hope that the high virulence of this pneumococcus will facilitate the preparation of serum which may be efficient in cases of ordinary "pneumonia" as occurring in Europeans. In excuse for these many shortcomings we can only say that the present work was carried out in the spare time snatched from our private practices, and that we feel constrained to publish our results thus early in the hope that other observers will establish our chief contention that infection by the pneumococcus is primarily a purely local phenomenon.

Johannesburg, South Africa.

THE USE OF FORMALIN LAMPS FOR THE DISINFECTION OF ROOMS (ALFORMANT LAMPS AND FORMOGÈNE RICHARD).

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THE disinfection of rooms, furniture, and bedding is a matter of great importance to all general practitioners and especially to those who live in the country. It must be the desire of all to possess a method which is both simple and certain and, at the same time, not destructive in its action. Numerous papers have appeared recently which have occupied themselves with the question of the disinfecting power of formalin vapour. It is generally allowed that formalin vapour is a powerful disinfectant and it therefore promises to replace those gaseous substances which have hitherto been in use and of which some are useless and others injurious to man and the objects around. Lately simple and complicated forms of apparatus have been designed for the rapid and continued production of formalin vapour, and these by their manufacturers have been recommended as being unfailing in their disinfecting action. Writers abroad, however, are gradually recognising the limitations of the formalin process and there is now an almost general consensus of opinion that formalin in the manner in which it is produced by almost all the different apparatus in use has only a limited power of penetration. There is no necessity for me to survey the extensive literature upon this subject of disinfection of rooms by means of formalin vapours, since it may be found in almost any recent volume of the *Centralblatt für Bacteriologie* and the *Zeitschrift für Hygiene*.

In this country three formalin lamps are in use, and having been frequently asked regarding their respective value I undertook a series of experiments in order to satisfy myself on this point, especially since others have already spoken with unveiled enthusiasm of these lamps. The Formalin Hygienic Company supply two simple apparatus—viz., the Alformant Lamps A and B; and the Germicide Disinfecting Association a somewhat more complicated lamp, the Formogène Richard Lamp. In this paper I propose to describe a number of experiments which were made under laboratory conditions with the purpose of independently testing the efficiency of these three lamps, which all profess to accomplish similar results. By means of laboratory experiments, however, we can only decide under what conditions formalin vapours are likely to act; the final verdict must be pronounced when an apparatus has been tested under practical conditions. The principle of the Alformant lamps depends upon the conversion of solid paraform into active formalin gas by means of heat in the presence of water and carbonic acid. Alformant Lamp B is a small, toy-like apparatus, and it is stated in the directions for use that one tablet of paraform is required for the ordinary sterilisation of 1000 cubic feet of air and ten tablets are required for thorough disinfection and certain destruction of all pathogenic germs in 1000 cubic feet of space, whether these be scattered about superficially or hidden in bedding, stuffed seats, books, &c. Alformant Lamp A is merely a larger model; otherwise it is said to act in exactly the same manner as Alformant Lamp B. In the Formogène Lamp the formalin is obtained by means of

the incomplete combustion of strong wood spirit. It is unnecessary for me to describe the mechanism of the lamps and I shall at once proceed to state my results.

1. *Alformant Lamp B (small pattern)*.—Two sets of experiments were made and in each case 25 tablets were burnt. A room was used, the windows, fireplace, and other openings of which were carefully closed and sealed, so that little or no formalin could or did escape. It has recently been stated that such stringent precautions are not necessary, but it seemed advisable under the circumstances to prevent any loss of the formalin vapour. The measurement of the room was 18 ft. by 12 ft. by 9 ft.—that is, its capacity was well under 2500 cubic feet, so that, according to the instructions, 25 tablets should have amply sufficed for complete disinfection. As test objects I used small strips of linen which had been dipped (1) in 24 hours old broth cultures of anthrax bacilli; (2) in 24 hours old broth cultures of typhoid bacilli; (3) in 24 hours old broth cultures of staphylococcus pyogenes aureus; (4) in sewage effluent; and (5) in an old typhoid stool. These were subsequently dried over sulphuric acid at 38° C. The dust of the room also served as a test object and animals were placed in the room during the experiment. The strips were distributed in the room at different places, some openly exposed on the benches and on the floor, others wrapped up in ordinary dusters. After 24 hours the room was opened and the strips at once dropped into broth, and the latter was then incubated at 38° C. The results of these 2 experiments are given in tabular form.

