high index frequently occurred, yet the condition was getting worse, and the weight (more important than all) was steadily tending downward.

It is held by all who use the opsonic method that vaccine treatment is most accurately and safely to be controlled by index determinations, but unfortunately in practice daily estimations can but rarely be performed. On the other hand, the majority of those who dispute that method, whilst they admit that theoretically an opsonic chart should be the ideal indicator, yet consider that errors of technique and personal bias are liable to invalidate the whole procedure and render it useless. If, now, it be granted that observations of excursions of the weight and of the opsonic index are but different methods of recording the course of immunity, then by means of the daily weight chart an opsonic curve is automatically obtained, and the objections to the index disappear. There remains a small minority who regard the opsonic index merely as a figment of an imaginative brain, and opsonic fluctuations as indicating changes in the grey matter of that brain rather than alterations in the serum under examination. For these the fact that fluctuations in the daily weight do occur as the result of tuberculin inoculation will require some other explanation, which one must leave to their ingenuity to supply.

How far this method is applicable in other vaccine therapeutics I am unable to say. It may, however, be of great value in the control of vaccines directed against secondary infection in tuberculosis.

Chart 4 gives the weight chart during four weeks when streptococcal vaccine for rheumatic pain and bronchitis was administered and controlled entirely by this method.

Chart 4.—Showing weight after streptococcal vaccine.

It will be noted that doses 1, 2, and 4 were of the correct size, but that dose 3 was too large.

In conclusion, I append suggestions for treatment of a case of phthisis by tuberculin, in accordance with the indications provided by a daily weight chart. Reference throughout is to T.R. or P.T.R. The daily weight is taken for a few days before the first dose, which should be small, in an afebrile case, say $\frac{1}{10}$ mg. of T.R., and whatever the weight curves may be, the interval between the doses should never be more than five days, until high doses are brought into requisition.

After a dose no curve may appear on the chart; the weight pursues its course steadily upwards, downwards, or in a straight line, as the case may be; one infers that the

dose is too small; it may be trebled on the third day. Should, however, a curve develop, then the next dose may be given in accordance with the accompanying table, and at that point in the curve indicated by the small arrows (see diagram).

After the patient has had a few doses, he may be instructed to come when the weight begins to fall after the rise, though not later than the fifth day.

THE BACTERIOLOGY OF THE MOUTH IN MAORI CHILDREN.

BEING PART OF AN INVESTIGATION INTO THE CAUSE OF
IMMUNITY TO DENTAL DISEASE IN THE MAORI
OF THE URIWERA COUNTRY, N.Z.

BY

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(Abstract.)

As stated in a previous report, a number of films were made from the mouth direct, in order to obtain a general idea of the number and character of the organisms present. All the films were made from perfectly healthy mouths, both as regards teeth and soft tissues. Except where otherwise stated, the subjects were children between the ages of 4 and 15 (approximately), since this represents the period of life during which European children appear to be most susceptible to dental caries. Four films were made from each of fifty immune individuals as follows:

1. From mixed saliva well triturated in an agate pestle and mortar, and stained by Gram's method.

2. From the gingival "deposit," of which there was in all cases extremely little, and in the younger children it was difficult to find. This was gently mixed with 0.9 per cent. sodium citrate on the slide, allowed to dry slowly, and subsequently stained by Gram's method, and counterstained with weak carbol fuchsin.

3. An attempt was made to estimate the number of organisms present in the saliva by making films of mixed saliva and citrated formalised blood, the idea being to count the organisms against the red blood cells, and so obtain an estimate of the number of organisms present in any given quantity of the saliva. It was not found practicable to shake the emulsion with sterile beads, but the saliva

was well triturated, and the mixture with the blood made as efficiently as possible. It has, however, been found, owing to the clumping of the organisms, their irregular distribution, and the presence of epithelial cells containing large numbers of organisms, that the slides are not of any practical value, for it was not possible to make a reliable count. The slides were stained by the Jenner method.

4. One film from the saliva was stained by Ziehl-Neelsen for acid-fast bacilli, and those showing acid-fast bacilli after ringing with Leitz object marker were further decolorized with alcohol to eliminate saprophytic bacilli.

