on its inner side, and overhung the thigh for a considerable distance. It measured 11 inches in its transverse and seven inches in its vertical diameter and was irreducible. In one patient an oval, hard body was felt in the upper part of the sac after reduction of the enterocele, of the size and shape of an ovary. Of the 18 cases, two only were noticed at birth, eight between the ages of 21 and 40 years, four between 41 and 60 years of age, and three between 60 and 70 years of age, while in one patient the first occurrence of the hernia was doubtful.

The causes of interstitial hernia in women are probably due to distension of the abdominal muscles during pregnancy, for most of them were mothers of large families.

The treatment of interstitial hernia in males is neither scientific nor satisfactory, for the pressure of a truss is mainly directed to covering the hernia and in most instances is unable to effect complete retention. As a rule, the deviated testes accommodate themselves under the truss without much inconvenience to the patient if the truss is properly adjusted. The testis may safely be left to take care of itself. Operative measures for the reduction and cure of the hernia are often attended with difficulty, as the separation of such an extent of the abdominal muscles renders the complete approximation of the parietes almost impracticable. The size of the hernia is so great that the abdominal cavity is unable to receive such a large accession of viscera, so that the question of an enterectomy must be considered to allow of the complete reduction of the extruded mass.

THE CAUSATION, PREVENTION, AND TREATMENT OF POST-PARTUM HÆMORRHAGE.¹

By G. F. BLACKER, M.D., B.S. LOND., F.R.C.S. ENG.,
OBSTETRIC PHYSICIAN TO OUT-PATIENTS AT UNIVERSITY COLLEGE
HOSPITAL; OBSTETRIC PHYSICIAN TO THE GREAT
NORTHERN CENTRAL HOSPITAL.

THE subject of our discussion this evening must always be one of great interest to medical practitioners. The appalling suddenness of the accident and the great risk to life entailed upon the patient render it a matter for congratulation that cases of post-partum hæmorrhage are not met with more frequently and that its occurrence can usually be avoided by proper prophylactic treatment.

In the University College Hospital maternity department during the period from August 1st, 1893, to Dec. 1st, 1900, 15,130 women have been delivered. Of this number 139, or one in 108, have suffered from some degree of post-partum hæmorrhage. In 100 of these cases, or one in 151, the amount of blood lost was not very excessive and did not cause any marked symptoms; in 31 of the cases, or one in 488, the loss was considerable and was accompanied by marked symptoms; while in eight instances, or one in 1881, the patient's life was endangered, two of these cases ending fatally—a mortality of one death in 7565 deliveries. Amongst 20,378 confinements in the Charité Hospital in Berlin only two deaths occurred from post-partum hæmorrhage—a mortality of one in 10,189. Veit,² who has collected a large number of statistics in addition to these, found amongst 47,065 labours only five deaths from atonic post-partum hæmorrhage—a proportion of one in 9413 confinements. Although the death-rate from post-partum hæmorrhage is therefore relatively small, yet the total number of fatal cases must be considerable. Dührssen³ states that 300 women die annually in Prussia from this cause, while the frequency of cases causing severe symptoms—viz., one in every 488 confinements in the University College Hospital maternity department—renders this accident of labour one of much importance.

I propose to discuss post-partum hæmorrhage under the three headings of Causation, Prevention, and Treatment, and to confine my remarks to the variety due to atony of the uterus.

Before passing on to consider its causation I may just

remind you of a few facts concerning the mechanism of the third stage of labour. The anatomical studies of Barbour,⁴ Pinard, and Varnier⁵ have demonstrated that at the end of the second stage of labour the placenta is still completely attached to the uterine wall. Separation of the placenta begins with the third stage of labour and is due to the contraction and retraction of the uterine muscle. It is this latter property of active retraction—or what may be termed the tonicity—of the muscle which prevents the occurrence of hæmorrhage when the utero-placental vessels are torn through during the separation of the placenta. The absence or inhibition of this power of retraction is the chief cause of post-partum hæmorrhage, giving rise as it does to atony of the uterus or inertia uteri. It is because the retraction of the uterine muscle is prevented by the presence of the foetus in utero that premature separation of the placenta is so often accompanied by severe hæmorrhage.

CAUSATION.

