exposing the organisms throughout to the modifying effects of environment.

3. The relative weakness of the stereotyping effects of cumulative heredity at this early date.

4. The fact that as all available spots were not preempted, there were wide fields open to successfully modified forms adapted to some new yet unoccupied station, who could then be very prolific, and thus give large play for further adaptation.

5. The frequency of generations in the lower animals and plants.

6. Probably a relative lack of seasonal rhythm.

7. While new forms of life and the flesh-eating habit were being developed a stimulus was put on various modifications to meet these new conditions.

Since early Paleozoic times animals have existed fitted for land and sea, salt water and fresh, air and mud, herbivorous and carnivorous, with the main methods of attack and defense outlined. So that one could hardly expect so radical or rapid changes thereafter.

I think this audience in this assembly will permit an old pupil of Shaler to indulge in a little philosophy and close on the eve of Sunday with a moral.

Haec fabula docet: that those societies of cells known as animals have not been the mere slaves of environment, nor even of environment and heredity conjointly, but have struggled, with more or less success, to maintain through varying environment that part only of their heredity which conduced to greater protoplasmic activity (or, to put it in every-day English, have striven to surround the great mass of the cells of which they are made up with the conditions best for their health and vigor), and the physical grade of the animal is in the ratio of its success in this struggle for the common weal of the constituent cells.

PARTIAL LIST OF AUTHORS CITED, IN WHICH WILL BE FOUND OTHER REFERENCES

ADAMS, F. D. "The Artesian and other Deep Wells of the Island of Montreal," Geol. Surv. Canada, 1904, p. 620.

BROOKS, W. K. *Journal of Geology*, ii. (1894), p. 455.

BLATCHLEY, W. S. 26th and 27th Annual Reports State Geologist of Indiana, pp. 11–159.

CHAMBERLIN AND SALISBURY. Geology, 1906.

DUBOIS, E. "On the Supply of Sodium and Chlorine by the Rivers to the Sea," *Kon. Ak. Van Wet. Amsterdam*, 1902, p. 391. "The Amount of the Circulation of the Carbonate of Lime and the Age of the Earth," *ibid.*, 1900, p. 43.

DALY, R. A. "The Limeless Ocean of Pre-Cambrian Time," *American Jour. Sci.*, xxiii., 1907, p. 93.

HUNT, T. STERRY. Chemical and Geological Essays, Salem, 1878, pp. 11, 118–122.

JOLY, J. "An Estimate of the Geological Age of the Earth," *Trans. Roy. Dublin Society*, 1899, p. 23.

MACALLUM, A. B. "The Paleochemistry of the Ocean in relation to Animal and Vegetable Protoplasm." *Transactions Canadian Institute*, 1903–4, p. 181.

MACKIE, W. Edinborough Geol. Soc., 1903, p. 247.

MEAD, W. J. "Redistribution of the Elements in the Formation of Sedimentary Rocks," *Journal of Geology*, 1907, p. 238.

MEYER. *Science*, May 10, 1907, Publication 67, Carnegie Institution.

NORTON. (Mineral waters of Iowa) Vol. VI., Reports Iowa Geol. Survey.

QUINTON, R. "L'Eau de Mer Milieu Organique," Masson, Paris, 1904.

ROTH, J. Phys. und Chem., Geologie.

SMITH, E. A. "Underground Water Resources of Alabama," Alabama Geological Survey, 1907.

SELBY AND DUVAL. "Sources of the Ohio Flora," Columbus Horticultural Society, 1899, p. 55.

WHEELER, BEAL and. Michigan Flora, 1892.

A. C. LANE

LANSING, MICH.

SCIENTIFIC BOOKS

Researches on the Affinities of the Elements. By GEOFFREY MARTIN.

The unfortunate part of the book is that any attempt to separate the grain from the chaff is made difficult by the amount of chaff.

The author attempts to represent the affinities of the elements for each other by means of a diagram. This diagram for any particular element is constructed by arranging the elements according to the periodic table. Then over each element erect a perpendicular whose length shall represent the affinity of the chosen element for the element in the table. Joining the points (ends of the perpendiculars) thus obtained, you have a surface which represents at a glance the affinity of the chosen element for all of the elements.

The fact that such a surface could be constructed by any one having a knowledge of the proper lengths of the perpendiculars needs no proof, and the author's mathematics on this subject could, we think, have been omitted with advantage. The real difficulty arises in determining the length of the perpendicular which shall represent the affinity in any given case. Where the heat of formation is large this is taken as measuring the attractive force. Where the heat of formation is small, or the data insufficient, the author determines the proper length by a comparative study of the compound with regard to its stability, etc. The surfaces as given by the author for thirty-one substances are therefore not claimed to be exactly quantitative, but only qualitative. The author points out the readily perceived fact that the form of the surface would be altered should the arrangement of the elements be changed. Also it would be altered by changes in pressure and temperature and would change its form completely with a change in the valence of the element.