Experiment I. (Alformant Lamp B).

Test material.	Exposed on table or floor.	Wrapped in dusters.
Linen strips dipped in sewage ...	+	-
Linen strips dipped in a typhoid stool ...	+	-
Linen strips dipped in culture of typhoid bacillus ...	+	-
Linen strips dipped in cultures of anthrax bacillus ...	+	-
Linen strips dipped in culture of staphylococcus pyogenes aureus ...	+	-
24 hours old culture of anthrax bacillus on agar-agar ...	-	-
Dust ...	+	...

+ = completely sterilised; - = not sterilised; and + = sometimes sterilised, at other times not sterilised.

We learn from this experiment that only the most superficially exposed material was disinfected and that the formalin failed to penetrate even through thin dusters.

A second experiment was arranged in exactly the same manner, 25 tablets being used as before. In this case all the linen strips, whether superficially exposed or not, had escaped the action of the formalin, so that this experiment was altogether negative, although all possible precautions had been taken.

Experiment II. (Alformant Lamp B).

Test material.	Exposed on table or floor.	Wrapped in dusters.
Linen strips dipped in sewage ...	-	-
Linen strips dipped in typhoid stool ...	-	-
Linen strips dipped in 24 hours old broth culture of typhoid bacillus ...	-	-
Linen strips dipped in 24 hours old broth culture of anthrax bacillus ...	-	-
Linen strips dipped in 24 hours old broth culture of staphylococcus pyogenes aureus ...	-	-
24 hours old agar-agar culture of anthrax bacillus ...	-	-
Dust ...	-	...

In this experiment disinfection failed completely.

It is evident, especially when we also consider Experiment I., that Alformant Lamp B is uncertain in its action and therefore untrustworthy. Hence this lamp, however

tempting in its modest simplicity it may appear, cannot be used for the disinfection of rooms, for certainty in its action must be a necessary condition.

2. *Alformant Lamp A*.—Having obtained such unsatisfactory or at any rate untrustworthy results with the smaller lamp I took the large Alformant Lamp A and using 50 tablets on this occasion I arranged the experiment almost exactly as the previous ones.

Experiment III. (Alformant Lamp A).

Test material.	Exposed on table or floor.	Wrapped in dusters.
Linen strips dipped in 24 hours } old broth cultures of typhoid bacillus	+	-
Linen strips dipped in 24 hours } old broth cultures of anthrax bacillus		
Linen strips dipped in 24 hours } old broth cultures of staphylococcus pyogenes aureus	+	+
Linen strips impregnated with } spores of the hay bacillus		
Dust	-	...

The previous experiment was repeated with the Alformant Lamp A, using again 50 tablets. The result was as follows:—

Experiment IV. (Alformant Lamp A).

Test material.	Exposed on table or floor.	Wrapped in dusters.	Placed in small book.	Placed in a blanket.*
Linen strips dipped in 24 } hours old broth cultures of bacterium coli	+	-	-	...
Linen strips dipped in 24 } hours old broth cultures of anthrax bacillus				
Linen strips dipped in 24 } hours old broth cultures of staphylococcus pyogenes aureus	+	-	...	-
Linen strips impregnated with } spores of the hay bacillus				
Linen strips dipped in } typhoid stool	-	-	-	...
Dust in room	-	...	...	...

* The blanket was hung over a cord and the strips were placed between the two layers.

We learn from these experiments that Alformant Lamp A is almost as uncertain in its action as Lamp B, that at best it only affects the most superficial organisms or materials, that it has little or no penetrating power, and that a single sterilisation is certainly insufficient.

It is difficult to explain how others, in this country especially, succeeded in getting better results; in my hands, however, numerous failures had to be recorded, so that although the lamp is infinitely better than SO₃, as ordinarily applied, it is not trustworthy enough for practical use when employed as indicated in the "directions for use." It may be mentioned that animals left in the rooms during the experiment invariably survived.

3. *Formogène Richard*.—Preliminary experiments showed that with a single lamp the results were uncertain and therefore I performed three complete experiments, using two lamps. In this case the odour of the gas which is given off is much stronger than is the case with the Alformant lamps, so that the cultivations at the end of the experiments were always made under considerable personal suffering on account of the strong irritant action of the gas, which made a prolonged sojourn in the room impossible. Animals left in the room during the process of disinfection invariably died, so that undoubtedly we are here dealing

with a much more powerful gas. The following results were obtained:—

Experiment V. (Formogène Richard—2 lamps).

