Some Experiments with Formalin Tablets

The following experiments on the effect of Formalin tablets on the organisms of the mouth, which form the subject of my thesis, were originally started for the clinical value they might be done in my practice.

I was anxious to find out if, in acute affections of the mouth and throat, also after the removal of tonsils, these tablets were not a better and pleasanter means of oral disinfection than gargling or swabbing.

I also wished to know whether it made any difference what particular tablet was used.

Swabbing I knew to be very valuable, if properly carried out, but this is seldom the case at home, and it has certain disadvantages.

It is disagreeable, and causes struggling, which may use up the strength of the patient when it is most important to preserve it; and, after the removal of tonsils, it probably delays healing by mechanical irritation of the surface.

Gargling, on the other hand, I believed was

of little use, unless a strong antiseptic was used, and its field of action is very small, when attempted by the ordinary child with an acutely inflammed throat. The fluid in these cases is never got beyond the anterior surface of the tonsils, unless some of it is swallowed, and for this reason a strong antiseptic is not safe to give.

I intended, however, to test gargling, by trying the effect of the commoner gargles, as generally used, on the organisms of the fauces, and comparing it with that of various formalin tablets; but as my results agreed with those in an article in the Lancet of March 28th 1908, written by Meredith Young, who went into the question thoroughly, I only did a few experiments, and then devoted my time more especially to the relative values of formalin tablets of different makes.

Before trying the effects of these tablets on organisms, it seemed to me the most important to know whether those of the same kind varied much in formalin strength.

It was also necessary, I thought, to find out, if the loss of formalin from age was sufficient to do away to any appreciable extent with their antiseptic power.

I therefore got tablets, either direct from the makers, or bought them loose from chemists, as patients would do, and compared their relative amount of formalin

Here I found that the tablets lost strength rapidly when kept, especially if exposed to the air, and as the slight differences in strength, which I found in fresh tablets in the same bottle, might quite well be due to volatilisation.

For this work I only tested how the tablets corresponded with one another, and not to discover the exact amount of formalin present; for one can always find out from the makers how much there is put in each of their tablets – 1/6 to 1/8 of a grain being the usual amount.

Another important subject I considered, was the dilution of the formalin when used as a mouth disinfectant in this form, or the amount of Saliva secreted during the dissolving of different kinds of tablets. This varied in quantity according to the sweetness and hardness of the tablets, just as the time they took to dissolve also varied, and I found that from 4 to a little over 8 drachms was the amount of saliva usually obtained: each tablet being

fairly constant in the amount secreted during its use.

As one would expect, the tablets causing the larger flow of saliva did not have as much effect as the others on the growth of organisms - the strength of the antiseptic being weaker. But in no case is the antiseptic a strong solution, as it varies from 1 in 1700 to 1 in 2000 or less of formalin. (After the tablet was dissolved I washed out my mouth with ½ an ounce of water, and tested this to see how much formalin was lost, by being retained in the mouth. The reaction was given in such dilution as to show that somewhere between 1/24 and 1/48 of the formalin of the tablet was left behind. This slight amount would make no appreciable difference in my estimation of the strength of the saliva, as it would only change 1 in 1700 to about 1 in 1736 or 1 in 1775, and 1 in 2500 to 1 in 2553 or 1 in 2609 respectively; and changes in the amount of saliva secreted would make much larger variations in strength than this.)

When this preliminary work was done, I commenced working on the action of the tablets on the organisms of the fauces.

This I at first intended doing by taking swabs from the throat, but gave up the idea as

impracticable for the following reasons.

To take up approximately the same amount of material each time one must swab the throat very gently, and, in that case, only get the organisms from the very surface. But, if one wants those implanted more firmly in the mucous membrane, one has to rub the swab in harder, and then the difference in number of organisms taken up by different swabs is very large, and depends to a certain extent on the pressure used, which is a very varying quantity.

It was partly on this account that I used loopfuls instead of swabs, and partly because the amount of material taken up by one swab, rubbed hard on the fauces, may be many times that taken up by the next one, and I did not see how the number of organisms could be compared if one did not know, even approximately, how the amounts of saliva compared.

I started, therefor, by taking loops of Saliva from between the pillars of the fauces, smearing on Agar slopes, and incubating at 37°C for 3 days, then, after having allowed tablets to dissolve in my mouth, taking loops again, and treating as before and comparing the growths.

My intention at that time was to plate out the Agar, so as to be able to see the

different organisms present, and to count the colonies of each. Experience showed me, however, that the quantity of material taken up, even by a platinum loop, from between the pillars, varied too much, owing to the viscosity of the saliva, to allow a loopful to be regarded as a definite amount; and that a better way would be to make a number of experiments with formalin tablets and, from these experiments, get the general effect on the bacteria, watching especially the action on some particular organism.

This I saw would have to be one of the faster growing kinds, and having fair sized colonies; as usually the staphylococcal, and other minute colonies, were largely, or completely covered up by other growths on the agar slopes.

In my first few tests I found that Staphylococcus Albus was the commonest organism, but, after using tablets for a few days, this rapidly disappeared, and a yellow Staphylococcus took its place as the chief fast growing organism.

This work had to be stopped, however, as either atmospheric and dust conditions, or else the continuous use of formalin, had such an effect on the relative proportionate numbers of organisms present, that the results of different experiments could not be compared with one another with any great exactitude. I found later that taking formalin tablets, even at the rate of one per diem,

seems to have in time a distinct effect on the growth of organisms of the mouth.)

Still I was able to see that the tablets did have an effect on bacterial growth, though not to the extent found by Dr. Meredith Young in the Lancet; so I continued my work by finding the effect of Formalin impregnated saliva, of the strength it would be in the mouth, in retarding the increase of, or completely killing, organisms that had been immersed in it.

To do this I took a tablet in my mouth, and instead of swallowing the saliva secreted, while it dissolved, I collected it in a graduated vessel, so as to find the usual quantity secreted. The amount was usually about 5 drachms. To this was added a loopful of Yellow Staphylococcus of the mouth, taken off an Agar slope, and all was well mixed together with the platinium loop.

From this mixture I took loopfuls at different intervals, smeared them on Agar, and incubated, and compared the tubes with one another, to see how the number of colonies was changed by the length of time the organisms were in contact with the formalin impregnated saliva.

This was done a number of times with different kinds of tablets, which varied in the results they gave, but in none of the experiments, which are given

further on, did I obtain results nearly so satisfactory as those of other workers, who show complete sterility in a few hours.

My work does show however, that, for germicidal purposes, all tablets are not of equal value, and on experimenting clinically, so far as one can tell by watching the effect on different patients, this seems to be the case; for when the tablets are used in the treatment of disease No. I. seems to act the best.

On the whole the results with the tablets were disappointing to me, as I had expected more effect from them, but they are certainly an improvement on other forms of treatment for disinfecting the mouth, especially in children.

Tests with the tablets & fluid, whether those of the same brand usually contained the same amount of Formalin, when bought fresh, and how the different brands compared with one another.

The test for Formalin employed was the crude Sulphuric Acid and Potsid one, which was carried out as follows.

A tablet was crushed up in a mortar, and water added, and the supernatant fluid was poured off into a beaker: the sediment remaining was crushed again, and more water added & then poured off, and this was continued till the whole tablet was dissolved up.
To this solution was then added 3 drachms of milk, which was first tested & see that it was Formalin free. The solution was then made up & 6 ounces with water.

Samples of this were then taken, and, having been made into different dilutions, were tested for Formalin, by placing some in a test tube and running in strong Sulphuric Acid, so as to make a layer at the bottom.

A Positive reaction for Formalin was getting a distinct purple ring at the end of 5 minutes, the tube having been gently shaken at the end of

2½ minutes, so as to bring the solution and the Sulphuric Acid more into contact with one another.

(Many of the solutions which gave no reaction at first did so later, when left standing, and in cases where there was a faint colour already given it became stronger)

Tablet No III gave the maximum reaction soonest, whilst No I seemed to be slow in giving off Formalin. In fact sometimes this late appearance was so evident that it seemed quite probable that more formalin would be liberated in the stomach, after swallowing the saliva in which the tablet had dissolved.