The causes of post-partum hæmorrhage are, therefore, to be sought in the conditions giving rise to uterine inertia. These may, for convenience of discussion, be classified as follows:—

1. Feebleness, exhaustion, or malnutrition of the patient. This may be due to the condition of chronic starvation so common amongst the London poor, or to the occurrence of ante-partum hæmorrhage, or it may be the result of some disease complicating the labour, such as grave heart disease.⁶ The great danger of even a slight degree of post-partum hæmorrhage in cases of severe ante-partum hæmorrhage is well known. Ord⁷ has shown that labour complicated by myxœdema is very likely to be followed by hæmorrhage. Albuminuria is often asserted to favour the occurrence of post-partum hæmorrhage. This is not borne out by our experience, and its influence in causing this complication of labour is denied by Pinard.

2. Over-distension of the uterus and undue stretching of the uterine muscle such as occurs in cases of hydramnios or multiple pregnancies. Unstriated muscle if stimulated to contract passes into a condition of exhaustion more rapidly when stretched by means of a weight than when it is not so stretched.

3. Exhaustion of the uterine muscle from frequent child-bearing and prolonged labour. One of the commonest causes of post-partum hæmorrhage is the application of forceps and the delivery of the child when pains are absent and the uterus is exhausted and in a condition of secondary uterine inertia—the so-called “temporary passiveness” of Braxton Hicks.⁸

4. Pathological conditions of the uterine wall. The presence of fibroid tumours is especially liable to cause post-partum bleeding if the placenta be attached over the site of the tumour. Marked fatty degeneration of the uterine muscle has been described by Bossi⁹ in three cases of pregnancy, and he thinks that this may possibly be a cause of inertia in some instances. Fritsch¹⁰ has called attention to cases of uterine atony due to septic infection occurring during labour, the paralysis of the uterine muscle being analogous to that of the intestinal muscle seen so commonly in cases of septicæmia.

5. Some mechanical hindrance to the contraction and retraction of the uterus, such as the retention of the placenta in utero or the presence of adhesions between the uterus and surrounding structures. Graily Hewitt¹¹ described a fatal case apparently due to this latter cause, and in 102 cases of labour following the operation of ventro-fixation of the uterus Negri¹² found five cases of severe post-partum hæmorrhage due to the adhesions present—a proportion of one in 20, much above the average.

6. Too rapid emptying of the uterus, either by the application of forceps or after version. If the child be rapidly extracted after version in cases of placenta prævia with a rigid cervix tears extending through the placental site in the lower uterine segment are very likely to occur and dangerous hæmorrhage to ensue.

7. Extreme nervous depression and shock such as may

⁴ Atlas of the Anatomy of Labour.

⁵ Études d'Anatomie Obstétricale, 1892.

⁶ Vinay: Maladies de la Grossesse.

⁷ Allbutt's System of Medicine, vol. iv.

⁸ Transactions of the Obstetrical Society of London, vol. ix., p. 207.

⁹ Annali di Ostetricia e Ginecologia, December, 1896.

¹⁰ Handbuch der Geburtshilfe (Müller), Band iii.

¹¹ Transactions of the Obstetrical Society of London, vol. xi.

¹² Annali di Ostetricia e Ginecologia, August, 1896.

¹ A paper read at the opening of a discussion upon post-partum hæmorrhage at a meeting of the North London Medico-Chirurgical Society, Dec. 13th, 1900.

² Zeitschrift für Geburtshilfe und Gynäkologie, 1894.

³ Sammlung Klinischer Vorträge, Volkmann, 347 (Gynäkologie, No. 100).

follow the birth of a dead child may account for uterine atony in some cases. That such a mental condition should cause hæmorrhage is not surprising when we remember how frequently irregular cardiac action and vaso-dilatation are produced by various emotions.

8. The administration of chloroform has often been regarded as a cause of uterine inertia. That chloroform gives rise to post-partum hæmorrhage is probably not true, but that its administration has some effect upon the pains is easy to determine clinically and is proved by the observations of Pinard¹³ and Westermarck.¹⁴ The last-named observer finds that chloroform when given to the obstetrical degree lengthens the intervals between the pains, diminishes the frequency of the pains, and causes the individual contractions to begin more suddenly and pass off more rapidly. When given to the surgical degree it produces the same results but to a more marked extent. Pinard found that chloroform prolonged the intervals between the pains, while it diminished the severity and power of the pains, and he concluded that it affected the power of retraction of the uterine muscle rather than its power of contraction.

