

## LETTERS TO THE EDITOR.

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## Octopolarity and Valence.

Of the elements and their compounds there is a general property which is related to the peculiarities of their periodicity in a remarkable manner. This property is that of crystallisation, and in the isometric system is seen in its least complicated form. Among the conceivable causes which might act to produce the regular arrangement of particles evidenced in crystals, the view that considers the atom as having eight fields of polarity radiating from it, corresponding to the eight corners of a cube or the eight faces of an octahedron, agrees well with a wide range of facts. When an isometric crystal is heated and cooled under suitable conditions, polarity is developed in this manner. Four of the centres of polarity are positive and four are negative; the angle between the direction of like poles is  $109^{\circ} 28'$ .

Consider the bonds of chemical affinity or valence in the first two series of the elements. Helium, the first element of the periodic table proper, is devoid of affinity to combine; the valence of lithium, the first member of the first series, is one, of beryllium two, of boron three, and of carbon four. From stereochemical considerations it is believed that the four bonds of affinity in carbon are alike, and are disposed about the centre of the atom at angles of  $109^{\circ} 28'$  apart, as are the four portions of the isometric crystal that have the same polarity. In the first four members of the series there is a regular increase of one bond of affinity to each succeeding element, and all are of the same character. In the next member, nitrogen, the valence is five, but one is of a different character, while four are alike in all respects as in compounds of the type  $\text{NH}_4\text{Cl}$ . Nitrogen forms compounds also on another type of valence, as in  $\text{NH}_3$ , where it is trivalent. These three bonds of affinity are of the same character. Two bonds of opposite character, one positive and one negative, are rendered latent, a self-balanced pair. Oxygen, the next member, has only two active bonds and also latent pairs, but these are more difficult to render manifest than those of nitrogen. Fluorine has one active bond of affinity, and gives some evidence of possessing latent pairs also. The valence of neon, the last member of the series, is zero, being similar to helium. The next series of eight, Na, Mg, Al, Si, P, S, Cl, and A, corresponds perfectly in regard to the number of active bonds of affinity with the preceding series, while the latent pairs are more easily rendered manifest in combination, with the exception of argon, which has not been made to enter into chemical union. The series exhibits these valencies:—

$\text{Na}_1$	$\text{Mg}_2$	$\text{Al}_3$	$\text{Si}_4$	$\text{P}_5$	$\text{S}_6$	$\text{Cl}_7$	—
				$\text{P}_3$	$\text{S}_4$	$\text{Cl}_5$	—
					$\text{S}_2$	$\text{Cl}_3$	—
						$\text{Cl}_1$	—
						$\text{A}_0$	—

Thus the arrangement of the pyroelectric poles of an isometric crystal may serve to illustrate the changes of valence of the elements with increment of atomic weight. It would seem that when all eight polar faces have received the increment there is perfect balance, and the structure is no longer chemically active, as in helium, neon, and argon. Each of the first four members, Na, Mg, Al, and Si, has a definite valence which does not change, while P, S, and Cl have, beside the maximum valence, 1, 2, and 3 pairs respectively which can be rendered latent in pairs, as a positive field of force neutralising the effect of a negative field.

With this clue as to the nature of the increment of atomic weight, a conception of the structure of the atom can be formed which presents many remarkable and unexpected points of agreement with the system of the elements. If the increment of atomic weight or the principal factor of increment is due to addition of a ring, and no other structure

be found to adapt itself, the original atom form will consist of eight rings arranged like the eight circles inscribed on the faces of an octahedron. That rings will unite to form this as a structure of maximum stability will depend on their possessing the following properties. The material of the ring is a conductor of electric current, and a field of magnetic force permeates the space about the ring. The magnetic field on one side of the ring plane is of opposite polarity to that of the other side. The ring is elastic, and in vibrating would have a number of equidistant non-vibrating nodes about its circumference, separated by internodes of vibration. Briefly it is an elastic, current-bearing ring in rapid motion. After examining all conceivable combinations of this ring, it became apparent that the structure of maximum stability resulting from combination of these rings is that of eight rings arranged like the eight circles inscribed on the faces of an octahedron. The essential condition of stability is that contact of rings should be at non-vibrating nodes, otherwise the energy of vibration would drive them apart, also that the flow of electric current in contiguous rings should be in the same direction in each ring at the point of contact, otherwise there would be magnetic repulsion.

Rings may be added to the eight-ring structure in the order indicated above from study of the crystal and the change of valence in the series, and the stability of the structure retained or even increased. As the external arrangement remains the same, the first rings are forced inward, and as more are added the further in these first rings become, but they will not be strongly vibrating like the outer rings, and so can come in stable contact at any point of the circumference.

As there would very evidently be a limit to the number of series possible, a wire model was made of rings to determine this. When eighty rings were used, forming nine series of eight members each, after the original eight-ring form, no more rings could be added. The four innermost rings had come in contact and would go no further in, being arranged like the four circles inscribed on the faces of a tetrahedron. If a free ring was laid on the surface of the eighty-ring structure, it would be first attracted strongly by the magnetic field, and instead of being held in stable combination would be driven off by vibration of the internodes of the ring where it was laid. Such a structure would spontaneously lose rings, and these liberated rings, in accordance with their properties, would form the original eight-ring structure corresponding to helium.

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## Botanical Nomenclature.

An event of considerable importance to botanists is the publication of a new code of botanical nomenclature, prepared by a commission appointed by the Botanical Club of the American Association for the Advancement of Science. This document, which has the approval of a large number of the leading botanists of America, appears in the *Bulletin* of the Torrey Botanical Club for May, being printed in three languages. The commission proposes to move in the Vienna Botanical Congress of 1905 that the code now offered be adopted bodily, and all other articles abandoned.

In these circumstances, it must be admitted that discussion is opportune. The authors state that they have found the Paris code of 1867 unsatisfactory, because "many important principles are either not recognised, or else given altogether too meagre consideration, and that there is a want of definite and exact statement, which leads to ambiguity." While there is very much in the new code to approve and admire, it seems to me that upon certain points these very words are exactly applicable to it. Without attempting to cover the whole ground, I desire to refer to a few special points.

(1) "Names published for primary subdivisions of species are treated as subspecific names, however designated by their authors." One example given is *Zizia aurea*, var. *Bebbii*, Coult. and Rose. No example is given of a plant designated a form, or of mutation; are these intended to be excluded? It seems evident that many plants designated varieties are not in any sense subspecies, and so to consider