During my experiments of taking tablets I always found that I had a certain amount of indigestion, which varied according to the number of tablets I had used, and as to whether I had been taking them often or not. On the other hand, I have never had a patient complain of digestion being upset by the use of tablets, and this difference I put down to my mouth being in good condition, so that the formalin was chiefly killing the harmless and possibly useful organisms, normally swallowed in saliva, whilst in the patients' case the formalin was helping to decrease the number of pathogenic organisms being taken into the stomach.

It is stated by one firm that no formalin is taken into the stomach, as it is all given off in a nascent

state in the mouth; but I found that the Salivia secreted, whilst a tablet was dissolving in my mouth, always gave the formalin reaction well after 48 hours, and usually for much longer, so a large quantity of the formalin in a tablet must always be swallowed.

Tablet No I

This is the pleasantest tablet containing formalin that I have met with. It is rather soft, and causes a moderate flow of Salivia – usually about 4 ½ drachms are secreted during the use of one. It dissolves in the mouth in about twenty minutes, as a rule, if left to itself, but, if sucked, it goes to pieces very quickly.

The tests were done with tablets from a fresh sample from the makers.

By "poorly" in a result means that the purple colour was only able to be seen in a good light, and with a white background.

		Reaction		Reaction
1st Tablet in	12 ounces dilution	Good	In 24 ounces	Poorly
2nd ..	12 ..	Good	.. ..	Poorly
3rd ..	12 ..	Good	.. ..	Poorly

Four more tablets done in the same way gave similar results.

Tablet No II

This tablet is a little harder than No I, and has a rougher feel in the mouth. The taste of Menthol is very much stronger, so that it is not so pleasant, and it is objected to by children.

It takes a few minutes longer to dissolve and it causes rather more saliva to be secreted.

The tests were made with tablets obtained direct from the makers.

		Reaction	Reaction
1st Tablet in	12 ounces dilution	Moderate	In 24 ounces Nil
2nd Tablet	12 "	Moderate	24 " Nil
3rd Tablet	16 "	Moderate	24 " nil
4th Tablet	24 "	poor	30 " nil

Tablet No III

This tablet is much harder than either of the last ones, and has a smoother surface. It consequently takes considerably longer to dissolve and, even when sucked, it dissolves slowly.

The taste of Menthol is, in this case, also much stronger than in No I, and it is not so pleasant or so well taken by children.

Considerably more saliva is secreted whilst this tablet is in the mouth — usually 6 drachms or more.

The tests were done with tablets from a bottle

containing 50, obtained by a chemist for me from the makers.

		Reaction
1st Tablet in 24 ounces dilution		Good
2nd Tablet	24 ..	Moderate
3rd ..	24 ..	Good
4th ..	24 ..	Moderate
5th ..	24 ..	Good.

Tablet No IV

This is a hard flat sweet. It is rather more pleasant than No 2 & 3, and does not taste so strongly of menthol.

It does not seem to cause a large flow of Saliva, but, as it takes so long to dissolve, the saliva secreted is usually well over 6 drachms and sometimes 8 drachms.

These were got from an unopened bottle just come from the makers.

		Reaction		Reaction
1st Tablet in 12 ounces dilution		Good	in 24 ounces	Nil
2nd Tablet	12 ..	Good	24	Good
3rd ..	..	Good	..	Nil
4th ..	..	Good	..	Good.

The reaction appeared better after some time with these tablets.

These tablets were sweets got from a nearly finished bottle in a chemists shop. Same kind as last.

		Reaction		Reaction
1st Tablet	in 2 ounces		in 4 ounces	nil
2nd Tablet	2 ..	poorly	4 ..	nil
3rd ..	2 ..	poorly	4 ..	nil
4th ..	2 ..	poorly	4 ..	nil
5th ..	2 ..	poorly	4 ..	nil

Tablet No V

This tablet comes next to No I in regard to pleasantness. It is softer than the last few and feels rather like soap stone in the mouth.

It takes a long time to dissolve, and causes a free flow of Salvia – always over 6 drachms.

As it is quite flat, feeling almost bi-concave, it breaks up into several thin pieces at the finish.

These were a sample tube from the makers.

		Reaction		Reaction
1st Tablet	in 12 ounces	Good	in 24 ounces	fair
2nd Tablet	12 ..	Good	24	Doubtful
3rd Tablet	12 ..	Good	24	fair.

From this it appears that tablets when bought fresh from the makers all contain more or less

the same quantity of formalin, tho' there are always slight variations.

I then left 3 tablets from each of Nº I, II & III lying out in open boxes, in a room, for 2 months, to find the effect of exposure to the air on the formalin present. They were then tested as before.

Tablet Nº I		Reaction		Reaction
1st Tablet	in 1 ounce	moderate	in 2 ounces	poorly
2nd Tablet	1 ..	Moderate	2 ..	poorly
3rd Tablet	1 ..	Moderate	2 ..	poorly.

Tablet Nº II		Reaction		Reaction
1st Tablet	in 6 ounces	nil	in 2 ounces	~~Doubtful~~
2nd Tablet	1 ounce	poorly	2 ounces	Doubtful
3rd Tablet	1 ounce	poorly	2 ..	Doubtful

The first one here was made in too great dilution to start with, as it was the first tablet lying exposed that I tested, and I had not expected so much loss of formalin.

Tablet Nº III		Reaction		Reaction
1st Tablet	in 8 ounces	Moderate	in 12 ounces	nil
2nd Tablet	in 6 ..	faint	12	nil
3rd Tablet	in 6 ..	faint	12	nil

As this tablet is considerably harder than Nº I or II

it may be that it keeps its formalin better on that account.

In the middle of March I tested 3 tablets of N:o III from a bottle that I had had for 2 months, comparing them with tablets from a fresh bottle and found they had lost 1/2 of their formalin.

I then tested 2 tablets of N:o I that I had had for 5 months and found that they contained 1/4 of the formalin I found in fresh ones.

If more milk had been used to add to my dilutions, I would have got a formalin reaction in much weaker solutions. I found this afterwards when using Witte's peptone, instead of milk, to obtain the reaction.

My next experiments were to see the effect of the different tablets on the organisms at the pillars of my fauces. This was done by taking loops on the same side as that on which I had allowed the tablets to dissolve.

I rubbed a steralised platinum loop between the pillars of the fauces on one side, and then smeared the loop over an Agar slope, and incubated at 37° C. After that I allowed a tablet to dissolve between the cheek and gum, far back on the same side, swallowing the saliva, and when the tablet was finished, I took a loop as before, and this was also smeared on an Agar slope. I usually continued doing this with three tablets. One tablet was used about every half hour, and it took on an average about 20 minutes to half an hour to dissolve completely.

I was thus taking the tablets considerably oftener than patients usually do, and so was keeping up a more certain flow of formalin saliva over the fauces than is general.

Experiments with Tablet No. I 10th July 1909

A loop was taken from the pillars of the fauces on the Right side, smeared on an Agar

slope, and incubated at 37°C. Then one No. I tablet was allowed to dissolve in the mouth, and, as soon as it was finished, another was taken. The two tablets were finished in 40 minutes. Then a loop was taken from between the pillars of the fauces on the same side, smeared on an Agar slope, and incubated.
Two more No. I tablets were then taken in the same way, starting immediately after, — this again took 40 minutes. — A loop was now taken as before, smeared on Agar, and incubated.

Tubes after 2 days (48 hours) incubating at 37°C.

Tube I Before tablets were taken.
The 2 strokes made on the Agar slope are continuous lines of growth, showing by their irregularity that they are made up of colonies joined together. Most of the growth is that of a yellow Staphylococcus, but white patches show in places, due to a Staphylococcus albus.
After 24 hours more the growth had increased a little.

Tube II After 2 Tablets.
The 2 strokes are in most places separate colonies, just running into one another: in some places they are continuous lines. Whole growth is yellow.

