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 borne 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 serious 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 inflamed 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 common 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 less of formalin from age was sufficient to do away with any appreciable extent with their antiseptic power.
I therefore got tablets, either dried 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 three how the tablets corresponded with each other, 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—1/4 to 1/8 of a grain being the usual amount.

Another important subject, considered, was the addition 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 hardiness of the tablets, just as the time they took to dissolve also varied, and I found that from 1/4 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 we would expect, the tablets causing the larger flow of saliva did not have as much effect as the others in 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 2500 or less of formalin. (After the tablet was dissolved swashed out my mouth with 1/4 an ounce of water, and tasted this well how much formalin was lost by being retained in the mouth. The reaction was given in such dilution as show that somewhere between 1/24 and 1/28 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 on change 1 in 1700 to about 1 in 1736 or 1 in 1775, and 1 in 2070 to 1 in 2553 or 1 in 2809 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 faunus.

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 rub the throat very gently, and, in that case, only get the organisms from the very surface. But, if one wants these implanted more firmly on 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 in 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 planted, therefore, by taking loops of saliva from between the pillars of the fauces, smeared on Agar plates, 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 I 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 it 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 those experiments, get the general effect on the bacteria, watching especially the action on some particular organism.

This idea would have to be one of the faster growing kinds, and having fair-sized colonies—usually the phleococcal, and other minute colonies, were largely, or completely covered up by other growths on the agar plates.

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

This work had to be stopped, however, as other 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 using formalin tablets, even at the rate of one per dish,
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 denture; 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 disintegrated I collected it in a graduated vessel, so as to find the usual quantity produced. The amount was usually about 5 c.c.m. So this was added to a loopful of yellow Staphylococcus coccus of the mouth, taken off on Agar slife, and all was well mixed together with the platinum leaf.

From this mixture I took loopfuls at different intervals, planted 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 had complete
sterility in a few hours.

My work does show however, that, for some:
cadual 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, it seems to act the best.

In the whole the results with the tablets were disappointing also, as I had expected more
effect from them, but they are certainly an improve-
ment on other forms of treatment for disinfecting
the mouth, especially in children.
Tests with the tablets showed, 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 Protic 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 to see that it was Formalin free. The solution was then made up to 6 ounces with water.

Samples of this were then taken, and, having been made into different dilutions, were tested for Formalin, by placing one 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. II gave the maximum reaction presently, whilst No. I seemed to be slow in giving off Formalin. In fact sometimes this late appearance was so evident that it seemed more 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 too often or not. On the other hand, I was not more had a patent complaint 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 driven off in a nascent
plate in the mouth; but I found that the Salvia reacted whilst a tablet was dissolving in my mouth, always gave the formalin reaction well after 4/8 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 Saliva — usually about 4 1/2 drachms are reacted during the use of one. It dissolves in the mouth in about twenty minutes, as a rule, if kept dry itself, but if sucked, it grows 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.

<table>
<thead>
<tr>
<th>Tablet</th>
<th>Reaction in 1/2 ounces dist.</th>
<th>Reaction in 2 1/2 ounces</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>Good</td>
<td>Poorly</td>
</tr>
<tr>
<td>2nd</td>
<td>12</td>
<td>Good</td>
</tr>
<tr>
<td>3rd</td>
<td>12</td>
<td>Poorly</td>
</tr>
</tbody>
</table>

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 benzthol 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 salivation than precedent.

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

<table>
<thead>
<tr>
<th>Tablet</th>
<th>Reaction</th>
<th>Reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Tablet</td>
<td>12 mmes</td>
<td>Almost</td>
</tr>
<tr>
<td>2nd Tablet</td>
<td>12</td>
<td>Moderate</td>
</tr>
<tr>
<td>3rd Tablet</td>
<td>16</td>
<td>Moderate</td>
</tr>
<tr>
<td>4th Tablet</td>
<td>24</td>
<td>Poor</td>
</tr>
</tbody>
</table>

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 pushed, it dissolves slowly.

The taste of benzthol 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 drops or more.

