In an inquiry among the physicians of Switzerland, Wildbolz found that of 316 patients suffering from renal tuberculosis not operated upon 31.3 per cent. died within the first two years of the disease, and 27.2 per cent. within three to five years. More than half (58 per cent.) died within the first five years, and only 20 per cent. were alive after five years.

REFERENCES.

- ¹ Schmieden: *Deut. Zeit. f. Chir.*, 1902, lxii, 205.
- ² Braasch: *Amer. Journ. Med. Sci.*, January, 1920, 2.
- ³ Persson: *Annals of Surgery*, October, 1925, 526.
- ⁴ Wildbolz: *Chirurgie der Nierentuberculose*, 1913.
- ⁵ Bauereisen: *Zeit. f. gynäkolog. Urol.*, B. 2, 1911.
- ⁶ Walker, K.: *Lancet*, 1922, i, 684.
- ⁷ Brongersma: I Congrès Assoc. Internat. d'Urologie, 1908.
- ⁸ Heyn: *Virchow's Archiv*, Bd. 165, 42.
- ⁹ Braasch: *Journ. Amer. Med. Assoc.*, November 13th, 1920, p. 1307.
- ¹⁰ Zuckerkandl: *Zeit. f. Urol.*, 1908, ii, 97.
- ¹¹ Smirnow: *Folia Urologica*, vii, 1913, 229.
- ¹² Kapsammer: *Wien. klin. Woch.*, 1904, 16.
- ¹³ Beer: *Journ. Amer. Med. Assoc.*, October 30th, 1920, 1180.
- ¹⁴ Hattinger: *Zentralbl. f. d. Krankh. d. Harn. u. Sex. Org.*, 17, 1906.
- ¹⁵ Hyman and Mann: *Journ. Amer. Med. Assoc.*, September 24th, 1921, 1012.
- ¹⁶ Löwenstein: *Zeit. f. urol. Chir.*, Bd. 15, 1924.
- ¹⁷ Hrynischak: *Wien. klin. Woch.*, April 3rd, 1924, p. 336.
- ¹⁸ Foulerton and Hillier: *BRITISH MEDICAL JOURNAL*, September 21st, 1901, p. 774.
- ¹⁹ Kielleuthner: *Folia Urologica*, Bd. vii, 1912.
- ²⁰ Hobbs: *Tubercle*, 1923, November-December, vol. v, No. 2, p. 57.
- ²¹ Takahata: *Tohoker Journ. of Experiment. Med.*, viii, No. 2, December, 1926.
- ²² Fullerton: *Brit. Journ. of Surg.*, vol. xii, No. 46, 1924, 351.
- ²³ Braasch and Olson: *Surg., Gynecol. and Obstet.*, June, 1919, 555.
- ²⁴ Ekehorn: *Hygiea*, 1924, p. 353.
- ²⁵ Israel: *Folia Urologica*, 1911, Bd. vi, 257.
- ²⁶ Legueu: *Rev. de Chir.*, 1909.
- ²⁷ Thévenot: *Lyon Chirurgical*, March-April, 1921, 179.
- ²⁸ Heitz Boyer: *Congrès franç. d'Urol.*, 1923.
- ²⁹ Suter: *Schweiz. med. Woch.*, November 29th, 1923.
- ³⁰ Ferria: *La Riforma Medica*, March 19th, 1923.
- ³¹ Hogge: *Journ. d'Urol.*, xviii, 1924.
- ³² Gayet: *Journ. d'Urol.*, x, 1926.
- ³³ Judd and Scholl: *Annals of Surgery*, vol. 79, March, 1924, 395.
- ³⁴ Condamin: *Journ. d'Urol.*, January 31st, 1926.
- ³⁵ Young: *Practice of Urology*, vol. 1, 1926.
- ³⁶ Nitch: *Lancet*, January, 1925, p. 1.

STATISTICS OF POST-OPERATIVE SURVIVAL IN RENAL TUBERCULOSIS.*

BY

ANDREW FULLERTON, C.B., C.M.G., M.D., M.Ch.,
P.R.C.S.IREL.,

Professor of Surgery, Queen's University, Belfast.

WHEN a patient is brought to the surgeon for renal tuberculosis two questions obtrude themselves: (1) Is the lesion confined to one kidney? and (2) Is cure without operation possible?

