THE
RUMPET—LEEDE PHENOMENON
in the diagnosis of Scarlet Fever.

THESIS for the degree of M.D.

by

George Richardson, M.B., Ch.B.,
Resident Medical Officer,
East Pilton Hospital,
LEITH.
While resident at the Edinburgh City Hospital during the Winter of 1912, one's attention was drawn by Dr C.B. Ker to an article in the Munich Medizin Wochenschrift of February 1911 on the diagnosis of Scarlet Fever.

This was by two authors Doctors Rumpel and Leede who, in the course of investigating the condition of the blood in scarlet fever and other infectious diseases, had noticed that when bandaging the arm previous to drawing off blood from a vein, haemorrhages of varying sizes appeared on the distal side of the bandage in scarlet fever and not in other diseases.

They were induced by this phenomenon to bandage systematically the arm of every case of scarlet fever and they found that almost without exception a positive result was obtained. The conclusion arrived at was that in scarlet fever there existed what they termed "A certain capillary vulnerability".

Dr Bennecke writing in the same journal (April 4th 1911) confirms the statements of Rumpel and Leede, and he further states that he had observed the reaction several times in Measles.

Recognising the extreme difficulty of diagnosis in certain cases of scarlet fever, especially in mild cases/
cases where there has been little constitutional disturbance, where the rash is ill-defined and transitory and before any confirmatory desquamation has occurred, one was induced to investigate this phenomenon.

The first point to determine, then, was "Does the phenomenon invariably occur in scarlet fever". With this in view a series of 210 cases of undoubted scarlet fever, at periods varying from the 2nd to the 10th day, was submitted to the test, and in every case without exception the result was positive.

It was thus proved to one's own satisfaction that the reaction could be obtained in every case of scarlet fever.

Technique.

A domette bandage is tied tightly round the arm above the elbow, but not so tightly as to obstruct the arterial flow, the pulse should be just perceptible at the wrist. The bandage should remain on for 5-15 minutes and at the end of that time, if the bandage has been properly applied, the arm should be markedly cyanosed. Should the arm become a dead mottled white the reaction will not be obtained. In these cases the bandage should be removed, a few seconds allowed for the reactionary hyperaemia to become established, and the bandage reapplied.

The/
The reaction is difficult to obtain in babies with soft, fat arms, and one finally gave up trying the reaction on them.

In cold weather, also, the reaction does not show up well and in every case the arm should be kept warm.

One has used Rubber bandages as Rumpel and Leede suggest, but domette bandages were found to be much more satisfactory.

**Appearance of Reaction.**

After the bandage has been removed a few seconds are allowed for the congestion to pass off and then the skin at the fold of the elbow on the side distal to the bandage is examined for the reaction. This consists in the appearance of a widely varying number of minute petechial haemorrhages, fairly deeply seated, which do not disappear on pressure and are, in fact, made much more evident by stretching the skin.

The typical reaction is one where the petechiae are fairly numerous immediately distal to the bandage but become fewer and more scattered the further down the arm one goes, the entire area covered being rather more than that of the antecubital fossa. No reaction is seen on the extensor surface in the ordinary case.

On each side of this typical reaction variations are found down to the doubtful case where only two or three/
three petechiae are observed, and up to the intense case where the whole forearm on both flexor and extensor surfaces and also on the dorsal surface of the hand are covered with a profuse haemorrhagic eruption.

Dr Bennecke (Munich. Mediz. Wochen. April 1011) states that the reaction never occurs on the extensor surface of the forearm but with this one cannot agree, although it is true that in the ordinary case it does not appear in this situation.

**Explanation of Phenomenon.**

One outstanding point noticed was that the petechiae invariably appeared in those situations in which the rash had earlier appeared.

In scarlet fever they correspond exactly to the punctate spots of the rash, and further they never appeared on the palm of the hand - a situation where the rash is not seen.

Again, in Measles, the haemorrhages always occurred in small groups of six to eight petechiae corresponding to the site of the macules.

In other rashes, Drug, etc., the same thing was noticed.

Another peculiarity was that the petechiae disappeared with striking rapidity, the reaction being markedly diminished within a few hours and completely absent after two days at most. Further, no staining was/
was noticed after the petechiae had disappeared.

Dr Bennecke, with the object of finding out whether the petechiae were due to rupture of the capillaries or merely to diapedesis of the red blood corpuscles, examined microscopically a portion of skin removed from a patient who had given a good reaction.

He found extravasated red blood corpuscles in the corium round the capillaries and venules. This however did not in any way clear up the question in point.

Rachs (Ziegler's Bietr. 1910) showed that there was an exudate of a haemorrhagic nature in the scarlet exanthem, and that it appeared to be haemorrhage by diapedesis.

One is therefore justified in concluding that the Rumpel - Leede phenomenon is caused by intensifying this diapedesis, and not by rupture of the capillaries.

This statement is borne out by the fact that no petechiae appear on the palm of the hand where no rash occurs, and also that, as will be shown later, no reaction occurs before the rash has spread to the arms, but does occur after the rash has passed over them.

Further, one studied the appearance caused by rupturing the capillaries in a normal arm.

A bandage was applied in the usual manner, and the arm was struck several times over the antecubital fossae.
Several haemorrhagic spots were produced, but these were much larger than in the Rumpel - Leede phenomenon, did not disappear so readily and left slight staining.

How early does the reaction occur.

If it is true that the phenomenon is due to intensification of a diapedesis caused by a rash, one would not expect the reaction to occur until the rash had appeared on the arms.

In hospital one cannot expect to meet with many cases where the rash has not already extended so far, but one was fortunate in obtaining two cases sufficiently early to study this point. The first case, not scarlet fever on admission, contracted it on the 32nd day of her stay in hospital. The second case was a true scarlet relapse.

