ON TUBERCULOSIS IN CHILDHOOD AND ITS RELATION TO MILK.

BEING PART OF A PRESIDENTIAL ADDRESS DELIVERED
BEFORE THE ULSTER MEDICAL SOCIETY.

By JOHN McCaw, M.D., R.U.I.,

PRESIDENT OF THE SOCIETY; SENIOR PHYSICIAN TO THE BELFAST
HOSPITAL FOR SICK CHILDREN, QUEEN STREET, ETC.

My connexion with the Belfast Hospital for Sick Children for the past twenty years has given me exceptional opportunities for studying the disease, and I shall give as shortly as possible, the main points with regard to tuberculosis in childhood, and lay special emphasis upon the connexion which exists between tuberculosis and cow's milk.

1. *What amount of tuberculosis in children exists in Belfast?*

At the Children's Hospital, in Queen Street, Belfast, during the quinquennial period 1902-6, 26,193 cases were treated, and tuberculous disease in some form was met with in almost 20.0 per cent.—to be accurate, in 19.99 per cent. of them. Of this total, 4,049 were treated as in-patients in the wards, and 28.52 per cent. of them were tuberculous, while 22,144 new cases were treated in the out-patient department, and 18.26 per cent. suffered from tuberculosis in some form. If these figures be examined in detail some interesting points are brought out.

In the year 1902, 13.96 per cent. of the cases treated in the medical ward were tuberculous, while in the surgical ward 49.24 per cent. of the cases treated suffered from the disease in some form. During the same year, in the out-patient department, 6.65 per cent. of new medical cases were tuberculous, while on the surgical side 40.78 per cent. of the new cases suffered from the disease.

In the year 1903, 18.60 per cent. of the cases treated in the medical ward were tuberculous, while 40.76 per cent. of the cases treated in the surgical ward suffered from the disease in some form. During the same year, in the out-patient department, 5.67 per cent. of new medical cases, and 48.50 per cent. of new surgical cases, were tuberculous.

In the year 1904, 15.27 per cent. of the cases treated in the medical ward, and 39.81 per cent. of those treated in the surgical ward were tuberculous, while in the out-patient department 6.31 per cent. of the new cases treated on the medical side, and 47.74 per cent. of the new cases treated on the surgical side, suffered from tuberculosis in some form.

In the year 1905, 17.56 per cent. of the cases treated in the medical ward, and 40.64 per cent. of those treated in the surgical ward were tuberculous, while in the out-patient department 6.95 per cent. of the new cases treated on the medical side, and 38.86 per cent. of the new cases treated on the surgical side, were tuberculous.

In the year 1906, 14.04 per cent. of the cases treated in the medical ward, and 37.85 per cent. of those treated in the surgical ward were tuberculous, while in the out-patient department 5.16 per cent. of the new cases treated on the medical side, and 31.71 per cent. of the new cases treated on the surgical side, were tuberculous.

Through the kindness of Dr. Stevenson I have been enabled to examine the returns of the Ulster Hospital for Children for the years 1903, 1904, and 1906, and here again I find a similar, if more striking, record. During the year 1903 of all children treated in the wards 35.74 per cent. suffered from tuberculosis in some form; in 1904 the percentage is still higher, being 38.31 of all children treated; while in 1906, of all in-patients, 30.36 were tuberculous. The figures I have given carry one message of encouragement, and it is this, that the amount of tuberculosis met with at our local children's hospitals has been diminishing during recent years. With these statistics before me, I have no hesitation in answering the question set by saying that the amount of tuberculosis existing amongst children in Belfast is large; and in this I feel sure my hearers will agree.

The interesting question now arises: How do we in Belfast compare with other cities in regard to the amount of tuberculosis met with in children? To arrive at an answer to this question I have examined, on exactly the same basis, the returns of the cases treated at Great Ormond Street, London; the Royal Edinburgh Hospital for Sick Children; the Manchester Hospital for Sick Children at Pendlebury; the East London Hospital for Children, at Shadwell; and the Glasgow Hospital for Sick Children. Using the same methods of deduction, I find from the report of Great Ormond Street for the year 1905,

that the number of cases treated in the wards was 2,876 of which 778, or 27.0 per cent., were tuberculous. In the Royal Edinburgh Hospital for Sick Children during the year 1906, 1,968 cases were treated in the wards, of which 407, or 20 per cent., suffered from some form of tuberculosis. In the Manchester Children's Hospital at Pendlebury during the year 1905 the number of cases treated in the wards was 1,999, of which 436, or 21.3 per cent., were tuberculous. In the East London Hospital for Children at Shadwell during the year 1905, 2,054 cases were treated as in-patients, and of these 501, or 24.3 per cent., suffered from tuberculosis in some form. Lastly, in the Glasgow Children's Hospital during the year 1906 the number of intern patients was 1,177, and of these 27.95 per cent. were tuberculous. That these figures may be more readily compared, I will tabulate them in one column as follows:

1906—Belfast Hospital for Sick Children	{ No. of intern patients, £27. No. tuberculous, 26.10 per cent.
1906—Ulster Hospital for Sick Children	{ No. of intern patients, 247. No. tuberculous, 30.36 per cent.
1905—Great Ormond Street, London	{ No. of intern patients, 2,876. No. tuberculous, 27 per cent.
1906—Royal Edinburgh Hospital	{ No. of intern patients, 1,968. No. tuberculous, 20 per cent.
1905—Manchester Children's Hospital	{ No. of intern patients, 1,999. No. tuberculous, 21.3 per cent.
1905—East London Children's Hospital	{ No. of intern patients, 2,054. No. tuberculous, 24.3 per cent.
1906—Glasgow Children's Hospital	{ No. of intern patients, 1,177. No. tuberculous, 27.95 per cent.

This table shows a wonderful agreement amongst the returns of these hospitals as to the amount of tuberculosis met with. Had the reports all tabulated the cases in a similar way, it would have enabled me to be more accurate, and, I believe, would have shown a percentage return closer even than is here indicated. My firm conviction is that all children's hospitals meet with much the same amount of tuberculosis, and that that amount is very large.

2. *What types of the disease are met with?*

A glance at the statistics which I have given will be sufficient to demonstrate the fact that a certain number of the cases of tuberculosis met with at the children's hospitals are deemed suitable for treatment in the medical wards, while others are more properly sent to the surgical side. From this, then, one might say that there is a medical as distinguished from a surgical form of tuberculosis; and while this is true enough, still it is not sufficient, nor does it satisfy the question.

One of the most noteworthy deductions from the statistics is the preponderating amount of surgical tuberculosis met with when compared with that seen by the physician, and this point I wish very specially to emphasize, as having a most important bearing on causation and treatment. If the returns of the hospitals mentioned be examined, it will be found that the cases treated on the medical side consist of phthisis and meningitis, spinal caries and general tuberculosis; while on the surgical side the surgeon is deluged with chronic abscesses, tuberculous joints, lymphadenitis, and chronic ulcers. But it should be noted that many of the cases treated in the medical wards would be more properly classified as surgical—such, for instance, as lupus, spinal caries, etc.—which, if added to the surgical figures, would still more emphasize the preponderance of surgical over medical tuberculosis. These facts suggest the question, Is the disease as seen by the physician only another form of that met with by the surgeon, or are they different types of the same disease, and caused by a bacillus of a different species?

Recently the theory has been put forward that tuberculous affections of the human body are divisible into two types:—(a) a type caused by tubercle bacilli from the human, and called the "typus humanus"; and (b) a type caused by tubercle bacilli from the cow, and called the "typus bovinus." *These bacilli are varieties of the same species, but they give rise to quite distinct and different lesions, according to the method of infection. In the first (or human) type, the bacilli are inhaled in dust, and find a lodgement in the apex of the lung. From this site of infection the disease may spread and cause secondary infection of the intestines, or set up a tuberculous laryngitis. In the second (or bovine) type, the disease is con-