Recently I set out to investigate a series of 158 cases of tuberculosis of the bladder seen over a period of twenty years. It was found to be very difficult to trace these cases, but some useful information was obtained. One of the objects of the investigation was to compare the results of operation, when the kidney was affected, with those obtained by other measures, among which the most important and the most popular was the use of tuberculin.

Of the 158 cases there was definite evidence of kidney involvement in 141. In the remainder evidence was wanting—either on account of the difficulties associated with ureteral catheterization, or because, in the early days, it was assumed, probably without sufficient justification, that the bladder condition was secondary to involvement of the epididymis, prostate, or vesiculæ. Further observation has shown that tuberculosis of the sexual organs frequently coexists with or follows renal tuberculosis. Thus there were 87 males in the series, and in no fewer than 29—that is, in one-third—there were deposits of tubercle in the prostate, epididymis, or vesiculæ. In only 7 out of the 141 cases was there definite evidence, at the time of my examination, of a bilateral lesion—that is, in about 5 per cent.

In all cases an attempt was made to find a primary focus. A previous history of some tuberculous lesion was obtained in 26 per cent., and in 15 per cent. a focus was found at the time of examination in some part of the body outside the genito-urinary tract. In many cases, no doubt, hidden foci were present in glands, bones, etc., but they were not sufficiently obvious to arrest attention during an

ordinary clinical examination. This leads me to say that I have frequently been struck with the apparently robust health which many patients the subject of urinary tuberculosis enjoy. Many go on for years with much inconvenience and suffering before the general health becomes seriously impaired.

As opposed to the views I have long held regarding the localization of the infection to one kidney, and the prospects of cure without operation, a recent paper by Gilbert J. Thomas and Thomas J. Kinsella¹ is very interesting and instructive. These authors have conducted a research in a well equipped sanatorium in Minnesota for the treatment of tuberculosis. Their conclusions include the following:

They argue that tissue destruction with renal tuberculosis is a late lesion, and that this is the lesion most frequently seen by the surgeon. They bring evidence to prove that early renal tuberculosis may end in arrest or cure. They believe that tubercle bacilli are carried to the kidney by the blood stream, and that every renal infection with tubercle bacilli must be primarily bilateral. One kidney may not overcome the infection so well as its mate, and a destructive lesion develops. They have never been able to demonstrate a case of excretory bacilluria. They have never removed a kidney which eliminated tubercle bacilli that did not contain a lesion of tuberculosis, though in some instances serial sections were necessary before the lesions could be found. Repeated urological examinations revealed many cases of unsuspected renal tuberculosis among their patients, nine-tenths of whom had active pulmonary lesions.

I have had very little opportunity of examining patients representing this class of case. Those who have been referred to me have had what these authors term "tissue destruction," and in the large majority, as I have stated, I have been unable to find evidence of bilateral infection. It is quite true, of course, that the absence of pus and tubercle bacilli in the specimen obtained by ureteral catheter from a kidney is not conclusive proof of its freedom from disease. Foci may be present in the cortex, for instance, and may not communicate with the pelvis, or an abscess in the parenchyma may be shut off, only discharging into the pelvis at intervals; but the difference between the urines excreted by the diseased kidney and by the presumably sound kidney has been, in my experience, so definite and decided in almost every case examined that I cannot come to any other conclusion than that the disease is unilateral, clinically, at any rate, in the cases coming under my observation. The specimen obtained from the affected side, besides containing pus and tubercle bacilli, is, in nearly 100 per cent. of the cases, of a low specific gravity. In the early cases the low specific gravity is associated with an increased flow, which may be termed unilateral diuresis. In the later stages the urine, though still of low specific gravity, may become diminished in quantity, until finally no fluid at all is secreted, and the discharge from the kidney may be represented by a semi-solid ointment-like material; or the ureter may become impervious, and all connexion between the affected kidney and the bladder cut off. The low specific gravity in the late cases is due to renal insufficiency, a condition which it may be possible, by chemical analysis, to distinguish from the hyperactivity seen in the early stages.