1. J. H. age 7 years. Admitted on 12th October; was sent in because her brother had scarlet, there was nothing about the child pointing to her having had the disease.

On November 11th her temperature rose to 101.4 and she complained of headache and sore throat. Brilliant punctate rash was present on neck and chest, but not on arms.

Bandaged for 10 minutes - Negative.

Next morning (Nov.12th) the rash was general, and on/
on the 14th November she was again bandaged, this time with a very typical result.

2. W.S. 5 years. History of headache and sore throat two days before admission. When examined he had a very well marked rash with a typical cleaning tongue.

Bandaged 5 minutes and good reaction.

This patient was negative on the 22nd day. On his 37th day he vomited twice and complained of sore throat. There was a good punctate rash on the trunk, half way down the upper arm, on the buttocks and spreading to the thighs. His hands and feet were desquamating.

Bandaged 10 minutes - negative.

Next day the rash had spread all over the body and he was again bandaged with a good positive result. These cases therefore show quite conclusively that no reaction will occur before the appearance of the rash on the arms, and at the same time one can conclude that should there have been no rash there will be no reaction - a most valuable point in the phenomenon.

How long does the reaction persist.

To determine this point a series of 134 cases was investigated:-

Name/
<table>
<thead>
<tr>
<th>Name &amp; Age</th>
<th>Day of Disease and Result</th>
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</thead>
<tbody>
<tr>
<td>I.C. 7 years</td>
<td>3rd + 10th + 18th + 30th Neg.</td>
</tr>
<tr>
<td>A.M. 13 &quot;</td>
<td>4th + 20th + 30th + 40th Neg.</td>
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<tr>
<td>M.B. 6 &quot;</td>
<td>3rd + 12th + 26th + 32nd Neg.</td>
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<td>M.J. 4 &quot;</td>
<td>3rd + 12th + 26th + 32nd Neg.</td>
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<td>M.W. 13 &quot;</td>
<td>4th + 12th + 15th Neg.</td>
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<td>J.H. 4 &quot;</td>
<td>4th + 10th + 18th Neg.</td>
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<tr>
<td>M.R. 21 &quot;</td>
<td>4th + 17th + 23rd + 30th Neg.</td>
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<td>B.R. 17 &quot;</td>
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<td>M.McC.10 &quot;</td>
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<td>A.O. 7 &quot;</td>
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<td>Mrs.H.25 &quot;</td>
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<td>D.O. 8 &quot;</td>
<td>3rd +</td>
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<td>H.S. 5 &quot;</td>
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<td>B.Y. 11 &quot;</td>
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<td>J.J. 7 &quot;</td>
<td>9th + 18th Neg.</td>
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<td>C.E. 7 &quot;</td>
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<td>C.T. 13 &quot;</td>
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<td>5th + 12th + 28th Neg.</td>
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<td>M.B./</td>
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<td>Name &amp; Age.</td>
<td>Day of Disease and Result.</td>
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<td>Day of Disease and Result</td>
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<td>Name &amp; Age</td>
<td>Day of Disease and Result</td>
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<td>3rd + 10th + 20th Neg.</td>
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<tr>
<td>W.R.</td>
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</table>
Taking the average of this series, it is found that the duration of the reaction is 29 days, that is to say Negative at the end of the fourth week.

The degree of intensity of the reaction is found to decline as convalescence advances, many cases being negative by the end of the third week.

The shortest period observed was thirteen days, the longest was ninety six days and this latter case was still positive at that date.

**Effect of Complications on the Duration of the Reaction.**

It was noticed, while carrying out the above observations, that the presence of complications seemed to prolong the duration of the reaction.

The case mentioned above was particularly noteworthy, J.S. age 8 years, who developed *Scarlatinal Nephritis*.
Nephritis on his 22nd day, and was still positive when discharged on his 96th day.

The following series of cases was therefore investigated to determine whether the presence of complications did or did not prolong the duration of the reaction.

