testing by his own method and von Pirquet's, only got four negative reactions in 30 cases of erythema nodosum.

Phlyctenular conjunctivitis and keratitis are of frequent occurrence in erythema nodosum. Lendon, in his work on *Nodal Fever*, says that they were present in 38 per cent. of the cases. This condition of the eye has a close relationship to tuberculosis. In an article on phlyctenulae, in the BRITISH MEDICAL JOURNAL of October 18th, 1913, Butler says: "I have been able to regard a tuberculous etiology as exceedingly probable in 70 per cent. of my cases. Professor Straub of Amsterdam thinks that 100 per cent. is nearer the truth."

Several observers have reported cases in which the hypodermic administration of tuberculin to tuberculous persons has given rise to an attack of erythema nodosum; and others who have excised nodules have noted that the sections show giant cells surrounded by epithelial cells, such as are to be seen in the section so kindly cut for me by Dr. Carey Coombs. In a contribution to *La Presse médicale* (November 19th, 1913) Professor Landouzy reports a case of erythema nodosum from which a nodule was excised. Tubercle bacilli were found in the histological sections, and another portion of the nodule when injected into a guinea-pig gave rise to local and general tuberculosis.

The evidence is too strong to permit our regarding the association of erythema nodosum with tuberculosis as merely accidental. It is far more convincing than the evidence formerly adduced to prove that the disease was of rheumatic origin—a view that is now rapidly disappearing. Personally, I am convinced that we have in erythema nodosum a distinct clinical entity,[6] probably a specific infective fever; but it seems likely that we have included under the same name other erythematous nodular rashes—some which should be classed as rheumatic, some as erythema multiforme, and others as tuberculous, the last-named being evidence of a widespread and not infrequently fatal septicaemia.

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THE EXPERIENCES OF SURGEONS IN SCLERO-CORNEAL TREPHINING.

BY

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IN the preface of the first edition of my work on *Sclero-Corneal Trephining in the Operative Treatment of Glaucoma* I wrote:

> I desire to lay my case fully and freely before the medical profession. At that bar we must one and all be tried, and I for one have no doubt that the ultimate verdict, even though it may be delayed, will be the just and right one, be it what it may.

Since those words were written a very extraordinary volume of evidence on this subject has been furnished. Within the short space of four years the operation of sclero-corneal trephining has made such a powerful appeal to the medical profession that it has been tried in every civilized country. Scientific assemblies, from the great International Congress in London downwards, have discussed it in all its bearings; the medical press has been full of reports of and opinions on it; and men of world-wide reputation have published their statistics, and have thereby arrested the attention of the profession. The aim of this article is to collect, even though in a condensed form, some of this valuable testimony. For the most part comment or criticism on my part would be out of place, and the unadorned tale of great workers will carry more weight than any embellishments that I can add to their story. Hence the bulk of the article will take the form of short extracts from the work of such surgeons. I do not fail to recognize that behind all this there lies a force much greater even than the individual opinions of a number of great ophthalmologists—a force comparable to that of a swollen river fed by innumerable rivulets—the force of widespread medical opinion. The number of men in many parts of the world who are quietly and unobtrusively trephining for glaucoma is legion—men who say they have done only a few cases, and who consider their evidence not worth having on account of the individual smallness of their statistics, but who, none the less, write and speak of the wonderful results they have obtained, and of the comfort it has been to them to find an operation so safe, so easy, and so satisfactory for a condition which previously reduced them to hopelessness. Surgeons such as these will not lightly give up the method; they are the backbone of its permanence, and, though it is not possible to place all their valuable evidence on record, it is none the less fully and deeply appreciated.

Wallis[1] collected the statistics from the case sheets of 91 patients, operated on in Moorfields Hospital, and wrote:

> I have excluded all but primary chronic glaucoma patients, and amongst these were not a few for whom the prognosis was very grave—cases that had failed to receive permanent benefit from previous operative methods (other than Elliot's), and absolute glaucomata; also all operations are included, whether performed by the honorary staff, by senior house-surgeons, or by clinical assistants. Of 91 patients suffering from primary chronic glaucoma, upon whom Elliot's operation has been performed, those who have developed repeated *plus* tension within a year of the operation give a case percentage of 9.8. The operation percentage of failures amongst these patients is 15.3—this larger figure is due to the cases that have failed to be improved by more than one operation in the same eye, and from failure in the two eyes of the same patient when this occurred.

It is obvious that the test of the value of trephining here dealt with is a very severe one, by reason both of the nature of the cases accepted for operation, and of the number and varying experience of the operators.

Stock,[2] of Jena, published the results of 118 trephinings for glaucoma, with eighty-eight good results (74.6 per cent.). Of the poor results fourteen were in operations undertaken for glaucoma absolutum, while the rest had vision not above $\frac{1}{60}$ before operation. This is a striking confirmation of what I have long said—namely, that our failures lie in the group of cases which are late in seeking relief. Vision improved after operation in 39.8 per cent., remained the same in 34.1 per cent., and decreased in 25.6 per cent.; in eight of those which showed a decrease this was due to the maturation of a previously existing cataract, in one it was due to haemorrhage into the vitreous, and in five to iritis.