The tests were done with tablets from a bottle.
containing 50, obtained by a chemist for me from
the makers.

<table>
<thead>
<tr>
<th>Tablet</th>
<th>Dilution</th>
<th>Reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>24 ounces dilution</td>
<td>Good</td>
</tr>
<tr>
<td>2nd</td>
<td>24</td>
<td>Moderate</td>
</tr>
<tr>
<td>3rd</td>
<td>24</td>
<td>Good</td>
</tr>
<tr>
<td>4th</td>
<td>24</td>
<td>Moderate</td>
</tr>
<tr>
<td>5th</td>
<td>24</td>
<td>Good</td>
</tr>
</tbody>
</table>

**Tablet no IV**

This is a hard flat paste. It is rather more pleasant than No. 203, 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 produced is usually well over 6 drachms and sometimes 8 drachms.

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

<table>
<thead>
<tr>
<th>Tablet</th>
<th>Dilution</th>
<th>Reaction</th>
<th>Reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>12 ounces dilution</td>
<td>Good</td>
<td>24 ounces</td>
</tr>
<tr>
<td>2nd</td>
<td>12</td>
<td>Good</td>
<td>24</td>
</tr>
<tr>
<td>3rd</td>
<td></td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>4th</td>
<td></td>
<td>Good</td>
<td></td>
</tr>
</tbody>
</table>

The reaction appeared better after some time with these tablets.
These tablets were puret got from a nearly finished bottle in a chemists shop. Same kind as last.

<table>
<thead>
<tr>
<th>Tablet</th>
<th>Reaction</th>
<th>Reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>Poor</td>
<td>Poor</td>
</tr>
<tr>
<td>2nd</td>
<td>Poor</td>
<td>Poor</td>
</tr>
<tr>
<td>3rd</td>
<td>Poor</td>
<td>Poor</td>
</tr>
<tr>
<td>4th</td>
<td>Poor</td>
<td>Poor</td>
</tr>
<tr>
<td>5th</td>
<td>Poor</td>
<td>Poor</td>
</tr>
</tbody>
</table>

Tablet No. V

This tablet comes next. The I viregard its pleasantness. It is softer than the last few and feels rather like soap pumice in the mouth.

It takes a long time to dissolve, and causes a free flow of Saliva — always over 6 drachms. As it is quite flat, feeling almost bi-coneaur, it breaks up into several thin pieces at the finish.

These were a sample tube from the makers.

<table>
<thead>
<tr>
<th>Tablet</th>
<th>Reaction</th>
<th>Reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>2nd</td>
<td>Good</td>
<td>Doubtful</td>
</tr>
<tr>
<td>3rd</td>
<td>Good</td>
<td>Fair</td>
</tr>
</tbody>
</table>

From this it appears that tablets still bought fresh from the makers all contain more or less
the same quantity of formalin, that there are always slight variations.

I then left 3 tablets from each of N° I, II and 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 N° I**

1st Tablet in 1 ounce moderate in 2 ounces poorly
2nd Tablet 1... moderate 2... poorly
3rd Tablet 1... Moderate 2... poorly

**Tablet N° II**

1st Tablet in 6 ounces ml in 2 ounces Doubtful
2nd Tablet 1 ounce poorly 2 ounces Doubtful
3rd Tablet 1 ounce poorly 2... Doubtful

The first test here was made in too great a 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 N° III**

1st Tablet in 8 ounces Moderate in 12 ounces ml
2nd Tablet in 6... faint 12 ml
3rd Tablet in 6... faint 12 ml

As this tablet is considerably harder than N° II.
it may be that it keeps its formalin better on that account.

In the middle of March I tested 3 tablets of W2 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 W2 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 put 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 sterilised platinum loop between the pillars of the fauces on one side, and then smeared the loop over an Agar slide, 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 slide. I usually continued doing this with three tablets. The 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. 1 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. 1 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.

**Table 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 was in places, due to a Staphylococcus Albus.

After 24 hours now the growth had increased a little.