The results of the examination of the films thus obtained will be found in the accompanying table. The outstanding features may be said to be, firstly, the very large number of organisms present, and, secondly, the great similarity to organisms found in European mouths. The organisms in the tables are, of course, classified only morphologically, and, as far as possible, according to their retention of Gram's stain.

The organism present most frequently and in the greatest numbers was a Gram-negative coccus, which resembled the *Micrococcus catarrhalis*. These organisms always occurred in clumps, and were present in 88 per cent. of cases in the gingival deposit and in 79.3 per cent. in the saliva.

The well-known *Streptococcus brevis* of the mouth was present in the greater proportion, both in the saliva and the gingival deposits. The *Leptothrix racemosa* seemed to flourish luxuriantly in a very large number (68 per cent.) of the mouths, sometimes occurring as isolated specimens, but more often in dense masses. For the most part these organisms were granular in appearance and stained some-

Weight Curve as Diagrammatically Represented Above.	Interpretation.	Dose Proportionate to the Last Dose Given.
1	Correct doses	Double the dose on the second or third day.
2		Increase by 50 per cent. on the third to fifth day.
3		Increase by 20 per cent. on the fourth to fifth day.
4	Dose too large	Decrease by 50 per cent. on the fifth day.
5	Dose much too large	Give half the dose on the third to the fifth day, when malaise has ceased.
6	Tuberculin to be changed or discontinued	Try bovine or some other form of tuberculin, or vaccines for secondary organisms.
7		

	Percentage of Films showing Organisms.	
	1. In Saliva.	2. In Gingival Deposit.
COCCI:		
Coccus Gram-negative ...	73.3	88
Staphylococcus ...	32.7	34
<i>Streptococcus brevis</i> ...	85.1	72
<i>Streptococcus</i> (large and in chains) ...	12.2	10
Diplococcus (large) ...	41.8	42
Pneumococcus ...	16.3	2
Sarcina ...	0.61	—
<i>Streptococcus longus</i> ...	—	6
BACILLI:		
<i>B. nasutus</i> ...	55.1	54
<i>B. mesentericus</i> ...	61.2	54
Short round-ended (Gram + and -) ...	26.5	32
Diphtheroids ...	8.1	4
<i>B. subtilis</i> ...	—	4
Fusiform ...	20.4	32
THREAD FORMS:		
<i>Leptothrix racemosa</i> ...	44.8	63
Fine threads (Gram + and -) ...	23.5	51
SPIROCHAETAE:		
Comma-shaped vibrios ...	22.4	74
<i>Spirochaeta dentium</i> ...	33.7	80

what irregularly. In 54 per cent. of gingival deposits and 28.5 per cent. of salivas there were present, also in large numbers, long fine thread-form organisms: for the most part these were Gram-negative, but they appeared to stain irregularly. They might possibly be classed as *Leptothrix binominata* (Miller). Spirochaetes and vibrios (Gram-negative) were very numerous, and in some cases seemed to exert an antibiotic effect upon the other organisms and to have grown largely to the exclusion of the remainder. Fusiform bacilli were found associated with spirochaetes.

A fusiform bacillus, a *Streptococcus longus*, and a capsulated diplococcus resembling the pneumococcus were present occasionally; their presence evidently occasioned no reaction on the part of the tissues. A very large streptococcus (*S. nasutus*) was found in a considerable proportion of cases: it occurred in chains of medium length (of from five to ten organisms), and was Gram-positive. A large, somewhat flattened Gram-positive diplococcus was similarly present in a considerable number of salivas and gingival deposits, probably the *Diplococcus crassus*.

Short, round-ended bacilli, sometimes retaining and sometimes losing Gram's stain, were frequently present. They might have belonged to one of several groups, but it was thought that for the present purpose exact identification could not be very accurate, and was not specially necessary. A streptothrix was identified in one gingival deposit film, and a yeast in another.

Speaking generally, Gram-negative organisms predominated. Again speaking generally, it seemed that in the salivas there were perhaps more organisms present than one would expect to find in a normal healthy European saliva, and that in the gingival deposit there were on the whole considerably more thread forms and spirochaetes than are usually seen in a similar preparation from the mouths of Europeans.