<table>
<thead>
<tr>
<th>Name &amp; Age</th>
<th>Complications</th>
<th>Day when Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>T.B. 5 years</td>
<td>Rhinitis</td>
<td>Negative on 49th day.</td>
</tr>
<tr>
<td>J.McF. 6 &quot;</td>
<td>Otorrhoea (double)</td>
<td>&quot; &quot; 36th &quot;</td>
</tr>
<tr>
<td>A.S. 2 &quot;</td>
<td>Adenitis: Rhinitis</td>
<td>&quot; &quot; 30th &quot;</td>
</tr>
<tr>
<td>G.G. 8 &quot;</td>
<td>Nephritis</td>
<td>&quot; &quot; 34th &quot;</td>
</tr>
<tr>
<td>D.A. 5 &quot;</td>
<td>Otorrhoea</td>
<td>&quot; &quot; 36th &quot;</td>
</tr>
<tr>
<td>W.B. 30 &quot;</td>
<td>Adenitis:Arthritis</td>
<td>&quot; &quot; 60th &quot;</td>
</tr>
<tr>
<td>J.S. 8 &quot;</td>
<td>Nephritis</td>
<td>Positive &quot; 96th &quot;</td>
</tr>
<tr>
<td>T.O. 10 &quot;</td>
<td>Rhinitis: Adenitis Otorrhoea</td>
<td>Negative &quot; 30th &quot;</td>
</tr>
<tr>
<td>W.W. 13 &quot;</td>
<td>Arthritis</td>
<td>&quot; &quot; 35th &quot;</td>
</tr>
<tr>
<td>J.B. 14 &quot;</td>
<td>Adenitis</td>
<td>&quot; &quot; 30th &quot;</td>
</tr>
<tr>
<td>S.W. 4 &quot;</td>
<td>Rhinitis</td>
<td>&quot; &quot; 31st &quot;</td>
</tr>
<tr>
<td>M.R. 1 &quot;</td>
<td>Otorrhoea</td>
<td>&quot; &quot; 45th &quot;</td>
</tr>
<tr>
<td>R.M. 11 &quot;</td>
<td>Adenitis: Rhinitis</td>
<td>&quot; &quot; 50th &quot;</td>
</tr>
<tr>
<td>T.K. 3 &quot;</td>
<td>Rhinitis</td>
<td>&quot; &quot; 34th &quot;</td>
</tr>
<tr>
<td>J.W. 6 &quot;</td>
<td>Adenitis</td>
<td>&quot; &quot; 40th &quot;</td>
</tr>
<tr>
<td>J.S. 10 &quot;</td>
<td>Nephritis</td>
<td>&quot; &quot; 38th &quot;</td>
</tr>
<tr>
<td>E.A. 15 &quot;</td>
<td>Adenitis</td>
<td>&quot; &quot; 34th &quot;</td>
</tr>
<tr>
<td>J.J. /</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name &amp; Age</td>
<td>Complications</td>
<td>Day when Negative</td>
</tr>
<tr>
<td>-----------</td>
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</tr>
<tr>
<td>J.J. 31 years</td>
<td>Arthritis</td>
<td>Negative on 40th day</td>
</tr>
<tr>
<td>W.Z. 7 &quot;</td>
<td>Rhinitis</td>
<td>&quot; 34th &quot;</td>
</tr>
<tr>
<td>G.C. 6 &quot;</td>
<td>Adenitis</td>
<td>&quot; 24th &quot;</td>
</tr>
<tr>
<td>A.M. 3 &quot;</td>
<td>Adenitis</td>
<td>&quot; 32nd &quot;</td>
</tr>
<tr>
<td>D.K. 9 &quot;</td>
<td>Adenitis : Otorrhoea Rhinitis</td>
<td>&quot; 37th &quot;</td>
</tr>
<tr>
<td>C.L. 4 &quot;</td>
<td>Otorrhoea</td>
<td>&quot; 30th &quot;</td>
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<tr>
<td>A.F. 2 &quot;</td>
<td>Otorrhoea</td>
<td>&quot; 30th &quot;</td>
</tr>
<tr>
<td>M.S. 4 &quot;</td>
<td>Otorrhoea</td>
<td>&quot; 30th &quot;</td>
</tr>
<tr>
<td>A.M. 13 &quot;</td>
<td>Adenitis</td>
<td>&quot; 40th &quot;</td>
</tr>
<tr>
<td>H.S. 5 &quot;</td>
<td>Adenitis : Otorrhoea</td>
<td>&quot; 40th &quot;</td>
</tr>
<tr>
<td>C.T. 13 &quot;</td>
<td>Adenitis</td>
<td>&quot; 32nd &quot;</td>
</tr>
<tr>
<td>J.C. 12 &quot;</td>
<td>Adenitis</td>
<td>&quot; 34th &quot;</td>
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<tr>
<td>M.W. 7 &quot;</td>
<td>Rhinitis</td>
<td>&quot; 30th &quot;</td>
</tr>
<tr>
<td>M.B. 18 &quot;</td>
<td>Adenitis : Otorrhoea</td>
<td>&quot; 31st &quot;</td>
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<tr>
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<td>M.B. 13 &quot;</td>
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<td>&quot; 28th &quot;</td>
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<tr>
<td>M.H. 25 &quot;</td>
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<td>&quot; 32nd &quot;</td>
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<tr>
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<td>Adenitis</td>
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<tr>
<td>J.C. 12 &quot;</td>
<td>Adenitis</td>
<td>&quot; 38th &quot;</td>
</tr>
</tbody>
</table>

The average of these cases is found to be **34 days**, as compared with the average of **29 days** for all cases.

In/
In other words, if complications are present the reaction is prolonged to the end of the fifth week, while without complications it is absent at the end of the fourth week.

This is rather opposed to the findings of Rumpel and Leede who state that the reaction lasts till the end of the sixth week, even if there are no complications.

**Bearing of Age and Sex on the Reaction.**

As regards Age, it has already been stated that in babies of under two years no reliance can be placed on the results obtained, and, in fact, one gave up investigating such cases.

On the other hand, in the few adults that one had the opportunity of studying, it could not be said that in them the reaction differed in any way from that observed in the case of children and adolescents.

As regards Sex one can only say that on the whole the reaction tends to disappear rather sooner in girls than in boys, very probably on account of the softer arms of the former.

**Effect of Intensity of Rash.**

Should there be an intense rash present at the time of bandaging, the reaction will also be intense. Further, when such a rash has faded if the test is applied very soon after, from three to four days, the/
the reaction is often extremely marked.

Apart from this, however, no further influence was noticed, the duration of the reaction was not affected.

**Effect of Intercurrent Diseases.**

Twenty-three cases were studied:

- Diphtheria and Scarlet 12 cases.
- Mumps " " 1 case.
- Chicken-pox " " 7 cases.
- Whooping-cough " " 3 cases.

but in none of them was any influence noticed.

It might reasonably be expected that Diphtheria would in some way modify the reaction, but no effect of any kind was observed.

Having considered the various features presented by the reaction in scarlet fever, the next most obvious point to determine was "Is the reaction peculiar to scarlet fever, or is it obtained on other conditions?"

Various diseases were tested as well as several normal persons, and such rashes, drug, serum, etc., as one came across.