**Table II** After 1 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 strains show colonies run together in a few places, but nearly the whole growth is discrete colonies of yellow staphylococcus.

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

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

**July 15th** A loop was taken from the piller of the fauceus on the left side, & then one tablet was 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
white gray staphylococcal colonies now
appearing. The ground glass appearance is
due chiefly to Staphylococcal colonies.

Sept 28th  Experiments done as before
Tube I  Before tablets.
48 hours  47 white tetrad colonies + many staphylococci
Tube II  After one tablet that dissolved in 1/2 hour.
48 hours  18 Tetrad growths also staphylococci
6th day  Has 28 tetrads showing.
  Tube III  After two tablets
48 hours  8 Tetrads.
6th day  Has 15 tetrads

Sept 29th  Experiments as before
This is after 3 tablets to the previous day.
  Tube I  Loops taken from opposite
side of flasks from yesterday work.
48 hours  70 grey white colonies  (Bacillus)
  Tube II  After one tablet.  20 minutes beforehand
48 hours  31 grey white colonies  (Bacillus)
  Tube III  After 2 tablets
48 hours  7 Bacilli colonies.
  Tube IV  & Tube V after 30 1/2 tablets
respectively.
8 hours no Bacillary growths.

Nov. 3rd

Tube I Lesp from left side of fauces.
3rd day Considerable growth all over surface of tube.
5th day 21 Staphylococcal growth. Considerable amount of Staphylococcal growth.

Tube II After one tablet. 20 minutes to dissolve.
3rd day Much less growth than in tube I.
5th day 19 Staphylococcal growths. About 1/2 of the streptococci in tube I.

Tube III After 2 tablets (also 20 minutes).
This loss was 3 or 4 times usual amount.

3rd day Growth seems about 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. Not 1/2 the streptococci in tube II.

Nov. 4th

Tube I Lesp taken from left side (same as previous day). Large Lesp taken.
5th day 70 Staphylococcal growths & considerable
amount of staphylococcal
Tube II after 1 tablet (20 minutes to dissolve)
9 then bottled for 10 minutes before taking large loop
5th day 45 staphylococcal & few amount of
streptococci.
Tube III after 2 tablets (20 minutes)
5th day 27 large staphylococcal & some
streptococci.
Tube III 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 in the use of formalin, and were
never back again in the same numbers as
at the start.

Experiments with Tablet A II, Jul 22nd
No formalin or other antiseptic had been taken
for 7 days, to 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.
me 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 10 min 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 1/2 hour after last tube and tablet was taken I waited 30 minutes.
3rd day. Very slight diminution in the number of white staphylococcal growths

July 25th

Tube I A large Zephyrus taken
3rd day. 12 staphylococcal colonies little white and yellow as much fine growth.

Tube II after one tablet (1 hour dissolve)
3rd day 14 staphylococcal colonies of both colonies. Not quite as much fine growth.

Tube III after last tablet (1/2 hour dissolve)
3rd day. 10 Staphylococcal colonies. Growth about the same as last tube.

Tube IV. Sporad.
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) soaked for 1/2 an hour and then took loop.
3rd day Rather less growth than in tube I

Tube IV spoiled

Tubes IV, V Taken immediately after tablets in the usual way.
3rd day Growth much the same in both tubes. It is about 1/2 that in tube I.

October 18th

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

Tube II after tablet which took 30 minutes to dissolve & then 15 minutes to settle.
Small loop taken
3rd day 20 Staphylococcal granules. It is 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 granules and more fine growth than in either tube I or II.

Tube IV After tablet which took 25.
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 that of yesterday.

In the evening took
Tube I. Medium rigid loop.
Tube II. After 2nd 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 formal I had taken.

Tube I: Loop taken from plate.

3rd day. Shallow whole slice was coated with white growth: a few yellow masses mixed up with them.

Tube II. After one tablet (30 minutes already) 3rd day white colonies look about 1/2 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 already) 3rd day. White colonies much decreased.
number, yellow much as in last

Take 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
the case that one week is not long
enough a rest to give 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 Accidents outside the Body

As I had found that taking any of the Formalin and marketed 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 Witt's Peptic Roeder to the solution instead of milk to give the necessary protein.

