On August 28, 1934, there came suddenly extensive haemorrhages in the central portion of the retina and many peripheral haemorrhages, and vision sank to counting fingers at 2 metres.

In this right eye the haemorrhages were confined to the posterior segment, but glaucoma became a dominating feature and on the suggestion of Mr. Whittington a paracentesis was performed on November 6, 1934. This relieved the pain for a time, but the tension gradually increased again and the eye became totally blind.

He was last seen on February 22, 1935, just before his departure for India and then he was having transitory attacks, at infrequent intervals, of pain in both eyes, but was completely blind.

The peculiar feature of this case is the development of vessels on both surfaces of the cornea and in a sense more remarkable still, their complete regression. No record of a similar happening has been found and it seemed worth while to record this.

TRACHOMA :

An investigation into the question of the presence of *Bacterium granulosis* (Noguchi) in Cases of Trachoma in Glasgow

BY

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HIDEYO NOGUCHI working at cases of trachoma among the American Indians at a reservation in New Mexico isolated a hitherto undescribed bacillus to which he gave the name *Bacterium granulosis*. Papers giving the result of this work were published in 1928, (The Etiology of Trachoma, Hideyo Noguchi, *Jl. Exper. Med.*, XLVIII, Supplement No. 2).

Since that time a mass of literature has appeared concerning the presence and aetiological significance of this micro-organism. A point which emerges is that different investigations show much diversity regarding the presence of the bacterium in cases of undoubted trachoma.

In view of this we set ourselves to answer the question whether or not *B. granulosis*, (Noguchi), was present in cases of trachoma occurring in Glasgow. The material investigated was obtained

from patients admitted to the trachoma wards under the charge of one of us (S.S.M.) at Stobhill Hospital. The patients were representative of those attending Hospitals and living in Institutions in and around Glasgow. All were early cases.

The general lines of the laboratory investigations followed those indicated by W. C. Finnoff and P. Thygeson, (*Arch. of Ophthalm.*, V, 527, 1931).

In our work on the earlier cases, human blood agar was employed and was found quite satisfactory; as it was more convenient to obtain horses' blood, as advocated by Noguchi himself, this was used in the later cases and was proved to be equally satisfactory.

Further, the presence of cocaine inhibited the growth of *B. granulosus* and hence the follicles were expressed while the patient was under a general anaesthetic. The plates were inoculated immediately and were then sealed by plasticine, care being taken that the surface of the culture medium was distinctly moist as 'dryness' inhibited growth. Thereafter, the plates were put in the dark and kept at room temperature, heat above 30° C. being adverse to growth.

In cases from which *B. granulosus* was recovered, a few minute 'dew drop' colonies appeared sometimes after a week but more often they were not seen until 15 days or even longer had elapsed. The colonies were subcultured several times to increase their vegetative properties and to insure the purity of growth. As the colonies grew older they became more opaque and passed through the stages of a dirty yellow to a brownish colour. As the plate originally used was repeatedly examined, even after the first colonies were seen, new minute ones continued to appear. Throughout, the colonies of the typical micro-organism were sticky, regular in outline and with a smooth surface.

A film stained by Gram's method showed the colony to consist of regular minute Gram-negative bacilli but in the older colonies their morphology became more pleomorphic. When examined by dark-ground illumination motility was a constant character.

Some colonies which were also composed of a Gram-negative minute bacillus which at first resembled those of *B. granulosus*, later became rough and umbonate; moreover, these did not ferment glucose.

If acidity was produced in glucose-peptone-water, further fermentation tests were carried out. The sugars were those mentioned in the paper by Finnoff and Thygeson to which reference has already been made, and prepared according to the formula of E. B. Tilden, namely, peptone-water containing 1 per cent. carbohydrate and 1 per cent. Andrade indicator.

The series consisted of 25 cases which from the clinical standpoint were undoubted examples of trachoma. Of these, no growth occurred in 5 cases. These belonged to the earlier part of the series and the fact that no micro-organisms grew on blood agar was probably due to the use of cocaine and to delay before inoculation of the plate.