9. Another possible cause of excessive bleeding after delivery is deficient coagulability of the blood. Such a condition occurs in cases of septic infection and hæmophilia. The latter disease is possibly more often suspected than actually met with, but the cases recorded by Kehrer¹⁵ show how dangerous a complication of pregnancy and labour it may be.

PREVENTION.

In discussing the preventive treatment of post-partum hæmorrhage it is necessary to consider the treatment of the patient during pregnancy and during labour. It is important that all patients should enter upon labour in as favourable a condition of health as possible. Attention must therefore be paid to the general health in all cases where this may be necessary. If the patient has lost excessively at her previous confinements small doses of ergot and strychnine combined with iron or hydrochloric acid may be given during the last month or so of pregnancy, as recommended by Dr. Lombe Atthill.¹⁶ Women with a history of hæmophilia should be given¹⁷ calcium chloride in 10 grain doses three or four times a day for the last two or three weeks preceding delivery. Although, as we have seen, it is very doubtful whether albuminuria *per se* is a cause of post-partum flooding, yet for obvious reasons it must be treated and the patient should be placed upon a strict milk diet. The great value and importance of preventive treatment is well exemplified by Spiegelberg's statement. He writes: "I certainly do not exaggerate when I say that severe post-partum hæmorrhage is almost without exception the fault of the attendant."¹⁸

In no less than 50 of the 139 cases occurring in the University College Hospital maternity department the child was born before any assistance arrived. In six out of the eight severe cases this happened, including the two cases in which the women died. It is, unfortunately, a common practice amongst the patients in this department to postpone sending for assistance until as late as possible so as to avoid the necessity of being examined. How dangerous a custom this is the facts I have mentioned show, and in all probability one of the two women who died lost her life as a result of this practice. The details of these two cases are shortly as follows.

CASE 1.—A woman sent up to the hospital for attendance at 9 P.M. on August 3rd, 1895. When she was seen slight pains were occurring every half hour. The membranes were unruptured and the internal os was of the size of a sixpenny piece. The pulse was normal. The patient was anæmic and feeble. At 10.30 P.M., as the conditions of the cervix had remained the same, she was left and instructions were given to send up again when the pains became more frequent. Between 4 and 5 A.M. on August 4th the husband came up to the hospital and said that the child was born. On the arrival of the student in attendance the patient was found to be dead. The bed was soaked with blood. The child was born and was alive; the placenta was retained partly in the uterus and partly in the vagina. The uterus was enormously distended and contained large quantities of blood and blood-clot. The pains had continued

very feeble until just before the end, when with three or four very strong pains the child was born. The sister of the patient was the only person present at the time. All attempts at resuscitation completely failed.

CASE 2.—A woman sent up to the hospital on August 28th, 1897, two and a half hours after the birth of her child, for assistance on account of severe flooding. On the arrival of the medical attendant the patient was found to be cold, extremely blanched, pulseless, and speechless. The placenta, retained and only partially separated, was removed by the hand. There had been very severe post-partum hæmorrhage which had, however, ceased. The patient was given hypodermic injections of ether and three pints of water and two ounces of brandy were injected into the rectum. She rallied a little but died just after intravenous transfusion had been commenced.

The prevention of post-partum hæmorrhage is of even greater importance than its treatment, and it may with truth be said that the skill of an accoucheur can be estimated by the number of such cases that occur in his practice. During labour it is often good treatment to rupture the membranes, even before the cervix is fully dilated, in cases where we fear the occurrence of hæmorrhage after delivery. During the second stage of labour care must be taken not to allow the uterus to become exhausted and to recognise as early as possible conditions likely to cause obstructed labour. When the uterus is in a condition of secondary inertia the mistake of delivering with forceps must be avoided and the case treated by opium and rest, while in cases of obstructed labour the necessary measures must be at once adopted to overcome the obstruction. When towards the end of the second stage the pains are feeble and no progress is being made ergot in doses of from half a drachm to one drachm of the liquor ergotæ ammoniatus may be given, if it is perfectly certain that the labour is an absolutely normal one. The practice of giving ergot before the birth of the child is undoubtedly in certain cases a very valuable one and it is regarded at the present time with more disfavour than it deserves. This method is especially applicable in cases where deep anæsthesia is necessary in order to complete delivery.