48 hours later nearly 1/3 of the growth is now white.

Tube III After 4 tablets

The 2 strokes show colonies run together in a few places, but nearly the whole growth is discrete colonies of yellow staphylococci.

48 hours later about 1/10 of the colonies are now white ones which are mostly small in size.

July 13th I took a loop from the fauces (3 days after the tablets were taken) and, after incubating for 3 days at 37°C, there was a free growth of yellow. Very few white colonies.

July 15th a loop was taken from the pillars of the fauces on the Left side, & then one tablet used, which took 1/2 an hour to dissolve, and half an hour after I took a loop. Then another tablet, and 10 minutes after it was finished, a loop again.

Tube I Before tablets

48 hours. Growth is yellow and becoming run together.

3rd day. Confluent yellow staphylococcal growth.

Tube II After 1 tablet

48 hours Growth is mostly discrete yellow. Running together in places.

3rd day. Colonies larger & more run together. Many white showing but chief growth is yellow.

Tube III after 2 tablets

48 hours 6 small colonies showing and some ground glass appearance.

3rd day 6 colonies of yellow staphylococci & some whitey grey staphylococcal colonies now appearing. The ground glass appearance is due chiefly to Streptococcal colonies.

Sept. 28th Experiments done as before

Tube I Before tablets.

48 hours 47 white tetrad colonies & many streptococci

Tube II After one tablet that dissolved in ½ hour.

48 hours 18 Tetrad growths also streptococci

6th day Now 25 tetrads showing.

Tube III After two tablets

48 hours 8 Tetrads.

6th day Now 15 tetrads

Sept. 29th Experiments as before

This is after 3 tablets the previous day.

Tube I Loop taken from opposite side of fauces from yesterday's work.

48 hours 70 grey white colonies (Bacillus)

Tube II After one tablet. 20 minutes to dissolve

48 hours 31 grey white colonies (Bacillus)

Tube III After 2 tablets

48 hours 7 Bacilli colonies.

Tube IV & Tube V after 3 & 4 tablets

respectively.

any other growths

48 hours No Bacillary growths.

Nov. 3rd

Tube I Loop from Left side of fauces.

3rd day Considerable growth all over surface of tube.

5th day 21 Staphylococcal growths & considerable amount of Streptococcal growth.

Tube II After one tablet: 20 minutes to dissolve

3rd day Much less growth than in tube I

5th day 19 Staphylococcal growths. Abut 1/4 of the streptococci in tube I

Tube III After 2 tablets (also 20 minutes)

This loop was 3 or 4 times usual amount.

3rd day Growth seems abut the same as Tube II

5th day 25 Staphylococcal growths. Streptococci rather more than in tube II

Tube IV after 3 tablets (also 20 minutes)

3rd day Not much growth to be seen

5th Day 2 Staphylococcal growths. Abt 1/2 the streptococci in tube II

Nov. 4th

Tube I Loop taken from Left side (same as previous day) Large loop taken.

5th day 70 Staphylococcal growths & considerable

amount of streptococcal

Tube II after 1 tablet (20 minutes to dissolve)

I then talked for 10 minutes before taking large loop

5th day 4 5 Staphylococcal & fair amount of Streptococci.

Tube III after 2 tablets (20 minutes)

5th day 2 7 ~~Large~~ Staphylococcal & some streptococci

Tube IV after 3 tablets (20 minutes)

Large loop taken.

5th day 20 staphylococcal & much less small growth. The whole surface has the appearance of much less growth than the last tube.

It will be noticed that Staphylococci decreased very rapidly, on the use of formalin, and were never back again in the same numbers as at the start.

Experiments with Tablet No II July 22nd

No formalin or other antiseptic had been taken for 7 days, & allow the mouth to become normal again in regard to Bacterial growth.

Tube I A loop was taken in the usual way from between the pillars on the Left side

3rd day Very little large growth: only colonies

are white. There is a large quantity of fine growth giving a ground glass appearance.

Tube II after one tablet (25 minutes to dissolve)

3rd day. There is quite as much growth of all kinds as in tube I

Tube III after ½ an hour after last tube was made a tablet was taken, which took 40 minutes to dissolve

3rd day No difference that I can see from last tube in quantity of growth.

Tube IV ½ hour after last tube another tablet was taken & lasted 30 minutes.

3rd day. Very slight diminution in the number of white Staphylococcal growths

July 20th

Tube I a large loopful taken

3rd day. 12 Staphylococcal colonies both white and yellow & much fine growth.

Tube II after one tablet (½ hour to dissolve)

3rd day 14 staphylococcal colonies of both colours. Not quite so much fine growth.

Tube III after two tablets (½ hour to dissolve)

3rd day. 10 Staphylococcal colonies. Fine growth about the same as last tube.

Tube IV Spoiled

Tube V Same as others. Taken one hour after lunch & no tablet since before lunch.

3rd day Much more growth than in tube I

Tube VI Tablet taken (½ hour to dissolve)

3rd day Considerable growth of all kinds

Tube VII Same as last (2nd tablet after lunch)

3rd day Growth much the same as last tube

Tube VIII Same as last (3rd tablet after lunch)

3rd day. Growth much the same as last tube.

October 14th

Tube I Very small loop.

3rd day. Not much growth.

Tube II after tablet (30 minutes to dissolve)

3rd day Much more growth than in tube I

Tube III after tablet (30 minutes to dissolve) Stalked for ½ an hour and then took loop.
3rd day Rather less growth than in tube I

Tube IV Spoiled
Tubes V & VI Taken immediately after tablets in the usual way.
3rd day. Growth much the same in both tubes. It is about ½ that in tube I.

October 18th

Tube I Took 2 small loops from the left side of the fauces.
3rd day 54 Staphylococcal growths & much fine growth.

Tube II after tablet which took 30 minutes to dissolve & then 15 minutes talking. Small loop taken
3rd day. 20 Staphylococcal growths. Yet so much fine growth as in last.

Tube III Same as last after second tablet and loop about 3 times as large.
3rd day 73 Staphylococcal growths and more fine growth than in either tube I or II

Tube IV after tablet which took 25.

minutes to dissolve and loop taken immediately.
3rd day 2 Staphylococcal growths and much fine growth.

December 9th

Tube I Loop taken as usual before any tablet was used.
3rd day. Moderate growth.

Tube II After tablet in usual way
3rd day More growth than in tube I

Tube III After 2nd Tablet
3rd day Growth less than in tube I

Tube IV after 3rd Tablet.
3rd day. Growth at least as much as Tube III

December 10th

Tube I Loop taken in morning.
3rd day Growth much the same as those of yesterday.
In the evening took
Tube I Medium sized loop.
Tube II After one tablet
Tube III after 2nd Tablet
Tube IV after 3rd Tablet.

3rd day. There is a moderate amount of growth in all the tubes. Tube II was from a large loop and contained the most growth. I could not say from looking at the tubes that the tablets had had any effect.

Most of the fine growth in all the tubes was Staphylococcal colonies: a few diplococci & Bacilli occasionally.

Experiments with Tablet No. III

July 7th This was really my first experiment and the first formalin I had taken.

Tube I Loop taken from fauces.

3rd day Nearly whole slope was covered with white growths: a few yellow ones mixed up with them.

Tube II after one tablet (30 minutes to dissolve)

3rd day White colonies look about 1/10 in number of those in tube I. Yellow same as last

July 8th

Tube I Loop taken from the opposite side from yesterday and 24 hours after.

3rd day. White colonies more than in tube II of yesterday. Yellow same as last.

Tube II after one tablet (30 minutes to dissolve)

3rd day White colonies much decreased in

number. Yellow much as in last

Tube III Same as last after 2nd Tablet 3rd day. Very few white colonies. Yellow much the same.

The white and yellow colonies in ~~both~~ all tubes were Staphylococci.

In all this too few experiments were done to be able to come to any real conclusion, but owing to the uncertainty of what organisms were to be found in the throat, after tablets had been taken for a few days, and it seeming to be the case that one week is not long enough a rest to get free from formalin, to let the ordinary organisms accumulate again, I did not think this line of work was suitable for continuing with.