The following results were obtained:

- Diphtheria 22 cases
- Whooping cough 10 " All Negative.
- Chicken Pox 7 "
- Normal Persons 13 "

**MEASLES.**

Rumpel and Leede and Dr Bennecke state that the reaction/
reaction is sometimes observed in cases of Measles and one agrees with them that a reaction is obtained, but when examined carefully it is not found to be of exactly the same appearance as that obtained in scarlet fever.

Fifteen cases were examined and of these seven were positive, and eight negative.

The striking feature about the reaction was that the petechiae were arranged in small groups of six to eight corresponding accurately with the site of the macules. In only one case did the petechiae, very few in number, occur between the macules as well.

The reaction was not so liable to occur if the rash had faded, in six out of the seven positive the rash was present at the time of bandaging.

In all the negative cases the rash had faded, only staining was left.

In the positive cases, the reaction was negative soon after the rash had disappeared, from the sixth to the eighth day. In one case it lasted as long as the twelfth day.

GERMAN MEASLES.

Only four cases were met with and of these two were positive and two negative.

The reaction obtained resembled that of scarlet fever much more closely than did that of Measles.
The petechiae were if anything larger than those seen in scarlet, they were more scattered and more irregularly distributed.

In the two positive cases the rash was present at the time, and they were both negative at the end of the first week.

**DRUG RASHES.**

One only met with two of these, the first an Opium rash, and the second probably due to Copaiba.

1. A.W. Age 45 years. Admitted on October 26th as Erysipelas. On admission the face was very flushed and the eyelids oedematos. Over the trunk and limbs was a well-marked punctate scarlatiniform rash. Temperature normal, pulse 82, tongue furred, throat normal.

   History of having taken a dose of Tinct. Opii and 0l. Ricini on October 25th, and the patient stated that she had a similar rash two years before after taking Tinct. Opii.

   On October 27th, the rash being still bright, her arm was bandaged for ten minutes with a markedly positive reaction, indistinguishable from that obtained in a good case of scarlet fever.

   On 1st November (six days after admission) when the rash had disappeared, she was again bandaged, this time with a negative result.
20.

2. D.M. Age 39 years; admitted as a case of scarlet fever.

On admission there was a bright scarlatiniform rash over the trunk and limbs, but no temperature, tongue and throat normal.

History of having taken De Wit's pills before admission. These pills probably contained Copaiba.

On the day of admission he was bandaged for 15 minutes with a slight but definitely positive reaction.

On the third day since admission, when the rash had faded, he was again bandaged, the result this time being negative.

ENEMA RASHES.

1. R.S. Age 6 years. A case of scarlet fever which on the 52nd day of stay in hospital developed an enlarged tonsillar gland with some constitutional disturbance (T.101).

The patient was given an enema at night and next morning there was a scarlatiniform rash present which had almost entirely disappeared by evening when the bandage was applied with a negative result.

2. A.W. 22 years. A maid in hospital who was suffering from gastric ulcer.

She was being fed by the bowel and on the third day of/
of treatment she developed a morbiliform rash on the chest and thighs, which changed to a general scarlatiniform rash on the next day. On the following day she was bandaged for ten minutes with a negative result.

**SERUM RASHES.**

The first of this series of seven cases was a rash due to antistreptococcal serum, the other six cases were all due to antiphtheritic serum.

1. *Mrs C.* Age 33 years. A case of puerperal fever who had received in all 90 c.c. of antistreptococcal serum. After an interval of eighteen days she developed a well-marked scarlatiniform rash on the trunk and arms, becoming urticarial on the thighs. Bandaged for ten minutes - Positive. Six days later when all signs of the rash had disappeared she was again bandaged, this time with a negative result.

2. *D.F.* Age 3 years. Had a slight patch on one tonsil. Swab+. Received 3000 units of antitoxin. On the 28th day she developed a general urticarial rash. Was bandaged for ten minutes with a negative result.

3. *A.G.* Age 4 years. Patching on both tonsils. Swab+. Received 3000 units. Two days later she developed a scarlatiniform rash on the trunk and/
and arms, becoming morbiliform on the buttocks and legs. Bandaged for ten minutes - Negative.

Four days after the appearance of the first rash, she developed a general urticarial eruption. Patient was again bandaged and again with a negative result.

4. J.B. Age 22 years. Speckling of both tonsils. Swab–+. Received 1500 units. Two days later he showed a general scarlatiniform rash. Next day - the rash having faded - he was bandaged with a negative result.

5. J.D. Age 18 years. Patching on tonsils and uvula. Swab–. Received 4000 units. Two days later he developed an erythematous rash over the face, trunk, and arms, becoming urticarial over the thighs and legs. Was bandaged for ten minutes and a marked exaggeration of the rash was produced, but no petechiae. Four days later when the rash had quite gone, he was again bandaged with an entirely negative result.

6. J.R. Age 2 years. A laryngeal case, received 20,000 units.

After an interval of twenty days, he developed an urticarial rash on the trunk, erythematous on the arms and thighs. Bandaged/
Bandaged for ten minutes - Negative.

7. C.D. Age 19 years. Speckling on both tonsils. Swab+. Received 1500 units. Five days later he developed a general urticarial rash. Bandaged for ten minutes with a negative result.

The real test of the value of the phenomenon comes when one investigates cases which are doubtful, where there may be merely a history of vomiting or sore throat and of a rash having been seen; cases where there may be only an indefinite rash or a suspicious tongue to go upon; cases of mistaken diagnosis, etc., and of these one had the opportunity of studying a considerable number.

The first series, one of 17 cases, shows the value of the reaction from a negative point of view. These cases were all sent in as scarlet fever, but none of them desquamated and none of them were positive to the test.

J.A. Age 21 years. History of sore throat and rash. On admission there was a red mottled flush only present on the chest and not in any way resembling a scarlet rash. The tongue was coated, papillae not enlarged, the throat was slightly congested.