In one case in both saliva and gingival deposit there were present numbers of unbranched thread forms with distinct gonidia, the whole retaining Gram's stain. These were not so large as a *Leptothrix racemosa*, and were not at all granular. Very large, broad bacilli and diplobacilli were found in one or two cases: these were Gram-positive (these might possibly have been a very small yeast form).

Leucocytes were present in the majority of films from the *materia alba*, though in most cases they showed plasmolysis, and in others were disintegrating. In only one case was active phagocytosis observed. It was conjectured that perhaps the films from the gingival regions

would have shown that immunity was due to phagocytosis, but no such evidence was forthcoming. This absence of active phagocytosis in saliva agrees with what one of us (H. P. P.) found experimentally on a previous occasion.¹

Desquamated epithelial cells were common in the saliva films, and usually, though not always, were loaded with organisms—as a rule the *Streptococcus brevis*—and it is a question as to what extent this may be regarded as a true phagocytosis similar to that which is seen in endothelial cells elsewhere.²

In the saliva films stained by the Ziehl-Neelsen method only two acid-fast bacilli were found. They were stouter than tubercle bacilli, but showed some irregularity in staining. They were ringed on the slide and further decolorized with alcohol when the red colour was discharged, thus showing the bacilli to be of the acid-fast group other than tubercle.

In order to test the possibility of carrying out more accurate and detailed bacteriological work without fitting up a laboratory on the spot, swabs from the gingival margins were taken in 6 cases at the last village visited and forwarded by post to the laboratory at Dunedin. They, however, occupied exactly a week in transit (despite the fact that the guide rode in with them eight miles to the nearest post-office on the same afternoon that they were taken), so that undoubtedly many of the less hardy varieties died out.

The following organisms were isolated from each swab:

1. Pure culture *Staphylococcus aureus*.
2. *Streptococcus brevis*.
3. *Streptococcus longus*.
4. *Staphylococcus aureus*.
5. *Streptococcus brevis*.
6. *Streptococcus brevis*.
7. *Streptococcus longus*.
8. *Streptococcus longus*.
9. *Streptococcus longus*.
10. *Streptococcus longus*.
11. *Streptococcus longus*.
12. *Streptococcus longus*.
13. *Streptococcus longus*.
14. *Streptococcus longus*.
15. *Streptococcus longus*.
16. *Streptococcus longus*.
17. *Streptococcus longus*.
18. *Streptococcus longus*.
19. *Streptococcus longus*.
20. *Streptococcus longus*.

The swabs were inoculated on agar, inspissated serum, and in peptone broth; blood agar was not used, owing to the age of the swabs on receipt.

It is interesting to note, first, that the varieties of organisms isolated by cultivation were for the most part those least in evidence in the smears made direct from the mouth; and, secondly, they were precisely similar to what one might expect to find in swabs from individuals in an ordinary civilized community. We came to the opinion that any conclusions based on cultures made from swabs so long after being taken would be very unreliable, and that, if detailed work was to be done, it would be necessary to have a bacteriological equipment on the spot—a matter of considerable difficulty and expense, owing to the inaccessible nature of the locality.

CONCLUSION.

Although this cannot be put forward as a detailed and exact bacteriological report on the oral cavity of Maori children, yet we think there is quite sufficient evidence to show that immunity to caries and oral infections is not in such children due to the absence of those organisms which are usually regarded as causal factors in such conditions.

Towards the cost of this research a grant was made by the Royal Society of Medicine. If circumstances permit, the investigation will be renewed in November and December next.

REFERENCES.

- 1 *Prevention of Caries* (Cartwright Prize Essay), p. 191.
- 2 *Ibid.*, p. 192.

THE late Mr. Edward Nettleship left estate of the gross value of £26,768, with net personality sworn at £23,225. The testator left the bulk of his property to his wife for life, and on her death £3,000 to St. Thomas's Hospital to create or augment a fund for the endowment of lectureships in the Medical School, £1,000 to the Royal London Ophthalmic Hospital. Subject to some further bequests, he directed that if the ultimate residue of his property should exceed £9,000 then a further £2,000 should be paid to St. Thomas's Hospital Medical School, for the same purpose as the above legacy of £3,000, and £1,000 additional should be paid to the Royal London Ophthalmic Hospital.