I have been able to demonstrate by repeated ureteral catheterization in cases of renal calculus that pure reflex unilateral diuresis occurs, with low specific gravity, and dilution of the specimen from the affected side, and that, on removal of the cause, the rate of flow, the specific gravity, and the composition of the urine rapidly return to normal, and become identical on the two sides.²

A similar diuresis occurs in the early stages of tuberculosis, and appears to be due to reflex vaso-dilatation, in contradistinction to the vaso-constriction which gives rise to reflex anuria—a condition well known to occur in certain cases of calculus.

My colleague Dr. Mayrs of Queen's University, Belfast, has recently made analyses of the urines of 35 patients under my care with various unilateral kidney disorders. These analyses have been carried out in order to ascertain whether ureteral catheterization can throw any light on

* A contribution to a discussion on renal tuberculosis in the Section of Surgery at the Annual Meeting of the British Medical Association, Edinburgh, 1927.

the nature or extent of the renal impairment. Reflex diuresis must be distinguished from renal insufficiency, as in many cases dilution results from increased rate of excretion alone, and it is in trying to recognize the distinctive characteristics of these two conditions that the fundamental difficulty is encountered. Owing to possible leakage past the catheters the volumes of urine from the two kidneys cannot always be compared with sufficient confidence to justify a positive diagnosis of unilateral diuresis, while, even if the occurrence of diuresis has been satisfactorily established, more serious impairment of function is not excluded.

A method of attacking the problem is to compare the concentration of various substances (chloride, urea, phosphate, creatinine) in the urines secreted simultaneously by the two kidneys. But although this has been done in numerous cases the results fail to give all the information required, because we are not quite sure what alteration in the ratio of creatinine to urea, for example, should normally result from an increase in the rate of flow, when this is the only variable factor. At the same time, a careful study of such changes is not without value. Probably chloride excretion will afford the most reliable distinction between diuresis and insufficiency, but a good deal of work remains to be done. It is a general principle that in diuresis the composition of the urine approaches more nearly to that of the plasma, and hence, if the diuresis is unilateral, the chloride concentration of the urine on the affected side should be closer to 0.6 per cent. NaCl than that from the normal kidney. An increase or decrease of chloride concentration may thus result, which can be interpreted by comparison with the chloride content of the normal urine; the latter being above or below 0.6 per cent. according to whether the excess of chloride in the organism is large or small. On the other hand, in renal insufficiency the chloride of the urine is always low, and often considerably lower than that of the plasma.

The object of these remarks on low specific gravity is to stimulate research, so that it may, perhaps, be possible, from an examination of the specimens from both kidneys, to state what degree of disorganization has taken place in a kidney affected with tuberculosis, should the surgeon be tempted to give a trial to non-operative methods of treatment.

There is another point to which I would like to direct special attention, and that is the fallacies and difficulties associated with ureteral catheterization. The introduction of a ureteral catheter may upset the sphincteric mechanism of the ureteral orifice, and may thereby give rise to erroneous conclusions, and, in addition, may entail some risk of infection of the sound kidney.

A girl, aged 23 years, was cystoscoped, and catheters were introduced into both ureters. A small number of pus cells were found on the right, or presumably sound, side. The examination was repeated and the bladder was emptied during the collection of the ureteral specimens. That on the right was scanty in quantity, clear amber in colour, had a specific gravity of 1010, and was free from pus. That on the left was copious, pale, and cloudy, had a specific gravity of 1005, and contained many pus cells. Fluid was now introduced into the bladder through the cystoscope. After a few ounces had been injected the patient began to complain of pain on the sound side, and immediately a quantity of watery fluid appeared as a distinct layer, supernatant to the amber fluid previously obtained. The fluid in the bladder had evidently reached the pelvis of the kidney past the ureteral catheter, and had found its way out again, through the lumen of the latter, into the collecting test tube. On removing the fluid from the bladder clear amber urine was again obtained from the ureter of the sound side.

The significance of this from the point of view of diagnosis, and of possible infection of the sound kidney by ureteral catheterization, is obvious. I make it a rule now to empty the bladder before commencing to collect the ureteral specimens.

Again, in a certain proportion of cases it is impossible to catheterize the ureters. This is due to extensive ulceration, and great irritability of the bladder. Attempts to persist in cystoscopy may cause much bleeding and straining, and are not devoid of risk. It is for these cases that I have suggested and carried out retroperitoneal catheterization of the ureters by open operation.³ The ureter may be exposed by stripping inwards the peritoneum

after an incision in the parietes similar to that used for appendicectomy. In tuberculosis of the kidney if a thickened ureter be found on one side it ought not to be disturbed, as the small puncture made to receive the ureteral catheter may not heal, and may persist indefinitely as a fistula. On the sound side with careful technique and accurate suturing there need be no extravasation of urine.

