or when the spinal symptoms have been severe and long-continued, death ensues.

Rabbits were extremely insusceptible, doses up to 2 grammes, given subcutaneously, producing no effect except slight diarrhoea. In cats, however, 1 gramme caused excitement, great dilatation of pupils, very great increase in the reflexes, and diarrhoea: 1.7 gramme caused violent tetanus, extreme diarrhoea, and death from exhaustion in six hours. The *post-mortem* appearances were extremely striking. The muscles did not respond to stimulation, the small intestine presented a moniliform appearance, and was so contracted as to occlude the lumen, while the bladder was also extremely contracted. The heart's action was comparatively little affected until just before death, which seemed to be due to failure of respiration.

(To be continued.)

THE PRACTICAL VALUES OF CERTAIN ANTISEPTIC AGENTS.

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FIVE years ago it was stated by Dr. Koch, in his prefatory remarks upon the then little understood subject of disinfection, that up to that time the method of action of antiseptic substances had not been accurately known; and he further added that one great explanation of our ignorance lay in the fact that we understood very little indeed of the nature of contagia. What he then said as regards contagia applies almost equally at the present time, although as regards disinfection a very great advance in the correct scientific knowledge of it has been made; and for this we are in most part indebted to the labours of him and his colleagues.

If the germ theory of infectious and infective diseases be correct, it necessarily follows in the light of their researches that our old ideas of disinfection are utter nonsense, and the methods absolutely useless. Everyone must, I fancy, be familiar with the sight of saucers containing carbolic acid, or other much less effectual agents, placed in odd corners of the houses wherein infectious patients are lying, and not less equally so with the look of perfect satisfaction on the faces of the inmates; and yet such saucers, with their contents, are barely able to destroy the infection even of the dust which falls into them. Further, the method of disinfecting apartments by means of a piece of burning sulphur is usually popularly supposed to be all powerful; and yet Koch shows that, for practical purposes of disinfection, sulphurous acid is useless.

And yet to such fallacies, if such they be, science herself ministers, for are we not taught that the close smell, for instance, of a room is an evidence of imperfect ventilation, on the ground that experience has shown the odorous qualities to be usually proportionate to the amount of organic particles present, and therefore by the use of deodorisers having diminished the one evil, that is, the smell, it follows that we are then apt to rate the sanitary condition of the room at a higher level than it deserves, and in this way the use of deodorisers is apt to do more harm than merely mislead.

Our knowledge of disinfection is based upon the results obtained by the action of certain antiseptic agents upon particular organised ferments, that is, micro-organisms, but in this way the knowledge gained cannot with absolute certainty be applied to any particular contagium unless the special ferment inducing the particular disease is already known, and can itself be obtained for experimentation, or a special secretion known by experience to contain it. For example, we can easily estimate the kind and strength of an antiseptic likely to cause destruction of anthrax or tubercular material, because we can easily obtain pure cultivations of either the anthrax or tubercular bacilli to experiment with, or in order to estimate the necessary antiseptic power for the destruction of the variolous contagium, we might experiment with lymph taken at a suitable time; but in this case, owing to possible fallacies, the number of experiments would require to be exceedingly numerous in order to preclude the possibility of fallacy.

As far as our knowledge goes, it is a clearly evident fact that micro-organisms are not all equally acted upon by antiseptics, and that many of the more common non-pathogenic bacteria are much

less easily destroyed than certain pathogenic species of which anthrax furnishes an example.

Of all micro-organisms, the spores of spore-bearing bacteria are by far the most difficult to destroy; but the same statement cannot be applied to the fully-developed and actively growing organisms of the same species. According to Koch, a solution of carbolic acid, of the strength of 1 in 1,250, or 1 in 850, prevents the growth of anthrax bacilli, while for certain others 1 in 500 is necessary. Exposure of the spores of anthrax bacilli to a solution of carbolic acid, of the strength of 1 in 50, for a week, did not affect them; and 1 in 33½ solution only succeeded in destroying them in seven days. So that we may infer that in any agent capable of destroying the spores of anthrax bacilli quickly, we have a trustworthy and efficient antiseptic. Tested in this way it has been found that carbolic oil (5 per cent.) did not affect anthrax spores after exposure to it for 110 days, and only killed the growing bacilli in six days.¹ Compounds of carbolic acid seem to be much less efficient than the acid itself. Chloride of zinc, in a 5 per cent. solution, did not kill anthrax spores in one month. Koch, therefore, concludes that such antiseptics are useless. However, I should scarcely like to accept these statements as applying absolutely in the practice of antiseptic surgery, and think that probably many others will agree with me in this, and there therefore arises the question, How is it that carbolic acid is successfully used as an antiseptic?—and I think no one will deny that it is so. Have we nothing to consider on the part of the tissues themselves? Do they not exercise an antiseptic action, through perhaps slight in degree, and varying with the constitution and general health of the patient. Would anyone give a favourable prognosis for an operation on a diabetic patient, or one suffering from chronic alcoholism, as in a healthy patient?