Experiments with Formalin Saliva on Throat Cocci outside the body.

As I had found that taking any of the Formalin and Menthol tablets caused an increased flow of saliva, I measured it, to see how much was secreted whilst one tablet was in the mouth, and also what dilution of saliva would give a reaction for Formalin.

For this I added some Witte's Peptone Powder & the solution instead of milk & give the necessary proteid.

A tablet was taken in the mouth and allowed to dissolve, but none of the saliva was swallowed — all being collected in a graduated ~~tube~~ vessel, so that the amount could be measured. Taken in this way, the tablets were usually finished in about half the time they took to dissolve when kept far back in the mouth. About 15 minutes was the average time taken by a tablet to dissolve completely.

The amount of Saliva collected varied from 4 to 8 drachms, according to the tablet used, and the formalin reaction was given in the same dilution as when the tablet was crushed up with water.

Experiments to find out the effect of Formalin Saliva on Organisms growing

on Media.

One No. I tablet was taken in the mouth and allowed to dissolve, and all saliva which collected during this time — 15 minutes — was measured and found to be 6 drachms.

Three Agar slopes containing discrete colonies of Staphylococcus Aureus were then taken, and some of this saliva was poured into each, so as completely to cover the growth. The Saliva was left in contact with the colonies 3 minutes, 10 minutes, and 20 minutes respectively. It was then poured off, and the slopes twice washed with water.

Tubes No. I & II were then incubated at 37°C, for 24 hours, and then loops were taken from them, & smeared on fresh Agar slopes.

Tube No. III had a loop taken from it, without first incubating.

3rd day. All three tubes show a large quantity of growth. Tube I has a large quantity of Sarcina Rubra.

From some of the Saliva itself, after standing for ½ an hour, to allow the formalin to act on the organisms it contained, a loop was taken, smeared on Agar & incubated.

3rd day Moderate growth of white-grey Staphylococcal colonies.

December 18th.-

One No I tablet was allowed to dissolve in the mouth, and 5 drachms of Saliva obtained, which was kept for 4 hours.

From this a loop was then taken, & smeared on an Agar slope, & incubated

3rd day Considerable Staphylococcal growth.

The rest of the Saliva was poured onto Coccal colonies on an Agar slope, & left in contact with them for 4 hours. The slope was then washed twice, a loop taken, smeared, & incubated.

3rd day considerable staphylococcal growth.

I repeated this experiment on 5 subsequent occasions but did not consider it satisfactory, as the surface organisms of a colony might be killed, whilst the deeper ones remained alive. I therefore continued with the following work

Experiments with Formalin Saliva & which Staphylococci had been added.

The Saliva secreted, during the dissolving of a a tablet, was collected in a vessel, and to this a loopful of Staphylococcus (a yellow variety) was added. This was then well mixed up, and

loopfuls taken at various times, and grown on Agar slopes. This work is in tables, starting on Page 63.

January 3rd No. I tablet was allowed to dissolve in the mouth, and 4 drachms of Saliva were obtained. To this a large loopful of yellow Staphylococci ~~was~~ was added, & all well mixed up.

When it was time to take a loop, to sow on Agar, I mixed the solution well up again with a sterilised loop, as I found that the cocci had a tendency to fall to the foot of the vessel. Then I withdrew the loop I had used for mixing, and smeared it on the slope.

Tube I Loop taken from the Saliva after it had stood for 4 hours acting on the cocci.
3rd day. Much growth: colonies all running together.

Tube II after 5 hours standing
3rd day. Very much the same as Tube I

Tube III after 6 hours
3rd day. Much the same as last.

Tube IV after 20 hours
3rd day No staphylococcal colonies to be seen.

Feb.

~~Jan~~ 5th Same as last. 5 drachms of Saliva.

Tubes I & II After 11 hours

3rd day Considerable amount of growth. Colonies lying close together but near all separate

Tubes III & IV after 12 hours

3rd day. Much the same as last.

I could not detect any difference between the 4 tubes.

Tube V After 24 hours

3rd day No growth to be seen.

Feb.

~~Jan~~ 6th Same as last. 5 drachms of Saliva.

Tubes I & II After 8 1/2 hours

3rd day Colonies moderately close together: about half the surface is covered by growth.

Tubes III & IV after 9 1/2 hours

3rd day. Much the same as Tubes I & II

Tube V After 23 hours

3rd day. About 40 colonies have appeared on this slope.

Febr. 7th At this time I had a severe cold in the head, so that I was unable to taste the tablets, and was taking 30p of Liq Morph in the 24 hours.

Same experiment as last only the Saliva obtained was reduced to 3 drachms.

Tube I after 9 hours

3rd day 10 growths

Tube II after 11 hours

3rd day 2 growths

Tube III after 24 hours

3rd day 1 growth.

These tubes were kept incubating for 4 days more with no increase in the number of colonies.

Feb. 8th Same as last. 4 drachms of Saliva

Tube I after 9 hours.

3rd day conciderable growth.

Tube II after 11 hours

3rd day Very slightly less than last

Tube III after 24 hours

3rd day The growth of the seen

Feb. 9th Same as last. 4 drachms Saliva.

Tube I after 13 hours

3rd day. Growth about half that in the 9 hours tube of 8th Feb.

Tube II after 23 hours

3rd day. 35 growths the seen.

Feb. 17th Same as last. I obtained nearly 5 drachms of Saliva in this occasion.

Tube I Made at once. I sterilised my platinum loop in the flame after making the mixture of Saliva & Staphylococci & then took a loopful.

3rd day The whole surface is covered with one continuous sheet of growth.

Tube II after 1½ hours

3rd day. Growth much the same as in Tube I

Tube III after 4 hours

3rd day Growth distinctly less than in Tubes I & II In some places there is a continuous flat surface of growth. In the most of the tube the colony centres

can be seen but they are most of running together, though clear places with no growth do show in some parts.

Tube III after 8 hours

3rd day. Not one half of the surface is covered with growth in this tube.

Tube V After 24 hours

3rd day. One growth.

Tube VI After 25½ hours

3rd day No growth else seen

Tube VII After 31 hours

3rd day No growth else seen.

After 8 days incubating Tubes V & VI had a few small staphylococcal growths.

Feb. 18th Same as last. 5 drachms of Saliva

Tube I. Made at once

3rd day. Whole surface is one sheet of growth.

Tube II After 24 hours

3rd day 2 growths.

Tubes of 13½ & 21 hours were spoiled

March 5th Same as last. 4½ drachms Saliva

Tube I After 19 hours.

3rd day. 30 colonies have appeared

Tube II After 27 hours

3rd day. No growth.

March 6th Same as last. 5 drachms of Saliva

Tube I After 17 hours

3rd day. Certain amount of growth. About 80 colonies.

Tube II After 24 hours

3rd day. 10 growths.

Tube III After 37 hours.

3rd day. No growth.

After 6 days incubating there were 12 colonies of Staphylococci all quite small.

March 17th Same as last. 4½ drachms of Saliva

Tube I After 15 hours

3rd day. The colonies are very small and very slow growing. There are about 100 of them altogether.

Tube II after 40 hours

3rd day. No sign of growth.

March 19th Same as befor. 4½ drachms of Saliva.

Tube I after 24 hours

3rd day. This was inoculated with 2 large loopfuls got with material hanging on so that each was at least 3 times the usual size.
The colonies are rather small in size. They are 40 altogether in number.

March 31st Same as befor. 3 drachms of Saliva

Tube I after 4 hours.

3rd day. One small place is a continuous sheet. The rest is most of running together. In ¼ of slope small discrete colonies

Tube II after 9 hours

3rd day. Colonies starting & run together in places: in other places quite discrete

Tube III after 11 hours

3rd day A few colonies run together but in near every place separate.

Tube IV after 24 hours

3rd day 12 moderate sized colonies & nearly 100 very small ones.

