people for acid and highly flavoured foods. Another reason why modern dietetic conceptions were often wrong was because, until recently, there had not been a reasonable standard for health. A child was found, for example, not only to like cereals and sugars, but apparently to flourish on them, growing fat and contented and lethargic, and the tendency was to regard weight as the criterion of health. The trouble was that the state of under-nutrition was not commonly appreciated. Malnutrition was understood when the child wasted away or developed tuberculosis, but more ought to be known about the state of under-nutrition before any extreme manifestations made their appearance.

Experimental Work on Foods.

The lecturer went on to detail some experiments on animals in regard to the effect of carbohydrates on growth, and pointed out that more activity was got by increasing the fat in the diet than by increasing the carbohydrates. Foods could be divided into two large groups: the first consisted of products such as milk, butter, cream, cheese, eggs, and green vegetables, like cabbage and lettuce; the other was made up of cereals (wheat, rice, oatmeal, maize, and all the prepared products made up of such things), vegetable margarine, lard, meat (including pork), also sugar, jam, potatoes, and tea, coffee, and cocoa. Of the first group the average man really got very little. An authoritative estimate showed that the amount of milk consumed per diem (including milk products) was equal only to a quarter of a pint a head of the population. Cheese was rather popular, but green vegetables were not commonly favoured, and his experience in hospital was that it was difficult to get patients to eat them at all. The second group of foods he had just catalogued was wrong in several respects; it lacked sodium, chlorine, calcium, anti-scorbutic vitamin, and if the fat of beef and mutton were taken away—and most people did leave such fat on their plates—the diet was also lacking in fat-soluble vitamin. The foods which were rich in calcium and fat-soluble vitamin were egg-yolk, cow's milk, human milk, and green vegetables; foods poor in this respect were white bread, rice (polished), potatoes, margarine, sugar, jam, and lean meat. He mentioned that from 1912 to 1917 the cases of xerophthalmia in Copenhagen increased in number steadily and considerably, but as soon as the Danish Government in 1917 prevented the export of butter, thereby making it available for home consumption, so that there was a sufficient quantity for each person, the whole trouble entirely disappeared. Just as in nature this fat-soluble vitamin was associated with calcium, so in the body there was experimental evidence for believing that calcium and something at any rate closely resembling fat-soluble vitamin worked in harmony—that, in fact, the body could not retain calcium, however much of it there might be in the food, if it did not have at the same time some of this vitamin.

The lecturer next described a basal diet for certain experiments on the production of rickets in dogs. The diet consisted of separated milk, white bread, yeast, orange juice, lean meat, and sodium chloride. If for the fat such a thing as linseed oil were used, rickets was produced; if cod-liver oil were used, there was no rickets. He had not been able definitely to affirm that this antirachitic vitamin was actually the fat-soluble, but it almost certainly was. Fats might be divided from the point of view of antirachitic action as follows:

<i>Good.</i>	<i>Moderate.</i>	<i>Poor.</i>
Cod-liver oil.	Lard.	Linseed oil.
Beef suet.	Coconut oil.	Olive oil.
Butter.	Rape.	Palm-kernel oil
Egg-yolk.	Cottonseed oil.	Babassu oil.

The hardened fats—hardened to make them tasteless and used for adding to margarine and so forth—were also very poor from the point of view of rickets prevention. Among the useful fats from this point of view was yolk of egg, which contained something absent from the white.

Diets deficient in fat-soluble vitamin had been found—as the result of experiments by Mrs. Mellanby on dogs—to give rise to a poor growth of the jaws and alveolar process, irregular placing of the teeth, delayed eruption and slow eruption, thin and defective enamel, teeth light in weight for their size, poor development of the gingival margin, as well as, generally speaking, a diminished resistance to disease. Dogs fed on cod-liver oil had good teeth, those fed on butter were moderately good from the dental point of view, though in certain respects defective, while those fed on linseed oil showed very bad formation of teeth and the tooth substance

as shown by a microscopical examination was defective. It had not been proved that this experimental production of badly formed teeth solved the problem of caries. Mrs. Mellanby had not produced caries in these animals, and the fact remained to be proved. One could only say that it was probable that animals or children with badly formed teeth would be more susceptible to caries. He showed microscopical slides to illustrate the remarkable changes of dentine according to the type of fat used.

REFERENCE.

1 BRITISH MEDICAL JOURNAL, December 4th, 1920, p. 862.

CALCIUM DEFICIENCIES: THEIR TREATMENT BY PARATHYROID.