Koch himself has shown that, if anthrax material be ingested, the bacilli are destroyed by the gastric juice, and only the spores escape, and thus intestinal anthrax always arises from spore infection—a fact, by the way, which tells strongly against the coccal theory of such diseases as are disseminated by milk and other articles of diet, and would suggest to us that our dessert should be taken when a plentiful supply of gastric juice is still available, so as to get the benefit of the antiseptic action thus afforded. Further, if we inoculate an animal by hypodermic injection with a non-pathogenic micro-organism, how is it that the bacteria become so quickly destroyed? Metschnikoff has shown that, in the case of non-virulent anthrax bacilli, the rods are taken up by the white corpuscles and thus destroyed, and bases on such observations a theory that protective inoculation gives to the white corpuscles the power which they did not possess previously of absorbing and then destroying virulent bacilli.

We know that the presence of an irritant in the tissues is always followed by inflammation, and we can therefore conceive that pus-cells, consisting as they do of white corpuscles or their homologues, may of themselves in this way destroy any organic particles which may chance to come in contact with them. Thus, as most of the antiseptics in common use are undoubted irritants, they, while exerting, in virtue of their antiseptic powers, an inhibitory action upon the micro-organisms entering a wound, at the same time call forth, in virtue of their irritant action, an army to repel their already-disabled invaders. Whether such a view can be at all tenable or not, we are forced to acknowledge that the statements thus experimentally deduced with reference to carbolic acid do not entirely agree with the results obtained in the practice of antiseptic surgery when using these identical agents.

On the publication of Koch's experiments, therefore, doubts began to be held as to the serviceability of the quondam favourite antiseptic, carbolic acid, and, following upon his advice, the use of corrosive sublimate began to be common in surgical practice, which use, I believe, still largely obtains. But with what results? I think that the balance of experienced opinion now tends to show that in trusting to perchloride of mercury surgeons have been leaning upon a frail reed. However, if we consider it from another point of view, we should thus expect to find that with a gradual increase in the use of corrosive lotions, etc., there should be a corresponding declension in the use of carbolic acid, but I learn differently. The dispenser to the Edinburgh Royal Infirmary, Mr. Arthur, informs me authoritatively that now, in spite of the increased use of corrosive materials, there is a greater

¹ Microparasites in Disease (Sydenham Society, 1886).

demand for carbolic acid in the shape of dressings and lotions than before corrosive sublimate was so much used.

In view, therefore, of the somewhat conflicting statements obtaining, I determined on a course of experiments for my own satisfaction with several antiseptics, on, however, a somewhat different line from that usually adopted, and more nearly akin to the conditions one finds in surgical practice, and the results thus arrived at having turned out very different to what we should, in the light of previous experiments, expect, I have deemed it suitable to communicate them to the profession.

Previously, however, to detailing these, I must refer to a communication made to the Royal Society of Edinburgh by Dr. Sims Woodhead.² He shows that if we add 5 cubic centimetres of fresh blood to 50 cubic centimetres of a solution of corrosive sublimate (1 in 1,000), nearly every trace of the mercuric salt is precipitated as albuminate of mercury, and he pertinently adds that, although the albuminate of mercury is soluble in excess of albumen, it does not necessarily follow that it appears there as perchloride, and therefore may not thus possess any antiseptic property. After considerable experimentation with various mercurial salts, he states that it may be concluded from the results of the experiments of numerous workers "that all the mercuric salts which can be kept stable and in solution have powerful antiseptic and germicidal properties, varying (*a*) according to the quantity of mercury they contain and (*b*) according to the acid or halogen with which they combine."

In surgical practice two great principles have to be kept in view: first, antiseptics—we have to prevent the occurrence of sepsis in our wounds; secondly, to remove sepsis if possible when it has occurred in a wound.