We think it hardly probable, even where the heat of formation is large, that it gives any very good idea of the actual size of the attractive forces involved. For the elements reacting are usually previously not monatomic and the heat of formation is the sum of the several reactions involved, to say nothing of a variable amount due to the physical changes. Moreover, T. W. Richards and J. Traube have separately pointed out that the heat of formation is probably largely dependent upon the changes in volume suffered by the reacting elements. When these facts are all considered the affinity surfaces constructed by the author at the expense of so much labor can hardly be taken as more than a guess. Much will have to be learned before any true affinity surface can be constructed.

From various facts cited by the author as collateral evidence bearing upon his point of view some of his conclusions are worthy of note either as being new or because they are derived from a more or less novel standpoint. Thus on page 42:

> It seems, in fact, that the force exerted by the bromine atom is always less than the force exerted by the chlorine atom on a given element or radicle, but is always proportional to it.
>
> The chemical attractions which *A* exerts on the various elementary atoms or radicles must be either equal or proportional to the chemical attractions which *B* exerts on the same atoms or radicles.

On page 74:

> It is the intensity of internal atomic forces with which the atoms are attracted together in the molecule which determines the intensity of the external attractive force between molecule and molecule, and therefore the volatility of the compound.

On page 99:

> Strangely enough, the melting-points of similar compounds does not appear to depend upon the weight of the molecules, but upon their chemical nature, because, as a rule, they melt at temperatures which lie close together in spite of great differences in their molecular weights.

On page 101:

> The melting-points and solubility in water can not depend largely upon the magnitude of the molecular weight, but must depend upon the chemical forces.

On page 111:

> Consequently we infer that the volatility of compounds is determined almost entirely by the intensity of the forces which bind together the atoms in the molecule.

On page 219:

> If this be so, a non-metal is nothing more or less than a substance viewed at a temperature too low for it to assume metallic properties; and conversely, a metal is a substance viewed at a tem-

perature too high for it to assume non-metallic properties.

So that the metallic and non-metallic conditions are simply phases, which all kinds of matter pass through as the temperature increases from zero upwards.

His explanation of osmotic pressure and solubility given in Chapter III. is worthy of note.

There are numerous misprints in the book.

We would end finally by a quotation from the preface and would give warning that the author's speculations are not confined to the preface and the appendices:

In appendix C is discussed from this point of view the habit of alcohol drinking, and it is suggested that it may be the beginning of an organic tendency that will ultimately lead to the elimination of water in living matter, and its replacement by the more mobile alcohol, in order that as the temperature of the earth and sun falls the aqueous fluid in living matter may be replaced by alcoholic fluids which will remain liquid under conditions which convert water into a solid state.

It is indeed a very curious fact, which has never been adequately explained, that men seem almost instinctively to avoid the use of pure water as a beverage. They drink either tea, beer or alcoholic liquids, but only water when they are either very thirsty or when other liquids can not be obtained. There must be some scientific cause underlying this tendency, and I think that appendix C opens out a very curious possibility as to what this tendency may ultimately lead to.

J. E. MILLS

SCIENTIFIC JOURNALS AND ARTICLES

The Journal of Experimental Zoology, Vol. IV., No. 2 (June, 1907), contains the following papers: "The Influences of External Factors, Chemical and Physical, on the Development of *Fundulus heteroclitus*," by Chas. R. Stockard. The eggs of *Fundulus* were found to produce definite types of embryos when treated with various salt solutions. The most striking type being the one-eyed monsters resulting from the use of sea-water solutions of $MgCl_2$. Osmotic pressures resulting from the use of sugar solution affected the eggs much more violently when they were being developed in fresh water than in sea-water. The effects of a weak salt solution are augmented by the addition of sugar to the solution. The embryos develop in a perfectly normal manner entirely out of water if kept in a moist amosphere, though they are unable to hatch unless put into water; then they very promptly break through the egg membrane and swim away. "Movement and Problem Solving in *Ophiura brevispina*," by O. C. Glaser. "*O. brevispina* moves in practically all of the ways possible for a pentaradiate animal; exhibits no sign of improvement from practise in the performance of the righting reaction or of freeing its arms of encumbrances. The behavior, in spite of its complexity, can not be considered a sign of intelligence." "Occurrence of a Sport in *Melasoma (Lina) scripta* and its Behavior in Heredity," by Isabel McCracken. "In this paper the author records the results of a breeding experiment carried through a series of seven generations, under controlled conditions of a dichromatic species of beetle in which a "sport" is of occasional occurrence. The results show that the sport, although inherently stable, as evidenced by its breeding true through selection, is entirely dominated by each of the dichromatic extremes of the species in a first cross, and is gradually eliminated from the lineage of each of these in successive crosses. "The Energy of Segmentation," by E. G. Spaulding. The paper presents the application, by means of experimental methods, and not simply as a postulate, as has heretofore been the case, of the first and second laws of thermodynamics in their generalized form to the event of segmentation. These methods were "compensation" methods; cleavage, in sea-urchin eggs, was inhibited by means of osmotic pressure, and from the values thus obtained and with volumes and surfaces known the energy-change was computed. The conclusion is reached, that, with these laws valid for the organic as well as the inorganic realm, these two realms fall as species within the same "natural classification" in which the principles stated by the two laws form the highest genus. "Experiments in Transplanting Limbs and their Bearing upon the