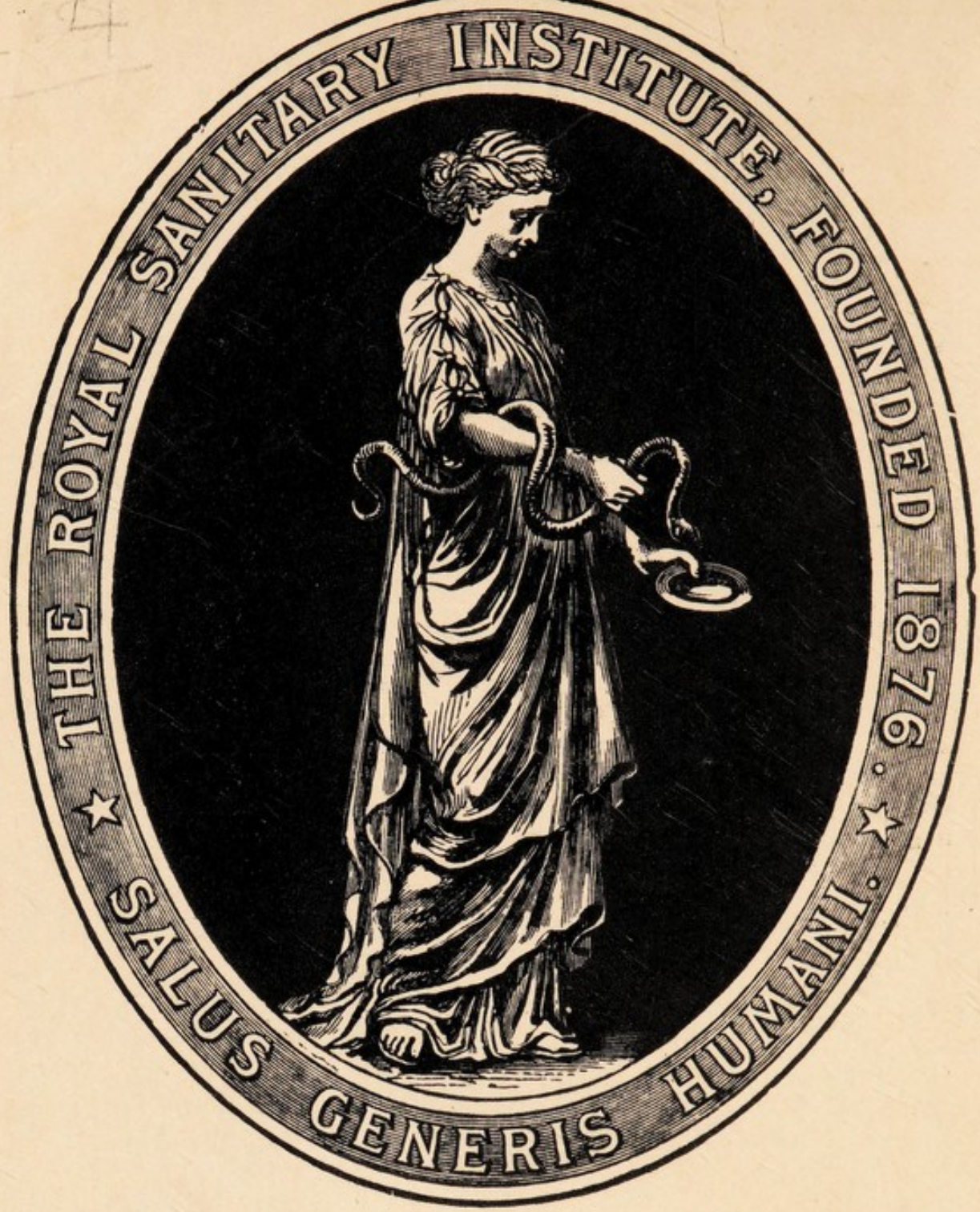
The child at school : being chapters on the medical superintendence of growth / by Sir Leslie Mackenzie.

THE MODERN HEALTH BOOKS



THE MODERN HEALTH BOOKS

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THE CHILD AT SCHOOL

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BEING CHAPTERS ON THE MEDICAL SUPERINTENDENCE OF GROWTH

BY

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EDITOR'S INTRODUCTION TO THE MODERN HEALTH BOOKS

THE general attitude towards Health, in this country, has changed perceptibly during the last fifty years. Scientific analysis of the factors determining health and the increasing recognition that many of them are within human control have been responsible for the change. Passive acceptance has given way to active interest and to a conviction that the conditions of health, so far as they depend on the efforts of the individual, or of the community, should be regulated to the best advantage.

The citizen of average intelligence to-day knows far more than his parents did about the means of securing his personal health, and he is eager to know more still. He appreciates the importance of accurate information on such questions as diet, ventilation, exercise, the choice of his house, the care of his children, infections, and epidemics. But he is not satis-

fied with knowing only how to live the healthiest life under present conditions: he has begun to believe that the conditions themselves can be improved, and good health become the birthright of mankind. He is convinced that even now fewer babies need die, and that throughout life there might be far less actual disease and invalidism.

This general impulse towards a healthier state of life is of immense value, but the driving force must be directed: we must know what we want. Practical aims must be based on scientific facts; but facts as distinct from theories and notions are not easy to come by. The Modern Health Books are designed to bring within the reach of every one the latest expert opinions on the chief problems of health. They will help the reader not only to live a healthy life himself, but to form a right judgment on all those questions which affect the health of the community. But the subjects to be dealt with are not only important; they are of fascinating interest. And as every volume has been written, for the benefit of the general public, by a first-rate authority, it is (as it were) a ticket of admission for all and sundry to the marvellous laboratory where Science is remaking the modern world.

D. F. H.

AUTHOR'S PREFACE

IN this fragmentary contribution to the medical superintendence of growth, I have emphasized four points: first, the social environment as affecting the school life; second, the fundamental importance of the study of nutrition; third, the official beginnings of medical inspection and its social significance; fourth, the principles of physical education. The fitness of the pre-school child and of the school child is part of the much greater problem of national fitness. The revelations of Sir James Galloway's report* to the Ministry of National Service do, I think, justify this general discussion of certain fundamental problems.

I have to thank the British Dental Association for permission to use parts of a paper read at their Edinburgh Congress in 1924.

1925. W. L. M.

* *Report upon the Physical Examination of Men of Military Age by National Service Medical Boards*, Vol. I., 1920 (Cmd. 504).

CHAPTER I

THE POINT OF VIEW

EDUCATION presupposes the medical superintendence of growth. This is enough to indicate the standpoint. To one whose business it has been for a generation to work towards better conditions of living in the tangled communities of a highly industrialized society, freedom to grow presents itself as a fundamental problem. But growth is not to be taken abstractly. It means the growth of a child born into the unimaginable complexities of a modern community. Nor is the word "medical" to be taken in the narrow sense. It ought to cover everything that goes towards the maintenance of the health of a psychophysical organism.

On the physical side, it is a symbol of the scientific effort to keep the child through his whole school life as nearly as possible to his physiological normal. On the mental side, it means the effort to secure for him the best

conditions for intellectual acquisition. In his nine short years at the elementary school, if he goes to school, he has to make the transition from irresponsible activity to ordered conduct. It is a momentous transit. He will require all his reserves of nurture. He is growing; he will continue to grow; and, under the stresses necessarily placed on him, his growth may be interrupted, or forced in wrong directions. At every stage he needs the care that only the skilled physician can bestow. He must be kept fit for education. To keep him fit is not the duty of the teacher, but the duty of the physician. And education in the large sense is to be taken as the sum of the methods designed to fit the child for the long flight into life.

A problem, apparently so simple, demands the whole energies of social administration. To ask, therefore, that the teacher shall keep in touch with the doctor is not to ask too much; for the doctor, the teacher of health, can do something to help the schoolmaster, the teacher of ideas. But there is this to remember: the purpose of medical superintendence is not itself a medical purpose; it is intended rather to aid in the producing of as high a type of human being as the inherited capacity of the individual entitles him to be.

It is, in a word, designed to help in the production of fitness. But education is the fine flower of all our efforts. Mentally and physically the child must remain supple and fresh. He must be saved from the perversion of his instincts. He must be considered from start to finish as a self-conscious and growing personality acting and reacting in the rich and varied world of civilized life. To guide the growth of personality is the problem of education.

In what follows there will be no attempt to deal with school problems in detail. That is the function of the many admirable text-books and researches. To-day, as never before, teachers, psychologists, and doctors are working together with a single eye to discovering along special lines the best methods of training the mind without impairing growth, and of establishing character without creating conflict of motives. The school medical service is not twenty years old. The school psychologists came to the school but yesterday. The results of their activity are already full of promise. Here I cannot profess to estimate their technical value: I wish once more to concentrate attention on the general conditions out of which some school problems grow.

What is my title to offer any views at all? Every year the educational world is flooded with new books. To throw another upon the stream needs some apology. But this I can say for Professor Matthew Hay and myself: when we were instructed by the Royal Commission on Physical Training (Scotland) in 1902 to investigate samples of the school population of Scotland, we were obliged to formulate certain vital conclusions on data of doubtful adequacy; and to-day we have some satisfaction in noting that our small primary research has been verified a thousand-fold during these twenty years. The medical examination and treatment of school-children are now among the accepted duties of the public authorities. This is a fact of immense social importance. If, in what is here written, I contribute little or nothing that is new, I may be permitted the pleasure of surveying the great movement and reminding myself of the principles that underlie it and guide it. To the many workers in the world of education I offer these chapters merely as notes by the way. Twenty years ago we tried to establish a case; to-day we have only to describe facts.

Twenty-three years ago, the Royal Commission on Physical Training (Scotland) was constituted. In my evidence before the Com-

mission, I sketched the peculiar time-table of the Grammar School of Old Aberdeen. The method there was essentially this: a severe prescription of work to be prepared; a daily school session of not more than $3\frac{1}{2}$ hours (with short break) on three days, and not more than $4\frac{1}{2}$ hours on the two other days. The secret was intense concentration for short periods and then absolute freedom for a large proportion of each day. When I suggested that this conception might be of use in elementary, as well as in secondary, schools, Sir Henry Craik, K.C.B., who was a member of the Commission, at once put his finger on the weakness of the argument; for he brought out that the particular school could select its pupils, that there was no obligation to retain at school any pupil that did not work, and that the conception was not applicable to any school where these conditions could not be fulfilled.

The particular school did, indeed, act as a winnowing fan; for no matter what a pupil's ability was, great or little, he worked or he left. But under compulsory education those conditions cannot be fulfilled. The public schools ("public" in the Scottish sense) must provide for all children of school age. It is not open to them to select or to reject; it is their duty to provide education fitted to every

child that comes. Obviously, a system possible in a selective school cannot apply without modification where selection is impossible. Nor is that the only thing to consider. For in the selective schools, whether preparatory, higher grade, or secondary, it was open to assume that the health of the pupils rested on adequate conditions at home. But the public school is faced with a much larger problem; for it cannot in any given case assume the adequacy of home nurture.

Here we pass to an entirely new problem. When a child enters school, the first question to be answered is: Is he physically or mentally fit to profit by the education offered him? This leads to investigation of his history; and this in turn brings us into direct contact with the social conditions of his pre-school life. These conditions determine what the school has to do as a mechanism of the social organization. A school, in mathematical terms, is seen to be a "function" of social conditions. When, therefore, we consider the child at school and the superintendence of his growth, we cannot think of him as merely a child of five; we must think of him as a concrete person with a long history. The superintendence of his growth will then be seen to involve the whole relations of the pre-school to the school life.

CHAPTER II

THE SOCIAL ENVIRONMENT OF THE CHILD

WHERE do the school-children come from? The shortest way to indicate an answer to the question is to survey in imagination the raw material from which the school population is selected. If, any summer afternoon or evening, you walk through the old or congested areas of an industrial city, you will always see scores upon scores of children playing in the streets. This is the undifferentiated mass, the units of all ages from children at the breast to self-sufficient school-children. But let us look for a moment at the true recruits for school—the pre-school children. The mothers sit on the doorstep nursing, talking, and watching. Possibly there are other places than the street; but they love its life and stimulation. They can keep an eye on the toddler, who is learning to balance himself and revealing strange instincts in the

process. He is too concentrated on the business of new acquisitions to take part in any game but his own. If he falls, he laboriously rises again, and thinks nothing of it. He toddles on a wide basis of support, for he has never yet needed to stand to attention. His day will come; but meanwhile he must first learn to balance, then to walk and, in walking, to maintain his equilibrium. It is always a wonderful experiment, and there is no mother too hardened to find an interest in it. Nor is this surprising, for her infant is repeating in himself a great step in the evolution of the race.

Then look at the ex-toddler of four, or his senior brothers and sisters of five and six. To them play is a possibility and a necessity. They can imitate and fall in with the team. Once, as a battalion passed along Prince's Street, Edinburgh, I happened to stand beside three children: the oldest, perhaps, five; the middle, four; the third, two. The person in charge of the battalion was only establishing the rhythm among his raw recruits, and kept repeating, "Left", "left", "left". Instantly the oldest girl started, "Left", "left", "left", stamping her left foot to the time of the march. Within the next instant the second infant repeated the movement and

stamped with the same regularity, and within a second or two more the toddler of two was doing the same.

That story is repeated in a thousand varieties everywhere. But it is not mere imitation: it is activity seeking an outlet, and taking the form that the environment suggests.

Near-by is a group of children old enough to play a concerted game in twos or threes or fours. Not a minute passes before there is a dispute; but it is settled as readily as it arises. If there are tears, they are soon dried; if there is anger, it is soon dissipated; for the minds are still very fluid, and any fresh impression supplants the emotion. Still another group show a definite purpose in the organization of their games. These, you conclude, are obviously the school-children; for if they are not playing at schools, they exhibit a definiteness in their work that reflects some ordered system. Perhaps the street is "up", barrows are about, heaps of stones are at hand, and these must be shifted from place to place. Labour starts at once, for there is no "ca' canny" in that community. And so we might proceed with an endless analysis of biological activities.

There is initiative; for each child has a purpose of his own and acts on his wish when it gives satisfaction or stops acting when it

gives dissatisfaction. There is imitation; there is order; there is system. There are, in fact, the rudiments of early education. It is not yet a formed community like a hive of bees; it is a community of play, just on the borderland of discipline.

But not far away some man or woman is shouting: there is a quarrel among the adults. Whether there be drink or not, the voices are loud; the children swarm round; the toddlers are left standing, and the mothers speculate on the causes. They know who it is and why it is. It is not long before a policeman appears; the crowd scatters; the games are resumed, and life goes on as before. What meaning the infants put on these events it may pass the wit of man to discover; but the events are realities that mould their future. If, when sundown comes, you watch where the families go, you discover that every child knows his way home and takes it without a thought. If the "entry" is dim or the stair dark, this makes no difference; the older help the younger, and the mother puts the baby into the cradle, the toddlers to bed, and superintends the whole ritual of "a lodging for the night". Perhaps it is a one-room house, and she is a careful and conscientious woman. It takes a long time to see things through. Perhaps she has been

on duty since six in the morning, and has little energy left. But those secrets you will not discover directly. They come to light only in roundabout ways, when the health visitor comes to consult about the baby, or the school officer to inquire about the school ages, or the sanitary officer to report on overcrowding, or the medical officer of health to arrange for the removal of an infectious case to hospital.

There may be other visitors too : the factor for the rent, or a friend to ask for assistance, or the doctor to treat the sick, or the undertaker to remove the dead. In this hidden hinterland of the street, infection finds its nesting-place and selects the condemned.

There are other things ; but this is enough. It is clear to you that the home, at least in this congested area, is a focus of many energies ; it keeps touch with the greater realizations essential to the life of every large community ; it cannot run alone. The beginnings of education were all there, had you been privileged to watch them ; but it is only the beginnings. The instincts of the children show us the way ; but, in spite of the loud cries of the children, our industrial cities think first of the grown men and women. It is easy to see why the schools, the playgrounds, the open spaces are wanted.

Perhaps, however, you think this is only a town problem. But when you go to the hamlets and villages of the industrial areas, or to the quieter reaches of the country places, you find in a degree the same problems occurring. There is, of course, a feeling of greater freedom. As a rule, the smaller towns, and certainly the villages, are better adapted than the cities to provide for the rushing minds of the pre-school infants. The pace is not so fast; the stimulations are not so insistent; the units of space are relatively larger. But the experience of the child welfare centres in every area where a few scores of families gather, is always more or less the same in kind, varying only in degree. As we shall see later, the figures of the medical inspections of school-children bring out a sharp difference between city and suburbs, and between both and the rural areas. And the difference is in favour of the rural areas. There are many factors in the case. Parents have more time on their hands; they devote much of it to their children; but however devoted they may be, they cannot create for themselves the institutions or the organizations their families require. That is, indeed, chiefly why the villages and the towns came into existence. In the open order of the rural villages, life is more or less freed from the

mechanism of streets ; there is a more intimate touch with unrestrained nature ; and there is more colour, larger spaces, and less hurry.

Now take a few hours in a mining county. You will find there robustness of fibre, strong men, strong women, active and well-fed children ; but you will also find the crowded house, and, in the leisure time of the men, you will discover many traces of the reaction against the relative darkness of the pit. You will find, too, clouds of smoke for miles, and you will understand why the heavier industries must attract the stronger people. But in spite of all the advantages incidental to the strenuous life, the number of ailments among the pre-school and the school-children is considerable and constant. It is found that the child welfare clinics, like the school clinics, never want for cases.

When we pass to the rural areas proper, the type of life changes. There is less strain on the parents and children. Life is altogether slower. But the pre-school child has the advantage of the open fields, and, on the whole, profits by the better sunlight and fresher vegetables. Here too, however, the school clinics tell their tale of defects, and there is always work for the various medical services.

So far the naked-eye survey ; let us now look to the stage where the more intimate conditions can be studied, and take a few examples from actual records. If we are to study the effects of housing on the health of the children and, therefore, on the recruiting for school, we can gauge the broad general result from the extended investigations recorded by the Royal Commission on the housing of the industrial population of Scotland, rural and urban (1917).* In this investigation, the one-room house came into prominence, but that was inevitable. For the one-room house is the easiest to study in isolation. In Scotland, more than 400,000 of the population at the date of that report lived in houses of one room ; but those houses were not all equally bad. Many of them were adequate for the particular purpose ; but broadly the charges laid against life in one room were as well established as when the late Dr. James Burn Russell, Medical Officer of Health of Glasgow, wrote his famous lecture on *Life in One Room* thirty-seven years ago.

Briefly, the Royal Commission concluded that, for the purposes of ordinary family life, "the one-room house is quite unsuitable."

But the one-room house is only a convenient

* Cd. 8731.

type for showing forth the evils of all overcrowding. That is the real problem. It matters little whether the house has one room or two rooms or three rooms; where there is overcrowding, the same results always follow. It may, too, be said that, as the one-room house lies on the economic margin, it attracts to itself the less efficient of all classes. In the wide meaning of efficiency, this might be allowed, with certain qualifications, to be true; but in the mining areas, where the one-room house is common, the populations are among the most robust of the whole community. Here, it is at once admitted, the danger of fallacious inferences is very great; but whatever the ultimate meaning of the facts may be, it was shown to the Commission that the families living in one-room houses, as they exist in Glasgow, cannot live a hygienic life. When corrected for age and sex, the death-rate is higher than the death-rates in houses of more than one room. The infantile death-rate is higher. "The one-room house also shows an increased disease-rate . . . diseases of digestion, diseases of the nervous system, diseases of the respiratory organs, measles, whooping-cough, diphtheria, all show a higher death-rate in the one-room houses than in the two- or three- or four-room houses. To

take one or two illustrations: one-apartment houses, the death-rate per thousand from diarrhœa was 25·3, as against 19·72 for two-apartment houses, and 10·48 for three-apartment houses."* Of pneumonia, Dr. Chalmers says: "At each age-period, almost without exception, the higher rates fall on houses of one and two apartments. It would, therefore, seem to be a disease entirely of environment and climatic conditions, resembling in its behaviour those of the more definitely infectious type. In infancy, the rate for the larger houses is equal to two-thirds of that of one apartment." In the one-room house, too, there tends to be an excessive proportion of children.

But the case against the one-room house need not be emphasized. It has been accepted by Parliament and the country. This means also that the case against overcrowding is equally established. The gigantic schemes promoted by the various Governments for the better housing of the peoples of Scotland and England now occupy the public mind to a degree never known before. The evils due to the existing conditions are reflected in the lives of the families, and must, for a long time to come, provide fresh materials for the pre-school and school medical services.

* *Royal Commission Report*, par. 662.

Several years ago the Local Government Board for Scotland instructed some of its officers to prepare a report on the administrative control of tuberculosis in a great industrial city. The method was not to accumulate masses of statistics, but to obtain concrete pictures of actual home conditions. The investigators took the cases in the order of notification, which may fairly be regarded as a random order. The purpose was not to discover the upward or downward tendency of tuberculosis as a whole, but to make obvious what the immediate problem in front of the Health Authorities was. Incidentally, there was much material that bore directly on the life of the pre-school child. It is impossible to convey by a selection the full effects of the report; but for our purpose a few typical illustrations are enough.

Consider what the fitness for school is likely to be when a child comes from homes like these. The house consists of one back room on the ground-floor of a tenement. There are six occupants—the patient, his wife, and four children, aged from 4 months to 11½ years. The two eldest children sleep in a chair-bed, and the other four, including the patient, in a set-in bed. The bedding is insufficient; and the furniture is scanty, most of it having been

sold. The window is open a little at the top. None of the rest of the household has a cough, but the eldest boy, aged 11½, is very thin and delicate-looking.

Take another case: The patient's husband died eighteen months ago from pulmonary tuberculosis, after an illness of over two years. His wife nursed him, and up till a month or two before his death, she occupied the same bed. The husband had been a mason, and his maternal grandmother and the maternal aunt had died from tuberculosis. The house consists of two rooms on the ground-floor of a tenement. There are four occupants—the patient and three children, aged 8, 9, and 11. The mother and one child sleep together in the kitchen bed, while the other two children sleep on a mattress laid on the kitchen floor. There used to be a bed in the other room, but it was sold. The windows were closed.

Or take this case: The house consists of two front rooms on the third flat of a tenement. There are seven occupants—the patient, his wife aged 36, and five children aged from 3 to 12 years. In the kitchen, the wife and three youngest children sleep in a set-in bed, and the two eldest children in a folding bed. The patient occupies the other room. The windows

were closed. A large bowl filled with sputum was in the bedroom.

Or again: The house consists of two back rooms on the third floor of a tenement. There are four occupants—the patient, his wife aged 31, and two children aged 7 and 10. Both windows were closed. In another case, where through ventilation was good, there were three occupants of two rooms—the patient aged 48, and two children aged 11 and 14. The patient sleeps in a set-in bed in the kitchen, and her daughter aged 14 in a bed-chair drawn up beside it. The other child, a boy, clean and healthy in appearance, sleeps in the bedroom. The patient is evidently very ill, but both she and her surroundings are particularly clean and tidy. The elder child does not begin work till midday and sees to the house till she goes out. The windows were closed because of fog.

In another case one daughter had died of inflammation of the brain at nine years of age. Another had died of whooping-cough at one year. Of five children living at home, the two youngest, aged $1\frac{1}{2}$ and 3 years, were rickety and anæmic. The eldest, a girl of 15, had to go out to work; but she had a cough and recently spat blood. The father had been a foundry labourer, but since his

illness had to come down to light labour.

These are illustrations of the effects of a single disease housed in industrial conditions. In the particular city there are approximately 10,000 cases, some of them carefully attended in hospitals, some in sanatoria, some in houses of one, two, and three rooms, but all of them suffering directly or indirectly from the difficulties of maintaining a supply of clean air and the greater difficulty of securing good light. These conditions are not the work of any one person or of any one generation; but the children issuing from such homes cannot be expected to start fair in the school race.

The evils do not by any means all lie in the great cities. Tuberculosis wanders everywhere; and wherever there is overcrowding, it does double work. The vast general problem has evoked in most countries of the world a proportional service of dispensaries, hospitals, sanatoria, systems of home care, and adjustments of industry. Those services are working steadily towards a better control of the disease, and any day may bring us a more magical method of treatment. There is ground for supposing that the great mass of the people are affected in some degree with tuberculosis, but harmlessly.