Bandaged fifteen minutes - Negative.

Did not desquamate.
M.A. Age 25 years. (Sister of above) History of headache, sore throat, shivering and rash. No rash visible on admission. Tongue furred. Bandaged fifteen minutes - Negative. Did not desquamate.

E.C. Age 6 years. History of sore throat and vomiting eight days before admission. Nothing in diagnostic any way observed on examination. Bandaged ten minutes - Negative. Did not desquamate.

J.W. Age 9 Years. History of having had scarlet seven years ago. Said to be in eighth day. No evidence of a rash. Tongue showed nothing. Bandaged fifteen minutes - Negative. Did not desquamate.

E.C. Age 2 years. History of vomiting. Tongue and throat showed nothing. Scarlatiniform rash limited to the trunk. Bandaged fifteen minutes - Negative. Did not desquamate.

B.L. Age 1 year. History of being out of sorts. No rash on trunk, flush on arms and legs, not punctate. Tongue showed nothing. Bandaged ten minutes - Negative. Did not desquamate.

J.C. Age 15 years. History of sore throat. Face flushed on admission, no rash present. Throat congested/
congested, tonsils swollen and speckled with follicular exudation. Swab negative.

Bandaged ten minutes - Negative.

Did not desquamate.

Diagnosed as a case of acute tonsillitis.

W. J. Age 2 years. History of sore throat, vomiting and sneezing five days before admission. No rash present. Tongue showed nothing.

Bandaged ten minutes - Negative.

Did not desquamate.

B. K. Age 9 years. History of headache and sore throat. Slight flush on trunk. Tongue showed nothing. Throat congested, clean. Swab +

Bandaged fifteen minutes - Negative.

Did not desquamate.

H. T. Age 1½ years. History of pneumonia fourteen days before admission. Sore throat and rash two days before admission. Nothing in any way diagnostic to be seen on examination.

Bandaged ten minutes - Negative.

Did not desquamate.

E. S. 20 Years. History of headache, backache, and sore throat. Face flushed, flush also on trunk. Tongue coated, papillae not enlarged. Throat slightly congested.

Bandaged ten minutes - Negative.

Did not desquamate.

Diagnosed as a case of influenza.

A. J./
A.J. Age 3½ years. History of sore throat and coughing twelve days before admission. Sent in because her sister developed scarlet a week later (her sister was an undoubted scarlet). On admission her tonsils were patched on both sides. Swab + . There was nothing pointing to a diagnosis of scarlet fever.

Bandaged ten minutes - Negative.

Did not desquamate.

Was a case of true faucial diphtheria.

C.H. 21 years. History of headache and sore throat three days before admission. On examination there was a flush over the body, the tongue was very dirty, and both the tonsils were patched. Swab + .

Bandaged ten minutes - Negative.

Did not desquamate.

Also a case of faucial diphtheria.

D.S. 16 years. History of headache, vomiting, and sore throat on the day before admission. On examination, the face was flushed and there was a flush over the body. The tongue was heavily coated and the throat congested.

Bandaged ten minutes - Negative.

Next day there were definite physical signs of pneumonia at the right base.

Then come a series of five interesting cases.

About the middle of January there were admitted from the/
The Simpson Memorial Hospital, four nurses and one patient, the latter being a typical puerperal scarlet in her third day, who gave a very good reaction and subsequently desquamated.

As a result of this three of the nurses who had been complaining of headache and sore throat a fortnight previously, and one who had complained of sore throat and vomiting eight days before admission were sent out. Of these four, the first three did not give any reaction and did not desquamate. In all probability they had suffered from influenza.

The fourth case, on the other hand, gave quite a good reaction and subsequently showed very typical desquamation. This nurse doubtless infected the patient.

Nurse D.  Age 25 years.  History of sore throat and out of sorts thirteen days before admission.

Nothing diagnostic on examination.

Bandaged ten minutes - Negative.

Did not desquamate.

Nurse R.  Age 23 years.  Out of sorts, headache and sore throat eighteen days before admission. Nothing diagnostic seen on examination.

Bandaged ten minutes - Negative.

Did not desquamate.

Nurse L.  Age 32 years.  Headache and sore throat fifteen days before admission.  On examination the tongue/
tongue was coated and the tonsils speckled. Swab negative.

Bandaged ten minutes - negative.

Did not desquamate.

Nurse M. Age 28 years. Sore throat and vomiting followed by a rash eight days before admission. Rash was stated to have been irritable. On examination there was an erythematous rash on the legs. Tongue and throat showed nothing.

Bandaged ten minutes - Positive.

Desquamated.

The next series of cases, 25 in number, are the opposite of the above, showing as they do the value of the test when positive.

These cases were for the greater part notified as "Observation Scarlet", and they certainly were very doubtful.

They were all positive to the test and all subsequently desquamated.

H.G. Age 2 years. Said to be in second day. Flush on trunk, blotchy rash on legs. Tongue suspicious.

Bandaged ten minutes - Positive.

Desquamated.

G.S. Age 8 years. History of vomiting and sore throat eight days before admission. Nothing in any way diagnostic to be seen on examination.

Bandaged/
Bandaged fifteen minutes - Positive.
Desquamated.

M.R. Age 1 year. History of rash and croupy cough four days before admission. Miliary rash was present on trunk and arms. Tongue suspicious.
Bandaged ten minutes - Positive.
Developed otorrhoea and subsequently desquamated.

M.R. Age 7 years. History of vomiting and rash four weeks before admission. No desquamation and nothing diagnostic to be seen.
Bandaged ten minutes - Positive.
Desquamated.
The history in this case was doubtless erroneous and therefore very misleading.