A tablet was taken in the mouth and allowed to dissolve, but none of the saliva was swallowed— all being collected in a graduated 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.

The 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 slipes containing discrete colonies of Staphylococcus Aureus were then taken, and some of this saliva was poured into each, so as completely 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 slipes twice washed with water.

Tubes No. I to III were then incubated at 37°C. for 24 hours, and then loops were taken from them, smeared on fresh agar slipes.

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

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

From some of the saliva itself, after standing for 1/2 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 -

The No.1 tablet was allowed to dissolve in the mouth, and 5 droppers 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 into local 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 to which Staphylococci had been added.

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


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

January 3rd. 740 tablet was allowed to dissolve
in the mouth, and 4 draemums of Salvia
were obtained. Do this a large leafful of yellow
Staphylococcus was added, all well mixed
up.

When it was time to take a loop to grow in agar,
I mixed the solution well up again with a
sterilized 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
poured it in the slope.

Tube I. Loops taken from the Salvia
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. 5th  
Same as last. 5 drachms of Salvia.

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

Tubes I & II  after 11 hours

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. 6th  
Same as last. 5 drachms of Salvia.

Tubes I & II  after 8½ hours

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

Tubes III & IV  after 9¾ hours

3rd day  
Much the same as Tubes I & II

Tube V  after 23 hours

3rd day  
About 40 colonies have appeared on this side.
Feb. 7th: At this time I had a severe cold in the head, so that I was unable to taste the tablets, and was taking 30 mg of Hydromorphone in the 24 hours.

Same experiment as last of the Salvars obtained was reduced to 3 droppers.

 Tube I after 9 hours

 3rd day 10 grosts

 Tube II after 11 hours

 3rd day 2 grosts

 Tube III after 24 hours

 3rd day 1 grosts

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

Feb. 8th: Same as last. 4 droppers of Salvars

 Tube I after 9 hours

 3rd day considerable 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 Salvia.

Take I. after 13 hours

3rd day. Growth about half that on the 9 hours take of 8th Feb.

Take II. After 23 hours

3rd day. 35 growth the seen.

Feb. 17th. Same as last. I obtained near 5 drachms of Salvia on this occasion.

Take I. Made at me. Sterilised my platinum loop in the flame after making the mixture of Salvia & Staphy locaree & then took a loopful.

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

Take II. After 13/4 hours

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

Take III. After 4 hours

3rd day. Growth distinctly less than in Take I. III. In some places there is a continuous flat surface of growth. In the most of the tube the colony contains
can be seen but they are mostly running together, though clear places with no growth do show in some parts.

3rd day. Just one half of the surface is covered with growth in this tube.

Tube IV After 8 hours

Tube V After 24 hours

3rd day. The growth.

Tube VI After 25½ hours

3rd day. No growth could be seen.

Tube VII After 31 hours

3rd day. No growth could be seen.

After 8 days incubating, Tubo V & VII had a few small stumpy loriccal growths.

Feb. 18th Same as last. 5 drophs of Salvia

Tube I Made at once

3rd day. Whole surface is no sheet of growth.

Tube II After 24 hours

3rd day. 2 growths.

Tubes 13½ & 21 hours were printed
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 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 incubation there were 12 colonies of Staphylococci all quite small.

March 17th. Same as last: 4½ drachms 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 before. 4½ drachms of Saliwá.

Tube I. After 24 hours.

3rd day. This was inoculated with 2 large lobules from the 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 before. 3 drachms of Saliwá.

Tube I. After 4 hours.

3rd day. The smallness is in a continuous sheet. The rest is mostly running together. In half the small discrete colonies.

Tube II. After 9 hours.

3rd day. Colonies starting to run together in places; in other places quite discrete.

Tube III. After 11 hours.

3rd day. A few colonies run together but in nearly 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. 6 droppers of Salvia

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 single and all running together.

