OBSERVATIONS ON RICKETS

MADE BY DR. MARTHA ELIOT AT THE SCHOOL OF TROPICAL MEDICINE

A study of bone development in children under two years of age has just been completed in Porto Rico by Dr. Martha Eliot of Yale University and her colleague Dr. Edith A. Jackson, which has confirmed the belief of some prominent physicians of the Island that children supposed to have rickets in Porto Rico are really not suffering from this disease but are suffering from mal-nutrition.

For the last three years Dr. Eliot and her assistants have been making a study of bone diseases in children, under the auspices of the United States Children's Bureau. New Haven, Connecticut, has been their headquarters for this work. That city was considered to have a climate typical of the temperate zone, and the object of carrying out the same study in Porto Rico was to make a comparison in bone development of the children of a northern climate with those of a tropical climate.

A lecture given by Dr. Eliot at the School of Tropical Medicine recently, brought out clearly just what rickets is and how this disease may be easily differentiated from mal-nutrition.

"Rickets," said Dr. Eliot, "is a chronic nutritional or metabolic disorder of infancy due to a lack of ultra violet radiation. It affects most strikingly the bones of rapidly growing children, but it also affects the muscles, in some cases the blood, and the nervous system. It may be prevented or cured by exposing the child to sunlight or by the administration of cod-liver oil which has the same effect as sunlight."

Rickets is spoken of now as a "deficiency disease" being due to the deficiency of one factor, namely, sunlight, which is necessary for normal metabolism in growing infants.

There are two important stages in rickets: The first occurs in babies from one to six months of age. At this stage diagnosis may be made by X-ray or blood examination. The symptoms may be restlessness and irritability and perhaps headsweating and constipation or perhaps there may be no symptoms. The physical signs vary. There may or may not be slow muscular development, slight enlargement of the costa chondral junctions and epiphyses of the corist,

craniotabes. At this stage the babies are usually well nourished. The second stage or that of clinical diagnosis is usually found in infants from six to twenty-four months of age, the symptoms being increasing muscular weakness, pallor, irritability, restlessness. At this stage of the disease deformities of bones become evident. Characteristic deformities of the chest known as Harrison's Groove and pigeon breast may result from the strain and stress of respiration on a weakened chest wall. The wrists become enlarged and the legs bowed. The child's muscular development is very slow, and it does not learn to walk, stand or sit up at the usual time.

Some of the results of rickets are as follows:

1. Decreased resistance to infections. Babies with severe rickets suffer from repeated infections of the upper respiratory tract, such as bronchitis, bronchopneumonia, otitis media, rhinopharyngitis. These may be increased by extreme deformities of the chest.

2. A gradual impairment of nutrition which eventually may lead to severe malnutrition. Malnutrition is probably secondary to rickets but occasionally the whole process is so rapid that malnutrition seems to accompany the disease from the earliest months.

3. Decreased resistance to gastro-intestinal disturbances.

4. In a certain number of cases infantile tetany may occur. This is a condition of increased irritability of the nervous system probably always secondary to rickets. There is a marked decrease in the blood calcium and an increased irritability of the peripheral nerves to the galvanic current and to the mechanical stimulation. Many of the convulsions of infancy are due to infantile tetany.

5. The deformities resulting from severe rickets may be so marked that they persist even into adult life. In mild rickets the deformities usually disappear.

Study of the blood of children with rickets shows changes in the calcium or phosphorous content. In the usual case of rickets the blood phosphorous is found to be low. The normal blood phosphorous is from four to six milligrams per 100 c.c. of blood. In rickets it is frequently below four miligrams. In those cases of rickets which are accompanied by infantile tetany, the blood calcium is found to be lower than the normal nine to ten milligrams per 100 c.c. of blood. This disturbance in the normal calcium-phosphorous ratio in the blood is evidence that the mineral metabolism of the whole body is probably disturbed. When the baby with rickets is treated with sunlight the blood soon returns to normal, and the proper conditions for bone repair are established.

X-ray photographs of the bones of a child with rickets show a decreased deposit of bone salts at the growing ends. The epiphyreal end of the bone appears concave instead of remaining convex or flat. There is flaring of the bone and it has the appearance of being frayed. When healing takes place lime salts are deposited and after two or three months the bone returns to a normal condition.

Rickets is a disease of the temperate zones and is rarely found in the frigid zone because of the diet of fish, oil and blubber eaten by the inhabitants or in the tropics because of the intense sunlight.

The disease usually begins in early infancy and may continue to the age of four if not treated. It is more severe in dark-skinned people, such as negroes and southern Europeans who migrate from warm climates to the north of Europe or of the United States.

Breast-fed babies may suffer from rickets but it is usually more severe in babies who are fed artificially. It is frequently found in rapidly growing children and is absent in children who have always grown slowly.

"The etiology of rickets", said Dr. Eliot, "has not been understood until recently. Various theories have been held in the past as to what has produced the disease. Some believed that it was the result of poor hygiene, namely, poor diet and poor living conditions; Findlay of Scotland has believed it was caused by lack of exercise associated with poor hygiene; Mellanby has held the theory that diet rich in oatmeal gave a predisposition to the disease; and the Vienna School believed it to be an infection. Palm of England suggested in 1890 that lack of sunlight was the cause of the disease. Hutchinson and Shah found rickets among the babies of the better-class women of India who went into Purda soon after marriage and did not take their babies out of doors until they were about two years old. They did not find it in the children of the peasants who lived out of doors. Huldschinsky demonstrated by X-ray photographs in 1919 that rickets could be healed by exposing children to artificially produced ultra-violet light. Park and Howland demonstrated by X-ray in 1921 that the disease is healed by the use of cod-liver oil. Various observers have shown that rickets can be healed by the influence of the sun alone. Cod-liver oil has been known to be beneficial in the treatment of rickets since the eighteenth century. In 1923 Steerbock showed that vegetable oils which are naturally useless in the treatment of rickets may be made potent if exposed in thin layers to ultra-violet light. This would lead us to presume that the efficiency of cod-liver oil in the treatment of rickets is due to the

action of sunlight on the cod or on the small fish or plants that the cod consumes."

In the first number of this REVIEW, and under the caption "Infant Mortality in Porto Rico" by Dr. A. Fernós Isérn, Assistant Commissioner of Health, the fact was brought out that what was being called rickets here was not real rickets, but malnutrition and other wasting conditions. This paper was read before the Porto Rico Medical Association at its 1924 annual meeting. The consensus of opinion there favored the statement.

The Annual Reports of the Department have also carried an explanation as to why "rickets" appeared as a cause of death in our statistics.

With the brilliant additional evidence we now have, no further doubt can be entertained and there is no further justification for rickets in our statistics.