Consider now another aspect of the social environment. Here is a city where some 23·4 per cent. of the married women follow some remunerative occupation. At the census of 1911, fifty-nine of the married women were of ages 15 to 19, and nearly 55 per cent. of these were occupied, as against 10 per cent. for another great industrial city, and 17 per cent. for a city partly industrial and partly residential. Of 695 married women, aged 20 to 24, 41 per cent. were workers as against 7·5 per cent. for the other cities. There were nearly 4,000 married women of 25 to 44, and 25 per cent. of them were so occupied, as against 5 per cent. in the other cities.

From the bare figures it is difficult to infer anything; but look back at the homes. The medical officer found that the infant mortality was largely due to improper feeding. This could be associated with the predominance of married women labour, but that is only the beginning of things. At the later pre-school ages, the same difficult conditions of household management persist; and though the administrations do effect a vast amount, they cannot be expected to neutralize completely the results of conditions so ill-adapted to the hourly and daily necessities of the years of

rapid growth. One factory inspector concluded that if there is actual physical deterioration among those working people, one great cause seems to exist in the systematic employment of mothers in mills and factories. The general problem is not before us ; all I emphasize is that the children from those homes come to the school with a history of poor nutrition and ill-tended growth. From any industrial city in the kingdom, facts like these can be gathered. There is no mystery about them. It is simply that, whatever the cause, the child, be his heredity good or bad, has little chance to grow to his full stature, and for the most part does not. That fact the figures of the later medical inspections at school put beyond question.

When, therefore, it is said that all children are not born equal, there is no need to dispute the fact. At the commencement of life, one child may differ from another for a thousand reasons of true heredity, defective pre-natal nurture, or maternal disease ; but, given healthy birth, the differences between one newborn child and another do not correspond in any close way with the differences in the economic grade of the mothers. In the evidence given before the Committee on Physical Deterioration in 1904, it was said by respon-

sible persons that, no matter what the economic grade, the child drew from the resources of its mother and did not necessarily suffer. From the biological standpoint, this is not unintelligible. But the point of the present argument is that, owing to defective post-natal environments, the children when they come to school show differences proportionally as great as the differences among adults.

One general inference is possible: until the destructive influences of the pre-school period are adequately counteracted, the schools will continue to be loaded with much preventable disease and defect. At the school ages, therefore, the medical superintendence of growth is necessarily complicated by the child's pre-school history.

So far I have been dealing only with the margin; but, in any modern society, the occupations are to be reckoned by hundreds; and in economic grades far below the highest, multitudes of homes provide adequate conditions of living, and furnish to the community a steady stream of first-class lives. As the economic grade rises, life gets cleaner and more strenuous. There is a better technique of service and adaptation, and the problem for the schools grows less difficult.

A point soon comes where the school recruit easily passes all his physical tests; and education may proceed on a basis of good nutrition. None the less, between the lower economic grades and the middle grades, the differences are so marked that, in a cursory inspection of any hundred children, it is easy to reconstruct their social history. This fact was strikingly brought out in the examination of 600 Edinburgh children, conducted at the instance of the Royal Commission on Physical Training. The differences between the children of the four public schools selected, two of them almost within a stone's-throw of each other within the city, were so marked as almost to provoke scepticism about the accuracy of the facts. There is no need to elaborate the point here. We shall deal with it more in detail in another chapter.

CHAPTER III

ILLUSTRATION OF ECONOMIC STRATIFICATION

THESE general facts are alone enough to indicate how varied in physique the school recruit must be. Fortunately, however, there are data to show that the children at school may, as it were, be stratified in correspondence with the social conditions of their homes.

In the year 1905, that is three years before medical inspection of school-children became obligatory in Scotland, the School Board for Glasgow "decided to institute records of physical measurements of the children attending their Primary and Higher Grade schools. At the same time, they also decided to ascertain certain particulars as to the housing and general physical surroundings of the children." The inquiry was undertaken at the suggestion of Captain Alan Foster, who was at that time Inspector of Physical Training under the

Scottish Education Department. In 1907 the Department published a Blue Book with a report on the data thus collected.

It fell to Captain Foster and myself to prepare the Report. The returns included records of children from 73 Primary and Higher Grade schools. They were classified by the Scottish Education Department. "From the vast masses of facts, it was decided to select the heights and weights of the children at the various ages and to classify these in correlation with the housing conditions. The number of rooms in the home is a good indication of the child's nutritional environment. The truth of this is confirmed in the series of tables. The returns contained many other valuable records; but these did not lend themselves so readily to precise and accurate tabulation."

The schools were broadly classified into groups. Group A comprised schools in the poorest district of the city—26 schools with 24,661 children. Group B comprised schools in the poorer districts of the city—27 schools with 25,348 children. Group C comprised schools in a district of a better class—11 schools with 11,453 children. Group D comprised schools in a district of a still higher class. In this class were included four out of

five of the Higher Grade schools in the city—9 schools with 11,395 children.

These groupings indicated a real social gradation. In Group A the number of one-room houses was as high as 19 per cent.; the number of three-room houses fell as low as 8·7 per cent. In Group D the percentage of one-room houses was as low as 0·6 per cent.; the percentage of three-room houses was as high as 40. Groups B and C fell between those extremes. The groupings of the schools thus roughly followed the distribution of the one-, two-, and three-room houses. Returns were made for 72,857 children, of whom 36,883 were boys and 35,974 were girls. Mentally defective children were omitted. All through the sixty-two elaborate tables, the heights and weights were compared with the standard averages of the Anthropometric Committee of the British Association. The heights and weights were further classified in correlation with houses of different sizes. The leading conclusions were brought to a focus in a series of six graphic diagrams, showing at a glance the significance of the whole investigation.

Substantially, the facts are these: "The children of the one-room houses are, at every age from five to fourteen, lowest in height and weight. The children of the two-room houses

come next; the children of the three-room houses next; and the children of houses of four rooms and upwards stand highest. Thus, at the age of five, the one-room boy weighs, on the average, 37·2 lb.; the two-room boy, 38·6 lb.; the three-room boy, 39·5 lb.; the four-room boy, 40·1 lb. At age nine the corresponding figures are 51·4 lb.; 53·1 lb.; 54·8 lb.; 56·6 lb. At age eleven the figures are 60·0 lb.; 62·2 lb.; 64·5 lb.; 66·2 lb.

For height, the corresponding figures at age five are 39·0 in.; 40·7 in.; 41·4 in.; 39·9 in. At age nine the figures are 46·5 in.; 47·6 in.; 48·2 in.; 48·9 in. At age eleven the figures are 50·1 in.; 50·9 in.; 51·7 in.; 52·4 in. The heights and weights at the other ages showed a similar relationship. The figures for girls at the corresponding ages showed corresponding averages.

"It may, therefore, be said that, as surely as a child comes from a one-room house, he is likely to be found smaller and lighter than a child from a two-room house. Similarly, the child from a two-room house is smaller and lighter than the child from a three-room house. These results, whatever be their ultimate meaning, confirm the results obtained from an analysis of the various death-rates. Further, as the conditions that interfere with growth

operate constantly from hour to hour and day to day through life, we are entitled to assume that the relationship between the one-room and two-room children of the school ages will also be found among the one-room and two-room children of the pre-school ages. Indeed, we might expect that the growth at the earlier ages would show more serious differences than growth at the school ages." *

Here, therefore, we have positive proof that the children at school reflect the social conditions represented in the school. It would be interesting to discuss whether this definite result, which has been confirmed by later investigations, is due to the physical conditions of overcrowding, or whether this in turn is due to complicated economic conditions, or whether the persons of inferior heredity tend to congregate in the mean streets and the cheaper houses, or whether the environments broadly symbolized by differences of house room are, in their various degrees, more or less destructive to growth. The theory of the facts does not touch the facts themselves; and with these facts the School Health Administrations have to deal.

* *Report to Carnegie United Kingdom Trust on Scottish Mothers and Children,* by W. Leslie Mackenzie.

Obviously, if there are such differences between one set of children and another, the physical and mental output at school must differ according to the different strata studied; and as the growth of the children is already permanently affected at the beginning of the school period, the after-life of those children will continue to show corresponding differences. It may very well be that height and weight, or the ratio of weight to height, do not constitute successful tests either of nutrition or of growth; but they are the simplest direct tests we possess, and, in the particular investigation, the differences were so marked that they could fairly be attributed to some positive interference with the process of growth. In the curves based on the figures, the one-room curve is uniformly lower than the two-room and the three-room. The selection of the areas had been made by men familiar with the various social grades represented in them. It may be taken as certain that the 72,000 children examined represented fairly the areas trained by the schools.

Since the date of that Report, many other special investigations have been made; but, so far as I am aware, this investigation is the most extensive of its kind in this country. The results confirm the conclusions already indi-

cated by the general death-rate, the infantile death-rate, the tuberculosis death-rate, and the death-rate of children from one to five years. The investigation shows that the health and efficiency of the child at school depends through and through on the sufficiency of the home.

Thus from our general survey of the social environment and special investigation of particular parts of it, we appreciate the magnitude of the problem presented to the School Health Administrations.

CHAPTER IV

THE DISEASES AND AILMENTS OF THE PRE-SCHOOL CHILD

WHY do we dwell so long on the life of the pre-school child? Simply because the problem of the child at school is largely determined by the conditions of the pre-school children, and those conditions in their turn are determined by the social environment and its imperfections. In Scotland the child enters the elementary school at five years of age. This age is fixed by administrative convenience. It has no relation to biological conditions at all. The continuity of the child's life is not interrupted by the years, but only punctuated by them. To suppose that the first five years of life are divided in reality from the later years is, as it were, to confuse real time with the sequence of figures on the clock face. The child's life is a unity, not a series of separable lives. It is important to note the point. For the diseases and ailments

found at school are in a very large measure the product of the pre-school period.

In a book written twenty-one years ago, I said *: "The school child, as he appears at school, has already lived through a long and adventurous history. He is born of parents of a given race, of a given community, themselves featured and developed by incalculable complexities of influence. He has inherited certain predispositions of his parents. He may have been affected by the parental diseases. He may have suffered in his life before birth. He has, through many critical moments, struggled into individual existence. He has survived all the serious vicissitudes of his first week, his first month, his first year, his first five years. He has learned to walk, to talk, to assert his place in the mimic community of children. He has acquired individual habits. He has laid the basis of morals. He has come to some sense of individuality in the family. He has at last made the great transition from the home to the school, from his cradle community to the community of strangers, from the soft nurture of family sentiment to the realities of discipline. At every stage in his history he has acquired something that his

* *Medical Inspection of School Children.* Mackenzie and Matthew. William Hodge & Co., 1904.

whole life will not extirpate. He has been touched with some diseases that make him safe against them for ever. He has found his organs fit enough to carry him thus far. He is now about to enter a much vaster struggle, a more remorseless ordeal, a life full of greater stresses, energies, and dangers."

I emphasized then the importance of searching out some of the influences that govern the pre-school life. To enumerate these exhaustively was impossible; I selected the following: the racial inheritance of the school child, his pre-natal nurture, the effects of soil and climate, the effects of housing, the effects of occupation, the effects of food. It was impossible to keep distinct the pre-school effects of these factors from their effects during school-life; for they modify the whole life of the child at school and culminate in the production of an individual of a definite height, of a definite weight, and of a determinable stage in growth. In a word, those social factors were our guide in framing a programme of school medical examination.

When the medical inspection of school-children was proposed, there were many not unfriendly critics to assure us that, in beginning with the school child, we were beginning too late; but the words quoted show that

the promoters of medical inspection were not unaware of the pre-school problems. But the work had to begin where the children could be found. From the beginning we carried our vision forward into adolescence, but also backward into infancy. The work had to begin where the greatest service could be done, and where the child could most easily be examined. At that date, too, there was another practical reason: at the entrance to school, the child passed definitely under the control of a public authority charged with the duty of his education. Since that date a comprehensive system of child welfare has been established through the length and breadth of the land. All the factors in the health history of the child from before birth to the school age can now be specially studied at child welfare centres, child clinics, child hospitals, and the other group of institutions arising out of the child welfare movement.

When the words quoted were written, they were largely a forecast. To-day they are capable of some quantitative expression. Numerous school medical reports for England and Scotland contain masses of materials gathered from the medical examinations of the school entrants. Some years ago Dr. Lewis D. Cruickshank, formerly medical officer and

inspector of physical education to the Scottish Education Department, compiled, from the official reports, some groups of facts to show the typical condition of children at the age of entering school. In his compilation he chose five representative towns and eight representative counties. On this wide basis he was able to frame a reliable estimate of the incidence of defect and disease among the 82,000 (approximately) school entrants examined annually. The figures cannot be taken as constant, for, in the course of the years, many of the conditions vanish under inspection. But some of the groups of disease probably do not yet vary much in amount from year to year.

Dr. Cruickshank, from the few selected reports, concluded that at least 42·5 per cent. of the children entering school suffer from diseases that are largely preventable. If to those figures are added the number suffering from defective teeth (70 per cent.), the total exceeds 100, showing that the actual number of defects discovered considerably exceeds the number of children examined. This is common in the experience of medical inspectors. Many of the children suffer from more than one defect. Most commonly, defective teeth are found combined with some other defect. Of

the special conditions collated, the percentage occurrences are as follow: verminousness of head, 8; verminousness of body, 2; defective nutrition, 10; diseases of skin, 1·6; enlarged tonsils and adenoids (marked), 4; marked enlargement of neck glands, 0·3; diseases of eyes, 4·7; diseases of ear and defective hearing, 3; diseases of lungs, 3·5; rickets, say, 5; non-pulmonary tuberculosis, 0·4; total, 42·5. In an entrant population of about 82,000, the gross numbers affected range from about 250 to more than 8,000.

These are the children that answer the roll-call at the age of five. At the very outset of their school career, they present a formidable health problem to the school health administrations. They reflect in their conditions and ailments the influence of their social environment. In considerable numbers, they are already suffering from chronic diseases. None of the conditions begins on the day when the child presents himself at school. Each condition has a long history. Even the presence of vermin means that perhaps for months or years the child has suffered from some chronic irritation and has failed to secure his right amount of sleep.

But, at the worst, uncleanliness of body or

the presence of parasites can be prevented, and the reports consistently show that the measures taken for prevention are effective. In fact, the exactions of the school-life, even in the days before medical inspection, had considerable effect in securing clean bodies and clean clothing. Undoubtedly, the inspections have helped forward the movement. This is true both in town and in country. There is, too, a repercussive effect on the homes. The requirements of the school intensify the parents' sense of responsibility. Meanwhile, the facilities for cleansing grow steadily greater. In the large cities, the good schools provide baths or shower-baths, and usually the municipalities make easy terms with the education authorities for the use of the public baths. In a report published by the Carnegie United Kingdom Trustees some years ago, a survey was recorded of the bathing facilities in all the great centres of population. In this respect the city of Dunfermline is among the first. Many years ago, the Carnegie Dunfermline Trustees provided a handsome installation of baths for all the inhabitants of the city, and in particular for the school-children. This is only a part of the many civic efforts at Dunfermline for the promotion of the physical welfare of the children.

With diseases of the skin, too, the measures taken show many signs of success. Skin troubles at school are relatively easy to deal with; but until the work of the pre-school clinics is further developed, there will continue to be a small crop of skin diseases at the school entrance age. The presence of any skin disease is itself an index of neglect; but the numbers of these diseases are relatively small, and they are not difficult to control.

But with enlarged tonsils and adenoids the case is different. The evil results may be slow, but they are serious. In the figures under review, only the severe cases are recorded, and these are only a proportion of the actual occurrences. But the problem of the tonsils is part of a much larger problem. Surgery has to deal with the end-product. In this field the methods of prevention are yet to be discovered. Possibly, when the science of the glandular systems of the body is further advanced, new methods of treating these troublesome conditions will reveal themselves. It is certain that much of the retardation at school is due to the partial obstruction of the nasal and pharyngeal passages. As yet, there is no simple solution. This is one among the many problems for research. Until the great epidemics of childhood—measles, whooping-

cough, diphtheria, scarlet fever—are brought under better control, the crops of troublesome obstructions are likely to continue.

As for enlarged glands, their name is legion. In many cases, the cause is incipient tuberculosis. The chronic diseases of the eyes and of the eyelids and of the ears are, in large measure, the product of the acute specific illnesses like scarlet fever or measles. For more than a generation the central and local authorities have been holding up to the light the immense damage that is due directly or indirectly to those diseases; and the medical services are still faced with years of systematic work.

A large proportion of diseases of the heart among children, at entrance, are no doubt congenital. Here the condition is a function of so many variables that it is not possible to hope for rapid improvement. But with the chronic bronchitis of children under the age of five, it ought to be possible to do more. Probably the bronchitis is partly tubercular; but whether tubercular or not, it indicates a serious want of skill in the nurture of the pre-school child.

Nutrition, teeth, and rickets demand special discussion. Here it is enough to say that the school health administration is faced with a

large crop of troubles that are not in any sense due to the schools or the school-life. The only logical course for preventive medicine is to establish for the pre-school child a system as effective as the school medical service. This is the aim of the schemes for maternity service and child welfare. Those schemes will ultimately secure the better preparation of the child for school.

CHAPTER V

THE GROWTH OF THE SCHOOL-FUNCTION

THE survey of the social environment showed that all the elements of a school are implicit in every group of parents and children. The play of the street passes into organization as rapidly as the child is able to respond. The beginnings of every grade of school can be found there. If we studied closely these elements of social embryology, we could trace out the threads that lead to many types of specialized culture. And the specialization begins very early. Recently discussion has crystallized about the following: the Day Nursery, the Toddlers' Playground, the Nursery School, the Children's Camp, the Kindergarten, the Montessori group. But these are very shifting sands. The concepts are vague and run into one another. They are made definite only for purposes of practice. They are not, therefore, to be taken

too rigidly. They are merely rough formulæ in the course of social development. The one type fades into the other; and often what begins as one ends as another. When attention was yet concentrated exclusively on the infant under one year, more was heard of Baby Clubs, Baby Welcomes, Schools for Mothers, and Crèches. But, behind all these, the principle is the same: the child at a very early stage needs an environment larger, richer, and better organized than the ordinary home can, as a rule, provide. It may be that the splitting up of any social group into individual houses has destroyed something of the free organic life and interchange of the clan or tribe; and the child, instinctively resenting the narrow limits of a room, and fearing all adults except his mother, longs for the occasional sight, touch, and word of his equals in age. It has been observed that, in Holiday Homes for children just over the official school age, the day is happy so long as play continues; but the longing for the mother soon emerges. And no such homes are biologically sound unless a mother, or a mother's substitute, is there. At Humbie, in the south of Scotland, where there is a group of Edinburgh Holiday Homes, it is recorded that one boy communicated to a new-comer

that "this would be a fine place if a body just had his mither." The flash of longing reveals the organic liaison between home and school.

For the reasons already suggested, it is in the industrial cities that those cravings of infant life are most obvious, and it is there that the efforts to satisfy them have been most systematic. In the rural areas, with their diluted population, the need for the Day Nursery or the Nursery School would not readily come into people's minds; for the mother is at home; the child has the free run of gardens and fields, the free company of the domestic pets, the wild birds, or the animals of the farm. But, as you enter the villages of the industrial world, you can infer from many trifles the craving for companionship. And in the large industrial towns, where the houses shrink into stone shelters, the child is more of a prisoner, and the mother is often too occupied in making a living to spend much time in creating a fairyland of nature.

Let us look then at some of these schools graded to prepare the child, step by step, for the ordeal of his school entrance at five.

In the Crèche or Day Nursery, nutrition takes the first place; education, the second.

But in the conduct of those institutions, it makes all the difference in the world when the " house mother " understands the ways of establishing good habits by exploiting the spontaneities of the child. As understood in France, the crèche is a home where a nursing mother may place her child during the time that she is absent at work. To bring up a child is an occupation; to earn a living at the same time is a burden. But economic necessity created the crèche, and even now that the urgencies of the Great War no longer press, there are places where the same necessity stimulates the creation of Day Nurseries. The main purpose of the early French institutions was merely to keep the infant conveniently near where the mother worked, that she might come from time to time and feed it on the breast. But, in this country, the Day Nursery has passed far beyond these limits. It is no longer a place for the care of the suckling. It takes in children of 1 to 3 years or more.

In the later developments, it is difficult to find any difference between the Day Nursery proper and the Nursery School; for, as soon as the children can talk or walk, the need for guidance and control shows itself. Inevitably the Day Nursery becomes a Nursery School.

But the economic purpose of the Day Nursery is marked by one permanent difference: if the mother is working a full day, the child has to be kept from morning to night. In the Nursery School, on the other hand, the hours can be adjusted strictly to the purpose of relieving the mother at home by keeping her child in a right environment at school. At the best, the Day Nursery is an unfortunate necessity. It means that, for many hours of the twenty-four, the mother and child are kept apart just at the time when the maternal care is emotionally at its best. Where, however, the Day Nursery passes into the Nursery School, the ultimate loss of emotional contact between child and mother is less, and where the right persons are in charge of it, the possible evil to mother or child may be very small and evanescent. But the Day Nursery cannot be regarded as in the strict sense an educational institution; it is a by-product of industrial development, and is already fading into the Toddlers' Playground and the Nursery School.

Some years ago, Dr. A. K. Chalmers, late Medical Officer of Health of Glasgow, suggested at a meeting in Edinburgh that experiments might be made with an open-air crèche. The

result was the first Edinburgh Toddlers' Playground. It is well to record the genesis of this special institution, for, in many forms, it has been developed in many parts of the world; but, so far as I know, it did for the first time give a name to a very definite problem—the problem of the toddler just emerged into the walking and talking stage.

So long as a working mother has an infant to nurse, a house to keep, and a husband to feed, the toddler at home is certain to be a serious handicap on her domestic activities. To remove this handicap in the over-pressed homes, the city of Edinburgh, through its staff of health visitors, has established a Toddlers' Playground. Admission to the playground is conditional: first, there must be a baby at home needing nursing; second, the mother must undertake to prepare the school-children properly for school, and to prepare the toddler for transference to the playground; third, she must maintain a reasonable standard of tidiness in the home. With the school-children at school and the toddler in his superintended playground, the mother is enabled to attend both to her baby and to the preparation of the midday meal. In time for the midday meal, the toddler is taken home, and has the rest of the day in which to look forward to

his next visit to the playground. The equipment of the playground is of the simplest: sufficient open space, with the usual infant properties of sand, rocking-horses, etc., and an open-air shelter for rainy days. Even under the conditions of the Edinburgh climate, the experiment has succeeded in every respect. The homes are stimulated to maintain a better standard, the mothers' energies are economized, the baby receives more attention, and the toddler has improved not merely in habits but materially in health. One test of the health improvement has been noted by the medical man in attendance. It is that the "running noses", so commonly incidental to the life of the children, have spontaneously disappeared. From this fact many important inferences could be drawn; but one broad inference is enough, namely, that the stimulus of the cool air, the process of preparation for the playground, the transference to it, the two hours' occupation of it, and the return home, all result in a generalized improvement of nutrition and a toning up of the whole tissues.

The playground is in charge of a skilled and paid attendant. Wherever the idea has been mentioned elsewhere in Scotland, it has met with warm acceptance. The scheme of child welfare established by the Edinburgh Health

Authority includes several Toddlers' Playgrounds. This experiment has fully justified itself.

At first there was some difficulty about the attendance; for sometimes the toddler was not ready when called for; sometimes there was no person to take it to the playground. But in a short time the attendance grew steady, and the playground became a functional part of the child's life as a whole. The mothers told of extraordinary differences, mental and physical. "The listless, apathetic, voiceless child," so wrote the superintendent, "has been turned into the bright, romping, talkative urchin who is beginning to see that life is worth living after all. I get quite long conversations out of little mites now that once sat in a silent heap on the floor."

In Liverpool, the playgrounds, provided for the children in the re-built areas, supply in some degree the conditions of a toddlers' playground. The essential function of the playground is to enable the overladen nursing mother to get relief for a couple of hours from the too-exacting demands of toddlerism.

The Toddlers' Playground is only a stage on the way to the Nursery School proper.

Every one is satisfied with the idea of the

Toddlers' Playground, the Nursery School, the Play Centre, the Kindergarten, and the Montessori group, all taken as stages in the progress from the cradle to the school; but, as things are, only a small fraction of the pre-school children of this country can as yet be provided for. The administrative and economic difficulties are very great. Our old towns in their designs take little account of the special needs of children, so that to-day, instead of being a triumphant progress, the march of the pre-school child is blocked by a thousand social obstacles inherited from the past. But to the extent that this group of pre-school institutions can operate, the gain to the individual child is incredibly great. He has restored to him something that he lost when his forefathers made up their minds to live in cities, and converted the free life of the hills, the forests, the fields, and the sea-border, into the regulated mechanism of overbuilt towns and lightless courts. But the town has a thousand advantages; and the problem of the town-planner is not how to break up the towns and scatter the peoples over the unoccupied areas, but how to design his towns so that the essentials of health, safety, and amenity shall be duly honoured.