In practice the first is usually, with proper precautions, fairly successfully managed; but in the case of the second it is the exception rather than the rule to find it accomplished. Of course I do not here refer to small wounds, which are much more easily managed, but to large ones, the result of recent operations—as, for instance, such a wound as is made in excision of the mamma, and large deep cavities like those of psoas abscesses. I have in my experiments endeavoured to keep in view the two conditions, and to so arrange that they might be applicable to them.

Mr. Watson Cheyne has stated that the results obtained after inoculating animals with certain bacteria went to show that, while large doses produced death, smaller ones only gave rise to certain local manifestations, and he therefore formulated certain laws, namely:—

1. The pathogenic dose of a virus varies inversely with the pre-disposition of the animal to the disease in question.
2. In animals not very susceptible to a disease, the severity of the affection varies directly, within certain limits, with the amount of virus introduced.
3. Up to a certain point the length of the incubation period varies inversely with the amount of virus introduced.

I was somewhat curious to learn whether or not any analogy could be drawn between such animal experiments and those which consisted in the inoculation of antiseptified culture media. It is a somewhat noteworthy point that in all observations made with regard to antiseptics, absolute statements are usually made with regard to the antiseptic or germicidal properties of certain agents, as, for instance, that a solution of carbolic acid in water (strength 1 in 500), will prevent the growth of certain bacilli, etc.

Now, if one compares the statements of Koch and Klein with reference to corrosive sublimate, they will find rather striking discrepancies, but which I think can be explained by the fact that in no case has any standard test been employed, owing to the fact that it is almost impossible to standardise any test which will serve.

While workers have in each case stated exactly the strength of the antiseptic, they have not stated the *amount of micro-organismal material used to inoculate the culture media*, or to be acted upon by the antiseptic, and hence if the readiness of a standard solution to become septic varies at all with the amount of bacteria introduced thereto, it is conceivable that there will be in all such statements a possibility of wide discrepancy.

To avoid mistakes, the only way is always to institute a comparative series of experiments, and thus, to give an example, if two persons working on different lines with antiseptics of various kinds happen each to be experimenting with one in common, it is easy, by considering the results obtained by each with this special antiseptic, to apply comparison to the others.

² Vol. xv, pp. 235-49.

Experiment I.—This consisted in placing in each of a large number of test-tubes 10 cubic centimetres of a nutrient solution, made as follows: Darby's fluid meat, 2 per cent.; cane sugar, 1 per cent.; water to 100 parts. These were then plugged with cotton-wool, and sterilised. Subsequently they were divided into three series, namely, neutral, acid, and alkaline, and in the subsequent operations each inoculated with an equal amount of the same organismal material. The inoculating material consisted of a mixture of the following bacteria: 1, bacillus subtilis; 2, bacterium innominatum; 3, staphylococcus pyogenes aureus; 4, rose-coloured torula; 5, sarcina lutea.

In these I had a number of morphologically, and in some cases, also, physically, distinct micro-organisms. After having inoculated the test-tubes containing the solution in this way, they were then replugged and placed in the incubator, and kept at a constant temperature of 32° C. for 48 hours. At the end of this period, observations were made, and consisted as follows:

Note.—In these experiments, *a* signifies that the tubes remained clear, while *γ* that they became turbid. *δ* signifies that they were examined, and inoculations made from them into Koch's jelly, and that it remained sterile. *ε* signifies that, after such test had been applied, it was found to contain organisms.

TABLE I.—Neutral Nutrient Solution before addition of Antiseptic.

Strength.	Hydonaphthol.	Carbolic Acid.	Corrosive Sublimate.
1 in 300	<i>a</i>	<i>a</i>	<i>a</i>
1 in 350	<i>a</i>	<i>a</i>	<i>a</i>
1 in 400	<i>a</i>	<i>a</i>	<i>a</i>
1 in 450	<i>a</i>	<i>a</i>	<i>a</i>
1 in 500	<i>a</i>	<i>δ</i>	<i>a</i>
1 in 550	<i>a</i>	<i>ε</i>	<i>a</i>
1 in 600	<i>a</i>	<i>ε</i>	<i>a</i>
1 in 650	<i>a</i>	<i>γ</i>	<i>a</i>
1 in 700	<i>a</i>	<i>γ</i>	<i>a</i>
1 in 750	<i>a</i>	<i>γ</i>	<i>a</i>
1 in 800	<i>a</i>	<i>γ</i>	<i>a</i>
1 in 900	<i>a</i>	<i>γ</i>	<i>a</i>
1 in 1,000	<i>a</i>	<i>γ</i>	<i>a</i>
1 in 1,250	<i>a</i>	<i>γ</i>	<i>a</i>
1 in 1,500	<i>a</i>	<i>γ</i>	<i>a</i>
1 in 2,000	<i>a</i>	<i>γ</i>	<i>a</i>
1 in 3,000	<i>δ</i>	<i>γ</i>	<i>δ</i>
1 in 3,800	<i>a</i>	<i>γ</i>	<i>a</i>
1 in 4,800	<i>δ</i>	<i>γ</i>	<i>δ</i>
1 in 6,000	<i>a</i>	<i>γ</i>	<i>a</i>
1 in 8,000	<i>δ</i>	<i>γ</i>	<i>δ</i>
1 in 7,200	<i>a</i>	<i>γ</i>	<i>δ</i>