Test material.	Exposed on table or floor.	Wrapped in dusters.	Placed in a small book.	Placed in a blanket.	Placed in a covered glass dish.	Placed in a bundle of cotton wool.
Linen strips dipped in 24 hours } old broth cultures of bacterium coli	+	+	+*	+	...	-
Linen strips dipped in 24 hours } old broth cultures of anthrax bacillus						
Linen strips dipped in 24 hours } old broth cultures of staphylococcus pyogenes aureus	+	+	+†	+	...	...
Linen strips impregnated with } the spores of the hay bacillus						
Dust	-	...	...	...	...	...

* Between pages 24 and 25. † Between pages 10 and 11.
‡ Between pages 100 and 101.

Experiment VI. (Formogène Richard—2 lamps).

Test material.	Exposed on table or floor.	Wrapped in dusters.	Placed in a small book.	Placed in a blanket.	Placed in a covered glass dish.	Placed in a bundle of cotton wool.
Linen strips dipped in 24 } hours old broth cultures of bacterium coli	+	+	+*	+	...	-
Linen strips dipped in 24 } hours old broth cultures of anthrax bacillus						
Linen strips dipped in 24 } hours old broth cultures of staphylococcus pyogenes aureus	+	+	+†	+	...	...
Linen strips impregnated with } spores of the hay bacillus						
Dust	-	...	...	...	...	...

* Between pages 24 and 25. † Between pages 18 and 19.
‡ Between pages 10 and 11.

In the following experiment the flue of the gas stove was left open in order to test whether it was necessary to observe the strictest precautions in sealing the room.

Experiment VII. (Formogène Richard, 2 lamps; flue open).

Test material.	Exposed on table or floor.	Wrapped in dusters.	Placed in a small book.	Placed in a blanket.	Placed in a covered glass dish.	Placed in a bundle of cotton wool.
Linen strips dipped in 24 } hours old broth cultures of bacterium coli	+	+	-*	...	...	...
Linen strips dipped in 24 } hours old broth cultures of anthrax bacillus						
Linen strips dipped in 24 } hours old broth cultures of staphylococcus pyogenes aureus	+	+	+†	+	...	...
Linen strips impregnated with } spores of the hay bacillus						
Dust	-	...	...	...	...	...

* Between pages 24 and 25. † Between pages 10 and 11.
‡ Between pages 18 and 19.

In this experiment the results were not quite so good or certain as in the previous cases and probably this was due to the fact that much of the formalin vapour escaped through the open flue.

Experiment VIII. Effect upon faecal stains and blood-stains.—Experiments were also made as to the effect of formalin vapour on faecal stains or blood-stains. It is important to know whether such stains are rendered indelible or not, for if they are it is obviously impossible to disinfect sheets or other materials soiled with faeces or blood without previously washing them. It was found that, as has already been shown by others, handkerchiefs stained with blood or faeces, although completely sterilised by the vapours produced by two Formogène Richard lamps, are ruined, because no amount of washing afterwards will remove the stains. It is therefore impossible to use formalin vapours for the direct disinfection of linen soiled with faeces or blood.

Experiment IX. Effect upon aniline dyes.—Silks dyed with aniline colours, as supplied by the "Farbwerke vorm. Meister Lucius und Brüning, Höchst," as patterns (standard colours on silk, 1894, No. 350), were exposed for 24 hours to the action of formalin vapours produced by two Formogène Richard lamps. It was found that the dyes were not destroyed or even altered in the slightest degree. Weak solutions of the following stains—methylene blue, gentian violet, Victoria blue, dahlia, methyl violet, thionine, Hoffmann's blue, Ehrlich's hæmatoxylin, and hæmalum—were similarly exposed for 24 hours, with the result that hæmalum alone was bleached. Therefore the formalin gas evolved by this lamp was perfectly harmless to the dyes in general use. It may be remarked also that metal and polished wood were in no way affected.

These results show the limits of room disinfection by these formalin lamps and I shall reproduce them in the shape of final conclusions. In other experiments which need not be detailed here I was able to confirm the view expressed by others, that active formalin vapours act best in a warm atmosphere, for I found that when I kept the gas burning during the twenty-four hours there were generally less failures with the sterilisation of dust than when the experiment was carried out under ordinary conditions.