CHAPTER VI

THE RELATION OF THE SCHOOL AND THE FAMILY

A QUESTION that troubles many minds is this: how do all these activities of the public authorities affect parental responsibility? There is a widespread suspicion that every fresh departure in social organization means the destruction of some element in the responsibility of the parent for his children. There is less suspicion of the part played by voluntary bodies in the development of the social functions of the family; for it is assumed that free co-operation of families, through voluntary association, differs in ethical significance from the extended co-operation implied in an official communal service.

The official child welfare schemes, however, have all grown out of schemes spontaneously arising in local social groups. They have, it is true, been made formal through special

statutes; but they continue to combine the freedom and elasticity of voluntary service with the status of an official service. The usual clean-cut alternative between the voluntary and the official has disappeared. In some places, the same persons that initiated services like Day Nurseries or Play Centres have been retained as managers within the larger unity of the municipal service. To any given family the difference is imperceptible. Any common service, whether voluntary or official, pre-supposes the inadequacy of the individual family to fulfil its main purposes through its own mechanism. But to suppose that the mechanism of the family limits itself to what is possible within the four walls of a house is pure delusion. No family in any community could live for twenty-four hours on those terms.

Wherever there is a discussion about children, whether it be their early nurture or later feeding or education or medical care, there is usually someone ready to declare that social legislation of the type here discussed tends to the destruction of parental responsibility and the disintegration of the family. This, if it were true, would be a serious condemnation, even although it has not impeded, to any degree, the development of such social legislation. I believe

the criticism is due to a confusion of ideas. Civic organization is an outgrowth of the family. The purposes of the family cannot be realized except in a community where there is division of labour and social co-operation. Civic organization is one of the forms co-operation takes when it is a question of communal service. The communal services, such as hospitals, schools, and the like, are really instruments prepared to enable the individual parent to do, with social co-operation, what he as an individual could not do for his child. Accordingly, every fresh development of civic organization, such as the provisions now made for attending to the health of children, opens up new channels through which the family is enabled the better to realize its primary purposes of providing for the children adequate nurture and education. Every new facility carries with it a new opportunity for the parent. Every new opportunity develops the desire for realizing the family purposes along the lines of the opportunity provided. The desire thus created in the parent to use the common service for the benefit of his child is only another name for the awakened sense of parental duty. Hence it may correctly be said that parental responsibility is developed, not superseded, by civic organization.

Any other view seems to me to rest on the supposition that a parent is not bound to do anything for his child except what he, as an isolated individual, can do, and that he is not morally bound to use to the full the opportunities and administrative advantages provided by social co-operation. Pushed to its logical conclusion, this unthought-out doctrine ends in the idea that all division of labour, and, therefore, all social co-operation, necessarily relieves the parent of some duty to his children. Obviously this is not the case. To every new piece of social machinery created there corresponds a new parental duty. Briefly, parental responsibility includes not only what the individual parent can do for his child by his own unaided effort, but also what he has the means of doing through the common services available to him. So far, therefore, from relieving a parent of his responsibilities, the new legislation generated by the child welfare movement increases parental responsibility a hundredfold.

Whether this view be generally accepted or not, it is well to have it definitely stated. For, at one time or another in his experience, every social worker has to decide for himself whether, in extending this social organ or that, he

is not tending to disintegrate the primary social unit, that is, the family. Note, too, that I head the chapter "The Relation of the School and the Family"; not "School and Home". For the term "home" is apt to be confused with the activities possible within the mechanical limits of a house. The house, it is well to remember, is merely a focus of the family energies, a shelter, a resting-place, a temple of the family spirit. But as the human mind through the eye gathers into itself the glories of earth and heaven and loses its sense of finitude in the contemplation of the infinite, so the family within a house gazes through its windows on a world greater than itself, and realizes that its true fulfilment lies in the great ethical world within and beyond the walls of home. Between the day when the man and woman are led by forces not themselves to found a home, to the day when their children go forth one by one to take their place as citizens in the community of their birth, there is no breach of continuity, whether the purposes of the common life are realized through lesser organizations of spontaneous growth, or through the larger organizations of the cities and the nations. When families are divided from each other by stone walls, they are an

easy prey to the delusion that they are no longer part of any greater community. But from beginning to end, each human family is a new growing point of the common services, and, in co-operation with other families, attains to a richness of life not otherwise possible to it. Parental duty lies "in the nature of things". No one can say—"here it begins", or "here it ends". In the everyday life of the Western civilizations for the purpose of common service, we agree that each parent shall take upon himself the greatest individual burden that is consistent with his duty to the State; but his duty in the home and his duty beyond it are of the selfsame tissue, and until this fact is made clear in consciousness, the fallacy of making home and city alternatives to each other will continue to confuse the social thinker. At each stage of culture, the duty required of the father and mother at home will vary in amount and in kind; but, when the day comes for starting their child in life, they can use with their whole heart the systems of the common service, for these also are continuous with the service of the home. It should never be assumed that the mechanical subdivision of labour, followed by the mechanical subdivision of residence, obliterates the correlative duty of co-operation for the higher

realization of the family purpose. The family is an incipient society, and the home is an incipient city.

If this view be provisionally accepted, all the institutions here described fall into their proper perspective as functional expansions of the family.

CHAPTER VII

WHEN SHOULD A CHILD GO TO SCHOOL?

THE school, it appears, is a natural outgrowth of the family functions; but every parent must one day put to himself the question: When shall I send my child to school? He puts the question with misgiving, for he knows that the moment of parting has come. To his question no one can give an answer that satisfies him. He understands his child as no stranger can understand him; but he knows in his heart that he can lead him only a little way on the pathway of learning. And he has to persuade the mother. She knows the child's heart will break the day he enters the school door; for she has known him literally all his life, and no one else can claim that experience. It is always a difficult moment in the family when the first-born leaves the nest. The terror of that parting keeps the school question always alive, and

every mother of the generation has her own way of meeting it. Perhaps, in the end, the child solves it for himself, and goes. On the evening of the first day, he comes home a new person, and the parents, if they are wise, learn a new lesson. But in our older families, where the child is neither the first nor the second, the mother has her hands too full to think only of tenderness, and she has to think of order. Of one it is told that, when her boy ran home again the first morning, she brought him back to the teacher, flung him into the room, and said: "He's five and he *maun* bide" (He's five and he *must* stay). So have I seen the mother-cat discipline her kitten at the weaning time. It is rough work at the best; but the break has to come, and the problem is how to achieve it without a jolt.

One day we went to the Rachel Macmillan School at Deptford. It is a wonderful community. There the children themselves seek to enter, and the school age is anything from the cradle onwards. The director introduced us to one new person after another. She explained to us the striking differences in personality between one and another—the sensitiveness to impressions, the strength of will, the wealth of emerging ideas, the subtle move-

ments of thought and feeling. She showed the uncanny originality of one, the commonplace in another, the wealth of feeling in a third, and so through the endless variety of mind as it reveals itself in this garden of ideas. It is true that of our new friends some could not yet walk alone, and others could not talk, except in a subtle language that precedes our adult symbolism; but to the insight of the director, the lines of growth were already clear, and she knew how to follow, moment by moment, the ripening of the bud.

But Miss Margaret Macmillan has told her story many times to the world, and each time with a new invitation to wonder. At first, you hardly notice the place itself, for there are here no impressive buildings, no mechanisms to disturb the vision; little, indeed, but the open air and the light and some shelters to keep off the wind and the rain. But, even to live an hour here is to discover innumerable transfigurations of the commonplace into the beautiful. It is a training school, a thought-factory, a little world of suggestion. It was our first visit, and there was a light fog over the city; but it was easy to discover the direction; for, as in a light fog you look for the sun, so in Deptford you ask for the school by its name, and every one knows the way. As has been

written elsewhere: "In rearing the good race of to-morrow, the nation must look to the children of to-day." More than once, with her usual felicity, Miss Margaret Macmillan has added to the inspiration of her deeds at Deptford the inspiration of beautiful words: "Slowly, slowly the new edifice of to-morrow comes into sight—the educational edifice of the future. First of all one sees its light-glancing pinnacles, its universities thronged with youths and maidens of every order and degree, its gleaming doors on which are written the symbols of happier generations. A little later swims into the ken many a vision of noble rooms and workshops where millions of boys and girls will learn and work through the happy years of dawning youth. Yet the key to real success is not in these. The new life is not there. Eye hath not seen it as yet on this planet. For what nation has ever cared to remember in planning its systems that the revelation of life is not in the upper world of action of youth and boyhood, but in the dim under-world of infancy and sub-consciousness? Yet to include that under-world in one's plans is to plan wisely. Forgetting it, one may find that the light-glancing pinnacles are a new mirage and the stately class-rooms a new delusion."

Here, there is no question where to begin. The question is meaningless. And yet, in spite of all that these ideas teach us, the crude question of when school should begin still presses for an answer. The answer cannot satisfy; because the mechanisms we provide can never all respond to "the soft play of life".

But there are other approaches, and these it is our duty to study. Of such approaches, one has been, in some degree, worked out for us by Mr. W. H. Winch in his little book, *When should a Child begin School?*

Mr. Winch, working with an intimate knowledge of school conditions and curricula, has produced a careful statistical investigation of the "age at which children should commence their attendance at school". He says: "On the one side we have had the rule of three conclusions felt rather than expressed as an inference, that the more teaching the child gets and the sooner he begins school, the more progress he is sure to make. On the other side we have had a strong feeling, now, I think, growing in intensity and range, that attendance at school in England begins too early, and that there is an educational disadvantage in commencing so soon. I am not aware that any inquiry has been undertaken,

the facts and conclusions of which would be logically acceptable to both parties in the dispute. An English educationist turns naturally to Germany and America to see if any scientific inquiry has been made on this question in either of those countries. So far as I know, no such research has been made. There are, however, causes for this in addition to those operative in England. In the first place, school attendance is compulsory in Germany at six years of age, not, as with us, at five; and there are no municipal infant schools or kindergartens. In the United States, even in those more progressive educationally, six years is the usual compulsory school age."

It is not necessary to detail the methods of research followed by Mr. Winch, but it may be said that, in the correlation of the age at entry with the subsequent progress in school, his results are as objective as is possible within the conditions. He was here not dealing with questions of health, but purely with questions of educational advantage or disadvantage. Obviously this is the first question to study. If there is no educational advantage in attendance at school before the age of five, such attendance loses all its urgency. If there is a positive disadvantage, such attendance ought

to be checked. If there is neither advantage nor disadvantage, then the health of the child becomes the sole consideration. If there is disadvantage to the health of the child in early attendance, then early attendance may, without sacrifice of intellectual progress, be discontinued on hygienic grounds alone. For these reasons I consider that Mr. Winch's type of scientific research ought to be extended and verified by other observers. If his results be confirmed, the whole problem of children aged one to five can be tackled with less misgiving. It cannot be denied that misgivings of the detrimental effects of early education and discipline have led medical men, in many departments of medicine, to declare themselves emphatically against beginning education at the age of three or four or even five or six. It is, therefore, of primary importance to hear the conclusions of an educational psychologist whose sole interest is to determine whether any child really does benefit in intellect and character from school education begun as early as the age of three. Note, however, that Mr. Winch's problem is not, When should a child begin to be *educated*? but, When should a child begin *school*? He deals with the concrete conditions of school education in London, a specific system of education organ-

ized primarily for the development of intelligence. But even if the question is thus limited to school education, a definite result is of great importance, because it enables us either to adjust the type of school to the age of the child or to eliminate the school altogether from the problem. That is why I regard Mr. Winch's investigations as of first-class administrative value.

Mr. Winch's conclusions are, briefly, these :

" 1. That from the entrance age of three to five, early entrance confers no intellectual advantage on the child, either in his infant school work or in his subsequent progress in later school life.

" 2. That there is some reason to suppose that children who enter after five show some retardation in subsequent school progress.

" 3. That these conclusions are quite independent of the particular form of teaching adopted."

But Mr. Winch adds : " I am fully conscious that these children who enter after five are ' selected ' children. Some are weak in health, some come from very good homes and have had a good deal of instruction at home, and some have been driven into school by the compulsory attendance officers. So that I feel little confidence in any conclusion con-

cerning children who begin school, as these do, after the compulsory age. But as the proportion of children with 'poor homes' who enter after five is very small, it is probable that the whole circumstances of this group are, on the whole, above the average. If this is so, there is ground for supposing that entry after five is somewhat disadvantageous."

This carefully guarded conclusion points to the need for further investigation. A "poor home" is where, for any reason, adequate home supervision is impossible.

Mr. Winch concludes "that no advantage appears to exist in early entry so far as the subsequent attainment of good behaviour and the development of attentiveness are concerned".

The grounds for these conclusions Mr. Winch has set forth so fully that they can be subjected to the most complete scrutiny, and the methods of investigation can be extended indefinitely. The results certainly tend to confirm the opinion of many medical men. In so far as the ordinary school education is concerned, they coincide more or less with the conclusions of the Consultative Committee's Report, published in 1908. I cannot persuade myself that the range of the research is sufficiently wide to make the conclusions

apply definitely to all systems of education; but they certainly tend to show that the ordinary school is not the place, and the ordinary school curriculum is not the curriculum, for children aged three to five. It follows that if education is to begin at all, or to be effectively prepared for, before the age of five, it is necessary to devise other educational institutions.

The scientific arguments for these somewhat inconclusive conclusions Mr. Winch sets forth with much precision. Each item can be considered and decided by fresh experiment. But what it proves is, after all, only a small part of the case. In England, and since 1918 in Scotland, it has been open to any parent to send a child to school at three; but in both countries the obligatory age is five. In the development of public education it was not unnatural to open the doors to the early ages if the parents wished to send their children to school. But to anyone familiar with the invincible tendency of the teacher to teach, it was not obvious that the day-school, as developed, could fairly provide the subtle and elaborate environment needed to preserve the fluid mind of three-year-olds from a premature setting. None the less, we believe that, where the right teacher has entered in,

the nursery school, associated with the larger school, has worked the same wonders as the toddlers' playgrounds and the free kindergartens. In the nature of things, there is no reason to expect less; but the care of the pre-five infant was never a simple problem, and the skill to solve it is not universally distributed. If it were, the world would not have needed so much the brilliant *aperçus* of Pestalozzi or Froebel or the later discoverers in the world of childhood. The essential question to answer is, How shall we effect, with least disturbance to the continuity of mind, the transit from freedom to duty?

The main reason for the difficulty is that, at the earlier ages, the school must, in a much greater degree than at the later, take the full place of the family. It must see hourly to the correct nurture of the child. The teacher must nurse as well as educate, and the day is a running compromise between play and pressure. Yet, as the experience of the kindergartens proves, she can successfully direct the lines of habit, and help the individual infant to the acquisition of knowledge and the integration of character.

It is difficult to discover how acquisition so guided should interfere with the nutrition of the child, or involve any pressure of a

harmful kind. Here, it would seem, the fundamental idea is to devise ways whereby the child can convert its wishes most economically into actions that help in the control of its environment and in the realization of an articulate purpose. Theoretically, this preliminary selection of special lines of action ought to form a good groundwork for the work of his future. But, psychologically, the important thing is to conserve as long as possible the child's satisfaction in his own work. The tendency always is to over-teach, to insist instead of to watch, to press instead of to allow an action to develop. But this is the responsibility of the teacher.

Whether education conducted at these early stages does, as a fact, give better results than the older methods, is a matter for such investigations as Mr. Winch has conducted. But if we may assume that certain elementary activities can be organized to culminate, for example, in writing without sacrificing the spontaneity of the child, the age for beginning really depends on the skill of the teacher. Writing, as taught by the Montessori system, is a perfect instance of spontaneity directed to a purpose. If this or any other method necessarily involves the constant interference, repression, scolding, and discipline that very

frequently mark even the conduct of nursery schools, then, without doubt, the child is better left alone until it grows happy and fat in following its own desires. The whole value of the method depends on the ingenuity of the primary analysis and the naturalness of the ways of teaching. The first and absolute postulate is that, at least to begin with, the child's nutrition shall be promoted as much by its educational as by its spontaneous activities. At the earliest stages of all, the two should run into one. The second and equally absolute postulate is that the teacher must have the skill not to repress but to maintain an atmosphere of encouragement, for here she is superintending the growth of the will. She is watching the moment of transition from the point where the child acts for his own satisfaction alone to the point where he must act by habit with no immediate satisfaction in sight. It is true that, with the new instrument, he has awakened in him an untold joy; he will go on using it until he tires; but he will again and again return to it, and so effect the transition from the mere delight of movement to a habit of action in a field of neutral feeling. That is the primary transit in all acquisition.

The experience of the baby camps, toddlers'

playgrounds and the others, seems to show that, without sacrifice of healthy nutrition, the lines of many sound constructive habits may be laid and the pathway smoothed for the days of definite personal obligation. If this be so, the time of beginning depends entirely on the subtlety and fruitfulness of the teaching method. But if, as in many known cases, the activities of the child are sacrificed to the tidiness of the playground or the garden, or the cosmetic ideals common in mass superintendence of children, the children are better left to the scramble and grubbiness even of a second-rate playground in the street, or elsewhere. But the skilled teacher knows how to convert control from mechanical orders to organic order. The two things are poles apart.

Another test, we might, perhaps, draw from the careful researches of Dr. Cyril Burt among the London children. In his table of children passing the several tests, he includes children of three years of age.* As you look down the column for that age, you find that the six tests—pointing, two numbers, sex, surname, naming, picture (enumeration)—are passed by percentages varying from 65·6 at the lowest to 84·7 at the highest. Further, the same

* *Mental and Scholastic Tests.*

children passed the five tests for age four in percentages varying from 53·2 to 58·2. They also passed in lessening percentages eight tests for age five. Here, obviously, there is great variation in natural capacity; and if the children in such proportions can pass these "intelligence tests", it is legitimate to infer that they are already fit for education, if the correct education can be provided. In Dr. Burt's extended and subtle criticisms I have not found the point specially dealt with; but it seems to be implied. This I mention, merely because I do not wish to make him responsible for any inference of mine. But my inference seems reasonable; and from the general spirit of his investigations, I should think it not inconsistent with his scientific conclusions. The obligatory age of entry is five years; but here, among three-year-old children, there are indications that some come near the mental age of five. Similarly, many children of four approach the mental age of six. With any theory of a scientific beginning, some provision ought to be made for children of higher mental power; for nothing is more wasteful than to lose the early tide of growth. It may be, too, that some of those unequal to the three-year tests are so because of their imperfect nutrition. From the health

standpoint there is here an opening for an investigation of the home. In others, there may be disease; and the earlier this is seen to the better. Thus from many standpoints the early school offers opportunities to the responsible authority.

These considerations justify the conclusion that the age of three is not too early to begin school, if the school provided is of the right order. Such a school, equipped in the ways now understood in all good nursery schools, kindergartens, and allied schools, offers to the child an environment more adequate for the organization of his impulses towards life in a community than the casual life of the streets or the unsuperintended life of the back-courts. But even if everything that we can properly term education of the intelligence is left out of the reckoning, there is still a case for bringing the children together for some period of the day. It is a way of offering to the child something that adult companionship cannot bestow.

CHAPTER VIII

THE NATURE OF NUTRITION

HOW shall we approach the problem of nutrition? The openings are tempting and numerous. It is easy to adduce formulæ like Dreyer's, or Wood's, or Pirquet's, or other variations of the height, surface, and weight ratios; and in their proper context, all those formulæ have a high value. It is equally easy to adduce standard tables of height and weight; and these too have their value. There are also the much less definite impressions recorded in the "good, medium, and bad" of the Medical Officer's Reports; and those categories have their own value. Naturally, there is a constant search for some standard. What is a child's normal? How far does he deviate from it? Is he growing too slowly, or too rapidly, or erratically? Does he fulfil the usual sequence of physiological growth-periods? This is how Dr. James Kerr puts it: "The healthy child up till four or five is

chubby and fat; then a lean period follows for several years with the commencement of the second dentition; followed by another couple of chubby years, and again the lean and lank growth up to puberty. If these periods are remembered, no one will fall into the sad error of attempting to compare entrants with leavers by percentages of nutritional conditions, and from these figures speak of loss or gain during school life." * These are words of wisdom, and every school medical officer will see the point of them. But along all these lines we are dealing with what can be directly observed, recorded, and occasionally measured. Let us look a little below the surface.

Some time ago it was my duty to act as Chairman to a Committee appointed to inquire into the "milk standard", that is, the standards of fat and non-fatty solids to be required in good market milk. Milk is the primary food of the whole mammalian world. It has been investigated literally by thousands of experts. In our particular investigation, it seemed to me important that our recommendation should be based on the ultimate values of milk as these have, up to date, been verified by experts in nutrition. Probably, the sim-

* Newsholme, *School Hygiene*, Kerr's Edition.

plest way of proving how difficult the problem of nutrition is, and yet how imperative it is to find a solution, will be to set forth in the words of some of our expert witnesses the ascertained facts about this primary food. In this way we shall be able to understand better the significance of the numbers of observations on height, weight, periods of growth, colour of the mucous membranes, clarity and consistence of skin, dryness of hair, irregularity of nails, decay of teeth, deficiency diseases like rickets, incidence of tuberculosis, and many other conditions familiar to every student of malnutrition in children of all ages.

Fortunately we were able to secure the services of some investigators whose sole business for the time being was to find out the truth about nutrition. In this field it is so important to get down to essentials that I feel justified in making some extended quotations from the evidence. In no other way can I convey better the complications of this group of problems. Dr. John Orr is Director of the Rowett Research Institute at Aberdeen. The primary purpose of the Institute is to study animal nutrition. On the proteins of milk, Dr. Orr made the following statement : " Proteins are derived from protoplasm of living substance. All protoplasm is very much the

same. Thus the protoplasm of plants resembles in properties the protoplasm of animals. Nevertheless, there are distinct differences between plant protoplasm and animal protoplasm, and there are differences between the proteins—the basal substances of protoplasm—of plants and animals. Consequently, though two different proteins may be so very much alike that if one were given them in the form of a dry powder on a paper it would be difficult to distinguish them, the chemical construction may be different in the two cases. Might I give a simple illustration? Proteins are highly complex substances, but if you break them down, no matter where they are derived from, they all resolve themselves for the most part into about eighteen substances known as amino-acids. In something the same way as there are twenty-six letters in the alphabet, and many different words can be formed by different groupings of the letters, so these eighteen amino-acids can be grouped together to form different proteins. Therefore, it is possible to have an almost indefinite number of proteins, though they are all built up of the same few elementary substances.

"Now, if you have to build up a substance of a definite composition, and if these amino-acids are present in the proper proportions to

build up that substance, there will be a minimum of waste. On the other hand, if these amino-acids or 'building-stones' have been derived, say, from a certain plant protein, they are present in the proportions required to build up that plant protein, and thus you are using the proportions suitable for building up a plant protein to build up an animal protein; consequently, you are likely to have an excess of some amino-acids and probably a deficiency of others. For instance, if the amino-acids be named A, B, C, D, and so on, and the plant protein contains one of A, two of B, three of C, and twelve of D, and you want to build up an animal tissue that contains two of A, two of B, three of C, and twelve of D, you would need two plant groups to make one animal group and there would be a surplus of B's, C's, and D's. The reason why milk proteins are superior to almost all others is because they contain all the amino-acids necessary, and contain them in the proportions required by the young growing animal. . . . If you take an animal that is growing, and if you feed it with so much protein, the protein absorbed can be used for repair. What is not used for repair can be used for growth. If you feed equal amounts of different proteins to the same animal, the more the protein is

adapted to the requirements of the animal for repair and growth, the more completely utilized it will be. A perfect protein would give you nearly 100 per cent. utilization. The more imperfect it is—in other words, the less closely the protein is adapted to the requirements of the animal—the greater in amount the loss would be. Workers have conducted experiments at various places and tried different groups of proteins, animal proteins, plant proteins, and so on, and the results of all these have been in broad agreement—that is, that for a growing animal the proteins in milk surpass in value those from any other source, as is shown by the fact that you can get a higher percentage of them retained in the animal body."