veyed indirectly by means of tubercle bacilli taken into the body in raw milk, meat, etc. Here the infection is carried to the intestines and mesenteric glands, and gives rises to *tubercles mesenterici*, tuberculous peritonitis, tubercle of the pelvic organs, tuberculous lymphatic glands, tuberculous bones and joints, lupus, tuberculous meningitis, or acute miliary tuberculosis. Much may be said in support of this theory; and I will content myself at present by pointing to the enormous amount of surgical tuberculosis met with at an age when cow's milk is largely availed of—indeed, is the chief article of diet—as a circumstance of the highest moment, and also to the Report of the Royal Commission on Human and Bovine Tuberculosis. Experiments in the anthropoid ape pointed clearly to the fact that when the dose of bovine tubercle bacilli taken into the system is large, a generalized tuberculosis, starting from the intestines and mesenteric glands, is set up; whereas when the dose is moderate, the affection may remain confined to the intestines and mesenteric glands, which in time may extend to other glands and bones and joints. Here, then, I submit, is evidence sufficient to support the contention that the large percentage of tuberculosis met with in children is bovine, and caused by the ingestion of bovine tubercle bacilli in milk, meat, etc., and that this form of tuberculosis is chiefly surgical. But this theory goes a step further. It is affirmed by some that these two types of the disease are more or less antagonistic, so that a child when it becomes affected with bovine tuberculosis absorbs an antitoxin, which protects it against the human type of the disease, and similarly the human type renders it either less liable to be attacked by, or immune against, the bovine bacillus. In support of this contention the rarity of pulmonary tuberculosis in association with tuberculous glands, or joints, or bone disease, is pointed to; and the farther fact is relied upon, namely, that the vast amount of tuberculosis met with in the child is surgical, the result of infection with bovine bacilli, and also that the adult or human type of the disease is quite rarely met with at an early age.

My experience at Queen Street Hospital for a period of over twenty years undoubtedly confirms both these contentions. I have been greatly impressed with the fact that only very rarely indeed do I meet with a case of pulmonary tuberculosis in which the disease follows the adult type and attacks the apex of the lung. On thinking this point over, another series of events not uncommon have impressed me. I can easily recall numbers of children who have been under my care for extensive disease of the glands of the neck, in whom suppuration went on until it seemed that the glands must have become completely eliminated, and yet in not one of them did any secondary infection of the lungs take place, and they are to-day apparently as strong, vigorous, and healthy as the best of us. How comes it, if these children were flooded with virulent human tubercle bacilli, that their lungs escaped? It seems to me that the theory I have put forward affords a reasonable answer—namely, that they were suffering from bovine tuberculosis, and that this protected them from the human type of the disease.

To carry this argument to a logical conclusion: If this theory be correct, then human serum, or tuberculin R., should be beneficial when used for surgical or bovine tuberculosis; and vice versa, bovine serum should be beneficial in tuberculosis of human type. Much evidence could be adduced in support of this contention, and my experience, but more especially the experience of surgeons, is that in limited tuberculous lesions of a surgical nature the injection of tuberculin R is followed by favourable results. Dr. Nathan Raw of Liverpool, whose work in this connexion has been very extensive, writes me to say that he has obtained the most gratifying results from the use of these serums, and, after long observation of clinical cases and extensive laboratory work, he is convinced the theory is sound.

3. *What connexion exists between tuberculosis in children and cow's milk?*

I have shown that a large amount of tuberculous disease exists amongst children, and that the disease appears at a time of life when cow's milk is the main, or almost the main, article of diet. These two statements, taken together, are sufficient to establish a *prima-facie* case against cow's milk.

Further, I have shown that tuberculosis in children is very largely of the surgical type—that is, it is chiefly glandular, and almost certainly due to the bacillus of bovine tuberculosis which has been taken into the system in food. The Report of the Royal Commission establishes a close and clear connexion between cow's milk and tuberculosis in children, and must be considered final.

4. *What can be done to prevent or cure the disease?*

With regard to the first part of the question, two eminent opinions have been expressed, that of Professor Koch, who lays stress upon the transmission of the disease by contagion, especially by means of the respiratory organs; and that of Professor von Behring, who is of opinion that tuberculosis in children is principally disseminated through the alimentary canal, and he sees a fruitful source of danger to children in the tuberculous nature of much of our milk supply. I think both these pronouncements are true, but I hold strongly that the latter theory is the more important as regards children. Acting upon Koch's opinion, it is necessary that children be kept apart from those suffering from pulmonary tuberculosis, whose breath and sputa are loaded with infectious germs. This has been recognized in Germany, where visits are made to the houses of consumptives, children are removed, when this is possible, from such surroundings, directions are given, and patients are taught the most efficient means of disinfecting and disposing of their sputa, and the necessity for keeping their clothes, beds, furniture, and floors clean. Such means as these constitute a powerful factor in limiting the area of the disease and diminishing its virulence. Then much good has resulted from convalescent homes in the country, holiday camps, and forest schools. The country homes are simple but suitable buildings put up somewhere in the woods to which children may be taken and kept for the entire day. At these homes everything is conducted upon strictly hygienic lines, from the proper cleansing of the children to the furnishing of a suitable dietary, and the enforcement of physical exercise.