Experiments with Tablet No II, done in the same way as with Tablet No I

Table on Page 66

December 31st Same as before. 5 drachms of Saliva

Tube I after 4 hours

3rd day Large quantity of growth: all running together & flat surfaces of growth in places.

Tube II after 5 hours

3rd day. Much the same as last.

Tube III after 6 hours.

3rd day. Somewhat less than in tube I. Colonies large sized and all running together.

Tube IV after 18 hours.

3rd day 8 growths only.

In none of these 4 tubes was the Saliva mixed up before taking the loop, which was taken from the middle of the vessel.

Tube V after 18 hours.

This loop was taken from the foot of the vessel but without mixing up the Saliva.

3rd day. Somewhere between 150 & 200 growths in this tube.

Feb. 22nd Same as last. 5 drachms of Saliva

Tube I Taken immediately

3rd day. Whole surface one sheet of growth.

Tube II After one hour

3rd day. Whole surface one sheet of growth.

Tube III After 4 hours

3rd day Large part of the surface is a sheet of growth. The rest is colonies running together.

Tube IV After 7½ hours

3rd day. Much of the surface is a sheet of growth. The rest is colonies running together.

Tube V After 14 hours

3rd day Many very minute and slow growing staphylococcal colonies.

Feb. 23rd Same as last. 5½ drachms of Saliva

Tube I after 23 hours

3rd day Many minute & slow growing colonies

Tube II After 24 hours

3rd day Same as last.

Feb. 24th Same as last. 5 drachms of Saliva

Tube I after 6 hours

3rd day. All running together and in places continuous sheets of growth.

Tube II after 30 hours.

3rd day. 20 growths appeared.

Tube III after 38 hours.

3rd day. 20 growths appeared

Feb. 25th Same as last. 5½ drachms of Saliva

Tube I after 24 hours.

3rd day. Growth running together in a few places. Most of separate colonies.

Tube II after 33 hours.

3rd day. Between 75 and 100 growths.

Feb. 26th Same as last. 5½ drachms of Saliva

Tube I after 14 hours.

3rd day. Growths separate but large number.

Tube II after 24 hours

3rd day. Rather less than in last.

Experiments done with Tablet No. III
Tables on Pages 67 and 68

Feb. 19th Same as last. 5½ drachms of Saliva

Tube I Taken immediately

3rd day. Whole surface covered. Most a continuous sheet of growth.

Tube II after 14 hours.

3rd day. Moderate growth. About ½ of that of Jan 8 hour tube of Tablet I

Tube III after 23 hours.

3rd day. About 50 growths: slow in growing.

Feb. 20th Same as last. 6 drachms of Saliva.

Tube I Taken immediately

3rd day. Whole surface covered

Tube II After one hour

3rd day Whole surface covered

Tube III After 8 hours

3rd day. Large quantity of growth. Most of the colonies running together.

Tube IV after 14 hours

3rd day. Moderate growth. Colonies becoming confluent in places.

Feb. 20th Same as last. 6 drachms of Saliva

Tube I Taken immediately

3rd day. Whole surface covered.

Tube II after 16 hours

3rd day. Considerable growth. In many parts the colonies are confluent. This is much more than No. I tablet would have.

Tube III after 24 hours.

3rd day. Large number of very small colonies which are very slow growing.

Feb. 21st Same as last. 6 drachms of Saliva

Tube I Taken Immediately

3rd day Whole surface covered

Tube II after 10 hours (2 tubes made)

3rd day. Colonies all running together but showing centres from which each came. Both tubes much alike.

Tube III after 24 hours.

3rd day. Rather more growth than one would find on an 8 hour tube of No I tablet

Feb. 27th Same as last: Wet 6 drachms of Saliva

Tube I after 14 hours.

3rd day. Colonies running together in some places.

Tube II after 21½ hours.

3rd day. Colonies many but nearly all discrete

Tube III after 38 hours.

3rd day This tube got contaminated by a sporing Bacillus. 3 Staphylococcal colonies seen.

Feb. 28th Same as last. 6 drachms of Saliva

Tube I after 16 hours.

3rd day. Moderate amount of growth: all colonies are discrete

Tube II after 38 hours.

3rd day. 30 growths.

Feb. 28th Same as last. 6½ drachms of Saliva

Tube I after 20 hours.

3rd day. Considerable amount of discrete growth.
The colonies are small and slow in growing.

Tube II after 26 hours.

3rd day. Much the same as Tube I

Tube III after 38 hours.

3rd day. Between 50 and 60 growths.

Tube IV after 3 days.

3rd day. 3 growths.

March 1st One tube of 21 hours. 6 drachms Saliva
3rd day. all discrete & abnt 150 in number

March 4th Same as last. 6½ drachms of Saliva.

Tube I after 14½ hours.

3rd day. Large quantity of growth. colonies running together

Tube II after 20 hours

3rd day. Large number of discrete very small and slow growing Staphylococcal colonies

Tube III after 26 hours.

3rd day. Growth of Staphylococci seems much the same as in Tube II

Tube IV after 39 hours.

3rd day. 40 growths.

March 6th Same as last. 6½ drachms Saliva

Tube I after 6 hours.

3rd day Colonies all run together and in some places sheet of growth.

Tube II after 23 hours.

3rd day Much growth. Most discrete and small colonies growing slowly.

Tube III after 27 hours.

3rd day. Growth much less than last. & small in size of colony.

Tube IV after 32 hours.

3rd day. About 100 colonies: small in size and growing slowly.

March 15th Same as last. Over 6½ drachms

Tube I after 24 hours.

3rd day. This was a very small slope. The growth is not continuous but the colonies are all starting to run together tho' the centre for each is easily seen

Tube II after 31 hours.

3rd day. The colonies are many and small but not running together. It is much slower growing than tube I

Tube III after 48 hours.

3rd day. Not near so much growth as last and only a few large colonies but a good number of small ones.

March 18th Same as last. 6 drachms of Saliva

Tube I after 24 hours

3rd day. Small colonies running together in many places.

Tube II after 33 hours.

3rd day. Very small colonies and slow growing. Each colony is separate.

Tube III after 48 hours.

3rd day. Growth is very slow and colonies are very small but in large numbers.

March 21st Only 4 drachms of Saliva.

Tube I after 13 hours.

3rd day. Part of the surface is a sheet of growth

with no sign of colonies. The rest is most of colonies that have run together

Tube II after 19 hours

3rd day. The colonies are small and run together all over the slope but one can see that it is made of colonies.

Tube III after 24 hours.

3rd day. In many places the colonies are run together: over the rest of the tube the colonies are small & close together.

Tube IV after 37 hours.

3rd day. Only a moderate amount of growth. The colonies are all discrete and small in size.

The results with the last tablets are very poor: probably due to loss of formalin, as I tested some and found ½ the amount there was in fresh tablets.

Experiments with ordinary Salwa in which a loopful of Staphylococci had been put:

Table on Page 69

March 10th 5 drachms of Salwa were taken

Tube I after 14 hours

3rd day One is unable to tell that this is made up of colonies as it is most a continuous sheet of growth.

Tube II after 24 hours

3rd day. This slope is a continuous sheet of growth over all the surface, where the loop has been smeared.

Tube III after 36 hours

3rd day. This is very much the same as tube No I

March 13th 5 drachms of Salwa were taken

Tube I after 16 hours

3rd day. This is a continuous sheet of growth

Tube II after 24 hours.

3rd day. This also is a continuous sheet.

Tube III after 38 hours.

3rd day. This is near all over a continuous sheet of growth.

Tube IV After 48 hours.

3rd day. In most places this is a continuous sheet of growth but in some places one can see colonies.

Experiments with Tablet No IV
Table on Page 71

March 12th Same as last. Near 8 drachms of Saliva

Tube I Taken immediately

3rd day. Continuous sheet of growth over whole surface smeared.

Tube II After 16 hours

3rd day. Very large number of colonies which are all discrete

Tube III After 16 hours.

3rd day. Here there is more growth than in Tube II. The growth is all running together, tho we can see the centres from which the colonies come.