Tube IV. After 18 hours.
3rd day. 8 growths only.

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

Tube V. After 18 hours.
This loft was taken from the foot of the vessel but without mixing up the Salvia.
3rd day. Somewhere between 150 & 200 growths in this tube.
Feb. 22nd Same as last. 3 drachms of Salvia

Take I. Taken immediately.

3rd day. Whole surface one sheet of growth.

Take II. After one hour.

3rd day. Whole surface one sheet of growth.

Take III. After 4 hours.

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

Take IV. After 7½ hours.

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

Take V. After 14 hours.

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

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

Take I. After 23 hours.

3rd day. Many minute slow growing colonies.

Take II. After 24 hours.

3rd day. Same as last.
Feb. 24th  Same as last. 5 drachms of Salvia

Tube I after 6 hours.

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

Tube II after 36 hours.

3rd day. 20 growths appeared.

Tube III after 38 hours.

3rd day. 20 growths appeared.

Feb. 25th Same as last. 5 and a half drachms of Salvia

Tube I after 24 hours.

3rd day. Growth running together in a few places. Not separate colonies.

Tube II after 33 hours.

3rd day. Between 75 and 100 growths.

Feb. 26th Same as last. 5 and a half drachms of Salvia

Tube I after 14 hours.

3rd day. Growth separate but large number.

Tube II after 24 hours.

3rd day. Rather less than in last.
Experiments done with Tablet № III
Tables on Pages 67 and 68
Feb. 19th. Same as last. 5½ drops of Salvia

Tube I. Taken immediately
3rd day. Whole surface covered. Not a continuous sheet of growth.

Tube II. After 14 hours.
3rd day. Moderate growth. About 1/2 of that 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 drops of Salvia.

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 III. After 14 hours

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

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

Tube I. Taken immediately

3rd day. Whole surface covered.

Tube III After 16 hours

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

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

Tube III. After 24 hours

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

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 KIO tablet.

Feb. 27th. Same as last. 10 cc. 6 drops of Salvia

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 spongy Bacillus. 3 Staphlococcal colonies seen.

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

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 Salvia

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. Plate of 21 hours. 8 tracks of Salvia
3rd day. All discrete & about 150 in number.

March 4th. Same as last. 1/2 tracks of Salvia.

**Tube I** after 14 1/2 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. 6 ½ draehms 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. Many discrete and small colonies growing plenty.

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 plenty.

March 15th. Same as last. Over 6 ½ draehms

Tube I after 24 hours.

3rd day. This was a very small plate. The growth is not continuous but the colonies are all starting to run together 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 as 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 Salmia.

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 very slow and colonies are very small but in large numbers.

March 21st. Only 4 drachms of Salmia.

Tube I. After 13 hours.

3rd day. Part of the surface is a sheet of growth.
with no sign of colonies. The rest is mostly colonies that have run together.

**Tube II. After 19 hours.**

3rd day. The colonies are small and run together all over the plate 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 lack of formalin, as I tested one and found 1/2 the amount there was in fresh tablets.
Experiments with ordinary salvia in which a lump of starches were had been put.

Table on Page 69

March 10th. 5 drachms of salvia were taken

Tube I. After 14 hours

3rd day. One is unable to tell that this is made up of colonies as it is mostly 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 I.

March 13th. 5 drachms of salvia 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 nearly all over a continuous sheet of growth.

Take it after 48 hours.

3rd day. In most places this is a continuous sheet of growth but in some places we can see colonies.
Experiments with tablet No IV
Table on Page 71

March 12th. Same as last. 7/12 drachms Salvia

Take I. Taken immediately
3rd day. Continuous sheet of growth on whole surface merged.

Take II. After 16 hours
3rd day. Very large number of colonies which are all distinct.

Take III. After 16 hours.
3rd day. There is more growth than in Take II. The growth is all running together, the one can see the center from which the colonies come.

March 13th. Same as last. 7/12 drachms Salvia

Take I. After 15 hours
3rd day. This is nearly continuous growth. The colonies have run into one another very much, but one can see in most places that the growth is compact of colonies.