Instead of introducing a catheter, the needle of a small exploring syringe may be used, and the wall of the ureter punctured, just as is done in withdrawing blood from a vein. To facilitate collection of the specimen, the distal part of the ureter may be lightly clamped, so as to allow urine to collect in the proximal portion. This procedure should eliminate all risk of leakage, especially if the puncture be made obliquely through the wall of the ureter. By operative ureteral catheterization the exact amount of urine secreted by a kidney can be ascertained. The specimens so obtained are free from the risk of contamination by reflux of the bladder contents, and the operation is safer than sustained attempts to distend an ulcerated bladder.

I have used this method when, after careful search, the opening of the ureter in the bladder could not be found, and in one such case—a case of tuberculosis of the kidney—no ureter could be discovered on the opposite side, even after operative exposure of its normal position in the iliac region. This patient had only one kidney, which was tuberculous. In several other cases I have found a thickened and impervious ureter, demonstrating the final stage of the process of auto-nephrectomy, which is responsible for many of the so-called cures without operation.

TECHNIQUE.

In my most successful cases I have removed the kidney and as much of the ureter as I could reach through the lumbar wound. I have made no elaborate attempt to dissect out completely the perirenal fat. I have not found it necessary or desirable to dissect out the ureter. Indeed, I have only done this in two cases, and one of my worst results was in a case so treated. Some months after the operation urine began to leak from the stump of the ureter at its junction with the bladder, into the wound, which, after having healed by first intention, had opened up. This patient died seven and a half months after operation from uraemia, following an operation by another surgeon to repair this leak. The removal of infected glands surrounding the pedicle of the kidney close to the spine is attended with risk. A large blood vessel, such as the renal vein or the vena cava, may be injured. I do not say that these glands ought not to be removed, if possible, but I have often left them untouched when closely bound down in an inaccessible position, without any obvious disadvantage to the patient.

As a rule the wound in the parietes has been sutured without drainage. In a few cases a drain was left in for twenty-four hours. In some cases the wound broke down at one or more points a month or more after operation, after having healed by first intention. Final healing was the rule, after the sinus or sinuses had lasted for periods varying from a few months to a year or more.

I have tried all the recognized methods of dealing with the ureter at the point of section. My present practice is to inject with a hypodermic syringe pure carbolic acid into the lumen over an area of an inch or more before ligaturing and dividing the ureter. Catgut has been used in all cases for securing the pedicle and for the deep sutures, and silk worm gut for the skin.

STATISTICS.

Nephrectomy was carried out in 73 out of the 141 cases of renal tuberculosis. Five died as the result of operation—a mortality of 6.8 per cent. All the deaths occurred in the first 35 cases, the remaining 38 being without operative mortality. I have been able to follow up 55 out of the 68 survivors. Fifteen have since died, four of them after long periods of complete relief. Thus one died, 12 years after operation, from what was called a "cerebral attack"; one 9 years after, from cerebral haemorrhage; one 8 years after, from acute pneumonia; and one 9½ years

after, from gangrenous cystitis, probably non-tuberculous. All the cases enjoyed good urinary health in the intervals. This leaves 11 cases dying as the result, probably, of a continuance of their tuberculous infection. Thirty-one of the survivors are described as being well—one 20 years after operation, two 17 years after, one 16 years after, one 15 years, one 14 years, one 11 years, one 9 years, one 8 years, two 7 years, three 6 years, one $5\frac{1}{2}$ years, one 5 years, three 4 years, one $3\frac{1}{2}$ years, two 3 years, two $2\frac{1}{2}$ years, four 2 years, and three cases from 6 months to 1 year after operation. Including the four patients who died from other causes, eight years or more after operation, we have a total of 35 out of 55 apparently cured of their urinary symptoms—that is, over 63 per cent. Of the nine survivors who cannot be claimed as cures, one still has frequency and wears a urinal, though otherwise in good health, 12 years after operation. One has frequency 7 years after operation—his lungs are now said to be affected; one is said to be fairly well 5 years after operation, but he now has deposits in his epididymis, and is said to be suffering from spinal caries; one has still frequency and wears a urinal $6\frac{1}{2}$ years after operation; one still has frequency 2 years after operation, and deposits have appeared in epididymis and prostate; one still has frequency 2 years after operation; one still has frequency 1 year after operation; one is much improved, but not quite well, 1 year after operation; and one is much improved, with apparently normal urine, 4 months after operation.

