. Japp's views. Let us consider, in the first instance, the case of sodium chlorate, a substance which separates from solution in enantiomorphously related crystals. On allowing saturated solutions of this salt to crystallise spontaneously, we found that in only two experiments out of forty-six were equal numbers of dextro- and laevo-rotatory crystals deposited (*Trans. Chem. Soc.*, 1898, 606), the percentage of dextro-rotatory crystals in the 46 crops varying from 24.14 to 77.36; nevertheless, the weighted mean percentage of dextro-rotatory crystals obtained was 50.08 ± 0.11. It is obvious, therefore, that on crystallising this substance under symmetric conditions equal numbers of dextro- and laevo-rotatory crystals are finally obtained, and yet in a single deposit one or other form may be present in large excess.

On the publication of Prof. Japp's address, we hastened to obtain further experimental evidence bearing on this point. For this purpose a saturated solution of sodium chlorate was allowed to evaporate spontaneously, three unselected crystals of the salt of unknown rotation being introduced as nuclei; after a week's time each of the three crystals had grown to a large size, and was very well developed. One of these, weighing 47 grams, was removed from the solution and broken into small

pieces which were seeded into saturated solutions of the chlorate; the latter were then placed aside to crystallise. After a week's time these solutions were full of well-developed crystals, which were removed and examined; the crystals were 269 in number, and were all dextro-rotatory.

This experiment shows that an enantiomorphous system may originate from a non-enantiomorphous one without the introduction of any intelligently directive or enantiomorphous influence, and under conditions which might well arise in an inorganic non-enantiomorphous universe. This being so, it is illogical to assume in the present rudimentary state of our knowledge of the subject that enantiomorphism of this kind could not cause enantiomorphism in a system containing a substance such as racemic acid or some other externally compensated compound.

Now, although a solution of sodium chlorate deposits on the average equal numbers of dextro- and laevo-rotatory crystals, this does not preclude the possibility of other similar compounds which separate from solution in enantiomorphously related crystals giving a preponderance of one or other form, owing possibly to enantiomorphous influences exerted by surrounding conditions, such, for example, as the earth's enantiomorphism; in fact, as we have already pointed out (*Trans. Chem. Soc.*, 1898, 611), observations in support of this view are not lacking, although they require, and are now receiving, further examination.

We have also shown (*Proc. Chem. Soc.*, 1898, 113) that, apparently, a close analogy exists between the behaviour of sodium chlorate and of an externally compensated mixture of dextro- and laevo-rotatory sodium ammonium tartrates; this parallel we are at present investigating. The first step in our examination of sodium chlorate was to ascertain the ratio between the numbers of dextro- and laevo-rotatory crystals deposited from solution, with the results briefly summarised above; obviously a similar step is necessary in the case of the mixed tartrates. The results which have been obtained in these experiments contrast remarkably with those recorded in the case of sodium chlorate, and are absolutely at variance with the views expressed by Prof. Japp. Ten such solutions have so far been examined, and in every case a strongly dextro-rotatory deposit was obtained, the mother liquor, of course, being strongly laevo-rotatory. We put these experimental results forward with considerable reservation as the work is not complete and we may discover some disturbing influence; but, inasmuch as attention has of late been concentrated on this fascinating subject by Prof. Japp's equally fascinating presentation of it, we feel compelled to make this short statement of the results up to the present obtained in developing the work which we have in hand.

Much more might be written with a view to suggesting the possible sequence of events which might have led to the present conditions of organised nature, but it is of little use attempting such a task until a great deal more experimental evidence is before us.

F. STANLEY KIPPING.
WILLIAM J. POPE.

THE following seems to me a perfectly possible, although purely hypothetical, way in which any amount of an optically active compound could be formed by chance chemical processes.

Let an admixture of chemical compounds be such that only one molecule of an optically active compound is formed. Or, if you like, let a volcanic explosion scatter a collection of equal quantities of dextro and laevo molecules in such a way that one molecule only falls in a certain pool of water containing inactive bodies in solution.

This single molecule must be either dextro or laevo. Let us suppose it is a dextro molecule.

Furthermore, let it be of such a nature that it can react catalytically with surrounding molecules in such a way as to produce in these an asymmetric atom:

e.g.