Take 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 the agar plate.

Tube III After 38 hours.
3rd day. Between 150 and 200 granules. They are small in size and slow growing.

March 15th. Same as before. 8thachus salvia

Tube I After 15 hours.
3rd day. The colonies are fair sized and 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 in 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 droshus 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 distinct, rather small and not very numerous

March 21st Same as last. 7 droshus Saliva

Tube I after 17 hours.

3rd day. Between 250 and 300 growth.

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
March 21st. Same as last. 8 drachms Salvia

The test was run on 15th March from chemist.

Tube I after 5 hours.

3rd day. In some places there is a continuous plant; 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 well divided. Moderate in amount

Tube II after 48 hours

3rd day. 24 Growth.

March 26th. Same as usual. This was made
with a new salt just got from chemist.
Tube I. After 24 hours

3rd day. 30 gram in size. There are also a large number of Staphylococcal 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 gram in.
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 gram in have appeared and a number of very minute Staphylococcal gram in 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. The growth visible.

March 8th. Same as before. 8 drachms of Salvia

**Tube I.** After 8 hours.
3rd day. The whole surface of the peptic concave
March 12th. Same as last: Shaddock 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.

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.
April 2nd. Same as before. 7½ drachms Salvia.

Tube I. After 4½ hours.
3rd day. This is small colonies in very large number. In places it is a confluent sheet with other 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 3½ hours.
3rd day. 50 colonies has appeared.
Tube V. After 4½ hours.
3rd day. 12 growth
April 4th. Same as before. 7 drachms of Salvia.

Tube I. After 8 hours.
3rd day. Colonies are starting to run together.

Tube II. After 10 hours.
3rd day. Moderate amount of gastric juice 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 drops of 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 drops full of yellow staphylococci were rubbed up in 15 minutes of water, I then allowed to stand for 10 minutes; and after that the tops 10 minutes was taken off and added
To the saliva, which was then well stirred up. In this way there were no large lumps of casei, 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 16 hours

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

**Tube III** After 11 hours

3rd day. There are patches of clear medium blue 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 VII after 29 hours
3rd day. 33 growths

Tube VII after 34 hours.
3rd day 100 growths.

April 8th. Made as in last. 7½ drachms Salvia

Tube I after 12½ hours.
3rd day. Growth consisting of colonies running together in some places, and in others discrete

Tube III after 26 hours.
3rd day. No growth.

April 9th. Made as in last. 8 drachms Salvia

Tube I after 15 hours.
3rd day. Colonies near every where discrete, but in a few places running together

Tube III 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.
<table>
<thead>
<tr>
<th>Tablet N° I</th>
<th>Jan 3rd 4 dracons</th>
<th>Feb. 5th 5 dracons</th>
<th>Feb 6th 5 dracons</th>
<th>Feb 7th 3 dracons</th>
<th>Feb 8th 4 dracons</th>
<th>Feb 9th 4 dracons</th>
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* 5 drachms: 30 grmths
* 4 1/2 drachms: 30 grmths
* 4 1/2 drachms: 30 grmths
* 3 drachms: 30 grmths

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Summary of Conclusions from Experiments

Looking back over these experiments, in the order in which they came, 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 few 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 chemist's stock bottle, which had lost 1% of the formalin when given to me to test, and No. I lost 3½ in 5 months.

It is therefore 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, small tubes of tablets, if properly sealed, are the best form.

The increase in reaction of Salvarsan 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 to dissolve, and that did not cause a greater flow of saliva than 3 orachins during this time. Perhaps some of the softer kinds, if made with less wax, 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. 1 Page 17 in experiment 11 there is a decrease in the number of colonies after the use of the tablet and a decrease again after the second one. Also the white colonies take longer to appear, which shows that while organisms are not killed they are at least hindered from growing as fast as they otherwise would. In the 5 other experiments done, the same result is found with, in number 8, 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 staphylococci, others diphtheria and 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 loops.