It is, however, in the proper management of the third stage of labour that the secret of preventing post-partum hæmorrhage lies. Too often it occurs as a sequel of hasty and premature attempts to express the placenta, with the result that a portion of the placenta or membranes is left in utero. A sufficient amount of time must be allowed to elapse to permit of proper separation of the placenta, and under ordinary circumstances no attempt should be made to express it until from 20 to 30 minutes after the completion of the second stage of labour. From the time the child is born until the placenta is expelled one hand should be kept continuously upon the uterus. The dorsal position has many advantages during the third stage of labour, but in cases where bleeding occurs the necessary manipulations are most readily carried out with the patient on her side.

At the end of the second stage the fundus of the contracted uterus is usually at the level of the umbilicus. Towards the end of the third stage it will be found to have ascended until it lies from one and a half to two inches above the umbilicus.¹⁹ This indicates that the placenta has been separated and expelled from the upper uterine segment into the lower uterine segment and that it is in a condition in which it can be easily expressed.

It is more particularly in cases where it is necessary to revive an asphyxiated child, or where the medical attendant's attention is directed away from the mother, that severe post-partum hæmorrhage is likely to occur. It is impossible for a uterus to relax completely unperceived if it be watched with the hand during the whole of the third stage of labour. In any case where hæmorrhage has occurred or where the uterus shows a tendency to again relax it must be carefully supervised until it is certain that contraction and retraction are complete and permanent.

TREATMENT.

When post-partum hæmorrhage does occur the medical man must have a plan of treatment ready and be able to carry it out rapidly and efficiently. Personally, I do not consider that I am doing justice to my patient or to myself unless I have ready at hand the few appliances necessary to enable me to deal with such a complication should it arise.

The best method of treating a case of severe hæmorrhage

¹³ De l'Action Comparée du Chloroform, &c., Paris Thesis, '87.

¹⁴ Archiv für Gynäkologie, Band lxi., 1, 1900.

¹⁵ Ibid., Band x., 1876.

¹⁶ Brit. Med. Jour., March 3rd, 1897.

¹⁷ A. E. Wright: Brit. Med. Jour., July 25th, 1893.

¹⁸ Text-book of Midwifery, vol. ii., p. 228.

¹⁹ Varnier: La Pratique des Accouchements, p. 259.

will depend upon whether the placenta is still in utero or not. The ordinary treatment may be outlined as follows. If the placenta be retained it must be at once expressed, or if this is found impossible removed by the hand. A hypodermic injection of ergotin if ready may be given and the uterus kneaded through the abdominal wall while the nurse is ordered to prepare a hot douche. If the hæmorrhage be profuse and the uterus does not respond to the kneading bimanual compression may be carried out until the douche is ready. In the small number of cases where the hot douche fails to excite any uterine contractions and the tone of the muscle is entirely lost recourse must be had to continued bimanual compression, to plugging the uterus with gauze, or to the application of some styptic, such as perchloride of iron, to produce clotting of the blood in the vessels.

We may now consider these various methods of treatment rather more in detail.

It is impossible for the uterus to contract and retract while the placenta is still in utero, and therefore its removal must be undertaken before any attempts are made to excite uterine contractions. Whenever possible this should be effected without the introduction of the hand into the uterus. No time, however, must be lost if expression fails, and when necessary the hand must be passed into the uterus and the placenta and all blood-clot removed. The introduction of the hand has the advantage that it is a powerful excitant of uterine action. Ergot takes too long a time to act to be of much value in the treatment of a case of severe bleeding. In all cases where it is ready a hypodermic injection of ergotin may be given so that the assistance of its action may be obtained in rendering permanent the uterine contraction and retraction procured by other more speedy methods of treatment. In the less severe cases kneading the uterus is often all that is required to excite contractions and to arrest the bleeding. In the more severe cases this is not sufficient and in these a hot douche must be given.

There are several important details to be observed in employing this form of treatment. The water must be used in large quantities and at a temperature of not less than from 117° to 120°F. The uterine tube should be carried into the uterus up to the fundus and the whole of the inner surface of the organ irrigated by the fluid. This is rendered more easy and at the same time the hæmorrhage may be to some extent checked if the uterus be drawn down to the vulva with a vulsellum. This method of drawing down the uterus is at times alone sufficient to arrest the bleeding no doubt by the kinking and compression of the uterine arteries which it causes.²⁰ Some antiseptic may be used in the water, such as creoline or iodine, but plain hot water will do perfectly well in an urgent case.