Holiday camps provide children with a yearly or more frequent holiday in the country; such holidays do much to strengthen their bodies, and, at least, remove them for a time from undesirable surroundings. More recently still, forest schools have been tried in Germany and have proved most successful. Near Berlin, Charlottenburg, a school has been erected in the heart of the woods, to which pale, weakly children are sent and kept for months at a time. Here they are taught under the most advantageous condition, due regard being paid to their state of health. Scattered throughout France and Germany are numerous dispensaries, or *gouttes de lait*, at which children are brought under medical inspection, parents are instructed and advised, and good sterilized milk is supplied either free or at small cost.

Coming now to von Behring's view, that tuberculosis in children is principally disseminated through the alimentary canal, I believe we have here the most important factor in the tuberculosis of children. Many eminent authorities in this country adhere to this view, and have given expression to the opinion that the bacilli found in these cases are most commonly of the bovine type, and gain entrance into the system by means of the milk of infected cows. It may here be asked, What amount of bovine tuberculosis exists? The report of the Royal Commission on Tuberculosis states that "of all animals slaughtered for food in Great Britain and Ireland those of the bovine race seem to be more largely affected with tuberculosis than any other." In the absence of statistical information as regards our own country, the report proceeds to show that in Leipzig, of 9,303 cows slaughtered, 4,048, or 43.51 per cent., were tuberculous. The proportion of such diseased cattle in English cow-houses, which has been publicly and authoritatively stated to be about 30 per cent. by the late Professor MacFadyen, is, therefore, probably not excessive. In the year 1901 there were 1,887,414 milch cows in England, and 4,102,061 in the United Kingdom; 30 per cent of these means upwards of 560,000 tuberculous cows for England alone, and nearly 1½ millions for the United Kingdom. If 5 quarts of milk be allowed as a fair average yield per day for each cow, then 6,250,000 quarts of milk, the daily yield of tuberculous cows, are consumed in the United Kingdom. Again, it has been calculated, and is

admitted, that tuberculosis of the udder exists in 2 per cent. of dairy cows in the United Kingdom; this means that some 20,000 cows with active tuberculosis of the udder are to-day contributing to our milk supply, and some 100,000 quarts of milk teeming with virulent bovine tubercle bacilli are consumed each day in the United Kingdom. As a beginning, surely it is not too much to ask that these 20,000 cows with virulent disease of the udder be removed now and at once.

When it is remembered that even one diseased udder is capable of disseminating a huge number of tubercle bacilli, the bare idea of the amount of possible human tuberculosis from the milk of so immense a number of diseased cows is appalling. I regret I am unable to place before you any statistics bearing upon the prevalence of tuberculosis in cattle supplying milk to Belfast, but the following figures, taken from the report of the Medical Officer of Health of Manchester, Dr. Nevlin, are interesting in this connexion: During the year 1904, 432 samples of milk were examined, the number of farmers represented in the total being 318. Of these 318 farmers, 188 reside in Cheshire, and 21 of them (or 11.17 per cent.) sent tuberculous milk; 83 live in Derbyshire, and 5 of them (6.02 per cent.) sent tuberculous milk; 14 reside in Lancashire, and 1 of them (7.14 per cent.) sent tuberculous milk; 8 reside in Yorkshire, and 2 of them (25.00 per cent.) sent tuberculous milk. Are we in Belfast any better off in regard to the number of diseased cows supplying milk than Manchester? My firm belief is we are not. I am confirmed in this opinion from what I have seen when visiting some of the dairies within the city, and that much tuberculous milk is purveyed in our midst I think admits of no doubt. It is clear, therefore, that a large amount of tuberculosis in cattle exists, and the connexion between the disease in cattle and tuberculosis in childhood having been established, it follows that, if we would prevent the disease in children, the first and most important step is to stamp it out in cattle. In considering how this may be done it is necessary to remember that in tuberculosis, before the formation of tubercles in any part of the body, there is a stage of the disease of unknown duration during which the bacilli multiply and circulate throughout the body. To regard the disease as beginning with and being localized in tuberculous formations is to fail to recognize the bacillary stage of the disease, and is, therefore, wrong. This pre-tuberculous stage can only be detected by means of the tuberculin test; therefore, it becomes imperative that this test be applied to all dairy cattle, and that every cow reacting to this test be withdrawn and the carcass destroyed. To ensure success, however, compulsory and universal application of the principle is necessary. Fair compensation for the loss to the stock owner should be granted, and probably the sum of money that would be required for this purpose is the main objection to the enforcement of the measure by the Government. In the year 1865-6 an outbreak of cattle plague occurred in this country which involved the death of 233,000 head of stock. And what took place? The first consideration was the stamping out of the disease as quickly as possible and at any cost. But tuberculosis in animals is more widespread than cattle plague has ever been; it is always present in our herds, whereas outbreaks of plague are few and far between; and, what is worst of all, tuberculosis causes a vast amount of sickness and suffering and death and despair, which cattle plague does not. Surely this most astounding condition of things will not be permitted to continue much longer. The public—and, more especially, we members of the medical profession—should now and at once insist, both on hygienic and economic grounds, that it is urgently necessary to stamp out this awful disease of tuberculosis in cattle. It is estimated that the disease in animals may be eliminated in a single year, and, if so, what a year of triumph that would be!