It is thus evident that Tablet II 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. Hershey the 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 Staphylococcus or streptococcus. 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 plate to take with no growth of any kind. No. I Saliva kept for 4 hours (Page 31) showed fair growth.

Tablet II in the same work does not give so satisfying results. (Unfortunately here the organisms are not the same as with Tablet I.) In all the 5 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 no poor results.
Tablet No. III seems to be of more use than No. II, but still not as good as No. I, but in 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 would need enough time to allow 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 throat 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 areas, and only a very few giving grey colonies.

Whilst I was doing my last experiments I took a number of lodges from my anterior fauces and saliva and found that Staphylococci
were the usual organisms to grow 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 antibiotic 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 center 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 center, 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 Staphylococcus has little effect. Up to the end of 6 hours there is much growth, the considerable 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 steady 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 very few in number, or had disappeared altogether, that Staphylococcal colonies could be seen growing on the media. This shows that the Staphylococci 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 as much like he it 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 in that the fresh ones had and this probable 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 Salure in which the organisms seemed to live quite well, though not to multiply to any appreciable extent.

After this comes tablet No. IV, which is a very hard piece got from a Chemist.

Here one finds that 24 hours about compares 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 K35. My last experiments of the series are those with a tablet rather like K3 I in taste and, curiously enough, giving much better results than we would expect, considering the amount of Saliva present. Taking this into consideration it approaches K01 fairly closely.

The last 5 tablets of this kind, were treated by taking 2 large lozenges of Staphylococci, and grinding them up in 15 minutes of water, letting this stand for 15 minutes, and then taking the top 10 minutes 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 K35 is of interest here. I compare with my results.

Aheimkold took 10 c.c.m of normal, and K01 Saliva to each, 2 drops of a culture of Bacillus Prodigious was added and shaken up. Agar plates were incubated with 0.1 c.c.m of these, both immediately, and after 4 hours. In the first there were much fewer organisms in the K01 Saliva than in the normal stuff in the 4 hour plates the K01 saliva was sterile.

In another case the addition of 3 tablets to a culture of Bacillus Prodigious absolutely sterilised the culture.

I tried shaking up sterile Bouillon with K01 Saliva, and found on incubating, that the culture
was sterile. As this was very different from what I found on pages 304-31, where saliva tested after 1/2 an hour, and again after 4 hours, gave cultures of staphylococci, and also from tubes after 24 hours showing staphylococcal growth, I tried the other experiment. I made 30% saliva as usual and set under 1/4 drachms. I took loops at 2 hours, 15 hours, and 24 hours respectively, and incubated on agar plates and found after 3 days at 37°C.

After 2 hours the whole plate was studded with minute growths of staphylococci.

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 staphylococcal colonies were seen when the staphylococci were not killed.

Other work done has been trying the effect of 3 tablets dissolved in 10 cc 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 cc of water & meningococci added. This also was
people 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 me 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 use 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
played in clumps, and the inside ones of the
clump 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 M. T. would be the worst instead
of very good. Neither can it be put down to different
growth of organisms being tested, as I often used
2 different kinds of tablet on the same day,
on organisms from the same tube. The antiseptic
power of methal is not the reason either, as the	tablet with the least taste of this seem to be the
best ones. It may be that there is something
in the claims for HCl, that nascent formalin
vapour is given off in the mouth and so it acts	the best, but whether this is also the case with
HCl 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 to
some patent if continued for any length of time.

About 1 in 200 or 1 in 500 dilution of formalin
carried 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 faucets,
much 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 recent formaldehyde 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 medium 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 disturbance. HCl or HNO₃, 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 some 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 "Formamin" made by A. Wulffing & Co.
Tablet II is "Manthorform" made by Cortyn & Stacey Co.
Tablet III is "Oral Antiseptic" made by Parke Davis & Co.

Tablet V is "Forminol Pastille" made by A. Wander.

Seifert's article in Pharmaceut. und Therapeut. Rundschau No 14, 1906
Ley's in Medizinische Klinik No 16, 1906