Contrast with these the reports received of those treated by medical means, of which tuberculin was the one most frequently used. I have only been able to trace 41 out of the 68 cases not subjected to operation. These were of the usual type, and (except in 5 or 6 advanced cases) operation was not contraindicated when the patients were first seen. Of the total, 26 are dead—that is, 63 per cent. One lived for 17 or 18 years after the onset of symptoms, and died after the removal of a calculus, which had blocked the ureter of the affected kidney, and mushroomed into the bladder. One lived for 16 years. Fourteen died in from 2 to 6 years; three in from 1 to 2 years; and seven within a year after the onset of symptoms. Of the fifteen living, one is certainly well 13 or 14 years after the onset of symptoms; the urine is free from pus and tubercle bacilli; the condition of the affected kidney has not been ascertained. Another is well and free from urinary symptoms 5 years after they first appeared. The ureter of the affected kidney was exposed, and was found to be converted into a thick fibrous cord. There was no trace to be seen of its orifice on cystoscopic examination. These are the only ones, two in number, that I know of, who are really well. Of the remainder, one has carried on fairly well, with symptoms, for 16 years; another similarly for $15\frac{1}{2}$ years, and a third for 13 years. In none of these three cases was ureteral catheterization carried out. Deposits were present when first seen in prostate, vesiculae, or epididymis, and in all three tubercle bacilli were found in the urine. The diagnosis of kidney involvement was made by cystoscopic examination of the ureteral orifices. One early bilateral case is reported to be well except for an occasional "turn" of frequency, $7\frac{1}{2}$ years after the onset of symptoms. Lastly, in the other survivors, symptoms remain 5 years and under from the onset of their illness.

These statistics support the contention that, with our present knowledge, operation remains the most hopeful method of treatment in tuberculosis of the kidney. If done early, before deep ulceration has taken place in the bladder, relief is often immediate. Even in late cases, if the other kidney is sound, the patient may still be cured. Deep ulceration of the bladder, and the presence of tubercles in that organ—a late occurrence in my experience—render the prognosis less hopeful, especially as regards the relief of frequency of micturition. Even if healing takes place, the scarred and contracted bladder is unable to expand, and the patient is obliged to empty it at frequent intervals.

REFERENCES.

¹ *Journ. of Urol.*, April, 1927, p. 395. ² See *BRITISH MEDICAL JOURNAL*, February 2nd, 1924, p. 188. ³ *Brit. Journ. of Surg.*, vol. xii, No. 46, 1924.

DISCUSSION.

Dr. A. ROLLIER (Leysin) thought that heliotherapy could play only a subsidiary part in the treatment of renal tuberculosis. In every case of unilateral disease he advised nephrectomy as soon as the diagnosis was established, but heliotherapy was indicated as a pre-operative treatment for patients whose condition was bad, since it improved the general and tissue resistance, thus helping to prevent tuberculous infection of the wound. It was also useful in all cases of unilateral disease when the cystoscopic and functional examinations left any doubt about the integrity of the other kidney. Heliotherapy could be employed with benefit when the seminal glands, and particularly the prostate, were the seat of extensive disease which compelled the postponement of cystoscopy owing to the risk of trauma of the prostate, with the consequent danger of general infection. As a post-operative treatment it helped to prevent the infection of the wound, and assisted cicatrization of infected wounds. In bilateral renal tuberculosis heliotherapy was the treatment of choice, since it limited the extension of the lesion and diminished the pain of bladder ulceration. To be efficacious heliotherapy must be conducted with rigorous technique and special adaptation to the needs of the patient. It should be associated as often as possible with graduated labour.