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In a previous paper evidence was brought forward to show that in the circulating blood of the normal individual the calcium is present in two forms, ionized and combined. When coagulation of the blood occurs, the calcium in the exuded serum is found to be all in the ionized form, the normal amount present being about 10.5 mg. of calcium per cent. In certain ulcerative conditions² it was found that there occurred a deviation from the normal in the calcium content of the serum, some of the calcium being present in the combined form. In all cases of varicose ulcer when the blood was examined this abnormality was found, and in the belief that this might be concerned in maintaining the chronicity of the ulceration measures were taken to increase the ionic fraction of the calcium in the serum. The intramuscular injection of ionized calcium salts had a definite effect in promoting the commencement of healing in the ulcers; the oral administration of calcium had none. But the injections did not appear to have the power to cause complete healing, and it was not till parathyroid substance was given orally that complete healing was obtained. Further, it was observed that healing of the ulcer and rise in the ionic calcium content of the serum ran approximately parallel. From these observations it was concluded that the toxic substance produced by the varicose condition in some way injured the parathyroid glands, and also combined with some of the ionized calcium of the blood. In this way the calcium balance of the blood became disturbed, and the parathyroids were not able to rectify it. Finally, the decrease in the plasma of one of its normal constituents would tend to lower the resistance of the tissues, so that the ulceration, started by slight local trauma, would tend to occur within the varicose area, where nutrition of the tissues is least effective.

The present paper forms an account of the application of these views to a considerably wider field of disease. The conditions dealt with may be classed generally as chronic states of a toxic or infective origin, and, though they have this common factor, they are classified in medical thought and literature as separate and usually unconnected diseases. It is therefore necessary to lay some stress on the mode of action of parathyroid substance, so that the appearance of a claim to its action as a universal panacea may be avoided.

The mode of action of parathyroid is essentially physiological; it is most probably a double action—a more or less specific action on calcium metabolism combined with, or resulting in, a generalized stimulation of metabolism as a whole. It is an aid in the fight against infection of the chronic type, not by its specific action on the infecting organism, but because it places the tissue cells under the most favourable conditions for an adequate resistance; and among the factors concerned in this process not the least important is the maintenance of a proper calcium balance in the plasma. If the tissue resistance is adequate it is immaterial whether the agent that is actively harmful is of bacterial origin or otherwise. If a deficiency of ionic calcium in the serum is a factor in the decrease of tissue resistance, then parathyroid therapy should be of value in those cases where such deficiency exists; and it is explicitly stated that parathyroid is not a specific method of cure for such conditions, but rather a rational method of assisting the cellular

elements to exercise their proper defensive mechanisms. If, then, it is realized that the majority of chronic diseases in medicine are due to protracted absorption of toxic substances from a septic focus, that such absorption is accompanied by a decrease in the ionic calcium of the blood, and that the parathyroid glands are the regulators of calcium metabolism, the claims which are put forward in the following paragraphs for the value of parathyroid therapy in such states will not seem so unreasonable as they may at first appear.

Over one hundred cases of chronic states have been treated by parathyroid therapy, in all of which variations in serum calcium have been observed during treatment. In all cases the sequence of events is similar: improvement commences when the amount of ionic calcium in the serum begins to approach the normal figure. In addition a considerable number of cases in which the calcium examinations were not made have been treated. The following table may give some indication of the types of disease amenable to this method of treatment, though it is fully realized that it may be applied successfully to many other conditions outside this particular series:

Table of Diseases Amenable to Treatment by Parathyroid.

I. Chronic Toxaemias.

- (a) *Ulcerative.*—Varicose ulcer; gastric ulcer; duodenal ulcer; erosion of cervix uteri; gumma.
- (b) *Suppurative.*—Nasal sinusitis; tonsillitis; pyorrhoea; otitis media; bacilluria.
- (c) *Non-suppurative.*—Rheumatic group: Rheumatoid arthritis; osteo-arthritis; chronic rheumatism. Arterio-sclerosis. Eczema; chlorosis; sciatica.

II. Conditions of Uncertain Cause.

Menorrhagia; prostatic hypertrophy; urticaria.

While these cases represent conditions where toxic processes have been at work over varying periods, the following observations afford some evidence of the manner in which an acute attack may affect the calcium of the serum. The symptoms ran a natural course without special treatment against the calcium deficiency.

I. On November 26th the patient's temperature was 102°. On the 27th lymphangitis of the leg became apparent; the temperature remained high, but fell to normal on November 29th. On this day the calcium content of the serum was as follows: Combined calcium 1.4 mg. per cent., ionic calcium 8.5—total, 9.9 mg. per cent. On December 2nd the combined calcium was 0.8, ionic 9.6—total, 10.4 mg. per cent. On December 8th all the calcium was ionized (10.4 mg. per cent.). It was not till the next day, however, that the patient felt any pleasure in work.

II. A mild influenza attack. The patient had sore throat at midday on January 5th; rigor in the evening. Temperature 101°, pulse 80, respirations 18. Calcium content of serum: Combined calcium 1.8, ionic calcium 8.3—total, 10.1 mg. per cent. On January 6th the temperature was 100°. Serum calcium: Combined 1.5, ionic 8.3—total 9.8 mg. per cent. The following day the temperature was normal; combined calcium 1.0, ionic 9.1—total, 10.1 mg. per cent. On January 8th the serum calcium was normal (10.1 mg. per cent.).

