THE DISTRIBUTION OF CALCIUM IN THE UNIVERSE

There are two distinct approaches to the role of calcium and vital phenomena. First, through the clinical and biochemical study of life and the second chiefly physical. While philosophical discussion of this problem, must, of necessity, be out of place in this study, it is very appropriate that a discussion should be presented setting forth some of the newer data which relate to the distribution of the elements throughout the universe and the probable nature of their actions and re-actions under given conditions wherever those conditions are found. From the first of these approaches to our problem of the nature of the role of calcium to vital phenomena we trace backward from effect to cause, in the latter we proceed forward from cause to effect. If we shall study the nature of the forces which acting together produce life all about us every day, it should, if we could understand the processes, bring us to the same point to which we will find ourselves by working backward through the clinical and physiologic phenomena through normal states to pathologic ones. While most of this book will deal with the phenomena associated with the clinical and biochemical aspects of

vital phenomena in relation to calcium metabolism, normal and disturbed, it seems very desirable to at least make an attempt to approach the problem from the more purely physical aspect of causative factors.

In reviewing generally known factors regarding certain phases of the fundamental forces, the writer does so with only the wish to remind the readers of certain commonly understood phenomena and suggests possible relationship to our problem which may not have occured to some of the readers. Let us accordingly begin by mentioning for emphasis the importance of the periodic order of the elements which go to make up matter. Since in the light of the present interpretation of the available data, each element has a distinct relationship to all other elements and that all are constructed of the same building blocks, in different numbers, the four atoms of hydrogen go to make up one atom of heliom which is the second element in molecular weight and through the progression from the lightest element hydrogen with the atomic weight of 1.008 to uranium the ninety-second and last element in the known series with an atomic weight of 238.2. While for years a periodicity or rhythm of atomic behavior has been recognized the flood of discovery during recent

years regarding the nature and structure and behavior of the atoms has revealed the physical cause and significance of this rhythm. Since the elements have been shown to have properties which seem to indicate that they are built of positive and negative electricity in which electrons of the latter are circulating around protons, each element differing from another in the number of units that have gone to make up the number of circulating electrons and further that the shifting of these electrons from one level to another as they speed about in their orbits gives rise to the libration of definite radiations. By this means it has become possible, (since under given conditions each and every element will give off the same radiations or spectra,) to recognize these elements whenever and wherever found provided they are found under the required conditions. This has made it possible by the simple process of analysing the light from distant stars, to determine the elements entering into the domposition of that source of light. By this means, it has been demonstrated, for example, that 82 of the 92 elements which are now believed to exist, all but two of which have been found in the earth's curst or its atmosphere, 82 have been found in the sun and a large number, indeed,

a large percentage in some instances have also been found in other stars than our sun. It is a matter of particular interest to us in the study of calcium metabolism that all of the plants making up our solar system have characteristics which lead to the presumption that they, like our earth, are composed of these same constituents a s our sun. When our sun is photographed with a spectra photoheliograph as devised by Dr. Hale, he and others have been able to demonstrate the presence of great patches of calcium as concentrated calcium vapor on the surface of the sun with varying densities about areas shown to be sun spots and in patches indicating concentration. This is shown in Figure (Slide No. 1538, the sun showing sun spots and calcium vapor) Whether or not the matter constituting our earth originally had its origin in our sun, it is of particular interest to us in the study of the calcium problem to glance for a moment at its presence in our earth's crust. While the principal elements in the outer surface of our earth are: oxygen 47.3, silicon 27.7, aluminum 7.8, iron 4.5, calcium 3.4, magnesium 2.2, sodium 2.4, potassium2.4, hydrogen .2, carbon .2, calcium constitutes 3.7 per cent of the earth's crust and 0.5 of sea water. We immediately get some concep-

tion of the part calcium has played in the development of life on the earth when we realize that it is estimated that from 1 to 2 miles of depth of the floor of the ocean is made up largely of the shells of sea forms of life and further that the great masses of limestone rock formation covering extensive areas of the earth's surface are the consolidated remains of old sea bottoms many of them showing in intimate detail the design and minute pattern of the individual forms as disclosed in a never ending panorama in our limestone rocks.