Bimanual compression of the uterus is the best method to employ when the hot douche is not immediately available or where it fails to excite uterine contractions. The uterus seized by the hand on the abdomen is compressed against the anterior abdominal wall, the posterior surface of the symphysis pubis, and the other hand placed in the anterior vaginal fornix. The pressure should be exerted as far as possible upon the placental site; no great force is required and it can be continued for a considerable length of time, although at the cost of a good deal of fatigue on the part of the attendant. The chief objection to this method is the difficulty sometimes experienced in grasping the completely relaxed uterus between the two hands. Whether the fist or the extended hand be introduced into the vagina is a matter of indifference so long as the anterior and posterior walls of the uterus are kept firmly in contact. All the 139 cases of hæmorrhage occurring in the University College Hospital maternity department were treated by the hot douche or bimanual compression. In no case near full term was the uterus plugged with gauze or injected with styptics.

As a routine means of treatment plugging the uterus is certainly inferior to bimanual compression. There are, however, two classes of cases in which the latter method is specially indicated—viz., where the uterus is prevented from contracting and retracting by the presence of adhesions or by the existence of fibroid tumours in its wall. Schauta²¹ has suggested that in some severe cases of hæmorrhage the uterine vessels are atheromatous, and in any instance where this condition is suspected gauze-plugging would no doubt be the best treatment. Schmit²² has recorded a case of this

kind in which the patient died from uncontrollable hæmorrhage, although the uterus after plugging had failed was ultimately removed in an endeavour to arrest the bleeding. On microscopic examination well-marked hyaline degeneration of the vessels at the placental site was found. Plugging the uterus may be carried out in the following way. The uterus is drawn down to the vulva with a vulsellum—a manœuvre which has the advantage of assisting to arrest the hæmorrhage—or is pushed down by pressure through the abdomen. The left hand is introduced up to the fundus and all blood-clot removed. The strips of gauze or of any other available material wrung out of an antiseptic lotion are passed into the uterus under cover of the fingers of the left hand by means of a pair of uterine dressing-forceps or the intra-uterine douche-tube, and the cavity firmly and completely packed from above down. Special care must be taken that no space in which blood could accumulate is left between the fundus and the gauze. In bad cases the vagina should also be plugged. A large pad of wool may then be placed over the vulva and a binder and T bandage applied with considerable pressure. The plug is taken out at the end of from 18 to 24 hours. If hæmorrhage continues the plug must be removed, the uterus washed out, and then replugged.

Since 1893 there has not been any case of post-partum hæmorrhage alone in the maternity department or University College Hospital in which plugging the uterus has been required. This method has, however, been frequently employed for hæmorrhage after abortions and other conditions and is of great value in the treatment of some cases of rupture of the uterus.²³

The last mode of treatment I have to mention is the application of powerful styptics to the interior of the uterus, a method which at the present day is almost superseded by gauze-plugging. The drug most commonly used is the liquor ferri perchloridi fortior of the strength of one part to three parts of water.²⁴ It may be injected into the uterus by means of a tube, or the interior of the organ may be washed out with a sponge or wool dipped in the solution. It is undoubtedly a most efficient means of producing thrombosis, but its dangers outweigh its advantages. It is extremely likely to produce sloughing, septic thrombosis, and general septic infection. Turpentine and vinegar may also be employed in the same way.

In cases where the hæmorrhage has been successfully arrested but where the loss has been excessive the condition of the patient is usually very grave, and energetic after-treatment is required if her life is to be saved. The greatest reliance is to be placed in the treatment of such cases on the hypodermic injection of strychnine, ether, and digitalin. Ether may be injected in doses of 10 minims every 10 or 15 minutes until five or six doses have been given. Where cardiac failure is very marked hot water or normal saline solution should be injected. The former may be given by the rectum, the latter may be injected under the skin or into a vein. In severe hæmorrhage the most valuable of these methods is venous transfusion. Infusion of hot water or saline fluid has been carried out in 10 of our cases—five times by the rectum, four times into a vein, and once into the sub-mammary connective tissue. The amount of fluid employed varied from one to five and a half pints. One patient was transfused twice, three pints being introduced into one arm and two and a half pints into the other.