To protect children from the ravages of tuberculosis, the following rules may be formulated:

1. *The notification of all births within twenty-four hours.* This would enable health visitors to examine into the state of the child's surroundings; to have the child removed, or precautions taken, should any case of tuberculosis exist in the house; and to give suitable directions for the care of the child, and especially to encourage breast-feeding.

2. *Complete control of the milk supply by the State.* This should include the application of the tuberculin test to dairy cattle, and the removal of all such as react to this test; cleanliness in the collection of all milk, and in the transmission of it from the dairy to the consumer; the removal of dairies from the centre of large towns and cities.

3. *Medical inspection of school children and school premises.* First, to detect and remove children who are actually ill or unfit to attend school; and, secondly, to ensure proper ventilation and sanitary arrangements in the schools, and to prevent overcrowding. The elementary principles of hygiene should be taught to even young children; to older children the principles of domestic hygiene and economy should be added.

4. *Housing reform.* Dwelling-houses in the poorer districts should be made more sanitary, especially with regard to the free access to them of sunlight and fresh air. Ireland is behindhand in this respect—a circumstance which may, in part, account for its high death-rate from phthisis. A levelling-up of the social and domestic conditions of the poor is urgently required; for of the 1,200,000 children born each year in the United Kingdom, fully one-fourth to one-third of them are born to want and squalor.

5. *Segregation of advanced cases.* All advanced cases of phthisis should be segregated as far as practicable and treated in special institutions set apart for that purpose. Children who are allowed to live in the house with a consumptive are exposed to serious risk.

6. *Notification of the disease should be compulsory.* By this means health officers would know where the disease existed, and it would enable them to take suitable precautions against the spread of the disease, by disinfection and other means.

With the second part of the question—What can be done to cure the disease?—I need not detain you long. I have said that the large proportion of tuberculosis in childhood comes within the purview of the surgeons, and with them the treatment may safely be left.

Unfortunately, the profession still feel a want of confidence in tuberculin, or a dread of its reaction, but it should be remembered that its use at the present time is very different from what it was when first introduced. Formerly tuberculin was administered by rule of thumb, and often with disastrous results; now, thanks to the brilliant researches of Sir A. E. Wright, and the discovery by him of the opsonic index, the dose of tuberculin, its effects, and the most suitable times for injection, can be regulated with scientific precision.

This discovery has, in fact, brought treatment with tuberculin within the realm of safe therapeutics, and the clinical success which has attended the employment of this treatment has firmly established its position as a remedial agent of the first importance. In addition to the use of tuberculin, our efforts to cure tuberculosis, or stay its progress, must include good and wholesome food, healthy hygienic surroundings, an abundance of pure air, and such drugs as cod-liver oil in combination with the hypophosphites.

HAS A PURIN-FREE DIETARY ANY SPECIAL THERAPEUTIC VALUE?*

By CHALMERS WATSON, M.D., F.R.C.P. EDIN.,
ASSISTANT PHYSICIAN, ROYAL INFIRMARY, EDINBURGH.

In the course of the past year I have on several occasions been asked by practitioners as to the value of a purin-free dietary, and it appeared to me appropriate to make this subject the basis of my lecture this afternoon.

NATURE OF PURINS.

Purins are substances constructed on the base C_5N_4 . Those of chief clinical importance are uric acid, xanthin, hypoxanthin, adenin, and guanin. These purins are present in certain articles of diet, in the tissues, and in the urinary excretion, occurring either in a free state or combined with albumen in the form of nucleic acid.

* Abstract of a lecture delivered at the Medical Graduates' College and Polyclinic.