The retention of proteins of different kinds varies considerably. For instance, where milk is the source of the protein, the animal may retain for growth 63 per cent. of the protein; where oats are the source, 30 per cent.; where wheat is the source, 25 per cent. "The only proteins that show something like the high value of those of milk for flesh and blood formation are those of flesh and blood themselves. The proteins of milk have thus a special value due to the fact that they are prepared for a specific purpose, viz. to meet

the protein requirements in the young animal in the first stage of its growth. Their specific nature is further shown by the fact that casein, the chief protein of milk, occurs nowhere else in nature." *

But this is only one group of milk elements ; there are also the salts. "Though they yield no energy, these are essential parts of the structure of living tissue where they play an all-important rôle in practically every vital process. That they are absolutely essential to life is shown by the fact that animals live longer in complete starvation than if given food from which the salts have been extracted."

Even from these statements it is possible to make some inferences. Where the proteins of the food are not of the right kind, or where the salts are incorrect either in nature or quantity, the child's nutrition necessarily suffers. At once the problem arises—Do the foods habitually consumed provide in proper balance all those minimum essentials to healthy nutrition and growth ? If these elements in the diet are wrong, it matters little whether the height or weight correspond to any con-

* *Inter-departmental Committee on Milk, Evidence.* Stationery Office Publication.

ventional standards; the child will certainly suffer.

But there are other elements equally important. There is the fat. Fat, it is now known, is essential to growth. Whether this fact is due to a special condition of the fat molecule itself or to the presence of special and separable substances may be left here undecided; but the fact remains that, without fresh milk-fat, the child suffers. On this, Dr. Orr said: "From the point of view of the material requirements of growth, the proteins and the salts are more important than the sugar and the fat." But he added: "For a young infant the percentage of fat present is less important, but I want to make clear that there are certain properties in the fat that are at present being investigated and it seems that if these were cut off the infant would not grow. . . . There appears to be no constant relationship between the amount of fat present and the amount of this growth-promoting substance or property."

In this turmoil of elusive elements, is it a wonder that, under the stresses of inadequate or improper feeding, the children of the rapidly growing ages should show disturbances of nutrition? Much detail about particular in-

gredients like calcium, phosphorus, and iodine could be added; but these general statements are enough for the immediate purpose. In the sections on rickets and teeth, the effects of the accessory food factors (or vitamins) will be made clear.

When, therefore, a child is weighed and measured with a view to testing his nutrition, the criterion at its best must be considered only a rough practical expedient. To think of it out of relation to the extraordinary subtlety and complexity of animal metabolism is in the highest degree unscientific. Nevertheless, the criterion has to be used as one of the easily applied methods to determine whether a child is going forward healthily on his proper course or requires special medical attention.

Subject to these large qualifications, we may now approach the problem of nutrition from the other end, namely, the actual results found among children carefully observed and measured.

CHAPTER IX

THE MEASUREMENT OF NUTRITION

"IN the growing infant" writes Dr. James Kerr "nutrition is the most important thing; if that is unsatisfactory, every other consideration must be pushed aside until it is righted. Questions of education are but vanity; and to raise thrift or self-help into discussion is hypocrisy if those things stand in the way of remedying ill-nutrition in the child." *

These are the words of a man whose professional life has been largely spent in the superintendence of growth. He also says: "The only reliable way of assessing nutrition is from the estimate built up by a trained observer during a clinical examination. Measurement and such mechanical means may serve for groups, but fail signally for the individual, and it is only by application to the individual that any estimate becomes of value.

* Newsholme, *School Hygiene*, Kerr's Edition, p. 196.

This tends to be forgotten in the heaping up of meaningless and unmanageable piles of figures, which have become fashionable and give a spurious appearance of definite and accurate results to official reports."

This criticism is not unnatural where the primary interest is the clinical examination of the individual; yet the weighing and measuring of children has its definite uses, even clinically, and this Dr. Kerr would be the last to dispute. It should at once be conceded that no sets of standard tables and no variety of cunningly devised formulæ can, in the individual case, be a substitute for the physician's training and skill. In his discussion, Dr. Kerr himself, out of a rich clinical experience, gives many points to guide the School Medical Officer. As among the most practical methods for a first rough classification, he recommends the Brighton system. "The average weight for each height has been tabulated, and any child not up to the weight for its height is watched; it is taken that it requires feeding more than a child below both average weight and height for its age." This point is dealt with, from an independent standpoint, by Professor Clemens Pirquet in a short contribution to *A Review of the Work of the American Relief Administration in Austria, Year 1922–3.*

"Boys aged 12 with a height of 120 centimetres were 2·1 kilos. heavier than boys aged 6 of the same height, while with girls the difference was 2·5 kilos." Obviously the relation of age-height to age-weight is as important as the height-weight ratio by itself.

In a given case, there are many things that cannot be expressed in numbers, and yet judgment on them must be made, and treatment must follow the judgment.

How difficult it is to bring the clinical record of nutrition into consistency with the records of height and weight may be judged from this example. "A careful study of the figures relating to height, weight, and nutrition in the medical reports of two of the largest industrial areas in Scotland brought out the following interesting facts. In one area there was an improvement in the average height and weight of the groups of children examined as compared with the previous year, and among the same children a recorded increase in the number with defective nutrition. In the second area exactly the reverse was found, namely, a fall in the averages of both height and weight and an improvement in nutrition. While these facts appear anomalous, they are referred to merely as an illustration of the

difficulties one meets with in an inquiry of this nature."

From many standpoints it is eminently desirable to establish some simple, practical test of physical fitness, even if, in actual use, it enables the medical examiner only to separate roughly the normal from the abnormal. In recruiting for school, as in recruiting for industry or military service, it is an immense economy to be able to establish even a first rough classification. It may very well be that the skilled observer may obtain results better by ordinary clinical observation than the amateur with a mechanical formula; but this does not destroy the value of the tests.

They are to be regarded as, in the first instance, single-observation tests. To judge by the results of the recruiting medical boards, many men found at the first examination to be "under par" will, after carefully supervised feeding and training, become fit.

When we reflect on the endless variations in the social environment, we need not be surprised that, in any given group, the formulæ do not produce uniform results. But they are not, therefore, useless. On the contrary, they may be used to establish more refined degrees of fitness, and guide the examiner towards good lines of treatment.

It must be remembered that the organism is always in a state of flux; that no two persons come to the scales or the measuring-rods with precisely the same history of nurture; and that variations on the calculated standards must be judged in the light of all the facts.

The formula used by Dreyer in constructing his tables for the "Assessment of Physical Fitness" did not originate in the examination either of school-children or of adults; it arose out of a special research into "the blood volume of mammals as determined by experiments upon rabbits, guinea-pigs, and mice; and its relationship to the body weight and to the surface area expressed in a formula." It was there shown that the body weight had a definite relationship to the body surface.

For generations, vital capacity, that is, the difference between the deepest inspiration and the deepest expiration, has been used as a valuable index by itself; though perhaps too much has been expected of it. But Dreyer brought it into relation with the weight and length of the body and with the chest circumference. Whether the results obtained in given groups are any more reliable than those obtained by the height-weight-age standard is a matter for experimental investigation;

but it may fairly be accepted that, when four such fundamental measurements as the weight, the body length, the chest circumference, and the vital capacity are brought into definite relation, the result should give a valuable standard. In the results recorded by Dreyer himself, the proportion of correct inference from those four measurements is certainly very striking. No doubt complications enter when he has to divide the individuals into classes A, B, and C; and for those classes certain sub-standards have to be established. Such standards must rest to a certain extent on direct clinical observation and on other general tests of fitness, but, when all is said, if the four-measurements' formula does not give results that can be regarded as a check on general clinical observation, the formula must be revised and its weak points amended. Obviously, it is well worth while to obtain a working formula that shall have a reasonably definite relation to clinical observation.

Probably, in the case of children, where the rate of growth is always a disturbing factor, a formula may not be of so great a value as it is in the fully grown; but I cannot help thinking that the results already obtained by Dreyer himself and others in the application of his formula justify more extended experi-

ment. There is no doubt that the vital capacity is peculiarly sensitive as an index of "under par" conditions, whether these be due to immediate illness or to past illness. By some observers it is maintained that there is no advantage in the length of the body (torso) as against standing height; this, too, is a matter for continued experiment, not for mere manipulation of statistical quantities.

In Britain, during the War, the standard finally accepted for recruiting was devised by Sir Arthur Keith, F.R.S., and based on the stature of the "well-known thousand Cambridge students". The "standard thousand" included types of the best quality of men; and, in practice, the deviations from the standard occurred on the whole where they might have been expected. By Keith's standard, it was found that there was a striking difference between the Leeds men and the Sheffield men. "For some 12,000 Leeds men, the average index of fitness was found to be 65·1; for some 13,000 Sheffield men, the index was 79·08. The Sheffield men were found in physique 14 per cent. better than the Leeds men. Yet even the Sheffield men were ten points short of 'what a healthy sample of British people should yield'. The differences were

attributed to the differences in occupation."

These details are enough to show how important it is to obtain some working standard that will enable the examiner to make a rapid first classification of candidates.

CHAPTER X

CLINICAL TESTS OF NUTRITION: RICKETS

BY his recent researches on oatmeal, Professor Edward Mellanby has shocked the Scottish mind. There seems to be something peculiarly Scotch about oatmeal. Perhaps Dr. Samuel Johnson had something to do with it; for he declared in his Dictionary that oats were used to feed horses in England and men in Scotland. Perhaps, too, Sydney Smith's suggested motto for the *Edinburgh Review*, "We cultivate literature on a little oatmeal," had its effect. This witty twist of Virgil's phrase helped the proud oatmeal myth. Scotch porridge is not a mere preparation of a cereal; it is the symbol of a cult. Nine Scotchmen out of ten will tell you that they were brought up on oatmeal, especially if they have been country-bred. They will occasionally admit that there were other things: fresh milk, butter, eggs, curds-and-cream, cabbage,

potatoes, Swedish turnip, and some other vegetables. A Canadian dental bacteriologist, who had some part in an extensive research into rickets and scurvy, was staggered to be told that, if he wanted men of well-grown bone and magnificent muscle, he should go to the Highlands of Scotland to find them ; for there the people were " brought up on oatmeal ". He went to see for himself, and, on his way south, he explained to me that oatmeal was undoubtedly a staple part of the diet, but it was taken along with the other foods I have named. This is the truth.

In substance, Professor Edward Mellanby in his latest researches on " experimental rickets " has said no less.* What he does is to drive home by test after test the importance of *balance in diet.*

" Investigations carried out during recent years on the subject of diet " he writes " have not only brought to light the importance of quality of the food, but have also emphasized the necessity of balance among some of the essential constituents. This need of balance of food-stuffs depends upon the interaction of

* *Effect of Cereals and their Interaction with other Factors of Diet and Environment in Producing Rickets,* by E. Mellanby. M.R.C. Spec. Rep. Series, No. 93.

different dietetic factors, which is of such a nature that the alteration in the amount of one often necessitates change in another before normal development of function can result."

In this particular research, he deals with one aspect of this problem, the interaction of food factors on bone calcification.* "The conclusion to be drawn from this series of experiments is that the rickets-producing effect of the different cereals is in the following order: oatmeal (most), barley, polished rice, whole meal and white flour (least)." To counteract this effect, it is essential that the diet should contain certain ingredients named, provisionally, anti-rachitic vitamins. The name is not essential; the theory is still less so. Broadly, the fact is that, where a substance containing this vitamin, e.g. cod-liver oil, is given, the cereals do not produce rickets. He also shows, what was demonstrated in the Vienna researches, that the ultra-violet rays tend also to counteract the rickets-producing effect of cereals.

This is all very recent, but it need not disturb the Scottish or any other mind; for

* "Calcification" is that physiological process whereby bone and teeth—originally soft tissues—extract salts of lime (*calcium*) from the blood, and deposit these within their own structure.—*Editor.*

it is only a step forward in justifying scienfically the universally accepted view that cereals alone do not constitute an adequate diet. Scotch haggis, of course, comes into the picture, for it has a base of oatmeal; but to suggest that it is made of nothing but oatmeal would horrify the skilled blenders of its many ingredients. But Professor Mellanby meets the challenge with perfect frankness. "There is present" he writes "in the one cereal tested, viz. oatmeal, a chemical grouping which, after digestion and absorption of the grain, is capable of interfering with bone calcification. After many attempts had been made to explain this action in terms of known constituents of cereals and to find out the nature of the causative agents, some evidence has finally been obtained which suggests that a substance in oatmeal which interferes with the laying down of calcium in bones is associated with the fatty acids. This substance can be obtained. . . . Further work is necessary to establish the nature and properties of this cereal constituent and also to determine its mode of action." And again he says: "The challenge, for instance, immediately may be made, 'If oatmeal is so detrimental to bone formation, how is it that fine races of men have been reared on diets of which this cereal forms

a large part ?' If these results apply to man, as they almost certainly do in the case of the teeth and probably, therefore, as regards other tissues, then it is highly probable that the diet of these people also included much of foods rich in anti-rachitic vitamin, as for example, milk, eggs, fish of the fatty variety, including herring, salmon, mackerel, etc. In tropical countries where cereals such as rice, maize, millet form a large part of the diet, the sunlight is no doubt also an important factor in antagonizing their detrimental influence. Whether these answers are entirely satisfactory or not, only further investigation can determine, but the present work does show that perfect bone formation can be obtained even when large quantities of oatmeal are eaten if the rest of the diet be adequate. . . . Apart from extreme malnutrition, however, it would appear not improbable that in this country where the average diet is either deficient in or contains a border-line quantity of anti-rachitic vitamin and calcium, and where sunshine is negligible, the ingestion of oatmeal during pregnancy and lactation of women and in growing children does much harm."

These carefully guarded statements, which are grounded in actual and repeatable experiments, may or may not be accepted as

final; but any scientific answer must be made not in large-scale assertions but in more extended research. These and other researches of Professor Mellanby and the many others he names are alone enough to show how subtle and difficult the problems of nutrition are. It is, however, imperative that those problems should be solved; for otherwise the superintendence of growth will continue to be faced with endless problems of malnutrition, and the diseases flowing from it.

Rickets, therefore, may fairly be taken as one of the most subtle tests of the nutritive balance of a diet. The theory that a diet deficient in some anti-rachitic substance inevitably produces rickets has been subjected to a very severe test in the great research conducted by English investigators at Professor Clemens Pirquet's children's clinic in Vienna. The results are recorded in one of the special reports of the Medical Research Council.* In this investigation, based on an enormous number of individual observations, the results are such as to compel either acceptance or verification by further research. Professor Pirquet himself writes a preface to the report,

* Special Report Series, No. 77, *Studies of Rickets in Vienna*, 1912–22.

and states that the evidence finally produced by the English investigators converted him from his previous belief in the infectious nature of rickets to the belief that rickets is a deficiency disease. He states that a comparison was made of the progress of infants on a diet rich in fat-soluble vitamins with those on the diet usual in his clinic. "Of a large series of young infants, maintained under exactly similar conditions of excellent general hygiene, rickets developed only in those who received the diet poorer in fat-soluble vitamins, that is, cod-liver oil. Similarly, of children admitted with rickets already developed, healing in winter was only observed in those who received the cod-liver oil or light therapy."

He concludes that the production of experimental rickets in animals has a perfect analogue in the conditions determining the occurrence of rickets in the human infant. "Never in my life have I seen such ideal results in infant wards. Especially in summer and autumn was one struck by the good colour of the children, who were round and plump and good-humoured. Although all were artificially fed, they looked like breast-fed infants enjoying the care of a solicitous mother." This result he regards as being due to a "diet correct both in quality and quantity, accom-

panied by good nursing and general hygiene".

He goes one step farther; he says that "the British workers succeeded, with the accuracy of a laboratory experiment, in a city where rickets is extremely prevalent, in maintaining a number of artificially fed babies free from the disease, and further, in the same wards, were invariably successful in healing children admitted with rickets already developed. With this the chain of evidence appears to me to be complete that animal experiments on rickets are applicable also to man, that rickets is a disease of nutrition, and that deficiency of fat-soluble vitamins in diet is an essential cause of the disease."

Coming from a man of Professor Pirquet's competence, this pronouncement is of the highest importance. In a disease so widespread, there are endless differences of detail to be criticized and adjusted. The relative values of the accessory food factors and the varieties of light therapy in the prevention of rickets or in the cure of it still offer a large number of unsolved problems. But for practical purposes, one conclusion may now be taken as established: The primary condition of healthy growth in infants is a correctly balanced diet, and the nature of this balance is clearly indicated in the Vienna investiga-

tions as in many others. It may be profoundly difficult to determine which of the subtle ingredients produces the best or the worst effects; but of the effects of cod-liver oil, a typical anti-rachitic substance, no investigator has any doubt. Where cod-liver oil or its equivalent is present in the diet and, particularly, where it is supplemented by correctly adjusted light treatment, rickets does not occur. This broad generalization is of immense value as a verified groundwork of practical dietetics.

But to secure to every member of the infant community a diet adequate in calcium, phosphorus, and the essential accessory food factors is an administrative problem of enormous difficulty. Over twenty-five years ago, the Medical Officer of Health of Glasgow conducted a group of Medical Officers of Health through some of the worst areas of the city. Over and over again the remark was made, particularly by the English Officers, that they had never seen so much rickets in their lives as they had seen that afternoon. To-day cases may still be seen by the score in Glasgow and many other cities; but there is now ground for the hope that, by steadily working forward along the lines opened up by the many investigations,

this and the next generation will show a material reduction in at least one great disease of nutrition.

But the condition of the children is not the whole case. When some of those infants become mothers, the deformities due to their early rickets present a lamentable number of problems in gynæcology. Not long ago, a surgeon in one of the large poor-house hospitals showed me three children saved by Cæsarean section : mothers and children preserved alive. In one instance, the mother had undergone this terrible experience for the second time. In one hospital, three cases had been operated on in a single week. From the surgical standpoint, these children are a triumph of method and skill. But in every case, the date of the true remedy lay more than twenty years back. It is easy to say that these cases should not occur. They should not. But what an immense field of labour lies in front of preventive medicine ! Yet here, as those splendid reports of the Medical Research Council show, research leaves no room for despair. There is no finer feature of medical service than the numbers of skilled clinicians, surgeons, and investigators now dealing with a problem affecting, directly or indirectly, hundreds of thousands of the city dwellers.

CHAPTER XI

CLINICAL TESTS OF NUTRITION: TEETH

ALL nations recognize the importance of the teeth in the human economy. The problems centred round them are of primary concern to every civilization. As yet, solutions are sadly to seek. But those problems are very definite; the treatment of teeth is always urgent, and here I should like to indicate some of the factors that must be considered.

Recently I had the privilege of hearing one lecture of the admirable course provided by the Dental Board. It was to me a great fascination to hear from Professor Fawcett, in a lecture that was itself a model of exposition, the latest science on the growth of the bones round the mouth, and thus to be enabled to realize more intimately the scientific groundwork of all good dentistry. The delicacy of the embryological detail seems very far

away from the rough work of administration and the organization of good dental service. Does it need all these years of intricate biological, and anatomical research to make it possible for the dentist to do his work with intelligence? To this the Dental Board gives an emphatic "Yes". And they are right. When a great craft like dentistry reaches the pitch of technical excellence that now marks it in every department, nothing short of the best science is good enough to constitute its groundwork. For my part, therefore, I welcome on every hand all the lines of research now opened up with the object of illuminating for us the various relations of the teeth in the human economy: their embryology, their physiology, their pathology, and their social economics.

It would be easy to plunge at once into the causes of decay of teeth; but all I am here concerned with is what significance the recent researches have for the practical administrator in his effort to control dental hygiene. Theory and practice are both of immense importance; but, as the late Dr. Charles Mercier once said to me, "A good botanist may be a duffer at raising cucumbers."

Let us meanwhile steady our minds by a few actual facts. In this, as in the other

references, I confine myself to Scotland; but England furnishes similar figures in abundance. Eight years ago Dr. Lewis Cruickshank, who was then Medical Officer of the Scottish Education Department, collated the facts about defective teeth in school entrants, children of about five years of age. On the basis of five typical burghs and ten counties, he found that, in the burghs, 55 per cent. of the school entrants had one to four bad teeth; 27 per cent. had five or more bad teeth—giving 83 per cent. in all. In the counties, 38 per cent. of the entrants had one to four bad teeth; 25 per cent. had five or more bad teeth—63 per cent. in all. There is here a great difference between children of the burghs and the children of the counties; but in both cases the percentage showing decayed teeth at the age of five is enormous.

Dr. Cruickshank stated that "It is probably a conservative estimate to say that 70 per cent. of all entrants suffer from defective teeth, and that at least 25 per cent. of them have teeth in a very defective condition. This would mean for the whole of Scotland that at least 57,000 children begin school life every year with their teeth in a defective condition, and that 20,000 of them have more than five teeth in a state of decay. We have so far no

means of estimating the amount of suffering and disturbance of nutrition and growth that this gives rise to, but it must be very considerable".* "There is" he adds "no reason why children should ever suffer from toothache, etc."

These appalling figures, be it noted, concern only children of about five. In the *Fifth Annual Report of the Scottish Board of Health* (1923), occurs the following: "Of the school-children examined in 1923, 52·3 per cent. had from one to four teeth, and 13·3 per cent. had five or more teeth, in a state of decay—a total of 65·6 per cent. These figures were based on an examination by the medical officers without the use of special appliances, and there is good reason to suppose that a more thorough examination by a dentist would have revealed an even more unsatisfactory state of affairs. But on the examination by the medical officers, the problem of dental disease is seen to be formidable enough. It will be observed that the number of children with defective teeth exceeds by some 17 per cent. the number of all other ailments taken together. When the two percentages (65·6 and 48·3) are added together, the actual number of defects con-

* "Scottish Mothers and Children," *Report to Carnegie United Kingdom Trustees*, p. 230

siderably exceeds the number of children examined".

When it is understood that the number of children in average enrolment in the 3,246 State-aided schools in Scotland is approximately 867,000, the figure 65 per cent. has only too obviously a serious social and economic significance. Whatever be the theory of dental caries, or other dental disease, the practical work before us is enormous.

If we are to understand the relation of nutrition to teeth, we must understand first the embryonic nature of a tooth. From this point of view, the lectures organized by the Dental Board are of the highest value. They have now been published in a separate volume.

The three primary parts of the tooth are the enamel or crown, the dentine, and the pulp. The enamel originates in the epidermis; it is, in fact, like the hairs and the nails, a highly modified variety of the upper skin. The dentine, originating from an embryonic layer called the mesoblast, is essentially a bone; it is formed and nourished in the same way. The pulp is a highly specialized sensory end-organ of the nervous system.

What precisely happens when the crown of enamel is laid down I am not competent to say; but the formation of a tooth within the

dental sac in the gum is a process involving such delicacy in the inter-relations of the nervous, bony, and epidermal structures, that it is reasonable to assume that malnutrition affecting one tissue necessarily affects all the others. Later in life, when the tooth is fully formed in the jaw, when the pulp is partially calcified, and the cavity more or less filled up, and when the tooth becomes in some degree, perhaps altogether, continuous with the jaw, the tooth might be regarded as either a solid foreign body embedded in the gums or an attached piece of the skeleton. But, in its early stages, the tooth is an infinitely sensitive growing structure, and responds as readily as hair and nails to every alteration in nutrition. This hypothesis may, I think, be accepted as verified.

The effects of syphilis need only be mentioned; they are familiar to every one concerned with teeth. Equally, the gross effects of scurvy are manifest. But, as I have pointed out elsewhere, if there is any meaning in growth at all, there must lie between the gross end-products of scurvy and the first deviations from healthy metabolism, a whole series of conditions that cannot, perhaps, get definite names as diseases but are certainly real. This has been more or less verified.

Much evidence to the same effect is recorded in the reports of the Medical Research Council. The teeth begin to be calcified about the fifth month of pre-natal life. It is easy to understand that all embryological structures may be affected by substances conveyed from the mother's blood to the blood of the embryo. Whatever affects the mother for evil may ultimately affect her child for evil. There is nothing extravagant in supposing that, in the process of rapid growth, the young tooth is as sensitive to maternal errors of nutrition as every other tissue is. If the mother's diet is deficient in calcium and phosphorus, we should not be surprised to find irregularities in the proportion of calcium deposited in the embryonic skeleton, for the mother's body is the sole source of the child's calcium. It may be, as has been pointed out by Mrs. Edward Mellanby, that the calcium of the mother's skeleton may be sacrificed for the nutrition of her child, and it is quite conceivable that, without renewal of her own calcium stores, the mother might be able to furnish adequate calcium for her child.