The next two instances give the results of vaccine injections in the same individual. The vaccine used was the polyvalent vaccine for prophylaxis against influenza.

III. On January 18th, before injection, the serum calcium was normal (10.7 mg. per cent.); 1 c.cm. vaccine injected. Twelve hours after injection: Combined calcium 2.8, ionic 7.1—total, 9.9 mg. per cent. Thirty-six hours after injection the calcium content was as follows: Combined calcium 1.9, ionic 8.8—total, 10.7 mg. per cent.

Three weeks later a second injection was given and a similar result obtained. Before injection the serum calcium was normal (10.7 mg. per cent.). Twelve hours after injection the calcium content of the serum was: Combined calcium 2.8, ionic calcium 7.9—total, 10.7 mg. per cent. Twenty-four hours after injection: Combined calcium 2.1, ionic 8.6—total, 10.7 mg. per cent. Thirty-six hours after injection the serum calcium was normal.

In both instances the height of the local reaction was about twenty-four hours after injection, but in the second instance this reaction was less and the calcium returned more quickly to normal. Though acute conditions have not yet been studied to any great extent, there seems to be some evidence of an early disturbance of calcium metabolism.

Administration of Parathyroid Substance.

In order to standardize results to some extent, the same preparation of parathyroid (Parke, Davis and Co.) has been used throughout. Usually one-tenth of a grain has been given night and morning for the first four to seven days, and subsequently one-tenth of a grain daily. Such treatment may be continued for a considerable time; in no case has there been any symptom of overdosage. In the early stages

of treatment certain conditions may arise which may be alarming. The most usual is an exacerbation of the septic process responsible for the general condition; a purulent discharge may increase in amount or may appear where it was absent before; a chronic appendix may become acute and necessitate operation; very frequently a tooth may start to ache. In three cases it happened that while some other complaint was being treated with parathyroid the patient had an attack of erythema—almost erysipelas of the face—and in all three cases there was marked sepsis of the teeth. A case of this type may be quoted.

A long-standing case with a small tuberculous sinus from the hip was found to have a marked deficiency in ionic calcium. After a week's parathyroid treatment (gr. 1/10 daily) the discharge increased until there was a quite severe local condition and the old healed tracks opened again. It took two months' parathyroid treatment to get the blood normal again, and then healing recommenced. At the present time, four months from the commencement of treatment, the sinus is about the same size as at the beginning, but there is evidence that the healing is progressive and not stationary as it was previously.

The increase of suppuration at the site of the septic focus suggests strongly that the parathyroid given by the mouth is producing a stimulation of the natural defensive mechanisms of the body; that it is, in fact, acting in a physiological manner and not specifically on the invading organism. If such is indeed the case, then its use in all forms of chronic infection can be readily understood.

The groups of cases set out in the table may now be considered and cases quoted from them as typical instances of the effects of parathyroid treatment.

Ulcerative Conditions.

Varicose Ulcers.—All the cases of this condition mentioned in the previous paper have remained healed, and a good many more have been treated with success. In two recent cases the ulcers were less than a quarter of an inch in diameter, very painful, and very resistant to parathyroid treatment. In both cases a septic condition of the gums was found, and after this had been remedied the ulcers healed. A further examination of the cases of varicose ulcer described in the previous paper revealed the presence of a pre-existing septic focus. In phlebitis of varicose veins calcium deficiency has also been found, and the more acute symptoms have subsided rapidly under parathyroid treatment. Here again the removal of septic foci in the teeth has hastened the disappearance of symptoms.

Gastric and Duodenal Ulcer.—Twelve cases of this diagnosis have been examined for calcium deficiency, and in all deficiency was present. It is not easy, however, to found a diagnosis or prognosis on purely clinical evidence or on the results of parathyroid treatment without some confirmation from x-ray examination or from some other evidence. Several cases have ultimately proved to be carcinoma in some form, although the early symptoms or results of treatment seemed to point to a simple ulceration. In such cases, although the patient may appear to be much improved physically, abdominal tenderness does not disappear completely. In cases which are not malignant the abdominal tenderness usually vanishes completely, the pallor is lost, the appetite increases, and the patient appears to take a much greater interest in his work and general life. Many of the cases in which there is calcium deficiency are very depressed, but the depression is lost as the calcium deficiency is removed; it is possible that many cases of neurasthenia are in reality due to toxic absorption and deficiency of ionic calcium. The two following cases may be quoted:

J. W., aged 56, had severe haematemesis six years ago. Last year he had a similar attack. He had always been very careful about his diet, but had pain regularly about two hours after meals. When he came under observation there was tenderness over the right rectus about two inches from the costal margin. On October 29th his serum calcium content was as follows: Combined calcium 0.5, ionic 7.29—total, 7.79 mg. per cent. He was given parathyroid gr. 1/10 daily, and on November 15th his serum calcium was normal. On December 5th he had no pain or tenderness; he states that for years he had never been able to eat so well.