Mr. HENRY WADE (Edinburgh) described a series of seventy-eight cases in which he had operated. He thought that the diagnosis could be made independently of the demonstration of the presence of tubercle bacilli in the urine, and that frequently an x-ray examination would clear up the diagnosis by revealing calcification. Pyuria without organisms in the urine and diminution of the bladder capacity were very characteristic. On cystoscopy the "golf-hole ureter" was diagnostic. He performed a bilateral catheterization and a bilateral pyelography. The pyelogram might show the drainage system of one part of the kidney to be normal and the other part excavated; irregular contractions and dilations of the ureter were pathognomonic of tuberculosis. He had never obtained spontaneous clinical cure nor *post-mortem* evidence of healing, and therefore regarded nephrectomy as the correct treatment. Two of his seventy-eight patients had died. After an operation the ulcers in the bladder usually disappeared. If there was any frequency left, it was due usually to the small size of the bladder. The frequency and inability to dilate were sometimes due to a single remaining ulcer, the excision of which would bring about a rapid cure. A superadded streptococcal infection was very difficult to eradicate.

Mr. J. F. DOBSON (Leeds) referred to cases where it was impossible to tell by cystoscopy whether the disease was unilateral or bilateral, and catheterization by the ureters was impossible. Opening the bladder suprapubically would not help in the difficulty, but Mr. Fullerton's method of exposure of the ureters in the iliac regions was of immense assistance. Mr. Dobson said that he had modified the method; he exposed the ureters and found that it was possible to tell from their appearance, state of dilatation, peristalsis, and feel of the walls whether the corresponding kidney was diseased or healthy. It was unnecessary to open the lumen of the ureter. He had used the procedure with satisfaction in four cases of advanced disease when cystoscopy was unable to furnish the required information.

Mr. BERNARD WARD (Birmingham) based his remarks on a series of 57 cases. He believed that tuberculous infection started in the papillae, and that the upper papillae were affected more often than those in the lower part of the kidney. No operation should be undertaken unless the disease was limited to one kidney. A diseased kidney often secreted a large quantity of urine, and its removal threw a greater strain on the remaining organ which accelerated any disease present in it. The only certain method of diagnosis was to draw off urine from the infected kidney by the catheter. His custom was to estimate the combined renal function by means of the urea concentration

and blood urea tests, with chromocystoscopy, using indigocarmine injection, and to catheterize the ureteric openings. The last method was sometimes sufficient in itself by revealing the presence of pus cells in the collected specimen. He had found spinal anaesthesia a great help in performing cystoscopy; it did not interfere with renal function and gave greater relaxation of the inflamed bladder than the deepest general anaesthesia. He refused to operate upon patients with active disease elsewhere in the body, whether in the lungs, bones, or joints; mild infection of the genital tract, however, was not a bar to operation. He resected as much as he could of the ureter at the primary operation, since he had found that high division of the ureter often left a tuberculous fistula. In one case a pyonephrosis was removed unopened, but the whole wound broke down and took two years to heal; he thought infection had come from the perinephric tissues. If frequency remained after six months the patient was cystoscoped and any chronic ulcers treated by operation. In only 37 of his 57 cases of renal tuberculosis had nephrectomy been performed, with one death from miliary tuberculosis a few weeks later. He had traced 30 of these operation cases and found that 4 patients had since died. Of the remaining 26, 20 were apparently quite well and earning their own living, 6 were unable to earn their living, and one of these developed spinal caries and a psoas abscess, but was now getting about. Of the 26 patients still alive, one was operated on 15 years ago, one 12 years, one 11 years, two 8 years, three 5 years, five 4 years, five 3 years, and eight were operated on 2 years to 18 months ago.

Mr. TEMPLE MURSELL (Johannesburg) emphasized the importance of a thorough investigation of all cases of pyuria, as otherwise cases of tuberculous kidney would be overlooked until they had become advanced. He had never seen a patient cured without operation, though improvement sometimes occurred and persisted for as long as ten years. Early nephrectomy, followed by heliotherapy, gave the best results. He did not remove the whole ureter. Tuberculin was of great value in reducing residual bladder symptoms.

Mr. GORDON CRAIG (Sydney) had seen two cases of renal tuberculosis cured without operation. One patient had bilateral disease and a tuberculous tarsus; the latter was treated surgically. Tuberculin was administered, and now, fifteen years later, cystoscopy of the patient revealed no signs of disease. He recommended epidural anaesthesia for cystoscopy.

