DR. N. S. DAVIS, Chicago, in closing—I do not wish to trespass on the time of the Section longer. In my paper I freely admitted the importance of all reasonable means for destroying the tubercle bacillus or preventing its diffusion, but I also endeavored to emphasize the importance of removing all those causes that diminish man's vital resistance to the invasion of tuberculosis and all other infectious diseases. And as nothing has been said militating against the correctness of this view, I will not consume your time by presenting further illustrations.

DR. W. A. EVANS, Chicago.—I would like to offer the following motion: *Resolved*, That, whereas it is the sense of the Section on State Medicine that tuberculosis should be systematically investigated, and that an effort should be made to awaken public intelligence and public conscience on this subject; therefore, we instruct the President of this Section to appoint a committee on tuberculosis, said committee to proceed along such lines as their judgment may direct.

The motion was carried.

THE FREQUENCY OF RICKETS IN INFANCY IN BOSTON AND VICINITY.*

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My attention was directed to this subject by the apparent frequency with which a rosary was met with in the routine examination of infants. There seemed to be but two explanations for this frequency—either rickets was much more common in infancy in this vicinity than was commonly supposed, or else a rosary was normal and not an evidence of this disease.

In order, if possible, to answer these questions, 400 infants under 2 years of age were examined in the medical out-patient department of the Infants' Hospital, during June and July, 1898, for evidences of rickets. The majority of these children came from the more densely populated districts of Boston, Cambridge and Somerville; the rest from other parts of these cities and from the neighboring towns. The hygienic conditions of their homes were probably often of the worst, usually bad and rarely good. These 400 cases were consecutive, none being omitted for any reason. The cause of their attendance at the hospital was not, except in a few instances, rickets, but a great variety of diseases, mainly gastro-enteric in origin.

In this investigation evidences of rickets were sought for mainly in the bones. It was recognized, of course, that as the result of the impaired nutrition in rickets changes occur in all the tissues. It was deemed impossible, however, to detect these changes, or at any rate to be able to attribute them with certainty to rickets, except in the case of the bones. Here only could the changes be considered at all characteristic.

The following changes in the osseous skeleton were considered as evidences of rickets and were sought for in every case:

1. Increase in size of the frontal and parietal eminences.

2. Failure of the anterior fontanelle to diminish in size as rapidly as normal or to close at the usual time. The normal time of closure was placed at eighteen months; late, if anything.

3. Open sutures and craniotabes.

4. Delayed eruption of teeth. It was considered that an infant should have 1 tooth at 8 months, 2 teeth at 9, 6 at 12 months, 12 at 18 months, and 16 at 2 years. These figures are all rather later than the average.

5. Rosary. In order to avoid error only those enlargements were considered as a rosary which could be felt both parallel and vertical to the long axis of the rib. Three grades were distinguished; slight, medium and marked.

6. Other deformities of the chest: *a.* Protrusion of sternum. *b.* Retraction of sternum. *c.* Retraction at the insertion of the diaphragm and flaring of the lower chest.

7. Enlargement of the epiphyses at the wrists and ankles.

8. Deformities of the long bones of the extremities: *a.* Bow-legs. *b.* Knock-knees. *c.* Bowing of the arms.

Three other points were also studied as being important and common manifestations of rickets, although not diagnostic, as are the skeletal changes. These were: 1. Weakness of the spine. It was considered abnormal if the infant was not able to hold up its head alone at 3 months, and sit alone at 8. Marked general kyphosis—the curve of weakness—was also considered abnormal even if the infant could sit alone.

2. Marked enlargement of the abdomen.

3. Splenic enlargement. The spleen was considered enlarged only when it could be felt.

Only 82 of the 400 cases, or 20.5 per cent., showed none of the above signs of rickets. This number, moreover, is really larger than it should be, as it includes many babies only a few days or weeks old. At this age perceptible osseous changes have hardly had time to develop. Unfortunately no accurate data were kept with regard to the diet and surroundings of these cases. My impression is, however, that the great majority of them were breast-fed, and that they had no better surroundings than the others.