March 13th Same as last. 7½ drachms Saliva

Tube I After 15 hours

3rd day. This is near continuous growth. The colonies have run into one another very much, but we can see in most places that the growth is composed of colonies.

Tube II After 24 hours

3rd day. The growth in this tube is distinctly slow: it consists of small colonies closely studded together over the whole surface of a large slope.

Tube III after 38 hours.

3rd day. Between 150 and 200 growths. They are small in size and slow growing.

March 15th Same as before. Spirochaeta Salina

Tube I after 15 hours.

3rd day. The colonies are fair sized & in many places running together.

Tube II after 24 hours.

3rd day. The growth is more discrete than in tube I but colonies much the same size.

Tube III after 39 hours.

3rd day. The colonies are about the same number as the last but are very much smaller and slow growing.

Tube IV after 48 hours.

3rd day. The colonies are considerably more numerous than in tube III but they are

very minute in size and slow growing. There are about 24 larger colonies.

March 19th Same as last. 8 drachms Saliva

Tube I after 24 hours.

3rd day The colonies are just running together

Tube II after 48 hours.

3rd day. The colonies are all quite discrete, rather small and not very numerous

March 21st Same as last. 7 drachms Saliva

Tube I after 17 hours.

3rd day. Between 250 and 300 growths.

Tube II after 24 hours

3rd day. The colonies are small and can be seen quite separate over the upper half of the tube. In the lower half the colonies are running together but one can see that they are separate

Tube III after 34 hours

3rd day Growth showing a tendency, in several places, to run together but not half as much growth as in last tube. The colonies are of

a good size.

March 31st Same as last: 8 drachms Salvia
New sweet got on 25th March from Chemist.

Tube I after 6 hours.

3rd day. In some places there is a continuous
sheet: in others it is running together

Tube II after 7 hours

3rd day. Very much the same as last.

Tube III after 20 hours

3rd day Growth running together in places.

Tube IV

3rd day.

March 24th Same as last. 7½ drachms Salvia

Tube I after 33 hours.

3rd day. Growth most discrete: & moderate in amount

Tube II after 48 hours

3rd day. 24 Growths.

March 26th Same as usual. This was made
with a new sweet just got from chemist.

Tube I after 24 hours

3rd day 30 growths of good size. These as also a large number of Staph to coccal colonies

Tube II after 24 hours.

In this case the loop was smeared well over the lower half of the tube: then recharged and smeared over the upper half of the tube.

3rd day. In the lower half about 70 growths. In the upper half the colonies are more numerous – 2 or 3 times as many – but very much smaller.

Tube III after 38 hours

3rd day 20 growths had appeared and a number of very minute staph to cocci.

Some days later 15 more small Staphylococcal growths had appeared

Experiments with Tablet No V
Tables on Pages 72 and 73

March 7th Same as before. 8 drachms of Salvia

Tube I after 14 hours.

3rd day Most of the colonies are very small and slow growing. 50 colonies

Tube II after 19 hours

3rd day. There is much more growth than in last tube but it is extremely small colonies and slow growing.

Tube III After 24 hours

3rd day A few of the growths are large but the large majority of the colonies are small and slow growing. 150-200 altogether.

Tube IV after 48 hours.

3rd day. No growth visable.

March 8th Same as before. 8 drachms of Salvia

Tube I after 8 hours

3rd day The whole surface of the slope is nearly

covered with growth.

Tube II after 23 hours

3rd day 26 colonies have appeared.

Tube III after 33 hours

3rd day. No growth.

Tube IV after 48 hours

3rd day. No growth.

March 12th Same as last: 8 drachms Salvia

Tube I Taken immediately

3rd day. Whole surface covered

Tube II after 9 hours.

3rd day There are a large number of very small colonies which nearly cover the surface. All are discrete

Tube III after 25 hours

3rd day Many minute colonies in places running together

Tube IV after 33 hours

3rd day. About 100 growths.

April 2nd Same as befor. 7½ drachms Saliva

Tube I After 4½ hours.

3rd day. This is small colonies in very large number. In places it is a confluent sheet in others small colonies all running together.

Tube II After 9 hours.

3rd day. In a few places this is a sheet of growth: in the rest the colonies are starting to run together.

Tube III After 11 hours.

3rd day. In a few places the colonies are discrete but in most of the growth the colonies are tending to run together.

Tube IV After 34 hours.

3rd day. 50 colonies has appeared.
Tube V after 48 hours
3rd day 12 growths

April 4th Same as befor. 7 drachms of Saliva.

Tube I After 8 hours

3rd day Colonies are starting to run together.

Tube II after 10 hours

3rd day. Moderate amount of growth: some has

run down to the foot of the tube with water condensed.

Tube III After 24 hours

3rd day. 100 growths

Tube IV After 2 days

3rd day 6 growths.

April 6th Same as before. 7 drachms Saliva

Tube I after 9 hours.

3rd day. In some places continuous sheet of growth: in others colonies running together

Tube II After 24 hours

3rd day 12 growths

Tube III after 34 hours.

3rd day. 3 growths.

~~April 7th Same as before.~~

~~Tube I~~

April 7th Here 2 large loop fuls of yellow staphylococci were rubbed up in 15 minims of water, & then allowed to stand for 10 minutes; and after that the top 10 minims was taken off and added

to the Salvia, which was then well stirred up. In this way there were no large lumps of cocci, so the formalin would be more certain of getting at all the organisms.

Tube I After 1 hour

3rd day. Whole surface is a continuous sheet of growth.

Tube II After 10 hours.

3rd day. The growth is not luxuriant but there is a large quantity of fine yellow growth. The colonies are running together in most places.

Tube III After 11 hours

3rd day. There are patches of clear medium here with no growth. In other places the colonies have run together. The growth is yellower more luxuriant looking than last tube, but less in quantity.

Tube IV After 14 hours

3rd day. Growth is near all discrete colonies. About ¼ of the surface covered

Tube V After 24 hours

3rd day. 6 growths. This tube is contaminated.

Tube VI after 29 hours

3rd day. 33 growths

Tube VII after 34 hours.

3rd day 100 growths.

April 8th Made as in last. 7½ drachms Saliva

Tube I after 12¾ hours.

3rd day. Growth consisting of colonies running together in some places, and in others discrete

Tube II after 25 hours.

3rd day. No growth.

April 9th Made as in last. 8 drachms Saliva

Tube I after 15 hours.

3rd day Colonies nearly every where discrete, but in a few places running together

Tube II after 24 hours.

3rd day About 24 growths. Contaminated tube

April 10th Made as in last. 7 drachms

Tube I after 7 hours.

3rd day small colonies all running together: in other places continuous surface.

Tube II after 32 hours.

3rd day. No staphylococcal colonies

Tube III After 48 hours

3rd day No staphylococcal colonies.

April 11th

Tube I after 23 hours

3rd day 15 Colonies.

In all tubes where staphylococcal colonies are much decreased or absent, streptococci are to be found.