D.R. Age 9 years. Said to be in 18th day on admission. No desquamation visible, and nothing diagnostic to be seen.
Bandaged ten minutes - Positive.
Desquamated.
Another misleading history.

A.S. Age 7 years. History of sore throat three days before admission. Uniform flush present, tongue coated, throat patched. Swab +, received 1500 units of antitoxin.
Bandaged ten minutes - Positive.
Desquamated.
Was thought to be purely a case of diphtheria.

B.W./
B.W. Age 3 years. History of sore throat three days before admission. A very peculiar rash was present over the arms, buttocks, and legs, but not on the trunk. It was purply red, raised and blotchy for the most part but becoming confluent over the elbows and knees. The tongue was fairly typical.

Bandaged ten minutes - Positive.
Desquamated.
The case pursued quite a normal course.

J.F. Age 4½ years. History of headache and vomiting three days before admission. There was a doubtful rash only present on the legs. Tongue furred but not typical.

Bandaged ten minutes - Positive.
Desquamated.

R.McD. Age 7 years. History of vomiting and sore throat five days before admission. No rash visible and nothing diagnostic.

Bandaged ten minutes - Positive.
Desquamated.

A.B. Age 3 years. History of vomiting and sore throat five days before admission. Miliary rash present on trunk. Tongue and throat showed nothing.

Bandaged ten minutes - Positive.
Desquamated.
This case was thought to be sweat rash.

J.J. Age 7 years. History of headache and sore throat/
throat nine days before admission. Nothing diagnostic to be seen on examination.

Bandaged ten minutes - Positive.
Desquamated.

C.E. Age 7 years. History of headache, vomiting, and sore throat three days before admission. No rash present on trunk, blotchy rash on arms and legs. Tongue fairly typical.

Bandaged ten minutes - Positive.
Desquamated.

H.D. Age 19 years. History of sore throat seven days before admission. Nothing diagnostic on examination.

Bandaged ten minutes - Positive.
Desquamated.

W.B. Age 24 years. Rash noticed five days before admission. No constitutional disturbance whatever. No signs of scarlet on examination and it was thought to be a drug rash.

Bandaged ten minutes - Positive.
Desquamated typically.

F.J. Age 2 years. History of vomiting and cough two days before admission. Was sent in as diphtheria. Swab - . Left tonsil patched, tongue suspicious, no traces of a rash.

Bandaged ten minutes - Positive.
Desquamated.

J.B./
J.B. Age 7 years. Sore throat five days before admission. No rash visible, but the tongue was suspicious.

Bandaged ten minutes - Positive.
Desquamated.

M.W. Age 3 years. Vomiting and sore throat five days before admission. Traces of rash on back and thighs. The tongue showed nothing.

Bandaged ten minutes - Positive.
Desquamated.

E.R. Age 15 years. Headache and sore throat three days before admission. Very doubtful rash present, tongue showed nothing.

Bandaged ten minutes - Positive.
Desquamated.

M.S. Age 4 years. Admitted as a case of whooping cough. There was a paroxysmal cough on admission and she subsequently developed a typical whoop. At the same time an indistinct faded rash was noticed on the back, the tongue was furred but did not clean. The throat was slightly congested and both tonsils were speckled. Swab - .

Bandaged fifteen minutes - Positive.
Desquamated.

J.L. Age 10 years. Vomiting and sore throat eleven days before admission. Tongue was coated but not typical. There was nothing diagnostic.

Bandaged/
Bandaged fifteen minutes - Positive.
Desquamated.

C.I. Age 5 years. Sore throat and vomiting two days before admission. Face flushed and there was a flush over the body. Tongue was suspicious, and the throat was slightly congested.
Bandaged fifteen minutes - Positive.
Desquamated.

D.M. Age 31 years. Headache and sore throat three days before admission. Tongue suspicious, and there was a flush over the body with a blotchy rash over the elbows and knees.
Bandaged ten minutes - Positive.
Desquamated.

D.N. Age 10 years. Headache and sore throat five days before admission. Miliary rash present on trunk, thought to be a sweat rash. The tongue showed nothing.
Bandaged ten minutes - Positive.
Desquamated.

The following series of six cases bring home to one the fact that the test is not infallible. These cases were all Observation Scarlets, and though they were positive, they did not desquamate.

A.G. Age 3 years. Vomiting and out of sorts ten days before admission. Nothing diagnostic on examination/
examination.

Bandaged ten minutes - Positive.
Did not desquamate.

A.B. Age 17 years. Headache and sore throat with history of a rash on the chest six days before admission. Tongue was coated but not typical, there was nothing diagnostic present.

Bandaged ten minutes - Positive.
Did not desquamate.

M.G. Age 4 years. Sore throat nine days before admission. Nothing diagnostic observed.

Bandaged ten minutes - Positive.
Did not desquamate.

J.M. Age 6 years. Out of sorts and rash seen five days before admission. Nothing diagnostic to be seen.

Bandaged ten minutes - Positive.
Did not desquamate.

W.E. Age 10 years. Out of sorts six days before admission. Nothing diagnostic to be seen on examination.

Bandaged ten minutes - Positive.
Did not desquamate.

G.E. Age 5 years. Out of sorts and flush seen six days before admission. Nothing diagnostic observed.

Bandaged ten minutes - Positive.
Did not desquamate.

The/
The above three groups, then, comprise a series of 48 doubtful cases. Of these 17 which were negative did not desquamate; 25 which were positive desquamated; while 6 which were positive did not desquamate.

It is both interesting and important to note that one never came across a single case which was negative and subsequently desquamated.

The next series of eight cases bring out some interesting points. Six of them were relapses, two were suspected relapses.

Of these latter two, one was a case of acute tonsillitis, the other was an enema rash.

As regards the relapses it is of interest to note that they gave a positive reaction on admission and were again markedly positive with the second eruption.