Hydonaphthol is only soluble to the extent of 1 in 1,100 parts cold water, and hence all the tubes of this agent from 1 in 300 up to 1 in 1,100 contained a deposit of crystals of the antiseptic, and thus each only possessed a strength of 1 in 1,100. It is more soluble in acids and alkalis.

Experiment II.—The tubes in Experiment I were then reopened and each again inoculated with a drop of culture material and again incubated, with the result that several tubes which withstood the addition of the first drop now became turbid.

TABLE II.

Strength.	Hydonaphthol.	Carbolic Acid.	Corrosive Sublimate.
1 in 3,000	<i>a</i>	<i>ε</i>	<i>a</i>
1 in 3,800	<i>δ</i>	<i>γ</i>	<i>δ</i>
1 in 4,800	<i>δ</i>	<i>γ</i>	<i>ε</i>
1 in 6,000	<i>ε</i>	<i>γ</i>	<i>γ</i>
1 in 7,200	<i>γ</i>	<i>γ</i>	<i>γ</i>

In addition, it should be noted that carbolic acid from 1 in 500 also went turbid.

Experiment III.—These tubes were again opened and inoculated with three drops of culture fluid containing micro-organisms, and then placed in the incubator for three days. As a result of this it was found that the tubes containing corrosive sublimate remained exactly as recorded in the last experiment, but all of the hydonaphthol tubes in the series had become opalescent up to 1 in 2,500, which remained sterile.

Experiment IV.—To control the last experiment several tubes were prepared as before with the same nutrient liquid, and inoculated each with twenty drops of a very opalescent organismal fluid (the same fluid as before, but having added to it an equal bulk of very putrescent urine), and incubated for forty-eight hours.

TABLE III.

Strength.	Hydonaphthol.	Corrosive Sublimate.
1 in 2,500	<i>a</i>	<i>a</i>
1 in 3,000	<i>γ</i>	<i>a</i>
1 in 3,800	<i>γ</i>	<i>a</i>
1 in 4,800	<i>γ</i>	<i>γ</i>

Experiment v.—These tubes being opened, were then inoculated with other twenty drops of the same solution as the last, diluted to the extent of one-third its volume with ordinary tap water, and again incubated for forty-eight hours. As a result of this it was found that the tubes remained *in statu quo*.

So that, from a consideration of these experiments, we may conclude that, while the addition of organismal material in a certain quantity to an antiseptised putrescible fluid may not start septic fermentation, it yet in some way weakens the strength of the antiseptic present, so that if a subsequent addition of the same organismal material is made, septic fermentation may be induced. I have further found that this is not altogether dependent on the addition of living organisms, as a like result is obtainable if one adds at first, instead of living organisms, a piece of pellicle from a cultivation of *Bacillus subtilis* which has been boiled. This, therefore, suggests that the antiseptic enters into direct combination with the micro-organisms. I may further mention that by experimenting in this way I have succeeded in getting *Bacillus subtilis* to grow actively in a 1 in 5,000 solution of corrosive sublimate, and to form a very copious pellicle therefrom.

Experiment vi.—This has been referred to when detailing Experiment i, and consisted in making an experiment exactly similar, with this exception, that the nutrient liquids in which the antiseptics were contained had added to them in each case 0.75 per cent. hydrochloric acid.

TABLE IV.