Tablet No. I	Jan 3rd 4 drachms	Feb. 5th 5 drachms	Feb 6th 5 drachms	Feb. 7th 3 drachms	Feb. 8th 4 drachms	Feb. 9th 4 drachms	
4 hours	much growth						
5 hours	much growth						
6 hours	much growth						
8½ hours			½ covered				
9 hours				10 growths	½+covered		
9½ hours			½ covered				
11 hours		½ covered		2 growths	½+covered		
12 hours		½ covered					
13 hours						¼ covered	
20 hours.	nil						

Tablet No. I	Jan 3rd	Feb. 5th	6th	7th	8th	9th	
23 hours			40 growths			35 growths	
24 hours		nil		1 growth	1 growth		
Tablet No. I	5 drachms Feb. 17th	5 drachms Feb. 18th	4 1/2 drachms March 5th	5 drachms March 6th	4 1/2 drachms March 17th	4 1/2 drachms March 19th	3 drachms March 31st
Immediate	whole surface	whole surface					
1 1/2 hours	whole surface						
4 hours	much growth						much
8 hours	1/2 surface						
9 hours							1/2+ surface
11 hours							1/2 - surface
15 hours					100 colonies		

Tablet No I	Feb. 17th	Feb. 18th	March 5th	March 6th	March 17th	March 19th	March 31st
17 hours				80 growths			
19 hours			30 growths				
24	1 growth	2 growths		10 growths		40 growths	12 moderate 100 small
25½	nil						
27			nil				
31	nil						
37				nil			
40					nil		

Tablet No II	Dec 31st 5 drachms	Feb. 22nd 5 drachms	Feb. 23rd 5½ drachms	Feb. 24th 5 drachms	Feb. 25th 5½ drachms	Feb. 26th 5½ drachms
Immed		whole surface				
1 hour		Whole surface				
4 hours	much growth	near Whole surface				
5 hours	much			Whole surface		
6 hours	much					
7½ hours		near Whole surface				
14 hours		3/4 surface				½+ surface
18 hours 2nd 1st	150-200 growths 8 growths					
23 hours			1/4 surface			
24			1/4 surface		½ surface	½- surface
30				20 growths		
33					75-100 growths	
38				20 growths		

Tablet II = III	5½ drachms Feb 19th	6 drachms Feb. 20th	6 drachms Feb. 20th	6 drachms Feb. 21st	6 drachms Feb. 27th	6 drachms Feb. 28th	6½ drachms Feb. 28th
Immediate	whole surface	whole surface	whole surface	whole surface			
1 hour		whole surface					
8 hours		much growth					
10 hours				much growth			
14 hours	¼ surface	½ surface			¾ surface		
16 hours			½+ surface			½ surface	
20 hours							½ surface
21½					½ surface		
23	50 growths						
24			½ surface	½ surface			
26							½ – surface
38					3 growths	30 growths	50 growths
3 days							3 growths

Tablet No. III	6 drachms March 1st	6½ drachms March 4th	6½ drachms March 6th	6½ drachms March 15th	6 drachms March 18th	4 drachms March 21st	
6 hours			whole surface				
13						much	
14		much					
19						¾ surface	
20		½+ surface					
21½	150 grms Ks						
23			½+ surface				
24				¾ surface	¾ surface	½+ surface	
25		½+ surface					
27			½- surface				
31				½ surface			
32			100 grms Ks				
33					½ surface		
37						¼ surface	
39		40 grms Ks					
48				¼ surface	¼+ surface		

Saliva	March 10th	March 13th		
14 hours	whole surface			
16 hours		whole surface		
24 hours	whole surface	whole surface		
36 hours	whole surface			
38 hours		whole surface		
48 hours		nearly whole		

Tablet No. IV	8 drachms March 12th	7½ drachms March 13th	8 drachms March 15th	8 drachms March 19th	7 drachms March 21st	7½ drachms March 24th	8 drachms March 26th	8 drachms March 31st
Immediate	whole surface							
5 hours								nearly whole surface
7								nearly whole surface
15		nearly whole	½+ surface					
16	¾ surface							
17					300 growths			
20								½+ surface
24		½ surface	½ surface	½+ surface	½+ surface		30 growths	
33						¼ surface		
34								
38		150 - 200 growths	½ - surface				20 growths	
48			½ surface	¼ surface	¼+ surface	24 growths		

Tablet No V	8 drachms March 7th	8 drachms March 8th	8 drachms March 12th	7½ drachms April 2nd	7 drachms April 4th	7 drachms April 6th
Immed			whole surface			
4½				much		
8		near whole surface			½+ surface	
9			near whole surface	¾ surface		much
10					½ - surface	
11				¾ surface		
14	50 grosths					
19	½ + surface					
23		26 grosths				
24	150-200 grths				100 grosths	12 grosths
25			¾ surface			
33		nil	100 grosths			3 grosths
34				50 grosths		
48	nil	nil		12 grosths	6 grosths.	

Tablet No V	7½ drachms April 7th	7½ drachms April 8th	8 drachms April 9th	7 drachms April 10th	7½ drachms April 11th
1 hour	whole surface				
7				3/4 + surface	
10	½ surface				
11	½ – surface				
12		½ + surface			
14	¼ surface				
15			½ surface		
23					15 colonies
24	6 growths		24 growths		
25		nil			
29	33 growths				
32				nil	
34	100 growths				
48				nil	

Summary of Conclusions from Experiments

Looking back over these experiments, in the order in which they come, one finds that certain conclusions may be arrived at.

No formalin tablets keep well if exposed to the air, and, even when securely fastened in their bottle, there is loss of strength going on, if the bottle is occasionally opened to take out some, as occurs in ordinary use. This is well shown in the case of No. III, which lost half its strength from keeping for 2 months, and still better in the case of the last sweets in a chemists' stock bottle, which had lost 11/12 of their formalin when given to me to test; and No. I lost 3/4 in 5 months.

It is therefor most important, when the tablets are used, to obtain them from fresh supplies, and only to get enough to last for a short time. For this reason the small tubes of tablets, if properly sealed, are the best form.

The increase in secretion of Saliva, that takes place from their use, is in all cases greater than is necessary. With the very hard sweets this is so great that the antiseptic action of formalin is very much decreased,

and the best tablet would be one that did not take more than 20 minutes & dissolve, and that did not cause a greater flow of Salvia than 3 drachms during this time. Probably some of the softer kinds, if made with less Acid, Sugar, and Menthol, would act very much better than at present. (This view is not taken by the makers of one well known tablet who advertise it as the hardest on the market)

Turning now to the first work with organisms; one finds that with Tablet No. I Page 17 in Experiment 1) there is a decrease in the number of colonies after the use of one tablet and a decrease again after the second one. Also the white colonies take longer to appear, which shows that where organisms are not killed they are at least hindered from growing so fast as they otherwise would. In the 5 other experiments done, the same result is found with, in number 4, no colonies in the last tubes.

There is a decrease in Staphylococcal growth, and also in the small fine colonies, which proved on examination to be of different kinds, some being streptococci, others diplococci & others bacilli.

In cases where a loop has been taken larger than the one before, and more growth obtained,

there is really a decrease relatively to the size of the loop.

It is thus evident that Tablet No I has a retarding and killing effect on the organisms of the throat and, as it has a nice flavour and is readily taken by children, it is a valuable therapeutic agent.

These results of mine compare very badly with those of Dr Merrydew Young, who found no organisms after one tablet had been used. On taking a swab again 10 minutes later he got 35 colonies, and on a swab half an hour after, 150 colonies. But on none of these occasions did he obtain staphylococci or streptococci. I, on the other hand, in the many loops I have taken from my throat, after the use of formalin tablets, have never yet got a sterile tube with no growth of any kind. No I Salvia kept for 4 hours (Page 31) showed fair growth.

Tablet No II in the same work does not give so satisfactory results. (Unfortunately here the organisms are not the same as with Tablet I) In all the 6 experiments done there is very little change in growth seen, after the use of tablets. Why this was I do not know, as the tablets did not seem to have lost enough formalin to give so poor results.

Tablet No III seems to be of more use than No II, but still not so good as No I, but on the whole it is fairly satisfactory.

The results of these experiments are only moderately satisfactory, so far as the action of formalin is concerned, but it seems certain that, if one is working with Staphylococci, one week is not enough time to clear between each series of experiments, to allow the throat to recover its normal state after the use of formalin.

It is possible that the change in organisms with me was due to the fact, that some throats vary very much from time to time in their bacterial contents. I am inclined to think, however, that formalin, even in small doses, has a great effect on the organisms of a healthy throat, for I found in my work later on, where very little formalin impregnated saliva was swallowed, that, after taking tablets for some days, I only occasionally found staphylococci in cultures made, and, when they were present, there were no yellow ones, and only a very few giving gray colonies.

Whilst I was doing my last experiments I took a number of loops from my anterior fauces and saliva, and found that streptococci

were the usual organisms & grew freely.