Sir JOHN THOMSON-WALKER, in reply, said that he could not agree with Mr. Dobson that it was possible to deduce the state of the kidney from inspection of the ureter. Nor did he agree with Mr. Wade's method of diagnosis by pyelography. He said that clinical cures of tuberculosis of the kidney were always suspect; pathological recovery was very rare indeed. Indigocarmine injection was unreliable as a test for kidney function. The removal of the perinephric fat in advanced cases was impossible, and removal of much of the ureter was unnecessary. He did not recommend phenol injection of the ureteric stump, for the drug did not reach the thickness of the wall where the infection lurked.

DUTIES OF THE STATE IN RELATION TO THE NATION'S FOOD SUPPLY.

RESEARCH ON NUTRITIONAL PROBLEMS.*

BY

EDWARD MELLANBY, M.D.CANTAB., F.R.S.,
Professor of Pharmacology, University of Sheffield; Honorary
Physician, Sheffield Royal Infirmary.

SOME of those interested in this discussion must have wondered what exactly the officers of this Section of Preventive Medicine had in their minds when they used the words "What duties has the State?" Did they mean by "duties" obligations imposed at the present time by Act of Parliament? If so, the discussion resolves itself more or less into a recital of those official activities which bear on the subject of nutrition and feeding. It must be assumed that this is not wanted, but rather the consideration of the problem as to what an ideal State should do in regard to carrying out research in nutritional matters, in the instruction of parents, in maintaining food supplies, and providing cooking facilities.

In the first place it may be worth while to consider whether feeding problems are a profitable field for Government activity. Nobody would deny that State and local government interference in matters of health, especially as it is affected by sanitation and drainage, water supply, and limitation of spread of infectious disease, has been of untold benefit to the community. Is it likely that a similar interest in feeding will be followed by beneficial results of a commensurate order? Some may think not, but for myself, and speaking probably for all those in touch with modern work on nutrition, I should say that the outcome of a sane and forceful effort on the part of imperial and local governing bodies in this field would lead to as revolutionary a change in the general health of the community as has followed their work on matters of public hygiene.

In a sense the problem of correct feeding is even of a more fundamental nature than that of general hygiene, for whereas it is possible to bring about good health and perfect

development under bad hygienic conditions so long as the food eaten is very good, when the diet is defective the most perfect hygiene as we know it will not prevent bad physical development, ill health, and early death. Good hygienic conditions may for the moment be described as those conditions which reduce the chance of infection by micro-organisms, but nothing has been more prominent in recent work on feeding problems than the part played by correct feeding in increasing the individual resistance to infection. It is true that our knowledge of this problem is of an elementary nature, but the subject is one of active interest at the moment, and further facts of great importance will no doubt come to light very soon. I need only allude to the recent accumulation of facts showing the importance of vitamin A in increasing the resistance of the animal to inflammatory conditions of the respiratory passages and lungs as a forerunner of knowledge on the relationship between diet and resistance to infection. But apart from this large question of the relation of feeding to infection, there remain the purely metabolic disorders which are brought about by incorrect diet; among these may be instanced the bone deformities and the defective dental structure and growth of jaws which follow deficient vitamin D intake, the symptoms of scurvy due to deficient vitamin C, the nervous symptoms due to deficient vitamin B, the goitre due to deficient intake of iodine, the stunted growth due to deficient intake of biologically good proteins, and the ill effects of excessive and unbalanced cereals. These are some of the more recently established facts, and, even if they are not greatly extended in the near future, they are sufficiently important in themselves to justify the belief that it is certainly a most profitable line along which the activities of the State should be directed and hastened. The question now arises as to the methods to be adopted for the acquisition and diffusion of new facts concerning nutrition, and the relation of these facts to the public weal.

With regard to research on nutritional problems, the machinery, or at least a skeleton of the machinery, is present in the Medical Research Council. Since this body was set up a large part of its activities have been directed to the solution of nutritional problems. It was a most happy occurrence for the progress of nutritional studies that the Medical Research Committee was appointed soon after the enunciation of the vitamin problem, and that

* A paper read in the Section of Preventive Medicine at the Annual Meeting of the British Medical Association at Edinburgh in introducing a discussion entitled "What duties has the State in relation to the nation's food supply regarding research, instruction of parents, maintenance of supplies, and cooking facilities?"