Further, in those that had been followed out during their stay in hospital it was found that the reaction had become negative some time before the relapse occurred.

R.H. Age 5 years. Admitted on third day. Rash fading. Tongue typical.

Bandaged five minutes - Positive.

Was negative when tested on the second day.

On the 38th day she complained of headache and sore throat and next morning there was a well-marked punctate rash, coated tongue (which later cleaned typically)
typically) and a congested throat.

Bandaged ten minutes - Positive.

The following two cases are relapses in which the second rash appeared while the patient was desquamating. In the first case the relapse occurred in hospital; in the second the relapse occurred outside and the patient was admitted showing profuse desquamation and a typical punctate rash.

W.S. Age 5 years. Admitted on second day with a good rash and a typical tongue.

Bandaged five minutes - Positive.

On his 37th day, while his hands and feet were desquamating, he complained of sore throat and vomited twice. Next day there was a brilliant punctate rash present.

Bandaged ten minutes - Positive.

W.B. Age 6 years. Hands were desquamating and feet subsequently desquamated. Traces of a rash on the trunk, blotchy rash over elbows, buttocks and legs. Tongue typical, throat congested.

Bandaged ten minutes - Positive.

Desquamated a second time.

The next three cases were, as far as one could judge, true relapses.

M.W. Age 3 years. Third day. Fading rash. Tongue quite typical.

Bandaged/
Bandaged five minutes - Positive.

Negative on 28th day.

On the 36th day she had a relapse, typical scarlet rash, tongue covered with white fur, throat congested. 
Bandaged ten minutes - Positive.

E.P. Age 4 years. Second day. Brilliant rash. 
Tongue typical.

Bandaged ten minutes - Positive.

On the 30th day he complained of sore throat and vomited. Rash noticed next day, not very marked. 
Throat congested.

Bandaged ten minutes - Positive.

A.F. Age 2 years. Third day. Well marked rash, tongue typical.
Bandaged ten minutes - Positive.

Negative on 18th day.

On 31st day vomited, punctate rash, throat congested.

Bandaged ten minutes - Positive.

The next two cases are the suspected relapses spoken of above.

J.C. Age 13 years. History of headache and sore throat three days before admission. Had a fading rash. Tongue quite typical.

Bandaged ten minutes - Positive.

Desquamating on 22nd day.

On the 31st day the temperature rose to 102.4°. No rash present, face flushed, tongue coated, throat congested and tonsils patched. Swab -.

Bandaged/
Bandaged ten minutes - Negative.
Diagnosed as a case of acute tonsillitis.

R.S. Age 6 years. Vomiting and headache three days before admission. Well marked rash, a typical tongue.

Bandaged ten minutes - Positive.
On her 32nd day temperature rose to 101°, face flushed, no rash, tongue and throat showed nothing. Next morning there was a good punctate rash present.

Bandaged 10 minutes - Negative.
It was ascertained that the nurse had given an enema the night before, while the constitutional disturbance was accounted for by the presence of an enlarged and painful tonsillar gland.

The practical application of the test is shown by the following cases.

About the beginning of November there was an outbreak of scarlet fever in the diphtheria wards, three cases developing undoubted scarlet. Examination of every case in the ward revealed the following:-

J.N. Age 3 years. History of vomiting and shivering three days before admission. Examination showed a small patch on the right tonsil. Swab +.
Received 1500 units of antitoxin.
At the time of examination, after the outbreak of scarlet (ten days after admission) there was some cracking/
cracking of the skin at the nail fold.

Bandaged ten minutes - Positive.

Subsequently desquamated quite typically.

Nothing had been suspected on admission.

The next case undoubtedly caused a second outbreak about the middle of December.

R.S. Age 19 years. History of sore throat, there was patching on both tonsils. Swab +. Received 3000 units. A flush was present on the body at the time of admission, but nothing else in any way suspicious. The possibility of the case having scarlet fever as well was not considered.

As a result of three cases of scarlet occurring in the ward, this case was suspected by the sister in charge and one was asked to apply the test, which was done with a definitely positive result.

These cases occurred before one had charge of the Diphtheria wards. Afterwards every case in the least suspicious was tested, with the following results:-

F.J. Age 2 years. History of vomiting five days before admission. The throat was patched on the left side. Swab -. No signs of a rash, but the tongue was suspicious. Bandaged ten minutes - Positive. Was isolated. Desquamated.

C.I. Age 5 years. Sore throat and vomiting two days before admission; both tonsils patched; Swab +. Received 3000 units antitoxin. Face flushed, no rash/
rash. Tongue suspicious.

Bandaged ten minutes - Positive.

Isolated. Desquamated.

J.M. Age 31 years. Headache and sore throat three days before admission. Throat congested, both tonsils patched. Swab - . Flush on body, tongue suspicious.

Bandaged ten minutes - Positive.

Isolated. Desquamated.

D.H. Age 10 years. Headache and sore throat five days before admission. On examination the throat was very red, and the left tonsil was patched. Swab + . Received 1500 units of antitoxin. There was a miliary rash present over the trunk. The tongue showed nothing.

Bandaged ten minutes - Positive.

Isolated. Desquamated.

C.H. Age 21 years. Headache and sore throat three days before admission. Both tonsils patched. Swab + . Received 4000 units of antitoxin. Flush present over trunk. Tongue very dirty.

Bandaged ten minutes - Negative.

Not isolated. Did not desquamate.

B.K. Age 9 years. Headache and sore throat six days before admission. Nothing to be seen on the throat which was slightly congested. Swab + . Received/
Received 1500 units of antitoxin. The face was flushed and the tongue heavily coated.

Bandaged fifteen minutes - Negative.

Not isolated. Did not desquamate.