Miss K., aged 50. For many years she had had pain two hours after food and at night. She had been seen by many doctors and her condition had always been diagnosed as duodenal ulcer. But so far as she knows she had not had either haematemesis or melaena. On October 28th the serum calcium content showed: Combined calcium 2.6, ionic 7.45—total, 10.05 mg. per cent. She was put on parathyroid daily, and on November 2nd the serum calcium was normal. By December 6th the patient was taking parathyroid gr. 1/10 twice a week, and was eating food without caution as she had not done for years.

On December 29th she said that she had been quite well till Christmas Day, when she ate a mince-pie; the pain returned that night and was still continuing. Tenderness was obvious in the same place as before. Serum calcium: Combined 1.2, ionic 8.5—total, 9.7 mg. per cent. She was put back to parathyroid daily.

On January 12th she had had no pain for three days, but there was still tenderness. A wisdom tooth was suspected of sepsis, and she admitted tenderness there. Serum calcium: Combined 1.2, ionic 7.3—total, 8.5 mg. per cent.

She did not have the tooth removed till February 6th, and there was an abscess at its root. At the time of writing she continues well, without any precautions as to diet, without pain, and the tenderness seems to have disappeared. She now refuses to give up taking parathyroid since she puts down her relapse at Christmas to the dose having been diminished too soon.

Gumma.—Although only one case of gumma has been treated in this way it is of sufficient interest to warrant its special mention.

Miss E., a chronic epileptic, aged 41, had a gumma of the left cheek which had been very resistant to specific treatment for eighteen months. On November 9th she had begun her third series of neo-salvarsan injections, which had been alternated with mercurial injections and mercury and iodide by the mouth. The gumma was about the size of a florin. Serum calcium: Combined calcium 1.7, ionic 7.9—total, 9.6 mg. per cent. The patient was given parathyroid gr. 1/10 night and morning, and the injections stopped. On November 16th the serum calcium was normal; ulcer healing well. Parathyroid reduced to gr. 1/10 daily. On November 21st the ulcer was completely healed, and the patient stated that she felt better than she had done for months.

The parathyroid was gradually dropped to once a week after a month's treatment, and the ulcer remains healed, although she has had no further specific treatment. It is of considerable interest to notice that during parathyroid treatment the epileptic fits decreased to about one in three weeks from two or three daily at a few days' interval. This is in accordance with the results obtained by other investigators.

Suppurative Conditions.

Nasal Infections.—In these conditions there is a focus of toxic absorption situated in the accessory air sinuses of the nose—an infection which is difficult to treat, and which may also be combined with a greater or less degree of ulceration in the affected area. Deficiency of ionic calcium has usually been found in such cases, and the treatment by parathyroid has given encouraging results, as is shown in the following two cases:

Mrs. S., aged 41, had a foul nasal discharge for years, and for some months it had been getting worse, so that she could not breathe through either nostril, and used some ten or twelve handkerchiefs a day. She had been told that it was due to ethmoid disease, and had been promised alleviation by operation, but had had to wait for a bed in hospital. On October 29th the calcium content of the serum showed: Combined calcium 2.3, ionic 6.1—total, 8.4 mg. per cent. She was given parathyroid gr. 1/10 daily. By November 11th she was breathing easily through the nose, used fewer handkerchiefs, and the discharge was whiter and less foul. Serum calcium: Combined 2.2, ionic 7.4—total, 9.6 mg. per cent.

On December 24th she had had practically no discharge for ten days; there was but a little thickness in the throat in the morning; the mouth was shut during sleep, and the patient was generally better than she had been for the last two years. Serum calcium: Combined 0.1, ionic 10.0 mg. per cent.—that is, practically normal.

March 2nd: Patient stated that for years she had not been so comfortable. In January she thought she was quite well and dropped parathyroid, but slight symptoms returned, and she is now taking it daily, and keeping apparently well.

Miss R., aged 62, all her life had had nasal trouble, and as a girl had to use douches; she had always refused operation. Twelve months ago she had a troublesome iritis; six months ago a prolonged and difficult conjunctivitis with dacryocystitis, all traced to nasal infection. On November 12th the conjunctivitis returned. Serum calcium: Combined 0.8, ionic 8.0—total, 8.8 mg. per cent. Parathyroid given. By November 24th the eye was well, the nasal discharge less, and the patient was feeling better than she had done for weeks. Serum calcium: Combined 0.9, ionic 9.5—total, 10.4 mg. per cent. (almost normal).

January 16th: Has had no relapse, though there is still some discharge. Serum calcium: Combined 0.7, ionic 9.4—total 10.1 mg. per cent.

She continues well at the time of writing, and is satisfied that the discharge is steadily improving and that she can do her work better than previously.

In both cases the only form of treatment used has been the oral administration of parathyroid; both of them show that a long time may elapse before the serum calcium returns to normal, although signs of improvement commence when the ionic calcium starts to increase.