Rectal injections of hot water with or without brandy are of great value in cases where the circulation is not too feeble. They act as a powerful stimulant and in such cases the fluid is no doubt absorbed. In cases of severe hæmorrhage accompanied by a very feeble action of the heart it is quite certain that no absorption occurs either from the stomach or bowel. In such cases venous transfusion must be carried out and gives exceedingly good results. My experience of subcutaneous transfusion in cases of septic infection and other conditions leads me to regard it as too slow a method to use in cases of hæmorrhage. Common salt can be obtained in any household, but it is best to carry it as chemically pure sodium chloride or as a concentrated solution in a sealed glass tube. The solution employed should contain one drachm of salt to the pint, and must have a temperature of

²⁰ rendt: *Therapeutische Monatshefte*, January, 1898.

²¹ Medical Press and Circular, May, 1895.

²² *Centralblatt für Gynäkologie*, 1899, No. 35.

²³ Spencer: *Transactions of the Obstetrical Society of London* January, 1900.

²⁴ Barnes: *Transactions of the Obstetrical Society of London*, vol. xi, p. 219.

from 101° to 102°F. It will cool down to blood heat while passing through the transfusion apparatus. Care should be taken to see that the temperature is maintained during the operation, and this can most easily be done if the solution be prepared in small quantities at a time. It should in all cases be filtered through muslin before use. If it be necessary to repeat the transfusion another vein must be opened. When the patient has been revived and the immediate danger of death from syncope is staved off the extreme restlessness and headache that so frequently follow may be treated by large doses of opium or morphia. Any further tendency to syncope is best treated by raising the foot of the bed and the administration of liquid food and stimulants in small quantities at frequent intervals. The great risk of subsequent sepsis must not be forgotten and the convalescence of such patients is of necessity a slow process.

Wimpole street, W.

CALCIUM IODATE AS AN IODOFORM SUBSTITUTE AND GASTRO-INTESTINAL ANTISEPTIC.

By WILLIAM MACKIE, M.A., M.D. ABERD.,

VISITING PHYSICIAN AND SURGEON, DR. GRAY'S HOSPITAL, ELGIN.

MANY years ago Sonstadt came to the conclusion that the minute quantity of iodine contained in sea-water is present in the form of calcium iodate.¹ To this substance, existing, as he calculated, in the proportion of one part in about 250,000² parts of sea-water, he attributed "not only the salubrity of the sea, but, through the medium of the atmosphere, of the land also." At a somewhat later date the same chemist made "experiments on the properties of iodate of calcium as an antiseptic and disinfecting agent."³ Some of these experiments I have repeated, with this difference—that where Sonstadt mostly used the dry powder I have used a saturated solution of the salt, but the results obtained by me have in every instance been in complete accord with those obtained by him.

About 15 months ago I began tentatively to use calcium iodate in surgical practice as an antiseptic dressing in place of iodoform. For about the same time I have been using it, though to a less extent, in medical practice also. The results in both cases have led me to conclude that calcium iodate is a substance likely to prove of very considerable value both for external and internal use. Up to the present, however, my observations have been more particularly directed to its surgical applications. For the last six months or more I have used it without hesitation in all kinds of surgical work where iodoform is usually indicated and, I may say, to the almost total exclusion of the latter substance, and my belief in its efficacy has only increased with its continued use.

The theory of the action of calcium iodate as an antiseptic is not far to seek. It is an iodine compound containing 51 per cent. of iodine and in addition 16 per cent. of available oxygen. On contact with putrescible organic matter, whether in acid or in alkaline medium, like other iodates it slowly liberates iodine. In alkaline solution, while the organic matter is being oxidised by the oxygen set free from the decomposing iodate, the iodine by a reaction well known to occur in alkaline media slowly re-forms iodate through the decomposition of water. The iodate so re-formed in contact with another portion of putrescible matter yields further proportions of free oxygen and iodine to act as before, and so on. The process, therefore, is, so to speak, a continuous one. As most pathological discharges are alkaline we have present in such cases the necessary conditions of the continuous action of an iodate. In an acid medium, also, in the presence of reducing substances such as easily oxidisable organic matter, iodine is liberated and by the decomposition of water it sets free oxygen which is used up in oxidising any unstable organic compound that may be present. The iodine in this case passes into hydriodic acid or an iodide and so eventually ceases to act. If, however, the acid present in a medium be hydrochloric—as, for example, in the gastric juice—chlorine, though not the only substance liberated, is certainly the one liberated in greatest