FINAL CONCLUSIONS.

So far as my experiments go, Formogène Richard lamps are much more certain in their action than Alformant lamps A and B. Of the latter, B appears to me to be valueless, except as a deodorizer and A is too uncertain.

1. With regard to the Formogène Richard lamp it is necessary, as numerous preliminary experiments have shown me, to use two lamps, even for so small a room as the one in which these experiments have been made.

2. Formalin does not penetrate deeply and, as admitted by all competent observers, cannot be used for the sterilisation of blankets, linen, &c., heaped one upon the other; it is merely a superficial disinfectant.

3. It must be pointed out that blood and faecal stains are indelibly fixed in handkerchiefs and linen and such like material. Such articles must therefore be disinfected by means of boiling or steaming.

4. Metal, dyes, and most colours are not destroyed, although some aniline dyes may be slightly altered.

5. Dust and soil are not sterilised with certainty.

6. I agree, therefore, with F. Abba and Rondelli,¹ that formalin, if efficiently produced, is useful for the superficial disinfection of such substances as are injured by steam or liquid disinfectants or by irritant gaseous bodies such as chlorine.

When using the Formogène lamp for disinfection of a room strips of linen impregnated with staphylococcus aureus must be placed in the room as indicators; the disinfection is not complete unless these strips are sterile (Pfuhl's test).

A table has been prepared which allows of a ready comparison between the results obtained by the Alformant Lamp (A) and those obtained by the Formogène Lamp. It is evident from the table that results obtained with the latter are much more favourable than those obtained with the former. The experiments were conducted under identical conditions; the strips were exposed in the same places, they were prepared in the same manner, and subsequently tested by the same method. Recently Schlossmann has described a new process of disinfection by formalin

vapours which was tested in the Institut für Infektionskrankheiten and was pronounced to be highly efficient. As yet I have found difficulty in procuring this apparatus and therefore propose to report upon the same later. Trillat's apparatus I do not intend to discuss, because it is but little known in this country. It also, as shown by others, is useful only for superficial disinfection, and in this respect, provided that active formo-chloral has been used, works as well as, and no better than, the Formogène Lamp.

Tabular Comparison of Experiments IV., V., and VI.

Nature of organism.	Locality where strips were placed.	Alformant A, Experiment IV.	Formogène, Experiment V.	Formogène, Experiment VI.
Strips impregnated with bacillus anthracis.	Table I.	+	+	+
	Table II.	+	+	+
	In duster I.	+	+	+
	In duster II.	-	+	+
	In blanket.	-	+	+
	In book.	-	+	+
	In sawdust.*	-	+	+
	Under newspapers.*	-	+	+
Strips impregnated with bacterium coli.	In wool.	...	-	-
	In book.	-	+	+
	Table I.	+	+	+
	In duster I.	-	+	+
	In duster II.	-	+	+
	Under wool.*	+	+	+
	Under paper.*	-	+	+
Strips impregnated with staphylococcus pyogenes aureus.	In wool.	...	-	-
	Table I.	+	+	+
	Table II.	+	+	+
	Table III.	+	+	+
	Table IV.	+	+	+
	In duster I.	-	+	+
	In blanket.	-	+	+
	In book.	...	-	+

+ = successful disinfection.

- = unsuccessful disinfection.

* These experiments have not been specifically mentioned in the previous tables.

Cambridge.

OBSERVATIONS ON AN INFECTIOUS DISEASE IN LASCARS HAVING CLOSE RELATIONS WITH VARIOLA AND VARICELLA.

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THE following observations made upon a number of lascars admitted to the City of Glasgow Small-pox Hospital, Belvidere, in the spring of 1898 are of considerable interest in so far that the clinical features of the disease from which these men were suffering suggested in certain cases variola and in others varicella, while in all some of the symptoms presented were alien to both. 16 cases of the disease were observed in various stages. Some came under observation as early as the second day of illness, while others were not admitted to the wards till the fifth or sixth day. In one case only was the whole course of the disease observed from its onset till its termination. The patients were lascar seamen from a steamship trading between Calcutta and Glasgow. On board this vessel 69 lascars were employed, who were accommodated in the fore-castle and came little into contact with the European members

¹ Zeitschrift für Hygiene, 1898, vol. xxvii., p. 49.