Strength of Antiseptic, + 0.75 HCl	Hydranaphthol.	Carbolic Acid.	Corrosive Sublimate.
1 in 300			
1 in 350			
1 in 400			
1 in 450			
1 in 500			
1 in 550			
1 in 600			
1 in 650			
1 in 700			
1 in 750			
1 in 800			
1 in 900			
1 in 1,000			
1 in 1,250			
1 in 1,500			
1 in 2,000			
1 in 3,600			
1 in 4,800			
1 in 6,000			
1 in 7,200			

Experiment vii.—To control addition of HCl, six tubes were each prepared with nutrient fluid, and had added to them each 0.75 per cent. of HCl as the antiseptic, while other six had 1.5 HCl added. They were then each inoculated with the organismal fluid used and incubated. As a result, it was found that all the tubes containing 0.75 HCl became opalescent in three days, while 1.75 HCl acted powerfully as an antiseptic, and the tubes containing this quantity remained sterile even after the addition of a second dose of the organismal fluid, and incubating for ten other days, but began to fail on the third day, so that we have to conclude that the addition of this quantity of HCl (0.75) strengthens the antiseptic action of the agents used.

Experiment viii.—An experiment similar to Experiments i and vii, but differing from the last in having 0.75 per cent. of caustic potash added instead of hydrochloric acid.

TABLE V.

Strength of Antiseptic, +0.75 per cent., KHO.	Hydranaphthol.	Carbolic Acid.	Corrosive Sublimate.
1 in 300			
1 in 350			
1 in 400			
1 in 450			
1 in 500			
1 in 550			
1 in 600			
1 in 650			
1 in 700			
1 in 750			
1 in 800			
1 in 900			
1 in 1,000			
1 in 1,250			
1 in 1,500			
1 in 2,000			
1 in 3,000			
1 in 4,800			
1 in 6,000			
1 in 7,200			

Experiment ix.—Four beakers had each added to them one ounce of fresh minced beef, and then into one was placed 100 cubic centimetres of 1 in 20 carbolic acid in water; in the second, 100 cubic centimetres of 1 in 40 carbolic acid in water; in the third, 100 cubic centimetres of 1 in 1,000 corrosive sublimate lotion; into the fourth, 100 cubic centimetres of 1 in 1,000 hydranaphthol. As a result it was found that in the case of the 1 in 20 carbolic, a most tenacious mass was formed, which could hardly be got off the stirring rod, while the supernatant fluid was quite clear, and consisted only of water and a certain proportion of carbolic acid.

The 1 in 40 carbolic acid gave the same result as regards the supernatant liquid, but the same condition of the meat was not obtained. The particles in this case remained as distinct as they were when placed into the beaker. In the case of the corrosive no change was observed in the meat, but the fluid became of a dirty brown colour, and gave an additional acid reaction to blue litmus paper. The 1 in 1,000 hydranaphthol acted, as far as one could see, exactly as plain water does, the supernatant liquid being of a bright red colour, owing, as I found, to the hæmoglobin remaining unreduced. I have to note, however, that the hydranaphthol does, to a certain extent, combine with the albumen of tissues, but the combination is effected somewhat slowly.

I now determined to test the action relatively of corrosive sublimate and hydranaphthol upon the spores of *Bacillus anthracis* and *Bacillus subtilis*. In order to do so I made use of a somewhat different method to that of Koch. I prepared a series of small pieces of glass tubing, each 5 centimetres long, and having a bore of 7 millimetres in diameter. The one end was made slightly smaller than the other, which had a small hole drilled through it for suspension by means of a thread. Into each was then placed a small loose plug of glass wool, which was pushed down to the smaller end. A thread having then been pushed through the hole at the side of the mouth for suspension, the whole was included within a test tube, which was then sterilised in the hot air chamber for an hour at 150° C.

The tubes being ready were each prepared as follows: One tube was unplugged, and the piece of glass tubing drawn up to the mouth, when a visible piece of spore material, lifted by means of an osé, in the one series of cases from the surface of an agar cultivation of *Bacillus anthracis*, and in the other from an old bread cultivation of *Bacillus subtilis* was passed in and laid upon the plug of glass wool. After this there was poured into the test tube 15 cubic centimetres of a watery solution of the antiseptic, to be tested and there allowed to remain until the expiration of a certain period of time, when the tube was removed from the test tube and suspended in a litre flask filled with sterilised water, after which the spore material was removed and placed in a test tube containing Koch's jelly, and subsequently incubated.

Subsequent to this experiment I made a modification by washing the hydranaphthol-treated spores first with 75 per cent. alcohol.

TABLE VI.—*Bacillus Subtilis* Spores.