abundance. Chemical equation shows that calcium iodate in contact with hydrochloric acid liberates as nearly as may be four-sevenths of its weight of chlorine. On this fact theoretically depends its use as a gastro-intestinal antiseptic. As regards antiseptic action something no doubt depends on the chemical instability of iodates generally and of this iodate in particular, on the nascent action of the liberated products, and in this case on the fact that the base forms insoluble compounds such as carbonate and phosphate in contact with alkaline discharges, thus probably facilitating the free operation of the acid radicle of the salt, on which of course its particular virtue really depends.

From this view of its action it is to be inferred that calcium iodate acts more as a destroyer of the products of bacterial life than as a bactericide of any very decided degree of potency. Of its inhibitory power on bacterial growth there cannot however, I think, be any doubt. It would thus closely conform to iodoform in its action. Further, the function of the salt as a deodorant, of which I have time and again had ample proof, can be easily understood as the result of its chemical action. Iodates decompose sulphuretted hydrogen, precipitating it in part as sulphur, in part oxidising it into sulphuric acid. As the factor of foul discharges is no doubt in many cases due to volatile sulphur compounds, if not actually to sulphuretted hydrogen itself, we naturally expect a similar action in their case.

To pass to the practical side, the substance itself is most easily prepared—in fact, it can be prepared by any dispensing chemist as follows: Prepare an aqueous solution of iodine⁴ in potassium iodide. Dilute the same till it just transmits light through a depth of three inches. Stir up some bleaching powder with water and filter into iodine solution, with occasional stirring. After a time a crystalline precipitate makes its appearance. If it is not perfectly white, but some shade of brown or slate-grey, add more iodide of potassium and stir. Run in the bleaching solution to complete decolourisation of the iodine solution. Before collecting the precipitate add a small quantity of very dilute hydrochloric acid to dissolve any carbonate of lime that may have formed during the process. Collect on filter, wash once or twice with cold water, and dry on blotting paper or in an oven at a temperature not much exceeding 100°C. The product is $\text{Ca}(\text{IO}_3)_2 + 6 \text{H}_2\text{O}$. The particular point to be attended to is to keep the iodide of potassium in excess during the precipitation. Part of the iodide is itself oxidised to an iodate and by double decomposition with the chloride of calcium present in the bleaching solution falls as iodate of calcium. By this particular action on an iodide in alkaline solution the quantity of iodide of potassium is gradually reduced and may thus in time become insufficient to keep all the iodine in solution. From this secondary reaction the yield of calcium iodate is always in excess of what might be expected from the simple oxidation of the quantity of iodine taken.

Iodate of calcium is without taste or smell, though a slight iodine odour may be detected on opening a bottle in which it has been kept for some time. At 11.5°C. I found its solubility to be about one in 380 parts of water. In solutions of even this dilution, however, it shows a wonderful degree of potency in inhibiting decomposition, in preserving food substances, and in checking foetor, as the following examples will show (Examples 1 and 3 are practically repetitions of experiments by Sonstadt).

1. On March 21st, 1899, about two drachms of freshly passed urine were placed in an unsterilised test-tube and an equal quantity of a saturated solution of calcium iodate added to it. The mixture would thus contain about one part of iodate in 800 parts of the solution. A control was made in a similar test-tube by adding to the same quantity of urine its own bulk of distilled water. Both tubes were freely exposed to the air. At the end of a week the control stank abominably, while the tube containing the iodate was perfectly fresh and exhaled a somewhat aromatic odour which could not in any way be associated with urine. It continued to exhale the same pleasant odour and appeared perfectly sweet and clear up to June 26th when the experiment was brought to an end by an accident to the tube. A similar experiment by Sonstadt, where, however, the dry salt had been added to the urine, would indicate the possibility of its potency extending over a much longer interval. Another experiment

¹ Chemical News, 1872, vol. xxv., p. 197.

² Ibid., p. 242.

³ Ibid., vol. xxviii., p. 297.

⁴ The iodine is not necessary. A solution of potassium iodide may be used alone, the iodine being set free by the bleaching solution and dissolving in the excess of iodide.