The fact that 20 per cent. of these 400 infants had no rosary shows conclusively that a rosary is not a normal occurrence in infancy, but an evidence of disease. Corroborative evidence in this connection is the fact that a considerable number of infants examined in private practice, who were properly fed and lived in the best hygienic surroundings, failed to show a rosary. Further proof that a rosary, palpable during life, is abnormal, is furnished by the fact that slight beadings, imperceptible during life, are often found post-mortem and microscopically show marked rachitic changes.

Three hundred and eighteen, or 79.5 per cent. of the 400 cases showed more or less marked evidence of rickets. That is, if these 400 may be considered representative, and there seems no reason why they should not be, 80 per cent. of the poorer classes of Boston, Cambridge and Somerville suffer from rickets. This percentage is larger than *a priori* would have seemed possible. The explanation probably is that a large proportion of the cases were mild and would not ordinarily have been recognized as rickets unless a careful examination had been made. It is probable too, I think, that rickets is absolutely on the increase.

The ages, by months, of these 318 cases were as follows:

1 month	4	10 months	23
2 months	13	11 months	16
3 months	25	12 months	21
4 months	20	13 months	14
5 months	20	14 months	11
6 months	24	15 months	10
7 months	22	16 months	10
8 months	24	17 months	1
9 months	28	18 months	9

*Presented to the Section on Diseases of Children, at the Fiftieth Annual Meeting of the American Medical Association, held at Columbus, Ohio, June 6-9, 1899.

19 months	1	22 months	2
20 months	10	23 months	4
21 months	6		

These figures are of little value as showing the relative frequency of rickets at various ages, because they show only the relative proportions in the 318 cases, and not the proportion of cases of rickets to the total number of children living at these ages. They do not show, for example, that rickets is more common in the first year than in the second, but only that more babies under 1 year were brought to the hospital than from 1 to 2. They do, however, emphasize the fact that rickets is very common in the first year, and that well-marked bony changes may be produced, even in the first month of life.

The analysis of the individual symptoms in the 318 cases, under the conditions detailed above, gives the following results:

1. Enlarged eminences: frontal alone, 7; parietal alone, 35; frontal and parietal, 18; that is, 60, or 19 per cent. The youngest of these patients was 4 months old, but only 12 were under 9 months. The shape of the head was hydrocephalic in type in 2, and asymmetry of the head and flattening of the back of the head were each noted in 1 case.

2. The anterior fontanelle was larger than normal in 49 cases, or 15 per cent. The youngest of these was 5 months old. The posterior fontanelle was open in 5, varying in age from 5 to 10 months. The anterior fontanelle was prematurely closed in 4, whose age ranged from 7 to 11 months.

3. The sutures were open in 1 patient, and craniotabes was present in 1 other.

4. Dentition was delayed in 98 of the 190 infants 8 months or more old, i. e., 52 per cent.

5. Rosary: This was slight in 172, or 54 per cent., the only symptom in 103, with one other in 40. It was medium in 103, or 33 per cent., the only symptom in 24, with one other in 23. It was marked in 43, or 13 per cent., the only symptom in 4, with one other in 3. Of these 318, it was therefore the only symptom in 131, or 41 per cent., with one other in 66, or 21 per cent.

ROSARY AND ONE OTHER SYMPTOM.

Rosary.	Slight.	Medium.	Marked.	Total.
Delayed Dentition	17	7	1	25=38 per cent.
Large Eminences	8	3	1	12=18 per cent.
Large Fontanelle	5	2		7
Large Epiphyses (Wrists)	3	3	1	7
Large Abdomen	3	3		6
Weak Spine	2	3		5
Splenic Tumor	2	1		3
Retraction at Diaphragm		1		1
	40	23	3	66

That is, a rosary was present in every case. It was the only sign in 41 per cent., and was associated with but one other sign in 21 per cent. Slight degrees of beading were much more common than the more marked and, as would be expected, were more often the only sign than were the severe forms. Delayed dentition was the most common single associated symptom, and enlargement of the cranial eminences the next. This relation corresponds to that given by them when considered as single symptoms.

6. Other deformities of the chest were: protrusion of sternum, 1; retraction of sternum, 2; retraction at diaphragm and flaring of lower chest, 43, or 14 per cent. But 4 of these were under 9 months old.

7. Enlargement of epiphyses occurred: wrists alone, in 48; ankles alone, in none; wrists and ankles, in 2, a total of 50, or 16 per cent. The youngest of these was 5 months old. Only 8 were under 9 months. The great preponderance of enlargement at the wrists is striking.