One case of nasal infection has not been so successful; he had been operated on, but the result was not satisfactory, and he had been treated with vaccines. In October calcium deficiency was observed and parathyroid was given in addition to the vaccine. After three months there had been no improvement, possibly owing to the previously mentioned

action of vaccine injections on the ionic calcium of the blood. For the last month he has had parathyroid alone, and some improvement has occurred, though the outcome is still uncertain. One or two single cases of septic states deserve mention.

Chronic Tonsillitis.—The patient had chronically enlarged and septic tonsils, but refused to have them removed. A year ago he was operated on for appendicitis. Since then he has had an attack of quinsy in both tonsils. On November 7th the serum calcium was: Combined 2.2, ionic 7.7—total, 9.9 mg. per cent. Parathyroid gr. 1/10 given daily. On November 25th the serum calcium was normal. He felt markedly better than he had done for some time, and the tonsils were smaller. He continues in perfect health.

Herpes Zoster and Iritis.—Mr. B., aged 69, on September 9th, while away from home, had an attack of herpes zoster on the left side of the head, involving the eye. The eye caused some anxiety and he was sent to the London Hospital, where he remained six weeks. On January 13th, when he returned home, there was ulceration of the cornea and iritis. Light only could be distinguished with the eye, which was much inflamed. Serum calcium: Combined calcium 2.0, ionic 7.3—total, 9.3 mg. per cent. Parathyroid given.

On January 22nd the ulceration seemed to be healed, but the cornea was steamy and there was much chemosis; he could distinguish objects, and the sight was improving. Serum calcium: Combined 0.6, ionic 8.6—total 9.2 mg. per cent.

He went on improving for a few days more, and then for a fortnight remained at a standstill. He may have been absorbing toxins from the gut, as after a brisk purge improvement recommenced. By the end of February the chemosis had practically disappeared, and there was but a slight ground-glass appearance to his vision. He could read medium large print with the affected eye, and said that it was improving daily.

In another case there was traumatic cataract, iritis, and later a small hypopyon due to piercing the cornea with a thorn. After a month's treatment with parathyroid combined with the removal of some septic teeth the lesion healed. In a case of chronic otitis media parathyroid treatment was followed by a temporary exacerbation of the discharge, but at the time of writing the aural discharge has practically ceased. Two cases of bacilluria (probably *B. coli*) were treated in the same way. Both were of some years' standing, and suffered during the attacks from extreme depression or neurasthenia; in both the ionic calcium was deficient. One was obviously suffering from septic teeth, and in the other, while under parathyroid treatment, one tooth became painful and another became so loose that it could almost be pulled out. The former case had been treated by an autogenous vaccine but had always relapsed, and under parathyroid he is better than he has been before. In both the depression had ceased, and improvement is encouraging.

Non-suppurative Conditions.

Rheumatic Group.—Some twenty cases of rheumatic conditions have been examined and treated, and on the whole with very satisfactory results. In these cases again deficiency of ionic calcium was found and the same sequence of events occurred—namely, that improvement commenced when the ionic calcium began to return to normal. Cases may be quoted as typical of some of the results obtained.

Rheumatoid Arthritis.—Mrs. B., aged 45, for years had suffered from Graves's disease and was still not free from general symptoms. For over a year she had had osteo-arthritis and for some months had only been able to leave the house in a bath-chair. Many joints were affected, but especially the wrists, fingers, and knees. For some time there had been a septic focus in the nasal sinuses, from which there had been a discharge into the throat. A vaccine from this focus had kept her from becoming bedridden, but for weeks she had hardly been able to leave a chair. On October 22nd the serum calcium was: Combined calcium 1.6, ionic 7.4—total, 9.0 mg. per cent. Parathyroid treatment commenced. In one week the calcium of the serum had become normal. By November 12th the nasal discharge had greatly lessened, she had been out of doors, and with the aid of a stick had walked a mile; the joints were smaller and without pain, except for some stiffness in the morning. She has gone on consistently well; at the end of January the parathyroid was decreased to gr. 1/10 twice a week, but both pain and discharge returned. On resuming parathyroid daily these symptoms have abated, so that she can get about comfortably and do her housework.

One case was entirely unsuccessful. It was that of a lady of 77 with a rheumatic history of two years' duration. Three years ago she had had a bad attack of cholecystitis, but had refused operation. Her present condition is almost wholly limited to the right hip. She had had injections of a *B. coli* vaccine without benefit. Calcium deficiency was present, and parathyroid treatment was tried. After six weeks the serum calcium became normal in amount, but the only improvement in the patient was that she slept better.

One case of true osteo-arthritis was treated, but naturally no improvement was expected to occur in the joints affected.

The case was that of a lady aged 61 with a history of several years' duration; she was absolutely bedridden, and the joints affected were ankylosed with considerable distortion. As her blood became normal the pain decreased, she slept better, and felt generally better than she had done since the commencement of her illness.

