

in the shape of abnormal growth, a perversion of structure, and the alteration of normal conditions when we view the structures by the naked eye or by the microscope.

#### CAUSE OF RICKETS DEFECTIVE DIET.

The disease is caused essentially by defective diet. Other alleged causes, such as bad air, overcrowding, insanitation, and other conditions of which you have no doubt heard, cannot possibly produce rickets if the baby is properly fed. In the poorest quarters you will find babies absolutely free from rickets. In my lecture last year on *The Present Conditions of Infant Life and their Meaning*, I drew your attention to the practical absence of rickets in some of the poorest Jewish centres, the reason being that although they may suffer from insanitary conditions, they do not suffer from absence of proper food. Let me remind you also that the disease only occurs in infancy and early childhood, and to save you from confusion particularly in this respect I must explain that "Congenital Rickets" is a misnomer. No baby that has ever yet been born has been born with rickets. There is a condition resembling in some respects rickets, but on examination the resemblance is found to be a purely superficial one, and the conditions which have been described as congenital rickets belong to a different disease altogether. This is a branch of ante-natal pathology which I will not trouble you with to-day. But no baby is born with rickets, and therefore there is no such thing as congenital rickets.

It is a very common idea that the disease is confined to the bones, and that the whole effect of the disease is upon the bony skeleton. Some of the most characteristic features of the disease are seen as they affect the bones, but I wish to impress upon you that there is no more generalised disease than rickets. It affects the whole structure—the muscles, the ligaments, the organs of digestion, and the whole nervous system. As a matter of fact, some of the late bony deformities which are frequently seen, and are described as the results of rickets, are not so much the results of the disease itself as the results of the attempts of nature to counteract the effects of the disease—they are nature's attempt to cure.

#### A DISEASE IMPLYING WRONG STRUCTURE.

Rickets then is a disease implying wrong structure. I cannot do better, I think, in explaining its nature, than to ask you to study the erection and structure of a building, because all the defects of rickets are precisely of the same kind as the defects to be seen in

an improperly built house. If, for instance, you use mortar improperly made, you do not use proper lime, or the sand is not of the requisite quality, or you do not use the materials in their proper proportions, then your mortar will be very poor stuff. In the same way it is necessary to specify the quality of the bricks, having regard to the task they have to perform, and we have to study the composition and capabilities of all the materials that are used. It is precisely the same with the infant. In rickets, at the time that the infant is growing, the materials which are requisite for the growth of the tissues are of very inferior quality. The necessary consequence is that the whole of its structures are abnormal and pathological. I explained to you that the defects in the bones were by no means the only defects seen in rickets, but they do afford a very striking illustration of the precise character of the disease, because in the development of bone we have certain features which serve to emphasise and illustrate the diseased processes. I will first sketch upon the board the method by which bone develops. (Sketch made on the board.) Long before the baby is born, the centre of ossification for the shaft arises, and the ossification of the shaft ensues. Further layers of bone are thrown from the periosteum; but the growth of bone in its length occurs at the two ends—the epiphyses. The cartilage throws out some cells which form bone, and thus you have a continual enlargement at both ends of the bone. You will remember that one of the characteristic deformities is in the region of the wrists. The ends of the long bones are enlarged, because these are the regions of growth.

Let me illustrate what is happening in the bone. First let us take a normal bone. Supposing we were to take a section through the bone, and we were to view the cartilage developing into bone. Here we should find a mass of cartilage cells set very closely together. A little lower in the section we find rather larger cells preparing for their function in development. At a lower stage in the section we then find in perfect order certain cartilage cells proliferating; they now become rather different in shape, and appear in marked columns. This is the "blue zone." In this situation a change is taking place in the proliferating cells; they are becoming bone cells. And here we have the trabeculae of bone. (The lecturer sketched the microscopical appearances on the board.) In this sketch, therefore, we see the stages of bone development—cartilage cells, enlarged

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