8. Deformity of the long bones of the extremities was noted as follows: bow-legs, 16; knock-knees, 1; both, 1; bowing of arms, 2; a total of 20, or 6 per cent. The age of these was rather evenly distributed among the months between 5 and 23. The very small number presenting deformities of the lower extremities is probably to be explained by the fact that the great majority of the children were under 1 year old, before which time little or no weight is borne on the legs.

Weakness of the spine was noted in 42, or 13 per cent.; 13 of these were under 9 months old.

Marked enlargement of the abdomen was present in 47, or 15 per cent.; 15 were under 9 months, 4 of them being only 3 months old.

Splenic tumor was detected in 24, or 8 per cent.; 9 of these were under 9 months, and one was but 2 months old.

Too much importance must not be attached to these last three signs, as they are not all characteristic of rickets and may occur as the result of many and varied conditions. In these cases they may as well have been symptoms due to the same cause which produced the rickets, or to complications, as to the rickets.

A summary of these figures shows that a rosary is the most common symptom of rickets, in fact that it is an invariable symptom. It may be developed very early, even in the first month of life. It is the only symptom in about 40 per cent. of the patients under 2 years old. When it is the only symptom it is more likely to be small or medium-sized than large. It is accompanied by but one other symptom in 20 per cent. of the patients. This associated symptom is most frequently delayed dentition; next, enlarged cranial eminences. The next most common symptom is delayed dentition, which occurs in more than 50 per cent. of all cases. Enlarged cranial eminences are present in about 20 per cent. Abnormal size of the anterior fontanelle, retraction of the chest at the insertion of the diaphragm, with flaring of the lower ribs, and enlargement of the epiphyses each occur in about 15 per cent. Although these deformities are occasionally found in infants as young as 4 months, but few of them are met with under 9 months; that is, compared with the rosary, they are symptoms of somewhat late development. This is more evident when we consider that the majority of the patients were not over 9 months old. Enlargement of the parietal eminences is much more common than that of the frontal. Craniotabes is very unusual. Other deformities of the chest, besides retraction at the insertion of the diaphragm and flaring of the lower ribs, are rare. Enlargement of the epiphyses at the wrists is common; of those at the ankles, rare. Deformities of the long bones of the extremities are uncommon under 1 year of age. Bow-legs is by far the most frequent form. Weakness of the spine and abdominal enlargement are met with in about 15 per cent. and splenic tumor in about 8 per cent. of the cases of rickets in patients under 2 years old. These symptoms, while probably due in many cases to the rickets, are certainly not in all.

The parentage of the 318 patients was as follows: Russian and Polish Jews, 122; Irish, 93; American, 32; English, Scotch and Canadian, 17; Negro, 15; Italian, 15; German, 11; French, 7; Swede, 2; Finn, 2; Portuguese and Syrian, each, 1. These figures must

not be taken, however, as denoting the relative frequency of rickets in the various races. They merely show the relative proportions of the races that attend the clinic and make up the poorer classes. They are of importance, nevertheless, in that they show that no race is exempt from the disease and that the cause must be sought elsewhere.

An attempt was made to determine what had been the diet of these infants. It was found impossible, however, to make anything out of that in those over 9 months old, as the children of the classes from which these came are almost invariably given everything to eat after that age. The diet of the 180 not over 9 months old was as follows: breast only, 31; breast and cows' milk, 20; breast and condensed milk, 11; breast and general diet, 12; breast and proprietary foods, 3 (=77); modified cows' milk, 17; cows' milk and water, 24; cows' milk and general diet, 7; condensed milk, 26; condensed milk and general diet, 2; various proprietary foods, 27.

The great variety of foods used in these cases and the large number of children which were fed on the breast alone—the ideal food—or on the breast in combination with other foods, seems to show rather clearly that the food can not have been the most important factor in their etiology.

Since race and diet are not sufficient to satisfactorily account for the origin of the rickets in these cases, some other influence, acting on them all, must have been at work. The only one common to all is improper hygienic surroundings. These, therefore, must be considered, in this vicinity at least, to be the most potent cause of rickets in infancy.

CONCLUSIONS.