Sciatica.—Brief mention may be made of two cases of this complaint, as relief of pain seems to be a characteristic of the effect of parathyroid treatment. Mention of it will be made later in connexion with certain cases of inoperable carcinoma. In these two cases the serum calcium was deficient: (1) Combined calcium 1.2, ionic 9.5—total, 10.7; and (2) combined calcium 1.4, ionic 7.7—total, 9.1 mg. per cent. Sepsis of the teeth was present in each case, and both had been in bed for some time under other treatment; but after a short course of parathyroid treatment they were able to get up.

Acute Rheumatism.—So far parathyroid treatment has not been used much in this condition, but the variation of ionic calcium in the serum has been watched. Generally speaking, it can be said that as the patient improves the serum calcium returns to normal; if a relapse occurs, then the calcium becomes more deficient. In a case of this kind, which was being treated with salicylate, the serum calcium values were:

Nov. 12.	Combined calcium	2.2,	ionic	7.4—total	9.6 mg. %
Nov. 17.	"	"	1.5	" 8.5	" 10.0 "
Nov. 22.	"	"	0.9	" 9.6	" 10.5 "
Dec. 14.	"	"	1.6	" 8.6	" 10.2 "

The relapse occurred clinically between the last two dates. In this case the patient was put on parathyroid later, but did not lose all pain in the affected joint till four septic teeth had been removed. In another case parathyroid was given on the first sign of a bruit developing, and although a month elapsed before the serum calcium reached normal, the bruit disappeared, and the patient remains in good health.

Arterio-sclerosis and Raised Blood Pressure.—A small number of cases of this type have been investigated, and encouraging results have been obtained by parathyroid treatment. Deficiency of the ionic calcium of the serum has been generally found.

A clergyman, aged 69, had influenza a year ago accompanied by a foul nasal discharge. Following this he had cardiac dilatation and breathlessness, and in the summer definite anginal attacks developed, which culminated in two bad attacks while he was away for a holiday. He has also had very marked pyorrhoea. He has taken parathyroid since November 11th, and the anginal attacks have never appeared again, though his breathlessness remains unchanged. He finds, however, that his capacity for brain work has improved, so that he can work with more ease than he has done for the last six years.

A lady, aged 50, had a blood pressure of 185 mm. systolic and 125 mm. diastolic, for which obvious cause could not be found. Her serum calcium was deficient, and dental sepsis was suspected. Under parathyroid treatment her gums became definitely sore, but she refused to have any teeth removed. The serum calcium became normal and the pressure fell to 155 mm. systolic and 110 mm. diastolic.

A case of tachycardia in chronic Graves's disease may also be referred to:

Mrs. W., aged 48, has had Graves's disease for many years; tremor is still present, though proptosis and thyroid enlargement are now hardly marked. The pulse is normally 80 to 90, and rather easily upset. Occasionally very frightening attacks of tachycardia occur with a feeling of impending death, though no cause can be ascribed to their occurrence. She had pyorrhoea in four teeth and a deficiency in the ionic calcium of the serum. Three weeks after commencing parathyroid treatment the calcium deficiency was improved, her pulse was much more steady, and in spite of an attack of influenza she has not had an attack of tachycardia for three months, and considers that for years she has not been so well.

Conditions of Uncertain Cause.

In concluding this account of conditions benefited by parathyroid treatment, menorrhagia and prostatic hypertrophy must be mentioned. The former condition is often, but not always, amenable to parathyroid therapy; some six cases have been treated with success.

Prostatic Hypertrophy.—A clergyman, aged 62, in July had acute retention. He had suffered from frequency for some years, so that he had been unable to conduct his services without interruption. His urine was clear on withdrawal until the evening of the second day, when there was some blood present, which increased with each catheterization. He was therefore given a grain of calcium chloride intramuscularly, and within twenty-four hours the sensation of the prostate at the point of the catheter passed had changed from softness to firmness. This suggested a possible calcium deficiency, but at the time it was not possible to examine the blood; he was, however, given parathyroid. The catheter was used for ten days, and after that he steadily improved, so that for some months he has had no undue frequency, his services are not

interrupted, and he seldom gets up more than once in the night. His teeth are very septic, and twice since July he has had an attack of facial erythema, spreading like a subacute erysipelas. In these attacks the ionic calcium of the serum was found to be deficient. He has continued to take parathyroid once or twice a week, and as regards the prostate symptoms keeps well.

More than a dozen cases have been treated with complete success; two long-standing cases which are possibly carcinomatous have only been partly successful. The following are two interesting cases:

J. C., aged 81, was first catheterized on August 8th with much haemorrhage. He went into hospital and refused operation. He never regained power, and was sent out with a catheter, never passing anything without it. On October 6th the calcium content of the serum showed: Combined calcium 2.4, ionic 6.6—total, 9.0 mg. per cent. Parathyroid treatment was commenced. On October 18th the serum calcium was normal. One or two days immediately previous to this date he had passed a little urine spontaneously. On November 5th he was passing more and more urine with slight pain; the catheter was being used twice a day. He thought he passed about a pint daily without the catheter. He improved steadily, and on December 15th gave up the catheter for good. He has lost the fallow look he had previously, and has regained a healthy colour. He is disturbed once or twice only in the night, and says he is better than he has been for years. He continues to take parathyroid once or twice a week. Three bad teeth remain.