"It is very important that the mother's milk contain sufficient amounts of vitamin A; this is attained very conveniently by giving the mother cod-liver oil. A baby six weeks old, whose growth had stopped, was completely

restored as soon as the mother began taking one tablespoonful of cod-liver oil three times a day." *

At one of the Poplar Child Welfare Centres, Dr. Waller showed me a baby that refused to take the mother's breast, although she had abundance of milk. He went straight to the source of the trouble. It occurred simply from a mouthful of decayed stumps. In cases he has published, he has shown that when the stumps are removed, the infant again takes the breast, and growth proceeds as before. If the nutrition of the suckling is so readily affected, the nutrition of the embryonic tissues, including the incipient teeth, is much morelikely to be affected by the condition of the mother.

The point to be emphasized is that the tooth is not an isolated structure, but at every stage of growth shares, like other tissues, in the general nutrition. If this be so, the problem of the teeth is only one among the many problems of nutrition and growth. The association of defective teeth with rickets is, therefore, only a special case among many others. It would be an immense surprise if a disease like rickets, which affects the whole process of calcium metabolism † in the building

* *Phys. Abstr.*, ix, May, 1924.

† See note, p. 120.

up of the skeleton, should leave the teeth unaffected. The process of calcification does not differ in its essential nature from one bone to another, but there must be differences in the process of calcification between an epidermal structure and a bony structure. Differences doubtless can be shown ; but it is difficult to imagine that the process of calcification, however specialized in each separate calcifying tissue, stops in one tissue and at the same time proceeds in another. To come to closer quarters with rickets, Korenchevsky concludes : " The presence or deficiency of antirachitic factor and calcium salts in the mother's diet during conception, pregnancy, and lactation control, to a considerable extent, not only the general nutrition of the offspring, but particularly its skeletal development and the eventuality of the appearance of rickets." *

In what precise way calcification of the teeth is affected by variations in nutrition or diet is a matter of detail. It may well be that there is irregularity in the laying down of enamel, or perversion in the growth of the dentine, or atrophy of the pulp. These are matters of fact to be determined by research.

When, therefore, Professor and Mrs. Mellanby

* *M.R.C. Special Report Series*, No. 71, p. 160.

put before us certain definite results on the relation between nutrition, rickets, and denta deficiencies, they are in line with several other researches, and their results need not strike us as strange.

Here it is impossible to escape some mention of vitamins. It is perhaps a pity that thinking in this region of elusive substances has hardened around a single word. But scientifically the word is a provisional counter in the investigation. It may be a name for many different substances or for many different conditions of well-known substances. In either case it helps towards a definition of a difficult group of problems. As yet, we know very little for certain about the precise nature of the metabolic* changes which calcium undergoes in the body, and yet these are bound to affect the teeth. We know little about iodine as affecting or affected by nutrition; very little also of the effects of the thyroid and parathyroid† glands

* "Metabolism" is the technical term given by physiologists to all those changes which matter undergoes in the living tissues. It does not include the chemical processes of digestion, but it refers to those involved in assimilation, nutrition, and excretion.—*Editor.*

† The "thyroid" is a glandular mass resting on the larynx in the front of the neck. It has no functional duct. It manufactures from the blood an

on the metabolic role of iodine and calcium. In a region where so much is unverified, dogmatism has no place. It may, however, be taken as proved that very slight alterations in the diet may cause very great alterations in the process of nutrition. This has been verified in many researches, and not least effectively by Professor Mellanby's researches on rickets.

It may, then, be assumed that certain specific alterations in diet invariably result in certain specific alterations in the body tissues. This general proposition is hardly open to dispute. Professor and Mrs. Mellanby go much farther. In a lecture delivered before a division of the British Medical Association in March, 1924, Professor Mellanby says: "It has been shown by M. Mellanby that the structure and arrangement in the jaws of teeth of animals depend largely on their nutrition during the period of development, so that

internal secretion (thyroxin) which contains iodine. This complicated substance circulates in the blood, and influences the nutrition of the brain and the skin and its appendages.

The "para-thyroids" are small glandular masses embedded in the thyroid, whose functions are not fully understood. It is probable that their internal secretion has something to do with the capacity of the body to deal with calcium.—*Editor.*

it is now possible to produce almost any kind of imperfection of the teeth by arranging the diet of puppies. Here again a fat soluble vitamin plays a powerful part, and those substances containing it, such as milk, egg-yolk, cod-liver oil, suet, green vegetables, all favour the production of perfect teeth, while cereals, and especially oatmeal, tend to the production of badly formed teeth."

It has long been accepted that irregularity in the surface of the teeth means greater liability to the formation of carious spots. This fact is independent of any theory as to deficiency diets. But if it be true that teeth are so affected before eruption that the enamel is irregularly related to the dentine or otherwise imperfectly made, the erupted young tooth is likely to be more liable to attack merely on account of the microscopic irregularities of the surface. But in this there is no contradiction of the fact that the initiation of caries is due, as has been maintained, to the fact that the lactic acid from the sugar or starch of the food causes ultimately a breach in the enamel. Even if we accept this, the question still remains whether the resistance of the enamel to the occasional acid varies in correspondence with internal nutrition. The balance of evidence seems to me to be rather

in favour of the hypothesis that the resistance of the enamel does, in some degree, vary with the person's diet. On the other hand, there is little doubt that lack of care of the teeth may result in caries of the best teeth.

If, however, Mrs. Mellanby's results are verified, and it is finally shown that good diet results in the formation of better milk teeth, Professor Mellanby may be justified in saying that, "If this be true, the first method to be employed to reduce the scourge of teeth-defect in this country is to improve the formation of children's teeth by better feeding of the mother during pregnancy and lactation, and of the children so long as the teeth are being calcified—that is, for the first eighteen years. Better feeding means the greater consumption of such food-stuffs as promote good teeth formation, and the diminished consumption of food-stuff antagonizing this development. These experimental results have completely changed the point of view as to the cause of dental defect, for previously all attention has been directed to the action of bacteria and their end-products externally on the teeth, and the toothbrush has been the great stand-by. It has proved but a bruised reed." Whether we accept this sweeping conclusion

or not, the recent investigations constitute a challenge that cannot be declined.

As a supplement to this statement, I may emphasize once more the value of the teeth as indicators of general nutrition. Anyone familiar with the clinical course of infectious fevers knows how readily the nails show alterations in metabolism. Similarly, the nails show by their cross and vertical ridges an extraordinary sensitiveness to periods of nervous strain, or stress, or exhaustion. In fact, one can often read from the nails the strain-history of the previous four or five months. It is probable that, if we could make the necessary observations, the teeth would show similar changes. Dr. Lawson Dick says: "In cases of acute illness, especially fevers, the finger-nails are apt to show grooves marking the state of depressed growth of the cells of the bed of the nail during the progress of the disease. In the case of the teeth, a groove more or less broad or even a succession of grooves, with healthy enamel in between, may mark attacks of grave illness in the child. Frequently, without a history, a shrewd guess can be made at the period of the occurrence of some serious illness by the part of the enamel of the teeth which is affected. But it is usually a grave and prolonged illness

which leaves this mark, more especially measles followed by whooping-cough. Scarlet fever is less likely to have this effect." There are, no doubt, other factors, but these are enough to illustrate the point. As to nails, I can confirm these observations extensively; as to teeth, I inferred such variations, but I have never taken occasion to verify their occurrence. It is, therefore, all the more interesting to find an observer like Dr. Dick adducing so striking a verification.

The administrative problem facing a public dental service is now capable of being stated in general terms. Such a service must be related to the work of general medicine. It must take account of the pre-natal nutrition of the child. It must also take account of the nutrition of the suckling, and this means also care of the nursing mother. With these basic requirements well provided for, a dental service could work marvels in our community within a few years; but let it be stated with emphasis that the care of the teeth involves the care of the whole organism from conception to adult life. There cannot be good teeth unless the nutrition of the child is good from conception onwards; there cannot be good nutrition of the individual unless the teeth

are kept sound. Here I have made one assumption : I have assumed that throughout life we depend on our own teeth. This is a false assumption ; but it ought to be true. For the present, we have to depend either on the teeth we grow or on the teeth we buy.

CHAPTER XII

THE BRADFORD SCHOOL FEEDING EXPERIMENT

DR. RALPH H. CROWLEY, late Medical Superintendent, Bradford Education Committee, arranged an important school feeding experiment in 1907. It is one of the few school experiments conducted with strict regard to social and administrative conditions. It could not have been conducted at all except in a well-organized community. The Report was published by the City of Bradford Education Committee in 1907. After eighteen years, it still forms an excellent groundwork for the practical study of the feeding of school-children. In this, as in many another field of activity, the city of Bradford took a line of its own, and this experiment, like some others, deserves the study due to pioneer work. To-day, perhaps, slight modifications would be made in the various diets designed; but that is a matter of minor importance. The essential

thing is that the diets were based on the best standards of quality and quantity then available, and the results were sufficiently exact to warrant certain conclusions.

The object of the experiment was entirely practical. Thirty children from one school in one of the poorest quarters of the city and ten from an adjacent school were selected out of Standards I to IV. "The children most apparently in need of meals were chosen, though a few were included primarily on the ground of the then particularly poor circumstances of the family. In the majority of the cases, either the family income for one reason or another was very irregular, or the mother went out to work, or the family was a large one; but in one or two of the cases the circumstances were comparatively good." "As a control", sixty-nine children, as comparable as possible with those being fed, were selected from the same school and from two adjacent schools, where the poverty conditions were also as comparable as possible. "So far as size was concerned, these children may be considered satisfactory for comparative purposes, since their average weight closely approximated to that of the children fed, viz. 21 kilos (46¼ lb.) as against 22 kilos (48½ lb.)." In the interpretation, allowance was made for the fact

that the increase in the weight of children normally varies greatly at different seasons of the year; that the increase in the weight at any given season fluctuates sometimes, comparatively, even from week to week; that the provisional increase in weight varies with the age of the child, or rather with the weight to which the child has already attained. The children experimented on were weighed three times during the five weeks preceding the starting of the meals.

The meals were constructed according to the standards of the American researcher Atwater. They were worked out in detail by the superintendent of cooking. Breakfast consisted every day of oatmeal porridge with milk and treacle, followed by bread and margarine or dripping, with milk, hot or cold, to drink. "It will be noticed that oatmeal porridge was given to the children every day. I ascertained from the children that only one of them was in the habit of eating porridge, and he was a Scotch child. At the first breakfast thirteen of them refused to eat it; the next day there were only two, and from that day it was eaten and enjoyed by all. It was originally intended to have varied the diet for breakfast; but, on any occasion when this was done, the children were so disappointed at having no porridge

that practically no alteration in the menu was made. A more satisfactory breakfast from the food value point of view probably cannot be given for the money." The dinners had to fulfil certain conditions: they had to be practical as regards their preparation and serving; they had to be up to a certain standard in the proportion of proteins and fat; they had to cost only between a penny and a halfpenny for the material used; and they had to be such as would be enjoyed by the children. The superintendent of cooking prepared the menus for seventeen dinners fulfilling these conditions.

With the detailed criticism of the amounts of protein involved in the diets, we need not here concern ourselves. There is much controversy about quantities; but, in the light of the most recent researches, quantities, though far from unimportant, must be guided by the results obtained in the investigation of the "accessory food factors". The value of the experiment for practice is this: *it forms as nearly as practicable within administrative conditions a differential experiment on two groups of children from the same social environment.* There is the much larger question whether the less well-off children are underfed relatively to the better-off; but this the experiment, of set

purpose, does not touch. The results were broadly these: in the five preliminary weeks before the meals began, the increase of weight in the selected children and in the controlled children was almost the same. When the meals began, the weights of the selected children rose suddenly in the first week; the next week showed a slight loss as compared with the first; but the next two weeks showed a decided gain, while the controlled children during the same period lost slightly in weight. In the Whitsuntide holiday (eleven days) no meals were given, and it was found that the selected children had lost considerably, though they were still higher than the controls. After the holiday, when feeding was recommenced, the increase was more gradual than at the beginning of the experiment, and it took nearly a fortnight to make up for the effect of the holiday. There was a similar experience with the long summer holiday. Meanwhile, the controls rose steadily, but on a much lower plane.

This experiment goes some way to answer the question, *Are there any underfed children?* That is, are there any children in whose malnutrition want of food is the primary factor? This question involves several others.

First, *if there was no leeway to make up in*

nutrition, why should the selected children increase in weight even temporarily at a greater rate than the "controls"? As nearly as possible, the selected and the "controls" were of the same physiological stratum. Both lots came from necessitous families, where, it is presumed, feeding and all the other environmental factors were approximately the same. In the selected children, the regular scientific diet was the only new factor. Here we have a complete instance of the method of difference. A definite new factor is introduced into a given set of circumstances; it is withheld from an almost perfectly similar set of circumstances; a definite result happens in the first; a definite result is found absent in the second. It is possible that the care given to those children, the extra attention focused on them, had certain further results on the conditions of the home; but it is not likely that these conditions would be seriously altered, except relatively to the better-fed child. The increase of weight was so sudden and so large that it is difficult to suggest any other cause for it than the improved diet.

Why should it be so necessary to assert so obvious a conclusion? Simply because it has again and again been alleged, without experimental verification, that the effect of the food

factor has been grossly exaggerated, while the effects of the other environmental factors have been as grossly minimized. In the Bradford experiment, the other environmental factors were as nearly as possible constant ; the food factor alone varied. The result is so specific that it must be provisionally accepted until a more elaborate experiment justifies us in setting it aside. As, however, the Bradford experiment confirms multitudes of other scattered observations, we need not found the whole case on it alone ; we are justified in taking it rather as a more systematic verification of previous hypotheses.

Second, *it may be asserted that the recovered leeway is morbid, not normal.* It may be said that the normal increase was shown in the "controls", where the curve rises with a steady ratio through the four months of the experiment. But this seems to beg the question. How do we know that the increased weight of the scientifically fed children is morbid ? No one asserts that the children will cease absolutely to grow when food is lower than appetite could be trained to absorb ; but we have no right to assume that the rate of growth on the minimal subsistence diet is the normal physiological rate. In this particular experiment, we have no records of the

general condition of the children—the obvious signs of malnutrition, pallor, co-efficient of fatigue, capacity for work, delicacy of sensation, rate of muscular action, etc. Until these are shown to approach the physiological normal of children that feed entirely according to appetite where food is plentiful, we have no right to accept these "controls" as in any way more normal in their growth than the scientifically fed group. It is a common experience in hospital and in industrial schools that ill-nourished children feed ravenously for a short time after admission; they attain to a certain maximum, and then they run level with those reared on a full diet. The ravenous feeding must be interpreted as due to general innutrition.

Third, *if the selected children were normally incapable of growing in size and weight by any degree of super-alimentation, how do we account for the facts of these tables?* How is this normal so easily disturbed if the conditions are due to factors other than food? A normal so unstable cannot have deep organic roots. The increase of weight varies, no doubt, in rate according to the class of tissue. Fat may be more readily accumulated than muscle, and muscle more readily than bone; but all the tissues will benefit to some extent. The whole

metabolism must be disturbed by the new food factor. It is obvious that the disturbance is easily effected. In the under-fed child, the tissues seem to be in a state of morbid instability. They are ready to increase their rate of growth with a slight increase in the amount of assimilable food. This fact seems to indicate that minimal quantities of food tend, after a certain point, to reduce the whole rate of organic growth, and that increased quantities stimulate organic growth. And the Bradford Experiment gives ground for the supposition that these effects of food predominate over all other environmental influences.

Fourth, *immediate distaste for a new food is not a proof that the tissues are not hungry. It is simply a proof that hunger may be masked.* In a third of the children, there was a predominant distaste for porridge for two days. This was probably an adaptation, first, to the reduced quantity of food normally available; second, to the particular flavours prevalent in the food normally consumed. But the adaptation was easily modified; the taste was soon adapted to the new food, and the increased quantity rapidly developed a larger appetite, so that within three days every one demanded the food formerly rejected by some of them. This is only one of innumerable instances of the

education of appetite. The want of appetite is a symptom of physiological or morbid maladaptation. So long as the appetite remains on the low level, the organism absorbs and assimilates less food; there is less output of energy; there is less need for replenishment; there is consequently less hunger. But let the balance of nutrition be once effectively disturbed, and the body starts to grow out of its pace and passes on to a higher dynamic plane. The boy does more, feels more, acts more, gets hungry more quickly, needs and eats more food. His passing adaptation to his food environment is like the adaptation of the prisoner or the fasting man—an adaptation which, if continued, affects first his immediate nutrition and ultimately his whole growth.

Fifth, *the "controls" were children of approximately the same nutritional history. This makes the contrast all the more striking.* The contrast between the "controls" and the selected children is not so great as between both and the children of the richer orders; this only means that the period of experiment was short, and that the children all came to it out of the poorest social stratum. Six months of feeding do not reverse the effects of nine years of defective nurture. The "controls" go up

more slowly but more steadily. This implies that their food and other environment remain practically the same. The selected children go up irregularly ; but the variations correspond exactly to the time of feeding or non-feeding. *It is difficult to resist the conclusion that the resulting increase of weight is due to the food alone.*

The food factor tends to supersede every adverse influence. Bad air, over-work, interrupted sleep, diminished sleep, and all other environmental influences have a less destructive effect on the well-fed child. When sleeping-time comes, nothing will keep him awake. He has more vigour to combat the effects of bad air. He has more energy to neutralize over-work. With his growing energy, he becomes more competent to alter his environment and adapt it to himself. He becomes more discontented with every adverse condition. He is more difficult to restrain ; but he is readier to learn. A head master of a very poor school has stated that, after three weeks of soup-kitchen food, where no scientific attention was given to the diet, he always found his children more lively, more mischievous, more fit to react in school.

The test of successful feeding must not be confined to mere word-learning. We must

consider activities of every variety; increase in variety of sensation; increase in spontaneity of action; increased pace of acquisition; increased number of things done; increased interests; increased inventiveness; and generally an increase in the whole mental and bodily output.

The feeding has its derivative as well as its direct results. When a child is well fed, he sleeps well. This is partly mechanical, partly a physiological result. The mechanical distension of the stomach provokes a reaction of the secretory glands and the blood-vessels. There is a derivation of blood from the brain, whence it goes to other parts of the body, and sleep supervenes. When the child sleeps better, his general metabolism improves; for metabolism ultimately depends on his nervous integrity. Hence he becomes fitter for other nervous strains. But when these strains come, his muscular condition also improves. With this improvement he seeks more outlets for his energy; and with every action he grows, up to a limit, stronger. With every increase of strength, he improves his whole environment. He himself grows at a greater pace in every organ and tissue. His appetites increase in variety and in intensity—his appetites for food, for action, for sensation, for knowledge, for

sleep. He can remember better what he does, what he feels, what he hears, what he reads and sees. Hence he is fitter to be taught. Waste matters are more rapidly eliminated. Hence he organizes his experiences more easily. Thus the whole mental and physical systems improve at a greater pace.

If you look at the reverse picture, the argument becomes more evanescent. When food fails, the energies fail. If they did not, the organism would go more rapidly forward to exhaustion. The depression, the rapid fatigue, the failure of appetite, the readiness to sleep, the slowed growth, the general malnutrition, may be considered protective developments to keep the organism from exhaustion. If, while food fails, the appetite remains, the organism becomes thereby less fitted for any other purpose. The pain of hunger becomes a fixed idea, but ultimately disappears. This always occurs in extreme starvation ; but in the slow starvation of the underfed, the appetite tends within limits to adapt itself to the quantity and quality of the food available. When the food is small in quantity and poor in quality, the taste becomes keener to every food flavour ; the organism makes absolutely the most of every morsel of nourishment ; the whole metabolism is devoted to maintain the

minimum of nutrition. When, however, proteins fall below a certain point, waste rapidly ends in death.

That the adaptation of appetite to food occurs within the very short experience of children is placed beyond doubt by many food experiments. But it has been brought out very pointedly by the porridge incident in the Bradford experiment. The breakfast provided for the forty children included oatmeal porridge. Of the forty, only thirteen evinced any appetite for porridge. Within two days, however, all the children enjoyed porridge and considered no breakfast satisfactory without it. It may be that the new flavour of oatmeal, uninteresting at first, rapidly asserted its claim on the palate. It may be that the quantity of warm, soft material caused an agreeable distension of the stomach. It is certain that as the children increased in weight they maintained their appetite for a larger quantity of breakfast. The increase in weight was an almost immediate response to the increase in appetite. Had the appetite not been aroused by the larger quantity of material, it would probably have continued to be easily satisfied with a quantity so small that the weight would increase at a much lower rate. This is confirmed by the curve of the control children,

who increased steadily in weight but at a much slower pace.

From these typical facts, we may infer that appetite varies with the amount and quality of food. We cannot, of course, assign exact quantitative limits; but roughly, the larger the amount of food consumed, the greater the appetite becomes. Saturation point is ultimately reached; but only when the tissues have attained to a certain maximum immediate size and vigour.

The facts of super-alimentation in tubercular cases confirm this argument. In phthisis, for example, defective or perverted appetite is a symptom of the disease. The appetite is entirely disregarded for the time; its defences are broken down; feeding is forced; and the result is that in a few weeks, sometimes in a few days, the patient increases in weight and develops an appetite equal to his heaviest meal. What is so strikingly manifest in phthisis is, however, within certain limits, true in physiological health.

CHAPTER XIII

THE INITIATION AND DEVELOPMENT OF MEDICAL INSPECTION AND TREATMENT

KING EDWARD VII instituted a Royal Commission on Physical Training (Scotland) in 1902. In Great Britain this date marks the beginning of the movement towards the statutory medical examination of school-children in State-aided schools. It is true that in the large public schools, men like Dr. Clement Dukes of Rugby had for years studied carefully the condition of fitness of the boys in their charge, and the leading schools had their own doctors. It is also true that on the Continent, several countries, notably Germany, had already organized a systematic examination. But the first Parliamentary step in establishing a national system in Britain followed the work of the Commission. The Commission was not a Medical Commission, although it had one medical

member; and its immediate object was not to investigate health but the methods of improving physical training. It was assumed that if adequate facilities were provided at different stages of school life, the physical fitness of the children from infancy to adolescence could be secured. The reference was very wide: "To inquire into the opportunities for physical training now available in the State-aided schools and other educational institutions of Scotland; and to suggest means by which such training may be made to conduce to the welfare of the pupils; and further, how such opportunities may be increased by Continuation Classes and otherwise, so as to develop, in their practical application to the requirements of life, the faculties of those who have left the day schools, and thus to contribute towards the sources of national strength."

This, it is to be noted, speaks only of strength, not of health; but, although the larger part of the immediate results of the Commission's work was the establishing of medical inspection, the instinct that dictated the reference was sound; for, as the event shows, physical education (not now merely training) is conceived as an integral factor in the production of health and, therefore, of fitness. It is easy,

however, to see out of what roots the reference arose. The South African War was still in progress; the recruiting offices had to reject a large proportion of candidates, and the defects found, though familiar to the hospitals and out-patient departments, took on a fresh significance as indicators of national fitness. No doubt, in the course of time, the problem of fitness for the civil occupations would have emerged as a matter for national attention; but the fact remains that the initiative came from the impulse of the war.

The Commission was able to bring together the massed results of many scientific investigations on children; but their point of view was practical and, so far as Scottish school-children were concerned, relevant data hardly existed. It was decided that samples of Scottish school-children, taken at random, should be examined; and it was the reports on those children that formed the groundwork for the chief executive recommendations. The Commission accepted the following conclusions of the Edinburgh Report:—

"First.—The large number of serious and minor diseases directly and indirectly affecting physical efficiency and mental efficiency constitutes an overwhelming case for a medical inspection of school-children.

"Second.—The facts as to physical exercise at the various schools (four in Edinburgh, 150 children from each; two in poor quarters, one in a fairly good quarter, one in a good artisan or shopkeeper quarter) demonstrated that a primary condition of any good result from increased physical training is adequate food and adequate clothing.

"Third.—No systematic exercise ought to be practised or enforced without a preliminary medical examination of the vital organs, to ensure that irreparable damage shall not result.

"Fourth.—That exercises should be organized—not as at present according to the code standard in which the child is situated, but strictly in accordance with health, physical development, and vigour."

The Commission's Report was issued in 1903. In the same year, an Inter-departmental Committee was appointed: "To make a preliminary inquiry into the allegations concerning the deterioration of certain classes of the population as shown by the large percentage of rejections for physical causes of recruits for the Army and by other evidence, especially the Report of the Royal Commission on Physical Training (Scotland), and to consider in what manner the medical profession

can best be consulted on the subject with a view to the appointment of a Royal Commission, and the terms of reference to such a Commission, if appointed."

