slept, or was inert, the other with this dead weight as a center could but describe a circle—a course which it found endless. Here then arose a beautiful example of adaptability. It learned to drag itself sideways, wherever it would—over the whole yard. This was the right half (never the left) which has been spoken of as having a timid, quick and irascible temperament. They swam together well, but walked together awkwardly. As they walked, the fore legs acted simultaneously, so in turn the hind legs, leaving alternately the front and back of the shell without support. Thus by a slow teetering, or rocking gait, they could go where they would. In starting they almost invariably pulled persistently in opposite directions, which drew them laboriously backward three or four feet. Resting a moment, they would start together, as described above, and make the circuit of the yard.

With fate against them, they adapted themselves to their condition so admirably, and excited the admiration of so many that a false and exaggerated value was put upon them. Showmen offered sums out of all proportion to the actual value, which were rejected by the owners.

If so highly prized then it should in all consistency have been more zealously guarded. But while at large with other similar pets, a prowling cat singled out this one and pounced upon it. It was secured at once, but not before it had tumbled down the stone steps leading to the cellar.

It was returned to its aquarium, where the right head came out from its protecting shell at once; likewise the left head a half hour later. The next day it was itself again. It ate, walked and swam as usual, save the left head refused food, which was not unusual. The second day it was itself still, though the left head would take no food. On the third day it drooped. Though rallying at times and hurrying about as usual, the left one was soon dead, as were also the left legs. The cat's claw had pierced the neck close to the shell. The distress and uneasiness of the surviving half was very apparent. All its energies and activities were redoubled, yet it died in two and one-half hours later. Up to this time its only sign of weakness was an occasional gaping as if for more air.

This little monstrosity's short life continued from the first of June to the middle of September.

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SOME DIFFICULTIES IN THE PRESENTATION OF THE PERIODIC LAW.

The Periodic Law contains so much that is true, and promises so much further revelation as to the connection between the elements and the relations of their atomic weights, valence and other properties, that its permanent position in the science is assured. It truly deserves the name of the Natural System, first given it by Mendeléeff, but abandoned because it had been used some twenty years before by Odling for a very different sort of arrangement. It stands before us to-day as the statement of a natural law, though as yet undeveloped and imperfectly understood. There can, therefore, be no question as to the acceptance of the law of the inter-dependence of the atomic weights and other properties, and the peculiar relationship of the elements now known as the Periodic Law. This must be the basis of the science, and the proper formulation of the law will contribute to a wonderful development of it in the future.

But there may well be question as to the acceptance of any of the present statements of the law. The systematic arrangements of Mendeléeff or Meyer or Bayley are all necessarily tentative because of the serious imperfections in our knowledge. There is a probability that new elements will be dis-

covered. The properties including the important physical constants of even the well-known elements and their compounds are quite imperfectly known. A great deal of the future work of the chemist must be devoted to the detailed and patient study of the multitudinous compounds already known, as well as to the formation of new ones.

The increased knowledge of the future will render changes and modifications necessary in any one of the present systems, or, perhaps, will set all of them aside and evolve out of them one which will perfectly present the truths of the law. Understanding the heading of this paper to refer then not to the law itself, but rather to the present arrangements of the elements under that law, let us briefly look at some of the difficulties in their way.

An impartial observer would notice first the large number of unknown elements, necessary for the completion of most of these arrangements. Mendeléeff has blank spaces for at least thirty-five new elements, or, if a hydrogen period below lithium be granted, then forty-one more elements must be discovered somewhere, or more than one-third of the total supposed number. It would almost seem unreasonable to found any system upon the imperfect knowledge of less than two-thirds of the individuals to be included in it, were it not borne in mind that the ones now known constitute all but a small fraction of the matter of which the universe is composed, and again that they fall in the system in regular consecutive order, leaving only one unoccupied space among the first fifty-two members according to Mendeléeff. Even this blank has been filled, if the recent discovery of an element in monazite having an atomic weight of approximately 100 be confirmed.