The following conclusions seem to a certain extent justified: 80 per cent. of the children under 2 years old, of the poorer classes of Boston and the adjacent cities, have rickets. A rosary is not a normal phenomenon but is an evidence of rickets. It is a constant symptom of rickets. It is the earliest symptom to develop and in 40 per cent. of all cases in patients under 2 years old, is the only symptom. The next most common symptom is delayed dentition. Other symptoms, while they may show themselves at any age, do not, as a rule, develop earlier than the tenth month. The cause of rickets in Boston and vicinity is to be found in improper hygienic surroundings rather than in race or diet.

MENTAL FATIGUE.*

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The science of psychology has lately been coming into closer relationship with the science of medicine, and much may be expected from this connection. Psychology, the science of mental phenomena, ought surely to contribute something to medicine, which cares for the preservation and restoration of health to both body and mind. But up till recently the contributions were most frequently the other way around. The greater part of our knowledge of abnormal states of mind has been the gift of medical science to psychology. However, as the latter grows and solves some of her own peculiar problems, she will doubtless turn and try to help medicine, one of her nearest neighbors. As a sign perhaps, of such an attempt, I wish to present the results of a psychologic study of mental fatigue.

The word fatigue may mean either a fact or a feeling. By the fact of fatigue one means relative inability to do mental work—mental incompetency; while by the feeling of mental fatigue, one ordinarily refers vaguely to feelings which lead us to stop or avoid mental effort. In the fact of mental fatigue the student or medical practitioner may rightly be interested because of the part that it may play as a cause of, or a symptom of, nervous exhaustion, and because as a matter of mental hygiene, everybody doing mental work needs to know how to do it economically, to the best advantage, and when to stop. Each may rightly ask of the psychologist a clear, definite description of this thing, mental fatigue, an account of its causes and conditions. The feeling of mental fatigue is important because it is one of the common mental symptoms with which the physician has to deal. Even in normal ordinary life it is important in a high degree, because of its influence on conduct. Psychology should be required to more accurately describe the different mental conditions in people, which might be referred to by the words, "I feel mentally tired;" to discover to what degree these feelings are evidences of real mental inability, what connection there is between the feeling and the fact of mental fatigue, etc.

A common, if not a general, notion about the facts of mental ability and temporary inability or fatigue, is that the mind stores up during rest a sort of energy which it expends when it thinks. The mind is thought of as something like a storage-battery, or even like a barrel, which fills up with water as a consequence of nutrition and lets it run out when thinking goes on. A corollary of this view has usually been that as the mental energy was expended, the mind, by a sort of instinctive economy, spent it more and more slowly, that the rate of expenditure decreased as the amount to be expended diminished, that consequently the rate at which mental work could be done, the amount that could be done in, say ten minutes, decreased in proportion to the amount already done since the last rest. Something like this is Kraepelin's view. He says in his pamphlet ("Zur Hygiene der Arbeit"): " . . . the fact of fatigue is . . . an inseparable companion, nothing but the necessary consequence of work. So if we take the matter strictly, the fact of fatigue begins as soon as work begins"—*beginnt mit der Arbeit selbst.* The common view of the *feeling* of mental fatigue has been that it is a particular, unique feeeling, which parallels the *fact* of mental fatigue, and is directly caused by the latter.

During the last few months I have been studying the fact and the feeling of fatigue in myself and others. My conclusions differ decidedly from the common view stated, and also from the special views of some other investigators, particularly of Kraepelin, Griessbach, Henri and Vannod. I present them, accordingly, only as hypotheses which one may from his own experience correct or approve.

When we consider mental activity, we find that it follows the general biologic type of a reaction to a certain situation. A boy is asked: "How much is 13 multiplied by 17?" He reacts to this situation, viz., having the sense impression of the sound of that question—by remembering the way to multiply, by recalling the association formed in school between 7×3 and 21, by recalling 7 as the proper associate of 7×1, and 9 as the proper associate of $7+2$. So he gets 91, and similarly 13, and so on with the other associations necessary to complete the example. The value of the reaction depends on the accuracy of his associations; its speed depends on their readiness. Again, a person faces the situation of having to decide whether an animal, say a

*Presented to the Section on Physiology and Dietetics, at the Fiftieth Annual Meeting of the American Medical Association, held at Columbus, Ohio, June 6-9, 1899.