These Terms of Reference were subsequently explained and enlarged, as follow :—

" (1) To determine, with the aid of such counsel as the medical profession are able to give, the steps that should be taken to furnish the Government and the Nation at large with periodical data for an accurate comparative estimate of the health and physique of the people ; (2) to indicate generally the causes of such physical deterioration as does exist in certain classes ; and (3) to point out the means by which it can be most effectually diminished."

In its recommendations the Committee included proposals for an anthropometric survey, a register of sickness, an advisory council, labour colonies and public nurseries, medical inspection of factories, investigations into fatigue, alcoholism, infant mortality, employment of women, milk supply, feeding of infants, midwives, training of mothers, special schools for retarded children, medical inspection of school-children, physical exercise, crèches, and many other subjects.

As to medical inspection of school-children,

"The Committee consider that a systematized Medical Inspection of school-children should be imposed as a public duty on every school authority; and they agree with the recommendation of the Royal Commission on Physical Training (Scotland) that a contribution towards the cost should be made out of the Parliamentary Vote. The value of such an inspection is well illustrated by the particulars given in a recent report by Mr. George Andrew, of the Scotch Education Department, on the *Gemeindeschulen* of Berlin and Charlottenburg. From that report it appears that of 2,547 children examined on admission to the schools of Charlottenburg, 321, or 12·3 per cent., were rejected as being unfit for the work of ordinary schools, and of all the children examined, 63 per cent. were described as not completely normal." By such scanty data was this vast departure justified.

The two Reports and their emphatic recommendations made an immense impression on the Parliamentary mind. In 1905 another Inter-departmental Committee was appointed: "(1) To ascertain and report on what is now being done and with what result in respect of Medical Inspection of Children in Public Elementary Schools.

"(2) And further, to inquire into the methods employed, the sums expended, and the relief given by various voluntary agencies for the provision of meals for children at Public Elementary Schools, and to report whether relief of this character could be better organized, without any charge upon public funds, both generally and with special regard to children who, though not defective, are from malnutrition below the normal standard."

In 1907, Parliament passed, for England, the Education (Provision of Meals) Act; and incidentally this Act made Medical Inspection possible in England. In 1908 the Education (Scotland) Act of that year empowered the Scottish Education Department to require local Education Authorities to make an examination of school-children, and in the case of necessitous children to provide feeding and treatment. Later, in 1913, a short Act placed medical treatment on the same footing as the provision of feeding.

This brief record shows how the medical superintendence of growth passed into a system of public administration. From the beginning it was made clear that the superintendence of school-children involved, directly or indirectly, the whole health machinery of the

country. It is not often that we can make so precise the steps in the development of a great social service. But this service was marked by one striking fact: it sprang, as it were, fully formed from the Parliamentary mind. There was little, if any, unofficial effort to organize independent systems. The whole service, even at the experimental stage, was official from the outset. Of this, the correct interpretation probably is, that a service so far-reaching in its social consequences could not be left to the accidents of sporadic effort or to the generosity of wealthy men. But, on looking backwards, we can justifiably infer another principle: for the first time the public mind was roused to the necessity not merely of providing a good environment but of seeing that the individual was kept fit to use it. Intellectually, the concept of prevention had won the public assent. The rest was an affair of administrative detail.

Every new administrative idea generates its own machinery. Of this there are two classical examples available for study: the evolution of the system of medical inspection of school-children, and the system of examining recruits in the Great War. It would be interesting to study these together, and we should find many parallels. But we should

also find one fundamental difference: the recruits for the army had to be tested from the standpoint of immediate fitness for the various functions within a great army in the field; the school-children had to be examined to ensure that they were or could be made fit for the prolonged ordeal of school education and the still more severe ordeal of civil occupation.

At the Recruiting Medical Boards the first purpose was the immediate selection of fit men; in the schools, the first and final purpose is superintendence of children to be educated. The one system was organized for a temporary emergency; the other has been organized as a permanent social service. Incidentally, the examination of the adults strengthened the case for the systematic examination of the children. Later we shall discuss some of the results, but this may be said here: when, as shown in Sir James Galloway's Report to the Ministry of National Service, it can be said that only three men out of nine showed the necessary health and strength for the more severe forms of army work, the need for securing to the adolescent, and, therefore, to the child and to the infant, better conditions of growth is placed beyond argument.

Let us look a little more in detail at the

growth of the system of School Health Administration. The phrase, " School Health Administration ", I borrow from the two admirable books prepared by Louis W. Rapeer, M.A., Ph.D., of the American National Training School for Teachers, who in his *School Health Administration*, of date 1913, gives a well-filled-out account of the whole medical problem of the schools ; and in his *Educational Hygiene*, a comprehensive survey of the superintendence of growth from the pre-school period to the university. Dr. Rapeer is right when he emphasizes health administration rather than medical superintendence ; for the whole object of medical superintendence is to secure the health of the children. Unfortunately, as we shall prove, the masses of ailment and defect revealed in the medical inspections will continue to demand a service of medical treatment as well as of inspection for generations to come ; but, as the service develops, there is the hope that medical superintendence will gradually merge in the maintenance of health.

If, therefore, we wish to study in a concrete case the development of the medical system, we may find unlimited material in the fine series of Reports prepared from year to year by Sir George Newman, K.C.B., M.D., D.C.L., for the English Board of Education. To

those of us that started from datum line, it is inspiring to watch stage by stage the growth from substantial though relatively crude beginnings to the greater and greater specializations that mark the Reports of to-day. At the earlier stages, it was necessary to emphasize the relation of home to school and to plead for the examination of all children, not merely those known by untrained lay persons to be defective. This, indeed, marks the new departure of the new service : defects are searched out, not left to be revealed by chance. Cleanliness of body, too, continues to receive persistent attention ; for even in the Report for 1923 the figures for " verminousness " are enormous but steadily decreasing. " Uncleanliness " says the Report " is a criterion of the conditions of life in the home —it constitutes a sign of parental irresponsibility. An improvement in cleanliness represents a degree of betterment in domestic hygiene." In a table furnished by Sir William Hamer on ten years' work by the London County Council, it is recorded that in 1914, out of 1,053,218 examinations, there were 27·2 per cent. showing verminous conditions. In 1923, out of 2,052,904 examinations, there was only 18·1 per cent. Obviously, the whole system of cleansing methods has steadily

grown. There is a similar improvement in many other areas both in England and in Scotland.

Then we may look back and watch the development of "following up". This is a method of preserving the link between the school and the home. It is now an ordinary administrative proceeding all over the country. Gradually, medical treatment arises out of medical examination, and we have crops of school clinics. The types of clinic common in various hospitals have been steadily developed on the preventive plane, until, at the present day, every good school system provides for the trained examination of eyes, of ears, of skin, of teeth, and of all the major defects of the body. No medical system can proceed far without the nurse, and almost from the beginning the school nurse was a necessity. Now that medical treatment is an integral statutory part of the school system, the school nurses are a highly specialized body. Among the earliest institutions to be established were the open-air schools, and even these are now specialized into recovery schools, or schools for "sub-par" children and convalescents from infection. There has been a steady growth, too, in schools for children with special defects, physical or

mental. The nursery schools, to which we have already given so much space, merge here and there into the larger system of treatment, and they develop their own specialisms. Pre-school welfare glides into school welfare. It is only a matter of time when the medical superintendence of growth from before birth to the entrance into industrial life will command the special medical services appropriate to every age and stage.

Meanwhile, the training of the teacher has not been forgotten. Twenty years ago, at the training colleges, it was thought enough that the students in training should receive one or two lectures in ambulance work. To-day, at the leading colleges, every teacher in training passes through an observational course of personal and school hygiene as well as a course in general physical education. In Scotland, all the training colleges are under the management of a National Committee and Provincial Committees. The teachers are disciplined in the practical work of examining children for defects of eye, ear, skin, posture, movement, gait, teeth, throat, glands, etc. This, in their second year of training, is supplemented by recorded observations of the defects discovered at the practising schools. In this way, the scientific groundwork of

personal hygiene is developed into a system of practical application. The fruits of the teachers' training are manifest in the Reports of the School Medical Officers. Here, if anywhere, the teacher, the nurse, and the doctor may constantly work together as a medical team. In no other way can such numbers of individuals be passed even in partial review.

At the same time, the Medical Officers of Health develop their control of the infectious diseases, and the school medical service becomes a functional part of the greater health service.

Through these various developments, the school medical service, year by year, gets to closer quarters with the individual child. But at the base of all their work is the primary problem of individual nutrition; and here once more we get back to the life of the pre-school child and the social environment.

Let us now look at a few figures. In 1923, the total number of school medical officers, assistant medical officers, and medical or surgical specialists employed in England was 1,751. "Of these, 819 were whole-time officers, whilst the remaining 932 were private practitioners who undertook the work of medical inspection or medical treatment or both of school-children under arrangements made by

the 317 local education authorities." But this does not represent the whole case; for, in the first instance, the children needing medical treatment are referred to a private practitioner, and the number of such practitioners involved is great, though the figure is not stated.

Besides those officers, there were 469 school dentists, of whom 184 gave whole-time service. "These figures include 238 women doctors or dentists who were working in 131 different education areas." There were also 4,277 school nurses (including nurses employed by Nursing Associations) giving whole or part time. "Their work consists, under the direction of the School Medical Officer, in attendance at the medical inspections and at the treatment clinics, in cleanliness surveys in schools, in following up in their homes children found with defects, and in the nursing treatment of cases of minor ailment." This broadly indicates the service for England. In Scotland, the service is relatively much the same in numbers and functions.

What is the tale of defects discovered? Here are the figures for 1923—malnutrition, 2,391, or 4 per 1,000 inspected; skin diseases, 8,063, or 13 per 1,000; defective vision, 38,849, or 62 per 1,000; glands, 5,141, or 8

per 1,000 ; eye disease, 5,329, or 8 per 1,000 ; defective hearing, 3,440, or 5 per 1,000 ; ear disease, 6,604, or 10 per 1,000 ; nose and throat disease, 27,392, or 43 per 1,000 ; enlarged cervical glands, 1,593, or 3 per 1,000 ; defective speech, 321, or 1 per 1,000 ; heart disease—organic, 1,049, or 2 per 1,000, functional, 428, or 1 per 1,000 ; anæmia, 4,920, or 8 per 1,000 ; lung disease—non-tubercular, 5,570, or 9 per 1,000 ; tuberculosis—pulmonary, definite 211, or 0·3 per 1,000, suspected, 820, or 1 per 1,000, non-pulmonary 596 or 1 per 1,000 ; disease of the nervous system, 975, or 2 per 1,000 ; deformities, 2,781, or 4 per 1,000 ; other defects and diseases, 9,124, or 14 per 1,000. These are the defects found among 630,665 children of school age.

There is a similar record for the secondary schools. " Generally speaking, there appear to be fewer cases of malnutrition found in the secondary schools, and more cases of defective vision which are found to have received correction and attention. These two facts would suggest that the physical condition of the secondary school child is better than that of the public elementary school child. The number of the findings of the secondary school inspections are, however, comparatively small, and it is unsafe to draw definite con-

clusions from them. There are many factors and variants affecting the physical condition of secondary school-children."

These are only the total figures in the reports prepared at the Board of Education. They are clothed with flesh and blood by the numerous excerpts from the School Medical Officers' Reports. The Report for 1923, like its many predecessors, is a recent and conclusive proof that the School Medical Service all over Britain is a necessary preliminary to the final development of School Health Administration.

CHAPTER XIV

THE SOCIAL SIGNIFICANCE OF MEDICAL INSPECTION

MR. ARTHUR GREENWOOD, M.P., deserves the thanks of all those interested in the health and physique of school-children; for, in 1913, under the Ratan Tata Foundation (University of London) he published a careful study of the heights and weights recorded in the reports of leading School Medical Officers in Britain.* This study has a high practical value not merely for the figures analysed in it, but for the many lines indicated for study. The little volume is fully documented, and has already become a "companion" for School Medical Officers and social workers generally.

"The Ratan Tata Foundation has been instituted in order to promote the study and further the knowledge of methods of preventing and relieving poverty and destitution."

* *Health and Physique of School children*, 1913.

It is from this standpoint that Mr. Greenwood presents his material. The date, it is to be noted, lies in the period before the Great War. The School Medical Officers' measurements are, therefore, not affected by the peculiarly variable conditions of the last twelve years, and they may be held to offer a somewhat more normal picture of British school-children than figures collected within the four or five years of serious unemployment.

But the important fact about the publication is that it is written by a social investigator familiar with many varieties of society. To those of us that know how difficult it is to be exact even in matters apparently so simple as weighing and measuring a school child, it is a gratification that the rough practical work done in the schools can be made to yield inferences of genuine significance.

No single School Medical Officer can, as a rule, afford either the time or the energy to collate his own and other men's results, even where he has the wider experience that flows from extra-school investigations; and it is perhaps well to have an independent view of data collected with special reference only to school fitness and without special reference to social conditions. For, as I have tried to show all through these chapters, the child is

not an abstraction but a living unit in a definite social environment ; and every clear fact that can be recorded of his school condition opens a new path to the improvement of the social stratum to which he belongs. It is this fact that, in a large measure, justifies the steady effort of the whole School Health Administration to obtain and to classify quantitative data about the child at school. We have seen how the indices of nutrition vary even in the hands of highly skilled scientific investigators ; but this is only a reason for developing more exact methods, not for discarding even the broad results exhibited in the school reports. However much the personal equations of the School Medical Officers and the teachers may vary, the records of quantities are a continuous proof that each child is carefully scrutinized. To realize in some degree how important the scrutiny is, it is necessary only to read this lucid exposition of figures and to know how many practical problems emerge in the hundred pages. I select two or three of Mr. Greenwood's special points.

First, like other investigators, he seeks for some simple working index, and he found it in the device of the " index number ", a concept made familiar to us by the well-known method of estimating the cost of living. For

his purpose, the index number is explained as follows :—

"For each town or district, the average height (or weight) at each age was expressed as an index number, the average height (or weight) for the whole country at each age being taken as 100, thus :—

BOYS' HEIGHTS

Age.	England and Wales.	Berkshire (C.C. area).	Durham (C.C. area).
5	100	100·7	98·8
6	100	100·0	97·2
7	100	102·0	97·8
8	100	100·8	97·3
9	100	101·4	95·3
10	100	100·6	95·9
11	100	100·4	97·4
12	100	101·1	99·1
13	100	102·1	99·1
Total	900	909·1	877·6
Average	100	101·0	97·5

"According to the material available, therefore, the heights of the school-children in the Berkshire County Council area are, on the whole, 1 per cent. above the height of the children of England and Wales as a whole; whilst Durham County Council children fall 2½ per cent. below the average in height.

The advantage of this method is that it may be applied independently of age distribution, provided the age groups are fair samples. The reliability of the result obtained from compounding a smaller number of years of age than nine will depend upon the number of years available and the number of children in each age group. Four, or even three, different years, if the groups are large and the averages coherent, will be fairly reliable. The actual method of working was to reject all groups containing less than ten children."

He pressed the index number a stage further. "Having obtained the index numbers for heights and weights of both sexes, the sum of the index numbers divided by four will yield an index number for physique (as measured by height and weight) thus :—

	England and Wales.	Middlesex C.C.	Edmonton.
Boys' heights . . .	100	101·0	98·1
,, weights . . .	100	101·5	96·7
Girls' heights . . .	100	101·3	98·7
,, weights . . .	100	101·0	97·5
Total	400	404·8	391·0
Average . . .	100	101·2	97·8

"This final index number may be utilized as a means of comparing the children of

different districts or children of the same district at different times. Other methods of comparison, possibly superior, are of little actual use to the school medical officer and others owing to their complexity."

He considers also the weight-height ratio and other indices of nutrition, and gives some illustrations of their application.

Broadly speaking, his study forms a critical commentary on the standard set up in 1883 by the Anthropometric Department of the British Association. There being no other working British standard, this standard has been very largely used as a datum line. It was based on a large selection of children, and has been fully expounded in the reports of the Scottish Royal Commission and elsewhere. But, as Mr. R. H. Tawney, Director of the Ratan Tata Foundation, indicates in his introduction, "the development of Medical Inspection has, however, supplied him with materials which previous inquirers did not possess, and of these, it will be agreed, he has made good use. How much more extensive his survey is than that of the British Association may be judged from the fact that, whereas the latter dealt with between 42,000 and 43,000 individuals, Mr. Greenwood's figures represent about 800,000, and that the number

at some ages exceeds the total number on which the report of the British Association's Committee was based."

With this explanation, let us look at a few of Mr. Greenwood's results.

First, the annual percentage increase in height and weight. The figures studied show that "there is a fairly steady rate of growth in height of both boys and girls up to the age of seven years, whilst the rate of growth in weight is increasing; then follows a sharp fall in the rate of growth in both stature and weight, followed by a rise in weight to the age of ten. From the age of ten to twelve the rate declines rapidly, after which there is an increased percentage of growth." The practical inference is simple: "The case of children who during any year fail to increase in height and weight (particularly the latter) at the normal rate is such as to warrant medical attention."

Mr. Greenwood says: "We should, therefore, expect to see a retarded rate of increase in the case of children bred up in poverty; and the statistics for Newcastle apparently bear out this conclusion." But, in this respect, the Newcastle results do not agree with the Nottingham results. "Further inquiry shows that whilst the poorer children all through their school life remained slightly below the

average, the medium and better children did not maintain the superiority with which they commenced at the age of five." The results are "an indication that there is a tendency towards deterioration at the higher ages of the better and medium class scholars".

The falling off of children on entry to school is not unfamiliar in certain Scottish areas. It probably occurs most readily where the food ration of the pre-school child does not expand to meet the extra stress of school work. Probably, attendance at school results in increasing the intervals between meals and reduces the number of casual ingestions of food. In towns, this may not be so manifest; in the rural areas, the distance of the school from the home is a simple and sufficient reason. Frequently, the child may have to walk two or three miles to school, and the meal he is capable of taking is not equal to this output added to the activities of the school. As he grows older, he forages more for himself, and he can take a relatively larger meal. The matter is one for careful investigation; but those familiar with the day-schools of rural Scotland do not need to look far afield for an explanation. This disturbance of feeding, indeed, may, not unfairly, be offered as a reason for either arranging to feed the child at school

or to keep him at home to a later age. The British Education Acts confer on the local Education Authorities full power to provide feeding at school.

Second, urban and rural communities. Out of the figures, Mr. Greenwood is able to show a real difference between the heights and weights of urban children and those of rural children. "Urban", however, as he points out, is not to be taken as meaning strictly the children of town-dwellers. The term, as used in England, covers large areas that are, perhaps, predominantly urban in character but cover also considerable rural areas. Further, many rural children attend urban schools. The index number, therefore, cannot be applied rigidly. All that can be hoped for is that, where urban conditions predominate, some distinguishable bias is shown; where rural conditions predominate, the contrary bias is shown. Thus, in a summary table, on the assumption that one hundred is taken as the index number for England and Wales as a whole, the rural boys' heights come out as 101·4; the urban boys' heights as 100·2. For weights the figures are 103·3 versus 100·5. The corresponding figures are for girls: rural heights, 101·6; urban, 100·6. The corresponding weights are 103·1 versus 100·8.

Taking boys' and girls' heights and weights together, the final index educed is given: rural, 102·4; urban, 100·5. This is the general result.

The analysis, however, is made a little closer. The urban children are "slightly above the average for the whole country, the excess being rather more in the case of girls than boys. But whereas these urban boys and girls are on the whole 0·5 above the average as regards stature and weight, the rural children are nearly 2½ per cent. above". Relatively to height, the rural children are heavier than those from urban schools. These figures, as he points out, are not conclusive; and before any inferences as to the effects of the conditions of town life can safely be made, other factors such as race must be eliminated.

But the data enabled Mr. Greenwood to make a further comparison, namely, a comparison between the county council areas and the manufacturing towns. Here the difference in the index numbers is much more striking. For boys' heights, the county council areas show 100·4; weights, 101·5; against the manufacturing towns, 98·7 and 97·9. Taking the average for boys and girls, the county council areas show 101·2 as against the manu-

facturing towns 97·9. Mr. Greenwood shows that the town children are inferior to the average both in height and in weight; "but whereas the country children are relatively more superior as regards weight, those of the towns are relatively more superior—or less inferior—as regards height. . . . Taking boys and girls together, the country children are 1·2 per cent. above the average, and those of the towns 2·1 per cent. below".

These conclusions must be taken provisionally: they are not intended as rigid scientific generalizations, but rather as indications for further investigation. Probably, the deviation from normal for town children should, he suggests, be reckoned from 98, and for the country children from 101. But even with this qualification, there are considerable variations between the several areas. For instance, the Durham area shows an average figure of 96·6, as against Glamorgan and Monmouth, 98·5; the woollen towns, 98·1; all manufacturing towns, 97·9. "The Durham and district towns, however, show an appreciably smaller index number. The children in this district are, apparently, smaller and lighter than those of other industrial areas." It is interesting to note that this general result tends to confirm the results of Sir Arthur Newsholme's very

extended analysis of infant mortality in England.*

Third, the half-timer. The half-timer is largely a thing of the past. It would be interesting to give the story of the emancipation of the children from the mills. The movement began effectively with Robert Owen's "infant school"—the first infant school in Britain—at New Lanark. It has never died down; and, to-day, the world of education is, on the whole, persuaded that the "half-timer" is a mistake. It is too complicated a question to discuss in detail; for more than almost any other type of school child, the half-timer cannot be explained without a detailed analysis of social drifts. Mr. Greenwood is able to contrast figures from half-time towns and from non-half-time industrial towns. He compares the children at every age from five to thirteen. For the earlier ages, the half-time towns are "superior or equal to those other towns where there is no half-time". But, "whilst in the case of non-half-time girls, the index number rises regularly from the age of eleven, the index

* See *Second Report on Infant and Child Mortality*, 1913, Cd. 6909. This Report and the allied reports are indispensable historical text-books of the English position at that date.

number for girls in the half-time towns sinks to its lowest point at the age of partial exemption." But, he adds: "It should be noted, however, that in Oldham it was found that among both the boys and girls those who work half-time appear to be taller and heavier than those who attend school full-time." The explanations offered by the Oldham School Medical Officer in his annual report are: "(1) That those working half-time are on the average older than those not working; (2) that the tendency would be for the stronger and better-developed children to go to work, while the weaker and delicate children would be kept at school; (3) that the worker, as he is bringing in a wage, is better fed than those who are not wage earners." But in the Bradford series, it is pointed out that "in the case of the girls, there is a serious decline in the standard of both height and weight at the half-time age. The tables seem to bear out the contention that the physique of half-timers suffers in consequence of their employment in industry."

These discrepancies show how difficult it is to get at the truth about "half-time" merely from the consideration of nutrition as measured by height and weight. But, on the whole, we may agree with Mr. Tawney's

general statement that there is "weighty evidence for holding that the effects of partial exemption on the health of children are as disastrous as are the effects of the system upon their elementary education and (often) upon their subsequent careers". It may very well be that the half-time system necessarily acts as a winnowing fan for the selection of the physically abler children; but, in the career of the half-timer, there are many things that cannot be expressed in quantities, and, as I have said, the educational world tends more steadily to the conclusion that, educationally, half-time is a mistake. Such systematic investigations as have been made in Scotland uniformly tend to the same conclusion. But the problem to-day is as nothing compared with what it was in the days when Robert Owen led the revolt against the employment "of infants in the mills".

Fourth, poor children versus more prosperous children. The general conclusion here is "that whilst the poorer children all through their school life remain slightly below the average, the medium and better children do not maintain the superiority with which they commence at the age of five". There seems to be a tendency towards deterioration at the higher ages of the better- and medium-class scholars.

This suggests that, while the poor children find the school environment better than their ordinary surroundings, the better-class children do not. But here, once more, there is room for a good deal of further investigation. For instance, Mr. Greenwood indicates that "the lower the social scale of the children, the larger was their rate of increase in stature". This is not so paradoxical as it looks; for Mr. Charles Manning Child shows, in his *Senescence and Rejuvenescence*, that partial starvation tends to inhibit the process of senescence and the changes accompanying it. It is common knowledge that children suffering from acute infections, like scarlet fever, grow rapidly even when the diet has to be kept low for weeks on end. It is possible that the metabolism of bone growth is stimulated by partial starvation. "In men also" writes Mr. Child "a starvation period is often followed by an increase in vigour and body-weight, and starvation, properly controlled, is believed by many to possess a certain therapeutic significance."