T. G., aged 68, had retention on September 11th and required catheterization for three days. Serum calcium: Combined calcium 2.5, ionic 6.4—total, 8.9 mg. per cent. Given parathyroid gr. 1/10 daily. On September 30th the serum calcium content was: Combined calcium 2.7, ionic 7.3—total, 10.0 mg. per cent. On October 13th he passed urine more easily than for years; frequency usually not more than twice in the night. Serum calcium about the same. By November 3rd the serum calcium was normal. He was looking well and was satisfied with his progress. Later he complained of some fullness and indigestion after meals. His remaining four teeth were removed and the indigestion disappeared. He keeps well and is sometimes not disturbed at night at all.

Finally, a word may be said about carcinoma and the effect of parathyroid treatment. A certain number of inoperable cases of this condition were treated; deficiency of the ionized calcium of the serum was found in almost all cases. But although the administration of parathyroid produced a relatively rapid return of the serum calcium to normal, it did not have any apparent inhibitive action on the malignant growth. In a case of carcinoma of the stomach there was less vomiting, and also a marked diminution of pain, so that it was possible to reduce very considerably the amount of morphine given. In another case there was an increase in weight for two or three weeks, combined with an abatement of symptoms and a feeling of perfect health.

SUMMARY.

Though the cases described are representative of a variety of conditions, it will be noted that they have two common factors: all are due to some chronic toxic state, and all have a deficiency in the ionic calcium of the serum, due perhaps to a combination of calcium and toxin. In the majority of cases it was possible to find a primary septic focus, and sometimes the administration of parathyroid caused a hidden focus to become apparent by increasing the leucocytic reaction to the attacking organism. An examination of the literature tends to establish the proposition that the parathyroid glands have a double function: First, a regulation of calcium metabolism, and secondly, the power to render certain toxic substances harmless. Further, it may be noted that in animals where the parathyroid function has been interfered with, either by removal or ligation of the glands, if tetany does not supervene shortly and so cause death, there is a very strong tendency for the animals to die from an infective process.

It is possible that a somewhat similar sequence of events may arise in the cases described. The continued absorption of toxic substances from some primary septic focus may eventually lead to partial parathyroid insufficiency and a disturbance of calcium metabolism. These two conditions will cause a decrease in the resistance of the tissues, so that they are rendered more liable to a secondary septic process. The locality of the latter lesion will depend on local conditions of nutrition, blood supply, and so forth.

From the clinical observations described, it may be permissible to draw certain conclusions.

1. The ionic calcium of the blood becomes deficient in cases where a chronic toxæmia is present. Such deficiency may be regarded as one of the manifestations of the presence of a chronic toxic state, and is an indication that the septic focus should be carefully sought for and treated where possible.

2. Where there are lesions due to such states, healing does not commence until the ionic calcium of the blood approximates to the normal figure.

3. By parathyroid therapy it is possible to rectify the calcium balance of the blood much more effectively than by the injection of calcium salts.

4. The therapeutic use of parathyroid substance in the cases described is essentially physiological. It does not appear to act specifically against any one organism, nor any one toxin. Its action is to place the tissues of the patient under conditions more suitable for the performance of their normal functions, and for combating the effects of toxic processes.

NOTE (by W. R. G.).—The septic foci believed to be the primary cause of the calcium deficiency have in various diseases been found in a chronic ear discharge, the tonsils, the accessory sinuses of the nose, a chronic appendix, the gall bladder, probably the colon (as evidenced by colitis), possibly the uterus, but most often in the teeth. In this connexion the ulceration of the gums (pyorrhoea) has often been the cause, since the removal of the tooth has materially altered the condition of the disease for the better. When a red oedematous line leading from the ulcerating margin outlining the tooth is found suspicion should be at once aroused. From personal observation in these cases the apex of the tooth has always shown erosion.

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CARDIAC DISEASE AND OCCUPATION.

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ONE of the most important problems which confront the physician in regard to diseases of the heart is to give sound advice as to occupation. In former days the great importance of rest in heart disease was perhaps somewhat indiscriminately and unconditionally emphasized; nowadays it would seem that more stress is laid upon the advisability of exercise. This does not mean, of course, that medicine has swung violently from one extreme to the other of treatment, but that in days gone by physicians in their writings were more particularly concerned with advanced cases of heart disease, for which rest must always be the prime requisite. The increased facilities for discovering cardiac abnormalities have not unnaturally led medical men to regard such abnormalities as more serious than often they really are, and consequently to apply to them the same line of treatment which would only be suitable in the case of a quite definite disease.

The profession has been gradually learning that cases with cardiac disability are capable of doing much more work than was formerly supposed; true, there have always been wonderful cases of damaged hearts doing extraordinary things, but no prudent physician would base his advice upon abnormal and exceptional cases.