Antiseptic	Number of Minutes during which Spores were Exposed.					
1 in 1,000.	10	12	15	20	25	30
Corrosive	γ	γ	γ	γ	δ	α
Sublimate	γ	γ	γ	γ	γ	α
	γ	γ	γ	γ	δ	α
Hydranaphthol	α	α	α	α	α	α
1 in 1,000	δ	α	α	α	α	α
	α	α	α	α	α	α
Ordinary	γ	γ	γ	γ	γ	γ
Water	γ	γ	γ	γ	γ	γ
as Control	γ	γ	γ	γ	γ	γ

α Indicates that spores were destroyed

δ That slight growth was obtained.

γ That plentiful growth was obtained; that is, spores were apparently unaffected.

TABLE VII.—*Spores of Bacillus Anthracis*.

Antiseptic	Number of Minutes during which Spores were Exposed to the Antiseptic.					
	10	12	15	20	25	30
Corrosive	δ	α	α	α	α	α
Sublimate	α	δ	α	α	α	α
1 in 1,000	δ	α	α	α	α	α
Hydranaphthol	δ	α	α	α	α	α
1 in 1,000	α	α	α	α	α	α

In these experiments it will be noticed that in the cases of the ten and twelve minutes' exposures, apparently contradictory

results have been obtained, but this is I think to be explained by the fact that the quantity of spore material varied, as might be expected in each case.

In the case of hydronaphthol-treated spores washed only in water, no growth resulted in the case even of those only exposed to it for ten minutes.

From a consideration, therefore, of the preceding experiments, it is to be noted that the two principles of prophylaxis and cure of sepsis in surgery are each specifically distinct from the other, and further, that certain agents capable of being used efficiently as prophylactic against are absolutely useless as curative agents of sepsis, if once it gets a start in a wound. In other words, germicide and antiseptic are two very different terms.

Further, between the minimum and maximum actions of any special antiseptic we have carefully to differentiate, as we see that the minimum is easily vanquished, and it is upon the former that we have mostly to rely in practice.

We have thus seen that the maximum antiseptic action of corrosive sublimate lies very nearly at 1 in 4,800, while the minimum is 1 in 10,000. In the case of hydronaphthol, the minimum is somewhere about 1 in 7,200, while the maximum lies between 1 in 2,500 and 1 in 3,000.

Carbolic acid used with the steam spray is undoubtedly an efficient agent, if proper care and assistance be at hand; but in hospital practice very many circumstances, in some cases, combine to render futile all attempts at antiseptics in this way. As the result of careful observation, I should say that the carbolic spray is most likely to render efficient service in private practice, when it and its surroundings can be kept under the personal supervision of the surgeon himself, but should be dispensed with in hospital practice if a more stable substitute can be readily obtained.

If carbolic acid is to be used as a disinfectant for instruments, sponges, etc., it is evident from Koch's statements that they must be immersed in 1 in 20 lotion for at least two days. If this be impracticable, the other alternative is to boil them for an hour in water beforehand, and then to immerse them in lotion. But we also have to note that the tray containing the instruments must itself be aseptic, and this can not well be if the lotion is simply put into it just before the instruments, and suggests the necessity of having the lotion in for a long period beforehand. This, of course, will appear to many as an excess of fastidiousness, but, if we are to follow the dictates of science, it is absolutely necessary; not only so, anything short of this is simply to court failure.

The use of carbolic acid for washing out wounds is at best a dangerous method of procedure. I have already shown that, as the result of the action of 1 in 20 carbolic lotion upon muscular tissue and blood, there is formed a viscous or glue-like mass, and thus, if applied to a wound, there is formed on the surface of it a distinct layer of necrosed material. This, like most dead tissues, forms a suitable nidus for the growth of bacteria. Supposing, then, that carbolic irrigation be efficient in destroying the micro-organisms in a wound, this necrotic area has still to be cast off, and contributes in this way a form of suppuration, during the progress of which excessive care will have to be taken in order to prevent the entrance of fresh bacteria. But as it happens that such a proceeding is hardly likely to be successful, the surgeon using this method simply makes matters worse, in that, while he does not destroy sepsis, he ministers directly to it by giving the micro-organisms pabulum on which to feed. Thus we see that carbolic irrigation, instead of tending in the direction of the cure of sepsis, predisposes indirectly to pyæmia and septicæmia.