On the other hand, there is much evidence to show that children systematically underfed tend to become "dumpy", and growth is not completed until a later age than in the well-fed. But here again we are faced with

the profound complications of nutrition and growth, and, in the light of recent researches on rickets and other deficiency diseases, it is difficult to be sure of our conclusions. There is still much to be done in the study of the metabolism of bone before we can attain to any general explanation of these paradoxes of growth. From the researches on rickets it is manifest that minute differences in diet may cause immense differences in growth. And any general results from the index number must be taken with caution.

It is suggested that, to secure greater definiteness, children must be weighed more frequently than once a year. To show on what unstable ground we are treading, it may be added that in a study of " neglected " children at Edmonton, it was found that there is " a significant relation between the neglect of children and their height and weight, the neglected children being lighter and shorter, though there is noticeable exception in the case of the weight of girls age thirteen, whilst the differences between heights of neglected boys and all boys at five years of age is very slight ". In the Scottish Royal Commission's Report, much evidence was given of the differences between industrial school-children and other school-children. But it is manifest

that precise comparisons in precise conditions are extremely difficult to obtain. The general contrasts found between good schools and poor schools in Edinburgh pointed towards the conclusion that the poorer children are the lowest in height and in weight, and the facts already given for the Glasgow children confirm the conclusion. The broad result is that defective nurture means defective growth.

The inferences from the figures analysed by Mr. Greenwood in 1913 have been abundantly confirmed by the work of the last twelve years.

CHAPTER XV

THE PRINCIPLES OF PHYSICAL EDUCATION

THE last generation witnessed the transition from military drill to the hygienic exercise. Nearly two generations ago, when education was made compulsory in this country, it was assumed that the school child was always equal to the physical and mental tasks required of him. It was not long before this delusion was dissipated. Meanwhile the great whipping-in of children made more manifest all the difficulties that had long been familiar to students of education. The outburst of intellectual energies that marked the early part of the nineteenth century had culminated in this vast engine for the compulsory intellectualization of the whole people. Then the idea, long propagated by careful observers, that a good animal basis is essential to intellectual education, began to seize the Educational Boards. By and by it became obvious,

as modern psychology permeated the codes, that education, to be coherent at all, must cover the muscular as well as the intellectual activities of the organism. Forthwith, a method was sought to make up leeway in physical education which hitherto had been left to the chance of collective games in the open air or the spontaneous energies of the individual children. In the country, where the variety of physical life is greater and the conditions more healthy, the light and the air being rent-free, system was not so readily sought after ; but in the towns, where the life conditions are relatively oppressive, physical drill soon became popular. Naturally, the physical drill applied in schools took the form of military drill, which had been the best understood and the most practised. Naturally, too, the drill instructor of the army, being a convenient officer, was put to school duty.

Historically, our systems of school drill have emerged from our systems of military drill. But in transferring the system of physical training from the army to the school, we made one cardinal blunder. We forgot that, as the soldier is not a great child, neither is the child a little man. For every variety of education, this is a cardinal truth. But even

twenty years ago it was not understood by the public boards, nor is it entirely understood to-day.

Mark the differences between the soldier and the child. When a recruit joins the army, he is examined by a skilled medical practitioner, who determines the conditions of his eyes, ears, teeth, joints, heart, lungs, and other organs. His history is inquired into and recorded. He is put under a system of regular training. He has so many hours of duty, so many hours of relief. He devotes himself entirely to the production of a strong body. He gives his whole attention to the acquisition of the various drills. He must go to the gymnasium to develop his muscles ; he must go to the target to train his senses ; he must go through the fatigue of long marches to learn endurance. The need of the army is a strong man that can put forth great energy on emergency and maintain himself efficient through the prolonged hardships of the military campaign, where work is constant and food irregular.

But the after-life of the soldier is no special concern of the army. For five years or any other prescribed period the soldier must give to the army his best energies. He must be trained for its limited and special objects ; but, when these have been accomplished, he is not

necessarily better fitted by his experience for the more diffused energies of civil life. He may, indeed, be more or less exhausted and unfitted for further growth. But, all through his military training, he is under the constant supervision of a medical doctor. He is not only attended in illness, but he is medically directed in his training. In the gymnasium, for example, it is not uncommon for doctor and drill instructor to be present at the same time. Training is at every point strictly controlled by fitness medically tested.

When, however, the drill-sergeant passed from the army to the school, he came from the teaching of grown men to the teaching of growing children. And the men had been prepared for him by careful medical selection; the children come to him unselected and unprepared. Yet, among the children, he habitually exacted the same types of exercise as from the men. In some schools the whole appliances of the military gymnasium were transferred to the school gymnasium; and in many schools these discredited ideals of physical culture are still to be found. In skilled hands, the appliances may be made to give good results; but, in the hands of the drill sergeant who all his life had been accustomed to the rough discipline of men, they

could not be expected to produce any great educational result. And they did not. Meanwhile, the concept of growth had been steadily invading the systems of physical education. The difference between a grown adult and a growing child is not a difference of degree, but a difference of kind. The man at from 22 to 25 has completed his growth in height; the child of school age is relatively a fluid organism, changing from week to week. The man's bones are of full size and hardness: the child's bones are small and relatively soft. The man's muscles may, within limits, be developed without danger to his other organs; the development of the child's muscles may, unless rightly directed, rapidly produce or aggravate deformity. For example, many of the exercises on the trapeze, parallel bars, etc., entail repeated and sustained efforts, which are entirely unsuited for girls and boys, and tend to deform their immature frames and unduly tax their hearts. As Dr. Kerr in his Report for the year 1906 sums up the matter:—

"The ease with which deformity may be impressed on growing structures is well-known, but the impossibility of habituating a child's muscles to hard work is not generally understood. A child under 14 cannot be 'trained'. It is without muscular reserve. All excess of

energy is devoted to growth and development, and, if a tax is placed on energy by getting muscular work out of a child, there are no reserve powers." *

"The more recent systems of physical training have not only taken account of growth, but they have made it their cardinal conception. The exercises are designed to suit children at different ages and different stages of their development. The system, in a word, aims at being in general, and in detail, strictly physiological; that is, it is adaptable and adapted to the ever-varying capacities of individual children. It leads upwards from the very general free exercise of the infant to the elaborated exercises of the adolescent boy or girl. It also recognizes differences of sex as well as differences of capacity. It does not require from girls exercises elaborated for boys or men. It does not assume that strength is equal in all, as the military system, resting essentially on the tested physical fitness of a class or squad, tends to do."

These sentences are taken from a Memorandum prepared by Captain Alan Foster and myself for the Scottish Education Department in 1907. At that date the change of ideas

* *London County Council, Report by Medical Officer* (*Education*), 1906.

was already well established ; but the administrative changes had not yet supervened. From the physiological exercise of normal pupils it was an easy step to the hygienic exercise for those suffering from defects. Obviously, under a sound system of physical education, the exercise must be fitted to the child, not the child to the exercise. But no such system can be safely applied except under medical direction.

But this is not the whole case. As the Memorandum was intended to guide the transition in principle from a mechanical system resting upon wrong presuppositions, it was necessary to make explicit a fundamental principle in all physical education, namely, that physical education is a mental process. This was, indeed, the point that most needed to be enforced. To the educational psychologist, it was not new ; to the physical trainer, it was implicit, not explicit. It is so easy to make a clean-cut distinction between the training of the mind and the training of the body ; but, for education, the distinction is a nonsensical abstraction. Education cannot be separated into two parts, one mental and one physical. " All education is mental *and* physical. The mental processes affect the bodily processes as the bodily the

mental. Hence, in brief, we may say that education, mental and physical, must be conceived as one process." No matter what our ultimate metaphysical theory of the relation of mind and body may be, the psycho-physical organism has to be educated as a unity. It is very easy to forget this; but to forget it is to miss the essence of physical education. So conceived, physical education becomes a primary method of developing the dynamics of character. The voluntary raising of the hand, the assuming of an attitude, the swinging of a club, the concentration for a given action, the movement of the eye in recognition of a friend, the movements of the groups of muscles involved in articulate speech; in a word, all expressions of meaning, through muscular movement, are mental acts. The point is so elementary that it should not need to be stressed; yet I am satisfied that the confused distinction between training of the mind and training of the body arises out of the failure to perceive clearly that, for all purposes of education, we are not dealing with a body *and* a mind, but with a mind-body, or a body-mind.

Or we might look at the position from the mental side: every mental action has a bodily concomitant. Whether it be a sensation of light through the eye, or a sound through the

ear, or a memory of sights or sounds, or a prolonged reflection on an abstract problem, or an emotion of joy or sorrow, or whatever experience it be, there is somewhere within the organism a correlated series of physical activities.

It is true that through a large part of the school work this is properly taken for granted. It is equally true that to deal directly with the mind *as if* it could be dealt with by itself, is, in practice, perfectly right; for, through a large part of experience, the direct attack on the mind is our only possible approach to the hidden and unknown activities of the brain. But, even in the purest intellectual education, the whole organism is affected; the tone of the muscles, the tension of the arteries, the rate of the pulse, the temperature of the body, the nutrition of every tissue, all are affected by every concentration and relaxation of attention. The good teacher knows this, and instinctively allows for it. He will not keep a pupil too long in one posture, or too long at any task. From beginning to end of the day, he adjusts the extent and nature of the lesson to the physical as well as to the mental powers of his pupil. In physical education, the principle of action is precisely the same. In other words, physical education concerns itself

primarily with the mental systems that realize themselves through muscular movement.

Only when this is clearly apprehended, does physical education assume its proper place in the school curriculum. Physical education is not an alternative to intellectual education, but a part of it.

In this matter, it is difficult to use the common words without dropping into the very fallacy that we wish to avoid. But the change of name from "Physical Training" to "Physical Education" itself shows that the inter-relation of mental and physical is now well understood in practice.

But the special Memorandum had a further object: it was intended to reassert the need for careful discrimination in the exactions required for the physical education of a rapidly growing organism. Here, if anywhere, the medical superintendence of growth is essential for safety.

CHAPTER XVI

PHYSICAL EDUCATION (*Continued*)

LET us now, for a little, think merely of the physical side. Can we discover any physiological principle to guide the whole process of physical education? In a matter so complicated, it is very difficult to hit upon any single physiological formula that will not mislead. But if I were asked what the best practical criterion of physical education is, I should say that it is the maintenance of the heart action at its best for the longest possible period. This was suggested to me by the following sentence: "It is the function of a healthy heart and arteries to promote the maximum of blood displacement with the minimal alteration of pressures." *

This is "the whole law and the prophets" in physical training. Yet how many systems of physical training take this as their fundamental proposition? The sentence is a con-

* Clifford Allbutt, *System of Medicine*, Vol. III.

densed summary of all that physiology and clinical medicine have to say. None but a man of Sir Clifford Allbutt's immense range of scientific knowledge and practical experience could have uttered a proposition so full of scientific insight.

The popular exponent of physical exercise imagines that he does well when he forces the pace, when he drives his patient to the limit of endurance, testing to his last reserve the capacity of his lungs to breathe, the capacity of his heart to drive, the capacity of his vessels to stand the strain. For his immediate ends, possibly his methods for a time succeed. But he produces overgrown muscles, distended heart and vessels, and a hundred indirect results of these conditions. These results are the price he pays for the immediate success. To say what strain a heart will stand is extremely difficult ; to know when it has been over-strained is extremely easy. But the danger of over-strain will certainly be less if the patient keeps constantly before him that the purpose of exercise is not to test what heart and vessels will endure, but how to have the least strain on vessels or heart to fit them for maintaining in perfect efficiency the blood carried through the body. And this means to keep the blood

pure by correct balance of breathing and circulation ; to remove impurities from fatigued muscles by the continual flushing of the muscles with purified blood ; to maintain the growth of all tissue-cells by the diffusion of recently digested foods ; to stimulate the growth of blood-cells in the bone-marrow, and the formation of new colouring matter (the hæmoglobin) which is indispensable to oxidation of the living tissues.* And as all these processes finally depend on the integrity of the nervous system, it is also the function of the heart and arteries to maintain an equable pressure in the brain and the spinal cord, so that the nerve centres may take energy from the blood through correct nutrition, and void into the blood-stream their inevitable waste.

Note that the healthy heart achieves the "maximum of displacement". That is, by the single and complete contraction of the ventricle, it sends the greatest amount of blood into the large vessels. Sherrington points

* "Hæmoglobin" is the carrier of oxygen in the blood. The oxidation of the tissues is the fundamental and essential chemical process related to life. The oxygen, conveyed to the tissues by the blood and lymph, unites in some way imperfectly understood with the carbon, hydrogen, and other atoms in the tissues. In virtue of this oxidation, the all-important animal heat is generated.—*Editor.*

out "that in the heart-beat the object is to put a pressure on the contents of the ventricle * higher than that obtaining in the aorta, and, that aim reached, any further excess of pressure is useless and harmful, for it subjects the heart and the arterial wall to an unnecessary strain." † The primary fallacy of the popular athlete is that he does not understand this proposition. Let us explain it to him.

When the heart beats, it beats with its whole force. It is a case of all or none. We are speaking at present of the healthy heart. The diseased heart has too many peculiarities to be described in this way. The heart is always active. It has its period of highest activity, followed by its period of relaxation and rest. Its activity must be all exerted on the blood within at a certain pressure. If the pressure is too small, the heart fails to fill the great blood-vessels or to keep them filled. If the pressure is too great, the heart over-fills the blood-vessels, distends them unnecessarily, and tends

* The ventricle is the powerful, hollow, muscular left side of the heart. The muscles of which it is composed squeeze on the blood and drive it out under considerable pressure into the aorta, the great artery which springs from the left ventricle and gives rise to all the other arteries of the body.—*Editor.*

† *Integrative Action of the Nervous System.*

to dilate them at their weakest points. Here it is that the danger from over-pressure begins. When a blood-vessel is over-distended, the fibres constituting the vessel give way more or less unequally, forming, as it were, incipient pockets or dilatations. In the young and healthy, the elasticity of the vessel is so great that harm can rarely result. The heart beating at its hardest is rarely able to over-strain the vessels before the child is disabled by his exertions. Except in the rarest emergency, the child gasps for breath long before his heart pressure has done his vessels any harm. But, as the childish elasticity gives way to the greater rigidity of adolescence and manhood, the heart tends to become too strong a pump for the vessels, and the danger of over-strain is multiplied a thousandfold. With exercise there comes a tendency to exceed the necessary pressure.

It is practically impossible to develop the whole muscular condition by any one system of training ; and as certain forms of activity—running, jumping, gymnastics—tend to overfill the heart, there is an ever-present danger that the pace will be forced and the heart overdriven. But as the correlation of the heart-beat with the distributing functions of the arteries involves a mechanism of extraordinary

delicacy, it is very easy to throw the function of the heart out of relation with the capacities of the blood-vessels. It is when this happens that we realize the profound truth of Sir Clifford Allbutt's proposition. The athlete does not need to be a physiologist; but his trainer ought to be.

This great primary fact about the heart and vessels is, when one thinks of it, a simple necessity of racial evolution. If the heart habitually contracted more violently and more strongly than the equable circulation of the blood demanded, it would grow into an immense organ which would impede the action of the lungs and act like a foreign body in the chest. And this is really what happens when for one reason or another the heart is overgrown, a condition not extremely uncommon. But this condition is morbid; it is the result of physical over-strain of a healthy heart or slight over-strain of a diseased heart. Obviously, if the heart and vessels do not develop as a single system, the individual could not live to reproduce the race, and evolution would be impossible. As the heart is the first moving point in the embryo, so it is the last moving point in the grown man. As it has in itself, under correct nutritive conditions, the power to grow and develop into a valvular pump for

the blood, so also has it the power, unforced and unstimulated, to maintain the blood-pressure essential to the correct nutrition of the whole body. It is not that exercise is unnecessary : but it is that exercise should be taken always according to the principle that the minimal pressure in the arteries, not the maximal, is the ideal, provided the nutrition of the body is correctly secured. Normal exercise means growth ; forced exercise means over-growth ; and over-growth always means disease. From this fundamental principle we may deduce many points for practice. There are now delicate instruments known to every physician for estimating the pressure of the blood. By these the skilled physician knows when the vessels are growing too rigid. The method is not as a rule applicable to the growing ; but it contains physiological hints for the practical trainer. He must be taught that the constant dilatation of enfeebled vessels may be the beginning of a twenty years of " dying ", for such over-strain may hasten the onset of arteriosclerosis. He must be taught that the first sin of athletics is vascular over-strain. Whatever perfection of muscle he may achieve, he has achieved nothing but evil if the balance of heart and vessels has been broken in the process.

For children, therefore, a good system of physical education must honour two principles: it must be strictly adapted to the requirements at each period of growth; and it must, throughout, be based on the principle of equable pressures. For the very early stages, play, properly organized, furnishes all that the young child requires. For the child at school, the system must provide delicately graded and specialized exercises. These exercises may, for immediate practical purposes, be classified into two sets: exercises to secure good posture, and exercises to secure good carriage. Posture is, of course, itself a form of exercise; for the body can be kept balanced only by the perpetual exercise of co-ordinating and opposing groups of muscles. The difference in exercise, therefore, is not a difference between a static and dynamic exercise; it is a difference determined by the immediate purpose of the exercise itself. The text-books of physical training provide full and carefully-thought-out tables, built up to suit each group of ages. Each table has a system of its own; it begins with certain simple preparatory movements; it develops to a climax, and then eases off in a dying fall to rest. Thus, if you watch a skilled teacher handling a squad of children, aged about eight, you can trace in his com-

mands a steady evolution from simple movements to complicated, from easy to severe, from tension to relaxation. Work for each individual is easier when he finds himself the member of a squad, for then much less demand is made upon the will-power of each individual than if he were standing alone. In the squad, as in the dance, there is a subtle appeal not furnished by any other mechanism.

Let us look at the squad. A quiet order sets the squad in four open lines. Here, let it be noted, there is no shouting ; for, fundamentally, it is not intended that the exaction of an exercise should always hang on an outside command. It is intended that, in the end, the child shall be fitted to run alone of his own initiative, not to be perpetually waiting for an order. The more quietly the suggestions are slid into the mind, the more organic is the ultimate result. This is a training for free persons, mutually adjusted, not for soldiers under discipline. That is an important but a very different problem. Once the squad is arranged, they know that the work is begun. There is first a quick march. In a few simple evolutions the distances between individuals are adjusted, and ultimately individual positions are taken for the further movements. Already, the metabolism quickens. If you felt the

pulses you would find them faster ; the respirations are deeper, and the muscular tension is more marked. The teacher sees that the postures are correct. Here a back is too much bent ; there the attitude is too slouching, or the poise is awkward. By one adapted exercise after another, a correct attitude is secured.

Next, the teacher attends to the trunk. He knows from inspection and previous experience just what is wanted, both to correct and to develop, and the trunk exercises must fulfil both ends. Thus, with feet astride, the pupil is required to bend the trunk variously sideways. This is not an exciting exercise : it is ponderous and too uninteresting to be prolonged ; but it must be long enough to initiate or to continue a defined habit of action registrable in the nerve centres. Incidentally, the muscular apparatus is tuned up to meet the demands. From the less stimulating exercises, the teacher proceeds perhaps with a vigorous game, finishing by a quick march round the playground and then to the training stance, where the children are once more deployed to their individual places. In the marches, a new point emerges : the carriage of each child is tested. Good carriage means that the body in motion is well adapted to the physiological requirements of the moment. It means that

irrelevant motions are excluded. It is part of the training in attention. But there are still other points that come into this table of exercises; the pupils, feet astride, arms stretched upwards, make quick bending movements. This is to strengthen the abdominal muscles. Later, the dorsal muscles get their turn. The arms are lifted slowly sideways and upwards, and the head bends slowly back.

There are many varieties of these exercises; I note only the primary movements. The exercises, it will be noted, are intended to be at once corrective and developmental. Never for a moment must it be forgotten that the organism under training is fluid and dirigible. But, once more, these unstimulating exercises tend to kill out interest. But, by this time, the squad has warmed to its work and is equal to anything within its range. If conducted in cool and moving air, as it ought to be, the drill results in a wholesome quickening of the whole metabolism. The children are now ready for a more serious prescription. Without fatigue, they can stand discipline; they will readily compete in racing or jumping; they are prepared for an organized dance; and, by those vigorous and happy exercises, they may work off the energy generated by the earlier movements. If, at this stage, the pulses were

examined, they would be found rapid and vigorous; the respirations are manifestly increased in correspondence. Then comes the dying fall. The teacher gradually converts the vigorous and varied activities into a quiet march, and, with arms rising sideways, the pupils take a few deep breaths and thus pass gradually into rest.

If there is skill and insight put to these exactions, the children show the result in glowing eyes and faces, and pass out from the gymnasium better than they entered. They experience only a pleasant fatigue, if any, and they will come next day to the set lesson with intenser interest. The whole table takes, perhaps, only half an hour to work through; but it is half an hour of ordered intellectual exercise. The whole of the tissues are stimulated; the pace of nutrition is increased; there is nothing excessive; for the drill has been kept uniformly within the limits of fatigue. In this there is nothing incompatible with the uncontrolled play of the playground; and to this the children take with all the more zest that the whole muscular system has been healthily roused.

Through all the stages of school life, from infancy to adolescence, the same principles can be applied. But every age has its own

little differences, and the tables prepared make allowance for them. The concept of growth is honoured at every stage. This is not drill ; it is education. It is not training for a particular task ; it is preparation for the future. It is not an alternative to intellectual studies ; it is itself an intellectual study, but it strengthens the physical groundwork by varying the physical organs involved. How important this is, a single fact will show : the minute muscles of the eye are readily fatigued by even a short period of concentration on a given object, and the sensation of fatigue becomes acute. The motions of the whole body, involving the massive muscles, act as a derivative. In this sense, the larger movements are a relief to the brain.

The system of training here assumed spread over the world under the name of the " Swedish system ". It is based on a very minute study of anatomy and physiology. But, according to Demenÿ, it is suited rather to the cold temperament of the north than to the more active temperament of the south. But, under the steady criticism of experience, the system has adapted itself with marvellous simplicity to all the uses of the school. Everything depends on the temperament and training of

the teacher. I have seen an alert Dane bring a squad of lethargic children to a happy and glancing life with a few skilled words. He understood the quick actions of children, and he knew just how to bring into perfect accord the right exercise and the inner wishes of every child. The motions that take so long to describe became the ordered and beautiful expression of sheer delight. Criticism dissolved into appreciation. In the procession of the school ages, the exercises become more elaborate and more exacting until among the seniors the pupils are fitted to train along special lines for the heavier games, or, if games are discarded, to maintain the poise of health through all the several activities of their adolescent and adult life. For the need of the system, as of all education, is to cultivate initiative and to develop staying power. "In physical education, it is poise we seek, balance, adjustment to its object—in a word, the condition of maximum fitness for the longest period in any given organism." * Taught in this spirit, physical education becomes one of the most important methods of developing the dynamics of character. "But to yield its full fruit, physical education must be adjusted in kind and degree to the capacities

* Nelson's *Loose-Leaf Medicine*, Vol. VII.

of the individual person. This implies that the person comes to his physical education only after the most intimate medical scrutiny. This, in turn, means that, so far as practicable, the person, whatever defects or ailments he suffers from, shall be physically educated towards his own physiological normal. But to secure this, we must have an exhaustive system of medical inspection, and such treatment as the inspection indicates."

Here once more we pass over into the field of medical examination and treatment. But the system of physical education itself provides for the systematic treatment of many kinds of defect and deformity. The remedial exercise is as important a part of it as the physiological exercise. And here growth more than ever must govern treatment. The marvels achieved by remedial gymnastics must be seen to be believed. But the work is prolonged and wearisome and needs an elaborate training. The results, however, justify the efforts; and many deformities incidental to growth may be prevented or materially improved. From beginning to end, physical education ought to be an integral part of medical treatment, both preventive and curative. Not until it is fully developed from this standpoint can we expect from it the thorough benefit it is well calculated

to afford. This, however, implies a new synthesis of clinical medicine and physiology ; for the animating purpose is to maintain the physiological normal and to prevent the pathological deviation. On the other hand, this is not simply a problem of physical education : it is a function of the health administration as a whole. The need, however, for establishing this standpoint is more manifest in the school ages because at that time growth is capable, within limits, of control and direction.