In the case of any cardiac abnormality what one wants to know is whether the abnormal finding indicates any really serious disability at the moment or in the near future. There are quite a number of hearts which it would be well to regard not as diseased but as handicapped, and in much the same condition as a limb impaired by infantile paralysis which limits but does not prevent one's power of walking; no doubt in the case of infantile paralysis it is easier for the patient to discover unaided what he can and what he cannot do than is at first possible for heart cases. Such cardiac conditions would include not only certain valvular lesions and some arrhythmias, but also many hearts with no physical signs which for want of a better term one might describe as "subnormal hearts," where the functional capacity of the myocardium is less than normal, such cases being formerly described perhaps as weak or flabby hearts. Patients with such hearts insensibly drift into sedentary occupations, which suit them fairly well, and it is only when some sudden and unusual output of energy (as occurred so frequently in the army, when cases of this type were enlisted) is called for that the intrinsic cardiac weakness becomes manifest. Many of these cases, however, need not be confined to sedentary work only: they might be much more active, provided they could take their own time over the work. Many of them can earn as good wages as if they had no disease at all.

In a rough sort of way we may think of any given cardiac lesion as of a static or dynamic type, by which, of course, we

mean that in the one case the condition seems comparatively stationary, while in the other it is likely to progress. Cases which are likely to be of the static kind are usually those due to rheumatism, chorea, or scarlet fever occurring in early life; while those of the progressive type are in the main the cases which originate from arterio-sclerosis, or in which syphilis is admitted as a cause. Clearly very different occupations will be adopted for these two categories of cases, and it is only for the static ones that much activity can be permitted. Contrary to what is generally supposed, aortic regurgitation, when due to rheumatism, in a young adult has one of the best prognoses of all valvular lesions from the point of view of work; the reason why it has had such a bad prognosis in the past is that such cases have not been sufficiently distinguished from those of arterio-sclerotic and syphilitic origin, which certainly furnish the larger number of aortic lesions, and their prognosis is specially bad.

Are there any general principles which can guide us in the selection of work for cardiac cases? As a rule, all kinds of work which involve sudden spurts, although there may be comparatively long intervals of rest, are bad for most cardiac patients; the life of the docker and of the soldier, just to take two types, is liable to periodical rushes with unduly slack intervals, and such occupations should of course be avoided. In selecting an occupation it is specially important to consider whether the hours are regular and the work more or less the same from day to day and hour to hour, while there need be no undue sense of hurry in the doing of it. This question of regularity in work requires quite as much consideration as the number of foot-pounds of energy which the work may require to be put forth. Work which places a fairly heavy strain upon the lower extremities is much more easily tolerated than that in which the main strain falls upon the arms. Most forms of aortic disease, and undoubtedly those of the degenerative type, seem to be very unfavourably affected by any work which involves even a moderate strain upon the arms, such as carpentering, and this is particularly the case where there is any suspicion of angina. It should also be borne in mind that aortic cases, when otherwise doing fairly well, are often liable to transient attacks of giddiness, which should rule out the numerous occupations which necessitate going up ladders or close contact with machinery. It is unfortunate that there seem to be so many occupations in which "heavy lifting," though by no means the essential part of the work, yet is often required incidentally; thus a man is suddenly asked to move a heavy piece of furniture, and it is this which does the damage and not the regular work itself.

Apart from the actual occupation one should further inquire into how great the distance is at which a man lives from his work, for often it is not so much the occupation *per se* which proves too much for him as the long walk to and from it, with, it may be, a heavy uphill grind at the end of the day, or there may be the added excitement and anxiety about catching trains or omnibuses. Then, too, at the end of the day it makes a good deal of difference if a man lives in a two-storied cottage or has to ascend to the top floor of some model dwelling. In the case of women, the vast majority even nowadays are occupied in some way with a home, the complicated activities of which are not easy to curtail; often, however, the omission of one single item of household labour, such as "washing," may make all the difference to a woman being able to carry on or having to give up her work. Women as a rule are not good organizers of their own work, but the task is difficult, and they might say with Frau von Stein in a letter to Goethe, "It is not perceived that to discharge the thousand little details of life which we have to attend to more ability (for which we get no credit) is required than for the doings of a genius who is at once accorded honour and fame."

As will be gathered from what has been said, it is a great mistake to suppose that cardiac cases can only do sedentary work; many more active forms of work are open to them, but they require selecting and being carefully gone into. Clearly the most important thing to do is to make some attempt to estimate the power of the myocardium. The significance of the myocardium in the estimate of the seriousness of any cardiac lesion was recognized as far back as the time of Stokes of Dublin, who said:

"It is in the vital and anatomical condition of the muscular fibres that we find the way to cardiac pathology; for, no matter what the affection may be, its symptoms mainly depend on the strength or the weakness, the irritability or the paralysis, the anatomical health or disease, of the cardiac muscles."