Modifications of the Mendeléeff system do not require so large a number of additional elements for their completion, eight or ten satisfying all apparent requirements. In case the Mendeléeff system is correct, where are these to come from? The close scrutiny to which all terrestrial forms of matter have been subjected by chemical and spectroscopic analysis leaves little material to be called upon as the source of these elements. Still the recent discoveries of argon and helium teach us not to be too positive in our exclusion of unknown elements because of past investigations. The so-called rare earths will unquestionably yield several new elements. It seems a great pity that this scarce and valuable material cannot be collected and placed in the hands of some patient investigators whose labors might be supported from some research fund and who could tell us then just what the science had to expect from this source. A further thought is that some of these elements may not occur in nature, but that the future may teach us some way of synthesizing them, and then the whole list can be filled out. The brilliant victory over the difficulties surrounding the chemistry of the sugars and their synthesis, filling out their system so meagerly outlined in nature, would be ground for encouragement as to possible conquests among the elements.

The anomalous position of hydrogen forms a second objection to the Periodic Law. It is not counted in any of the periods of seven or of seventeen. Its introduction into any system in which the arrangement depends upon increasing atomic weight would throw out the sequence of the elements. Placing hydrogen at the head of the system, with connecting lines to all seven of the first period, as has been done by some, is a very questionable expedient. This is simply an unjustifiable return to the Proutian hypothesis, and is a violent distortion of all the facts concerning valence, positive and negative properties etc, for which the table is supposed to stand, and lastly it does not relieve the anomaly of the position.

A second supposition that hydrogen is the initial member of a period of seven which precedes Mendeléeff's typical elements, but which are as yet unknown, is much more plausible. The discovery of helium, and perhaps another element with very low atomic weight, lends strength to this supposition. Certainly the present anomalous position of hydrogen is a serious blot upon the system.

Wurtz has pointed out two difficulties in the system, both of which bear upon the nature of periodicity. The first is the lack of regularity in the differences between successive elements, and the second is that the gradations in properties do not seem to depend upon the degree of these differences. It has been also pointed out that the use of the term periodic in the case of these variations is not a strictly mathematical one, and that these periods, in passing from negative to positive values, should pass through a transition stage of either zero or infinity. It is true that very little has been done to discover the nature or the laws of this so-called periodicity, though some of the modifications of Mendeléeff's table make some points clearer and remove some difficulties. Chemists have generally contented themselves with calling any successive increases or decreases in properties periodic, whether they exhibited any regularity or not. This is too slovenly and unsatifactory for a true science, and those who love the science must labor to remove such a reproach. The obstacles to success are first inaccurate knowledge of the properties, and in some cases the absence of any definite standard of measurement for these properties.

Minor difficulties lie in the relative position of certain elements. Some are far from satisfied with the position assigned the triad, iron, cobalt and nickel. In some respects they are out of line with some of the elements apparently closely allied to them. Perhaps when what Blanchard has called 'cross analogies' are better understood these matters will be made clearer.

In the cases of at least two sets of elements, tellurium and iodine, and cobalt and nickel, the very best determinations of their atomic weights would place them in different relative positions from those demanded by the periodic system. These determinations have been repeatedly revised in the past few years, and yet the system still seems at fault. Which is wrong, the system or the investigations of the atomic weights? So many difficulties surround these determinations, and so many chances for errors lie in their paths, that most will decide in favor of the system and call for more thorough and patient search after impurities and imperfections of methods in the previous determinations.

The discovery of argon and helium has been regarded by some as giving a most telling blow to the periodic system. Article after article has been written on their possible position in the system. Several originators of systems have claimed to have predicted these new bodies. No supposed property nor absence of property staggers these prophets. They have foreseen everything. The whole question is, however, premature. Manifestly the position of any newly discovered element cannot be fixed until two things are definitely settled: first, the elemental character; and secondly, the more salient properties, as atomic weight, valence, etc. These questions are yet to be settled for the substances named, and there are some serious difficulties in the way of those investigating them. Until these questions are answered nothing can be done, and certainly a system which has answered admirably for so many of the elements is not to be given up on the half knowledge and half guess-work which surround the two newly found bodies.

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