From 13 cases colonies were obtained which at first had the cultural and morphological characteristics of *B. granulosis* but did not ferment glucose. Moreover, later the surface of these colonies became roughened.

From the remaining 7 cases, *Bacterium granulosis* was isolated. In 3 of these the properties of the micro-organism were the same in all respects as those of Noguchi's 'typical' form*; in 4, the micro-organisms were similar to Noguchi's 'atypical' forms.

The following table shows the fermentation reactions of the typical forms and demonstrates that they correspond exactly with Noguchi's results:—

Sugars	Noguchi	Case I	Case II	Case III
Glucose - - -	+ + + +	+ + + +	+ + + +	+ + + +
Dextrose - - -	+ + + +	+ + + +	+ + + +	+ + + +
Laevulose - -	+ + + +	+ + + +	- + + -	+ + + +
Mannose - - -	+ + + +	+ + + +	+ + + +	+ +
Saccharose - -	+ + + +	+ +	+ + + +	+ + + +
Raffinose - - -	—	—	—	—
Insulin - - -	—	—	—	—
Galactose - - -	+ + to + + + +	+ + + +	+ + + +	+ + + +
Maltose - - -	+ + + +	+ +	+ + + +	+ + + +
Salicin - - -	+ + + +	+	+ + + +	+
Xylose - - -	+	+	+	+
Mannitol - - -	+ + + +	+ + + +	+ + + +	+ + + +
Dextrine - - -	+ + + +	+ + + +	+ +	+
Arabinose - - -	+ to + + +	—	+ +	+ + +
Lactose - - -	+ +	+ +	+ + +	+ + +
Dulcite - - -	—	—	—	+
Sorbite - - -	—	—	—	—
Inosite - - -	—	—	—	—

It is necessary to indicate what constitutes an 'atypical' form. In morphology, staining reaction, motility, appearance of their growth on blood agar and action on glucose the atypical forms

* These three cases occurred late in the series and hence the remark made by one of us (S. S. M.) at the International Conference on Trachoma held in London in April, 1935, namely that *B. granulosis*, Noguchi, was not present in cases in the Glasgow area (*Brit. Jl. of Ophthal.*, Vol. XIX, p. 326, 1935).

correspond in every way to the 'typical' form; they differ, however, in their action on some of the other carbohydrates.

Much controversy has arisen as to the part played by *B. granulosis* in the aetiology of trachoma; moreover, other micro-organisms have been isolated and put forward as aetiological factors. Again, various authors have maintained that the condition is due to a virus, to diet deficiency and lastly that it is an expression of allergy.

With these views, however, this paper is not concerned. In our introductory remarks it was clearly indicated that considerable divergence existed in the results of those authors who had carried out work along lines similar to that of Noguchi and our investigation was undertaken merely to ascertain whether *B. granulosis* was present or not in cases of trachoma occurring in Glasgow.

We suggest that some of the discrepancies in the results obtained by various workers have been due to their not having allowed sufficient time for growth to have progressed to the extent of producing visible 'colonies' before pronouncing that the micro-organism in question was not present in the material examined. Again, some of these investigators may not have been conversant with the inhibiting action of cocaine on the growth of *B. granulosis*.

Lastly, the importance of immediate inoculation of the media, the keeping of the inoculated plates at room temperature and of maintaining a sufficiently moist surface should be emphasised.

Conclusion

An investigation has been carried out in order to ascertain whether *B. granulosis*, Noguchi, occurs in cases of trachoma in Glasgow. The results obtained, show that this organism is present in a proportion of these cases.

THE WATER-BINDING OF THE OPTIC NERVE AND OF ITS SHEATHS

BY

J. A. VAN HEUVEN *and* P. F. FISCHER

UTRECHT

AFTER our paper on the water-binding of the retina some interesting investigations have been published on the genesis of papilloedema, and it seemed to be of some importance that similar researches on nervous tissues should be done. For these reasons we continued our experiments.