The last case is one which was sent in as whooping cough but in which the history was suspicious.

M.S. Age 4 years. Headache, vomiting, and sore throat seven days before admission. Was a typical whooping cough. Nothing suspicious beyond the history.

Bandaged ten minutes - Positive.

Isolated. Desquamated.

CONCLUSIONS.

In the first place, this is an eminently practical aid to diagnosis. Very little experience is required to know when the bandage is properly adjusted, and to recognise the reaction given by a case of scarlet fever.

It is not an infallible test nor does it pretend to be, witness the six cases which were positive and did not desquamate.

I.

If there has been no rash there will be no reaction.

This is a most valuable conclusion to arrive at,
for it is equivalent to saying that if the test is
negative the case is not one of scarlet fever. Further-
more, this conclusion has been amply verified in
practice, not only on normal persons but more especially
on those diseases which are frequently mistaken for
scarlet fever, viz., acute tonsillitis, influenza,
pneumonia, and diphtheria, all of which were met with.

One cannot emphasise too strongly the importance
of a negative result.

As a corollary to this conclusion it might be
pointed out that negative results are obtained during
the invasion period of scarlet fever. This, of course,
is to be expected for there has been no rash over the
arms.

The test, then, is of no value during the invasion
period.

II.

If there is a rash present of a scarlatiniform
nature, there will almost invariably be a positive
reaction.

In the case of drug rashes, serum rashes, etc., it
has been shown that the reaction is positive but only
for so long as the rash is out. As soon as the rash
has disappeared the reaction is negative.

In the case of measles it has been shown that the
appearance of the reaction obtained is peculiar to that
disease, and further that no reaction is obtained after
the/
the end of the first week.

In the case of German measles, the reaction obtained closely resembles that of scarlet fever, and in one case the reaction persisted for as long as the twelfth day. Again the diagnosis between German measles and scarlet fever is not always easy especially in the former when the rash has left the circumoral region. Other symptoms of course may make the diagnosis clear, but one would have liked to have had more opportunity for studying the reaction in this disease.

On the whole, therefore, the point brought out by this conclusion is that the test is of little value during the eruptive period of scarlet fever. A positive reaction obtained when a scarlatiniform rash is present must be weighed up along with all the facts of the case.

III.

The test is of the utmost value in the diagnosis of scarlet fever from the fourth or sixth day up to the fourteenth or sixteenth day or later.

In no other condition than scarlet fever does the reaction persist for such a length of time. The average duration is, as has been shown 29 days.

This period amply covers that interval between the return of the typical "Red Strawberry" tongue to normal, and the appearance of the first signs of desquamation - an interval during which it is impossible to arrive at/
at a definite diagnosis.

The typical red strawberry tongue does not usually retain its diagnostic appearance later than the sixth or seventh day, while in many cases no desquamation may appear on the trunk or extremities and it may be three weeks before the hands begin to peel.

It is this hiatus which the Rumpel - Leede phenomenon fills in, in such a valuable manner.

Again in doubtful cases, that is to say cases known as observation scarlet so frequently met with, the test is of very great importance as an additional diagnostic sign. There may be merely a history of sore throat, no headache nor vomiting may have occurred. Again there may have been no constitutional disturbance whatever, or the history itself may be entirely misleading.

Again, apyrexial cases are met with, but more often one meets with mild cases where there has been little constitutional disturbance, and the other symptoms only slightly developed.

The rash may have been transient and altogether missed, or only the indefinite remains of a rash may be seen.

The tongue, which is so valuable a factor in diagnosis, may never reach its full development, i.e. it may never assume the red strawberry type.

Even as regards desquamation it is hazardous to arrive/
arrive at a diagnosis on that alone.

Desquamation frequently follows confinement to bed, especially is it seen on the palms and soles of those persons who have a tough skin.

Further, powdering of the skin is the rule in Rubella and in Measles, and is often observed after various drug and serum rashes and even after a simple erythema. Very typical pinhole desquamation was observed in the case of Opium rash described.

Considering all these points it will be at once apparent what a very valuable factor in the diagnosis of scarlet fever the Rumpel - Leede phenomenon is.

Personally, one found the reaction of even more practical value in the diphtheria than in the scarlet fever wards.

Cases are frequently notified as diphtheria because the throat is patched, but these cases are in reality scarlet fever where the rash has disappeared and desquamation not yet begun.

The swab taken of the throat may be positive, but then one must remember that scarlet fever and diphtheria frequently coexist in the same patient and further that scarlet fever patients often carry the Klebs - Löffler bacilli in their throats.

Many cases, then, are quite impossible to diagnose and it is in these that the test is of great value.

It/
It is of the first importance to be able to say whether a case admitted as diphtheria and which can only be termed suspicious at the most, is or is not suffering from scarlet fever, knowing as we do how very susceptible diphtheria patients are to that disease.

The excellent results obtained in this respect are shown in the last four pages of the thesis.

Limitations of the Test.
(a) In Babies.
(b) In German measles to a certain extent.
(c) During the invasion period of scarlet fever.
(d) While a rash is present on the body.

SUMMARY,

1. If there has been no rash there will be no reaction.
   (a) If negative, the case is not one of scarlet fever.
   (b) Of no value during the period of invasion.

2. If a rash is present on the body there may be a positive reaction.
   (a) Other facts must be taken into account with a positive result during this period.
   (b) Positive reaction invariably present if the rash is due to scarlet fever.

3. Of very great value after the rash has disappeared and before desquamation has commenced.
   (a)
47.

(a) In no other condition except scarlet fever does the reaction persist for such a length of time.

(b) Of extreme importance in all doubtful cases.

(c) Value as a practical method of diagnosis very apparent in the diphtheria wards.