Coming to consider the uses of corrosive sublimate, we have to note that it also causes the formation of a necrotic area if used for irrigation, but in a different way from carbolic acid. In the case of carbolic acid, the fluid left is still carbolic acid, although its strength may be considerably reduced; but in the case of corrosive sublimate the mercuric salt is almost entirely decomposed, and in the tissues we have a distinctly noxious agent left in the form of the albuminate of mercury, which, being soluble in excess of albumen, is thus liable to be absorbed. This, of course, inhibits the free use of this agent in the case of large wounds. Corrosive sublimate is undoubtedly useful as a preservative of distilled water, and thus fulfils its functions admirably when used by bacteriologists for moistening the filter paper in plate-cultivation apparatus, but its use should be restricted to such and like purposes, for even if ordinary water be used instead of distilled, the mercuric salt is soon reduced, as Klein has shown.

We now come to consider the new antiseptic, hydronaphthol, and I shall explain immediately what it is. I have already shown that for antiseptic purposes it is, when dissolved in ordinary water, not much more than half as powerful as corrosive sublimate is when dissolved in distilled water; but, under such circumstances as the surgeon meets with, it is much more powerful than corrosive (see Table V). Further, as it is non-poisonous, a saturated watery solution of 1 in 1,000 may be freely made use of.

Considered from the point of view of a germicide, it is seen that it is at least as powerful as corrosive sublimate for anthrax and more so for bacillus subtilis, when the latter even is being used under conditions most advantageous to it. I have given 3 grains in one day, and repeated it on three occasions successively to guinea-pigs without any effect, and I have myself taken it without experiencing any result whatever. It is further reported that doses of 15 grains have been given without any untoward symptoms whatever. Looked at in this way, the use of hydronaphthol is suggested to us as an internal antiseptic, and I have indeed made several experiments with it upon animals which, though encouraging in their results, do not warrant me in giving a definite expression of opinion. There can, however, be no doubt of the fact that in this agent we have an ideal antiseptic.

Hydronaphthol was discovered by Dr. Justus Wolf, of New York, only a few years ago. It is a secondary compound of betanaphthol, differing from it in having a molecule of hydrogen displaced by an equivalent of hydroxide. Its formula is $C_{10}H_7OH$.

The material I have used is that made by Messrs. Seabury and Johnson, and I have found it most convenient either to make use of a solution in alcohol in which it is soluble to the amount of 1 in 2 parts, or with glycerine added to the alcoholic solution so as to make it of the strength of 1 in 10. It is soluble in oil to the extent of 1 in 20, but is only dissolved in cold water to the amount of 1 in 1,100. In making use of a watery solution of 1 in 1,000, I had always to see that the water was kept lukewarm. A solution of 1 in 300 in warm water possesses very great germicidal powers, and such will be found of the greatest service in washing out septic cavities and wounds.

ON THE SEVERE VOMITING OF PREGNANCY.¹

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In this paper are analysed facts and cases elucidative of the pathology and etiology of the severe vomiting of pregnancy. First, twenty-three cases are discussed in which a necropsy was performed, but in which the state of the uterus is not mentioned. Death was attributed by the various observers to certain lesions discovered in other organs than the uterus. In connection with these cases the author discusses Matthews Duncan's views as to the relation between "icterus gravidarum" and the "pernicious" vomiting of pregnancy, and adduces Lomer's statistics on "icterus gravidarum" recently published, which prove that this disease is extraordinarily rare, and that, though more fatal to pregnant women, it is not confined to the female sex. The more common severe vomiting of pregnancy has, the author contends, no relation to this disease.

The author next considers the cases in which observations as to the state of the uterus in association with severe gravid vomiting are recorded, over fifty in number. First, eleven cases where retroversion or flexion of the uterus was present (four related in a former paper, seven new ones). Impaction or incarceration of the gravid uterus was the marked feature of these cases, as shown by the results obtained by reducing the displacement in curing the sickness.

Next are given thirty cases (twenty-two related in a former paper, eight additional ones), in which the gravid uterus occupied an anteverted and anteverted position, and in a tabular form is exhibited the frequency with which impaction or incarceration of the uterus was present in such cases. The table shows that in seventeen of these thirty cases the uterus was also impacted or incarcerated in the pelvis. It is evident, also, that the seventeen impacted cases were the most severe as regards the intensity of the vomiting.

Next are arranged in a tabular form twelve cases in which in-

¹ Abstract of a paper read before the American Gynecological Society, at Washington, 1888.