CHAPTER XVII

SENSORY ATHLETICS

THERE is an athletics of the muscles, and there is an athletics of the senses. What do we mean by this?

Every one knows that the capacity to see increases by looking; the capacity to hear by listening; the capacity to feel by touching. This is true of every sense. Between the untrained touch of the child and the infinitely delicate touch of the violin player there is a difference as great as between the flabby muscle of an underfed drunkard and the muscle of an athlete in high training. Strictly we cannot separate the training of the senses from the training of the muscles; but we need not, therefore, confuse the training in sensation with the training in movement. Sensation and movement hang together; but the sensory side is stronger in one man, the motor side stronger in another. Hitherto, for the most part, the theories of physical training have

rested on the assumption that to train in movement is the whole problem. Naturally, training founded on such a theory falls into the error of producing mere muscle, of developing mere energy of movement, of sacrificing the delicacies of sense to the gross ideals of the acrobat. A teacher of physical training once told me that as a boy he regularly spent all his pocket-money at the circus; he watched all the new tricks of the clowns and the acrobats; he then went to his own gymnasium and learned every movement. Later, he realized that he had trained himself admirably for a clown, but he found his muscles a hindrance to development, and he suffered from a constant anxiety to keep himself in good form. The same extraordinary blunder seems to have dominated the world of physical trainers for many generations. But it is a lop-sided ideal. It does not succeed even for its own purpose. It leaves the clown a perfect clown; it leads to excess of muscle; it breaks the balance of the organism; it ends in hearts enlarged, veins distended, and sometimes in nervous systems exhausted. It is time to ask the reason why.

Is it not because the athletics of the senses have been left to chance while the muscles were the chosen favourites? Not that the senses have gone untrained. Incidentally eye

and ear and touch and the sense of movement and the sense of temperature have been subjected to an endless variety of experiences; but they have not received the same systematic culture as the muscles. It is only at rifle practice that prizes are given for good vision. It is only among the children themselves that the delicate nerves of the fingers are taught to catch a ball. It is only on the cricket field that the co-ordination of hand and eye becomes the condition of success. And it may be allowed that in every game the cultivation of some one sense or of several is incidentally necessary. None the less, it is on the whole true that the education of the senses is largely a matter of chance, only here and there a matter of design. Girls are taught in great numbers to play on the piano, to sew, to knit, and to do some other things that develop delicacy of touch and correctness of ear. But boys, as often as not, receive through their whole school period no sensory training except what the playground gives them.

Is it possible to devise a system where the senses shall be first and the muscles second? Undoubtedly it is.

Robert Houdin, the French conjurer, tells us that to become a conjurer he had to devise some method of educating his touch to the

most subtle delicacy of discrimination, of teaching his eye to carry with it an instantaneous photograph of everything he saw, of bringing into absolute co-ordination the actions of his voice, his eye, and his hand. He tried many experiments. He admitted that the playing of the piano was a good discipline, because it brought ear, eye, and hand into co-ordinated action. It taught the fingers to work with all delicacy by themselves. It taught the eye to read a complicated musical score. It taught the ear to discriminate fine shades of pitch. At the same time it left the accomplished pianist free to talk while he played. Each one of these activities was itself a complicated series of nervous functions; the four series of activities going on all at once are too complex to be described in words. And they did not precisely suit his purpose; because they were directed to a limited performance—the interpretation of musical compositions. He looked for some system equally complicated, but adapted to the ends of the conjurer, who makes deception into an art and so achieves his glaring impossibilities.

As a boy he had been impressed with the jugglers at the fairs. He had seen them keep two, three, four, and six balls vaulting into the air and obeying their will with perfect pre-

cision. He knew, by trial, that to do this the juggler must take the most perfect care of his hands, of his eyes, and of his whole physical constitution. If the skin of his fingers be too moist or too dry, he misses the catch. If his eye be short-sighted or long-sighted, he misses the shadows of the balls. If the muscles of his arms, of his body, of his limbs, be badly trained, he grows tired too soon, he cannot attend, he cannot concentrate his nervous system on the ever-recurrent movements of his moving pets. Here, thought Houdin, I have discovered the way to train my fingers into delicacy, my muscles into infinitely varied motions, my eyes into quickness of vision, and all the time I can think and speak of something else. These are the conditions for a conjurer. Forthwith, he proceeded to practise ball-throwing. Every day of his long professional life he practised the throwing of one, two, three, and four balls until he could keep them playing in the air while he read aloud from a book placed in front, or spoke. If he remitted his practice at the balls, he found himself less adept at his conjuring tricks. His fingers lost in delicacy, his eyes in keenness, his muscles in precision of movement.

Once, Houdin had to perform at a Duke's palace. He had never entered the building

until that evening, when he proceeded straight to the stage. But he astounded his audience by naming book after book in the Duke's library, stating the section and shelf where each lay. He was supposed to be clairvoyant, and doubtless encouraged the belief. But the explanation was simple. In going to the room set apart for the performance, he had been led through the Duke's library. He swept his eye over the walls as he passed along, and in the few seconds took with him a picture of most that was there. He records that, to develop this faculty, he and his son would run past a shop window at full speed, glance at it in passing, and then relate to each other what objects they could remember. He declares that the son could remember much more than the father, and that, by cultivation, both son and father taught themselves to produce marvels of picture memory.

What the great conjurer did, any one in his degree can do. And the principle can be applied in some degree to every sense. It is applied in the arts and crafts, in every mechanical aptitude, from the grossest work of the quarry to the most delicate movement of the artist.

It is easy to construct a graded series of ball exercises: tossing of one ball with one hand,

passing a ball from hand to hand, tossing two balls with one hand, tossing two balls with one hand and one with the other, tossing two balls with each hand at once, passing three balls singly from hand to hand, four balls, and so on. Then there are the varieties of catching : with one hand, with two hands, with one hand and eyes averted after a glimpse at the curve made by the ball. Any person interested can adapt the tossing of balls to many forms of training for hand and eye. Incidentally, the attitudes necessary for these exercises develop muscular co-ordinations of many kinds, and increase the sensitiveness of the touch for all purposes. I know of no set of exercises better adapted for general sensory training.

CHAPTER XVIII

THREE POINTS IN PSYCHOLOGY

UP to this point, we have approached the facts mainly from the physical standpoint. But all along it has been implied that we are dealing with a psycho-physical organism. Some points, however, it is more convenient to discuss from the psychical side alone. Here, I do not aim at any "psychology of education". That field of study has, in the last forty years, produced a large group of general and special books and articles. It is hopeless to attempt a summary even of the methods, not to speak of the results, of those studies. I content myself with a few observations on three cardinal points: infantile memory; mental repression; the normal growth of the will.

The memories of infancy are an immensely important factor in the after-life of the child. By memory here I mean not mere conscious memory alone; but experience as recorded and retained in the mind-body system. For

example, Who can say when he learned his first word? Who can recall his first sentence? Who can tell you when he began to think, or to discriminate things by the eye, by the ear, or by the touch? Who knows when he first felt hot or cold? Where is the memory of our first breath? Yet at that moment the respiratory centre first began to act; the whole nervous mechanism of breathing—one of the most difficult of physiological problems—came into action with a cry; yet apparently no conscious memory of it remains. And so through hundreds of millions of other experiences. There has been a record; there is never any conscious recall. Of the experiences, the sensations and actions of which our day's life is compounded, multitudes must have begun before we were born; multitudes more occurred in our first year, our second year, or our third year.

Frequently some of the experiences of our second or third year can be consciously recalled. But the great bulk of them cannot; yet the muscles were always moving; the eye was always seeing; the ear was always hearing; the skin was always touching; the heart was always beating; the lungs were always expanding and contracting; the temperature was rising and falling; the processes of growth

and tissue exchange were always going on; and every experience coming by any of these channels of sense or motion was making its record on the brain, and we are each to-day what we are because those things happened. When you were born, you changed the light and atmosphere of a mother's and a father's whole world. You cannot recall the fact; but you had better believe it, for no fact is better attested. It is important for us to understand that this immense groundwork of non-recollectable experiences is a primary datum in psychology. But although you cannot recall the experience as it happened, none the less you act upon it. You cannot recall when you first uttered the syllables "ma-ma", and perhaps when you did, they had nothing to do with anything more than satisfaction in using the lips. But every observer knows that an infant is hardly a day old before it detects a difference between the person that does and the person that does not know how to hold it. By the end of a week, the child is a connoisseur in personalities. Long before the end of a year, he discriminates friends from strangers.

It is true that he easily forgets his mother even at the age of two or three. There is nothing more pathetic than the broken-heartedness

of the mother when, after a week in hospital, the baby of two or three prefers the nurse and turns from its mother in fear. To the infant of that age, every woman is a mother. This has a biological meaning; but we pass over it. The point is that all these experiences, although they are apparently forgotten, affect the after-life, and will again emerge in one form or another. Nothing that happens to a child is indifferent to its after-history; in particular no emotional experience is ever indifferent.

The problem of mental growth at the early stages is how to secure natural adjustments of the child to his varying environment with the least amount of irrelevant repression. Have you ever watched a toddler of two years bending down to raise a stick from the ground and just managing not to topple over on his face? Watch one hand extended in front, the other probably extended backward, the body carefully and slowly adjusted, the head drawn back, the centre of gravity kept right all the time, and then the triumph of acquisition! To him the winning of the stick is as great a joy as the discovery of the New World was to Columbus. For the time, he is regardless of everything and everybody. If at the critical moment he is interfered with, his whole nervous system, then in a state of high tension, receives

a rude shock, and the mechanism of nervous action is jangled. If you let him proceed and accomplish his wish, the beginning of an executive habit is established and a new channel of real experience is opened up. But if you interrupt him, he still wishes to obtain the stick ; he will not stop wishing when you take him home screaming ; he will resent your interference as an irrelevancy, and there will be generated in his mind the idea that there is something wrong. If, for some relatively innocent performance of this kind, he is sharply punished, he will forget the punishment, but his nervous system will not forget it. The wish realizes itself in some other form, and the foolish mother finds that some day he will cast her over and find in his own way whatever stick he wants. The ethical value of natural play comes largely of the fact that most of the things to be done are relevant to the imperious wishes of the child and are in themselves innocent. The tendency of the adult is to introduce irrelevancies, to enforce direction where direction does not really matter, and in this way to spoil the method of enforcing direction where it does matter. The child needs company of his own age and stage. For what has it to learn ? It has to learn within a few years the art of civilized living. It has

to make the transition from mere running wild at its own sweet will to running in harmony with wills other than its own. It will become a free member of the pack readily enough if it gets a fair chance, but the discipline of the herd is very severe. It is a subtle discipline, and usually follows the soundest method, namely, letting the child act of its own will, and find from its own experiences that certain things are not acceptable to the others. In later life we put it into English and say: "No, sir, those things are not done, you know."

In saying that the mind should be encouraged to grow with the least amount of irrelevant repression, I do not mean that every child should be allowed to do as it pleases. But on the other hand, a child should not always be required to do merely what the mother or some one else pleases. The whole problem is how to lead the child step by step, impression by impression, experience by experience, to learn to know and to feel that the whole world does not exist for his egoistic pleasure, but that he is a growing person within a community of persons; working with them; winning their likes or dislikes according as his conduct is well-adjusted or ill-adjusted. Whether it is good conduct or bad conduct depends upon the community he is born into; it never

depends exclusively upon himself. Good conduct is like a good accent. A good accent may be to some extent improved by the direct teaching of phonetics; good conduct may to a certain extent be made stable and correct by direct teaching of good precepts; but in the end good conduct is acquired by living with good people, as a good accent is acquired by living among good speakers. Mentally, the child is a focus of every influence to which he is capable of reacting.

We may pursue this matter one stage farther. The healthy new-born infant is full of spontaneous energy. It flings itself about more or less irrelevantly. It has intentions and makes violent efforts to realize them. Some it finds pleasant, some unpleasant. The pleasant actions tend to be continued and repeated; the unpleasant actions to be discontinued and dropped. When he comes to two pleasant actions at once, he must choose the one or the other; he cannot have both. If he yields to the one, he must repress the other. Thus, from the cradle, he is continually selecting what he shall do; he is constantly but quite naturally realizing and repressing.

As he grows older, his particular actions grow into conduct, and he finds that he is always faced with alternatives, of which he

must choose the one and repress the other. This is the process of natural mental growth. When irrelevancies enter in, when violent emotional shocks disturb his decisions, the mind tends to suffer and the process of natural repression becomes a process of morbid suppression. At the critical transits of the child's life, these morbid suppressions tend to work mischief. You can read their presence in a thousand actions of later years, in a thousand morbid evidences, in shynesses, in fears, in internal conflicts of every variety, ending many a time in broken careers and even in death. It is difficult to picture the infinite variety of the mind, how unstable it is, yet how persistent; how various and yet how irresistible. But when the skilled psychologist traces back the morbid phenomena of later childhood and adolescence, he finds many hidden and forgotten roots, and he is often able to re-establish continuity between infancy and manhood.

CHAPTER XIX

THE TESTING OF "INTELLIGENCE"

WHEN the child comes to school, he must be "placed". In the old days, it was: "Yes, sir, he knows his letters, and he can count, and he can read the Primer, and I am sure he will make a fine scholar, and . . ." The teacher, accepting the record with what grace the years had left him, would say smilingly: "Very well, we shall see what we can make of him." The mother turned home with a heavy heart, and the boy, full of fear and wonder, entered the new community of "scholars". In a day or two, his reactions to the subtle environment showed where he stood mentally and morally. In a month he was an "old hand". He had found his "class" and his place in the class. He did not perhaps undergo a prolonged individual examination for anything—senses, movements, or mentality; but still he found his place. How he fared in the end rested with the teacher, who,

if more or less an artist in the art of teaching, would for several years teach and test until the boy emerged with some knowledge and some system to practise the larger "art of living". Many tests of "intelligence" were there in fact, if not in form; but the use of them was left to tradition and instinct. And, then as now, there were good and bad teachers. By natural selection, the clever boy rose to the top and the dull boy sank to the bottom; but if faculty as such was not carefully tested, it did usually get a chance, and a feature of the older schools was that the "clever boy" scored all along the line. When the Professor of Greek said of Scott, who refused to learn Greek, that "dunce he was and dunce was to remain", he was merely a victim of irritation because a lad of genius could be so obstinate; and he lived to revoke the sentence "over a friendly bottle of Burgundy at our Literary Club at Fortune's".

Huxley, so we are reminded, was one of a schoolmaster's eleven children, and he said that he did not get much good from the school. These two out of many that history offers us suffered, for the moment, from the indiscriminating application of certain traditional tests. To-day, under the revised Binet or other tests, each would have vaulted easily

into the first place for pure faculty. These brilliant blunders are a comment on sclerosed systems of instruction rather than on the methods of education. Huxley himself lived to improve those methods, and now the "Huxley" method of teaching biology is as well understood as the system of Froebel. But the brilliant blunders were balanced by brilliant successes; and of these, too, history is full. It is, however, undoubted that the older systems tended to neglect the dull children and to let them struggle along wearily in the wake of the more brilliant. Yet there have always been teachers who saw the point. The late Sir Michael Foster of Cambridge, when a friend expressed surprise that he lectured to the juniors and left the seniors to an assistant, said: "Anybody can teach the seniors; I like to take the juniors myself." This was said of University students. But the beginner always needs the best teachers, and when the day of mass-education arrived, the older and more casual methods had to be revised, if only for economy in teaching. When every child has to be educated according to capacity, the clever child tends to suffer. The calendar age is not a safe index of capacity, and we are driven to look for something that secures greater justice to the dull child on the

one hand and to the clever child on the other. The school itself, however crude its tests may be, acts as a winnowing fan, and the case for " tests of intelligence " has already been made out by the mere fact that schools have spontaneously grouped themselves into various types—Nursery Schools, Deficiency Schools, Infants' School, etc.

It is, of course, easy to make fun of the many clever scales elaborated by the experts ; but equally it is possible to make fun of the older types of written and oral examination. In the teaching of the sciences, the " practical class ", often ridiculed as mere " object lessons ", long ago proved its value. The tests of intelligence may, indeed, like any other new group of ideas, pass into ritual, as much of the Froebel " gifts " did ; and the ingenious minds that devise and revise the tests and the ways of applying them may, in the joy of a new method, elaborate their technique unduly ; but, with the elusive mind of a child, the danger is on the other side. To-day we are not satisfied to be told that a child " knows his letters ". We first secure that he is reasonably fit physically. Can he see ? Can he hear ? Can he breathe properly ? Can he move normally ? Has he any deformities ? What infections has he passed through ? Are

his heart and lungs sound? Is he well nourished? And there are a dozen other questions to be recorded in the medical schedules. Satisfied with this record, we then grade him, if necessary, by "tests of intelligence".

These, let it at once be said, are the climax of thousands of experiments, not the fanciful construction of too curious psychologists. To those familiar with Binet's general work in psychology, it was not surprising that he should have sought more adaptable methods of testing intelligence than those consecrated by custom. But, as Professor Terman and Dr. Cyril Burt abundantly show, the Binet tests rest everywhere on a groundwork of general psychology. In the *Report of the Consultative Committee on Psychological Tests of Educable Capacity* (His Majesty's Stationery Office, 1924), Dr. Burt shows how the Binet tests emerged from a whole world of experiments. And the testing of these "tests" still continues. In his "memoranda" on Mental and Scholastic Tests, Dr. Burt puts principles and methods themselves to the test of comprehensive experiments on a scale possible only in great cities like London. In a rapid study of these memoranda, I find it difficult to decide which most to admire: the catholicity of the scientific

estimate or the mastery of the details. The tests have many limitations; but their value in the right hands is now beyond question.

"In discriminating the child of the special school from the child of the ordinary school, the scale as a whole is tolerably successful; in grading special school children amongst themselves it is almost as efficient; in grading the normal children amongst themselves it is less accurate than other tests that are now to hand; and in detecting super-normal ability it is altogether invalidated by the anomalies and the *lacunæ* among the problems for the higher mental years." * But Dr. Burt adds: "By its (the Binet-Simon scale) aid the intelligence of tens of thousands has been tested and measured—young and old, super-normal and defective, moral and immoral, the convict in jail and the pauper in the almshouse, rural labourers and university students, schools by the hundred, army recruits by the battalion, in short, men, women and children from almost every sphere of life. Pending the construction of some more scientific scale, whose validity has been as widely tested and whose authority is as generally revered, the Binet-Simon scale must, for rough and practical purposes, still hold and monopolize the field." Naturally,

* *Mental and Scholastic Tests*, p. 208.

Dr. Burt deprecates the idea of accepting any scale as final, and he proves the need for continued research by experiment. But this scale has a value in that it can be used as a first rough test by teachers themselves in the ordinary course of their work.

But what are we to understand by "intelligence"? Here it is easy to waste much time on definitions of doubtful relevance. Let it be understood that these tests are, in the strict sense, practical tests. That is, they are meant to determine—not the predominance of this mental element or that in any given case, but—the reactions of a personality in its ordinary social relationships. As Professor Terman puts it: "Binet's approach was a many-sided one. The scale includes tests of time orientation, of three or four kinds of memory, of apperception, of language comprehension, of knowledge about common objects, of free association, of number mastery, of constructive imagination, and of ability to compare concepts, to see contradictions, to combine fragments into a unitary whole, to comprehend abstract terms, and to meet novel situations." * This may be taken as a working idea of "intelligence".

Obviously, to apply the scale scientifically

* *The Measurement of Intelligence*, p. 46.

implies psychological training. But, given such training, a reasonable teaching value can always be found for an Intelligence Quotient based on the scale. But, like other instruments of measurement, such scales must be checked by prolonged study of the given child and repeated experiment.

One or two illustrations are enough. In thirty-four cases of mentally defective children, the Binet-Simon tests were applied annually over a period of six years. Dr. Burt found that the average "mental ratios" ran as follow: 63·7, 65·3, 64·5, 62·6, 59·8, 57·1. In all but eight, the mental ratios at the end of six years were smaller and "in six of these eight the low initial grading at the commencement of the period could be clearly traced to external hindrances, weakness of health, ill-treatment at home, irregularity of attendance, unsuitable methods at the previous school—impediments that afterwards were substantially alleviated." Again he found that mental deficiency might be apparent and temporary only. "Such children are creatures of deferred maturity; their development is not arrested, it has been postponed. . . . There is many a sharp child whose cycle of growth is like that of the mulberry tree, presenting first a long delay and then a sudden yield of flower and fruit together.

Their existence is recognized in the double scholarship examination. In London at the age of thirteen a second examination has been instituted specifically for those who, in the current phrase, 'bloom late' and whose anticipated powers, therefore, do not ripen by the age of ten." There may be "latent normality" as well as "latent deficiency".

There are many other important points. For example, mental tests show that the range of intelligence in mental defectives overlaps the range of intelligence in the normal. Further, there is considerable overlapping of consecutive age-groups. And a third general conclusion of immense importance is that the results of mental testing reflect the social status. "The 'superior' school is nearly a year ahead of the general average, the 'poor' more than a year behind." He finds that "the backwardness of the 'poor' school is likewise most obvious when the children emerge from the infants' department. It is apparently in early childhood that their minds wear most visibly the impress of their parents' poverty. . . . Among the ill-to-do some reach early their limit of growth; others mature late. Many of the brightest, too, leave for work at an age unduly young. But, above all things, for children from the lower social strata the harder literary

tests may lie for ever beyond their cultural horizon."

This result is confirmed by Professor Terman. Of 492 children classified by the teachers according to social class as "very inferior, inferior, average, superior, very superior", it was found that the Intelligence Quotient for children of the "superior" social class was "about 7 points above, and that of the inferior social class about 7 points below, the median Intelligence Quotient of the average social group. This means that by the age of fourteen inferior class children are about one year below, and superior class children one year above, the median mental age for all classes taken together." * How much of the difference is due to superior "original endowment" and how much to inadequate nurture is a separate problem.

These illustrations from among mental defectives and normal children are in line with what we might expect from our study of the social environment. They are enough to show the extraordinary fruitfulness of the new methods of testing when used, not as a mere mechanical system, but as a special application of the fundamental principles of psychology. "Method should be individualized, not uni-

* *The Measurement of Intelligence*, p. 72.

versalized; adaptable as clay, not rigid like a clamp; evolved progressively from week to week, modified for this pupil and reversed for that, not written down for all cases and occasions in a book." * This is part of a penetrating and wise criticism of the application of scales to syllabuses. All that I am here concerned to enforce is that the "tests of intelligence" are now to be taken seriously in the development of educational method and in the "placing" of the child at school. They do not supersede the judgment of the trained teacher: this no one emphasizes more than Dr. Burt. Nor do they touch the mass of psychological problems grouped under terms like "internal conflicts", "mental mal-adjustments" and their congeners. The methods of psycho-analysis, or, more generally, psycho-therapeutics, have their own field of application. But the tests of educable capacity have their relevance to the day's work of every school. One *caveat*, however, it is right to make, and Dr. Burt repeatedly makes it: no set of tests is to be taken as a final determinant either of ultimate attainment or even of immediate vocation. Demosthenes, we learn, was a stammerer, yet he became an orator. Temperament, character, emotional bias, interest, opportunity, temporary

* *Mental and Scholastic Tests*, p. 263.

lethargy, and a dozen other vaguely defined qualities of personality all come in to qualify the testing of " intelligence ". The square man in the round hole may, in the end, do the best work, and the irksomeness of duty may be the most precious stimulant of mental growth. These " tests " are not to be taken abstractly. If they are, they will follow all the others to the educational dustbin. *Every* system of examination may become sclerosed. In the end, it is the individual child that has to be " placed "—provisionally, and no " tests " of the moment can ever match " the soft play of life ".

CHAPTER XX

CONCLUSION

THE school, as a special organ of the family, has a triple function : to instil knowledge, to cultivate intelligence, and to develop character. The first it does by suiting the lesson to the mental age of the child ; the second it does by equipping the child with the methods of acquisition ; the third it does by placing the child in a community of his contemporaries. Success hangs on the capacity of the teacher to select the right knowledge, to assess individual differences of faculty, and to create the right atmosphere for the blossoming of personality. The problem would be simplified if every child came to school from a good social environment, with a good inheritance, and with a good record of personal health. But these conditions it is often impossible to fulfil : the facts I have discussed are only too decisive. To see that the best is done that can be done is the purpose of the

medical superintendence of growth. The technical methods, it is true, are imperfect; the administrative machinery is cumbrous; but the end of all education is to help towards the realization of the good life, and by this end all our efforts are consecrated.

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