In my next work, where formalin saliva is poured over growths, and allowed to stay there for some time, my results are very much worse than those of Seifert. He, however, used 1 tablet in 10 cc of water, which gives nearly twice as strong a solution of formalin as I ever had with Saliva, and this probably accounts for the difference. Also, I was working with organisms with large sized colonies, and it is certainly hard for the antiseptic to work its way right through colonies 1/10 of an inch or more in diameter. So, very possibly, the surface bacteria of the colonies were killed hours before those at the centre were beginning to feel the effects of the formalin, and, as I rubbed my loop hard on the slope and broke up the colonies, I picked up many organisms from the centre, where they had the best chance of surviving.

And now going on to the last series of experiments, one finds, in looking at the results of Tablet No. I, that the first few hours acting on Staphylococci has little effect. Up to the end of 6 hours there is much growth, tho' considerably reduced from that at the end of the first hour.

This decrease goes steadily on, till, by the end of 12 hours, there is a marked diminution in the number of colonies. By that time they have been reduced by more than half, and, continuing on, one sees the decrease steadily continuing, till by the end of 24 hours, the Staphylococci have been practically all killed.

I usually found that when the Staphylococcal colonies had been reduced to very few in number, or had disappeared altogether, that Streptococcal colonies could be seen growing on the media. This shows that the Streptococci of Saliva have considerable powers of resistance against formalin, as I usually found colonies in 24 hour contact tubes; but by the end of 30 hours tubes were generally sterile, even if incubated for longer than 3 days.

With Tablet No. II, by the end of 18 to 24 hours, the result is much like that of Tablet No. I at 12 hours, and up to the end of 38 hours there was still growth.

Very little work was done with this tablet however.

Tablet No. III is somewhat like No. II in results, as it shows considerable growth by the end of 24 hours — as much as No. I

at 12 hours — but by the end of 38 or 39 hours the effect is becoming very marked.

In the last few experiments with Tablet No III the results were becoming distinctly worse, so I got a fresh set of tablets, direct from the makers, and tested them against those that I was using, which I had then had for about 8 weeks. I found that the old ones had only 1/2 the formalin that the fresh ones had and this probably accounts for the marked deterioration in the results of the last experiments, and shows the necessity of new tablets in all work.

My next 2 experiments were with plain Salina in which the organisms seemed to live quite well, though not to multiply to any appreciable extent.

After this comes tabet No IV, which is a very hard sweet got from a Chemist.

Here one finds that 24 hours about corresponds to 12 hours of No I, and that by the end of 2 days there is still considerable growth. The dilution of the formalin is however nearly twice that of the other, so that one would not expect a very good result.

Tablet No V. My last experiments of the series are those with a tablet rather like No I in taste and, curious enough, giving much better results than one would expect, considering the amount of Saliva secreted. Taking this into consideration it approaches No I fairly closely.

The last 5 tablets of this kind, were tested by taking 2 large loopsful of Staphylococci, and grinding them up in 15 minims of water, letting this stand for 15 minutes, and then taking the top 10 minims of this, and adding it to the Saliva, so as to get the organisms as much separated as possible.

The work of some other men with Tablet No I is of interest here to compare with my results.

Rheinboldt took 10 c.cm of normal, and of No I Saliva each, 2 drops of a culture of Bacillus Prodigiosus was added & shaken up. Agar plates were inoculated with 0.1 c.cm of these, both immediately, and after 4 hours. In the first there were much fewer organisms in the No I saliva than in the normal, while in the 4 hour plates the No I saliva was sterile.

In another case the addition of 3 tablets to a culture of Bac. Prodigiosus absolutely sterilised the culture.

F. Levy tried shaking up sterile Bouillon with No I saliva, and found on incubating, that the culture

was sterile. As this was very different from what I found on pages 30 & 31, where Saliva tested after ½ an hour, and again after 4 hours, gave cultures of staphylococci, and also from tubes after 24 hours showing streptococcal growth, I tried one other experiment. I made No I saliva as usual and got under 4 drachms. I took loops at 2 hours, 15 hours, and 24 hours respectively, and incubated on Agar slopes and found after 3 days at 37° C

after 2 hours the whole slope was studded with minute growths, streptococci

after 15 hours a considerable number of minute growths still appeared.

after 24 hours. This tube was very nearly sterile.

This agrees with what I usually found, that streptococcal colonies were seen when the Staphylococci were mostly killed.

Other work done has been, trying the effect of 3 tablets dissolved in 10 c.c.m of water on Staphylococci and streptococci. In the first case the growth was sterile in 60 minutes, and in the second in 30 minutes.

Also 5 tablets were dissolved in 10 c.c.m of water & Meningococci added. This also was

sterile in 60 minutes. I do not think that such strengths as these are ever obtained clinically, and whilst showing that the tablets contain an antiseptic, they do not give one any idea of what effect formalin tablets may have in disinfecting a mouth. This can only be found if one dissolves up the tablet in the same quantity of saliva as it would cause to be secreted, when dissolving in the mouth, and uses this to test its lethal power on organisms.

It will be noticed that my results with the same kind of tablet vary to a certain extent, which is probably due in part to variations in the amount of formalin contained in different tablets after keeping, and in part to cocci having stayed in clumps, and the inside ones of the clumps not having got the full effect of the antiseptic. This last will also account for those occasions on which one finds an increase, instead of the expected decrease, in the number colonies, in tubes where the organisms have had longer contact with the formalin.

The difference in the actions of the various kinds of tablets is not easy to understand, as it hardly seems able to be put down altogether to the dilution caused by the amount of saliva secreted. For then No V would be the worst instead

of very good. Neither can it be put down to different growths of organisms being tested, as I often used 2 different kinds of ~~of~~ tablet on the same day, on organisms from the same tube. The antiseptic power of menthol is not the reason either, as the tablets with the least taste of this seem to be the best ones. It may be that there is something in the claims for No I, that nascent formalin vapour is given off in the mouth and so it acts the best, but whether this is also the case with No II I do not know.

Some of the tablets have acted moderately well in their experiments, though there is no doubt that a slightly stronger antiseptic action would be advisable, as I have stated before, but it need not be the strength used in some of the experiments done by other workers. To obtain that with formalin would be irritating to the mucous membrane, and possibly dangerous does patient if continued for any length of time.

About 1 in 1200 & 1 in 1500 dilution of Formalin caused by the Saliva would be a good strength, if at the same time there is not a large flow of Saliva. For, if there is much saliva secreted, it is constantly swallowed, and, though it passes over the fauces, most of the formalin is carried quickly into the stomach, instead of remaining about the throat where its action is wanted. With little saliva,

swallowing only occasionally will take place, and this will leave an antiseptic layer over the surfaces of the mucous membrane, which will stay potent for some time, especially if nascent formaldehyd is being given off. In this way also, the same amount of formalin should have a longer antiseptic action on the throat. Some change on this line might improve the tablets for the treatment of disease.

As a prophylactic, however, during epidemics, when all that one wants is to make the mouth and fauces an unsuitable midium for the growth of invading bacteria, I consider that a soft tablet would not be the best, as I found that the number I had to take during the day always caused gastro-intestinal derangement. No II or No V, I think, is quite strong enough as an antiseptic in this case, and, as these last for a considerable time, one can get the desired result by the use of very much fewer of them.

The chief advantage of these tablets is, that they are the most agreeable, and the most handy, form of mouth treatment; and that their antiseptic becomes intimately mixed with the saliva, and so makes an antiseptic coating all over the mucous membrane of the mouth and fauces. This antiseptic saliva is probably carried in the act of swallowing to many of

the lurking places of bacteria, which would not receive the solution used in gargling or swabbing.

The chief disadvantage of the tablets is the rapidity with which they lose their formalin, and the impossibility of telling from their appearance how much they have lost.

Tablet I is "Formamint" made by A. Wulfing & Co.

Tablet II is "Mentholform" made by Corbyn Stacy & Co.

Tablet III is "Oral Antiseptic" made by Parke Davis & Co.

Tablet IV is "Formitrol Pastille" made by A. Wander.

Seifert's article in Pharmacol. und Therapeut. Rundschau No. 14, 1906

Levy's in Medizinische Klinik No. 16, 1906