Meller,[3] of Vienna, has recently published a report based upon 389 Lagrange operations, and 178 sclero-corneal trephinings supported by the microscopical examination of a number of globes removed after failures. He states that "the great advantages of the Elliot operation is that its technique is so much more easy." In not a single case of the 178 was there an injury of the lens. He compares the two operations, dividing his cases into two groups—namely, (1) good results, Lagrange 69 per cent., Elliot 72 per cent.; and (2) bad results, Lagrange 8.4 per cent. and Elliot 2.4 per cent. "Complications, such as lens opacities, severe irido-cyclitis with atrophy of the globe, expulsive haemorrhage, etc., not at all infrequent after the Lagrange operation, are scarcely met with after trephining." He finds a tendency after both operations for the iris to block the wound, and is in favour of "a complete iridectomy in the Elliot operation." The percentage of vitreous loss is 3.4 per cent. after the Lagrange and 2.8 per cent. after the Elliot, and he finds that "vitreous prolapse after the Lagrange is a much more serious complication than the escape of a bead of vitreous from a small trephine opening." To show the genesis of relapses, he compares the figures found in the two operations. (1) After total iridectomy, Lagrange 9.3 per cent., Elliot 7.5 per cent. (2) After peripheral iridectomy, Lagrange 11.8 per cent., Elliot 18.7 per cent.; and (3) without iridectomy, Lagrange 20 per cent., Elliot 23 per cent. He therefore inclines to the view that iridectomy is more important than Lagrange or Elliot consider it to be.

With an equally high percentage of excellent results, the Elliot operation has a much smaller percentage of bad results than the Lagrange. Further points in its favour are the considerably easier *technique* and the much smaller number of complications, especially in the severe forms of acute and absolute glaucoma. With the Elliot operation only 15.4 per cent. of the absolute glaucoma cases ended badly, while 38 per cent. of such cases were lost entirely after the Lagrange operation.

As to indications he says:

The situation has been simplified to an extraordinary degree by the introduction of the Elliot operation. It is indicated in all cases of glaucoma, in acute as well as in chronic and simple; in secondary glaucoma, and especially in those cases of increased tension which have developed after the performance of other operations. It can likewise be recommended for hydrophthalmus, for it is attended with less danger than an iridectomy, or even a sclerectomy. The height of the tension has no effect upon the course of the operation or upon the development of complications, and especially not that bad effect which high tension must have in all methods of operating in which the eye is opened by a section.

Axenfeld[4] states that in his own operative material the trephine hole, after a varying period, and often quite quickly, became closed with such thick tissue, approaching to the level of the sclera, that free subconjunctival filtration was out of the question. He, however, modifies this statement by saying that it would be quite wrong to limit the successful cases to those in which a permanently filtering cicatrix, with formation of oedematous area, is found. His own experience—and he states that of many others also—is that numerous cases with closure without apparent filtration are favourably influenced; he suggests that possibly a subconjunctival microscopic filtration is present in these cases. The remark reminds the writer of the many cases which have been presented to him in various clinics as instances of cases in which the old-fashioned iridectomy had cured glaucoma, and in every one of which he has been able to demonstrate to the satisfaction of those present that though to the naked eye no filtration was occurring, yet such filtration could be readily demonstrated by the use of a spud or probe gently pressed upon the conjunctiva in the neighbourhood of the operation wound site. It is suggested that the same phenomenon may serve to explain the apparently anomalous cases cited by Professor Axenfeld.

Guglianetti, of Naples, before the International Congress of Medicine in London, reported 25 cases with favourable results in simple glaucoma, and varying results in other cases.

Pischel,[5] of San Francisco, operated nineteen times on 15 eyes, 3 eyes were operated on twice and 1 thrice. Vision was improved in 6 cases, the same in 3, and worse in 3; 3 eyes were blind before the operation. The tension was relieved in every eye. Field was larger in 7 cases, the same in 2, and smaller in 1; in 5 it could not be taken. He uses a dental engine to rotate his trephine, and warmly recommends it for the purpose. If the 3 blind eyes are excluded, it will be seen that vision was maintained or improved in 9 out of 12– that is, in 75 per cent.

Remmen[6] has reported 20 cases of Elliot's operation, in which the tension was reduced in every case, and in none was vision lost.

Wendell Reber,[7] of Philadelphia, has published the notes of 26 cases in which he operated for glaucoma by sclero-corneal trephining, and thus summarizes his experience:

Twenty-six eyes were operated on by Elliot's method in sixteen subjects. The results are as follows:

In six eyes that were sightless, the seat of absolute glaucoma, and in every way degenerated eyes, the patients were rendered free from pain and an eyeball that was cosmetically satisfactory was preserved to them. This is no small matter, as they were all the very type of eyes that are likely to develop explosive choroidal haemorrhage at the time of operation. Moreover, the teaching in many quarters is that in absolute glaucoma the safe measure is enucleation, an operation from which people instinctively shrink with horror. If trephining will preserve to such patients an eye that will be painless and quiet, it has on this premiss alone proven its title as an acceptable operation.

In five other eyes that were sightless, there was a small degree of vision gained by the operation, such as hand movements at 1 to 3 feet.

In the remaining fifteen eyes the results were good in that the eyes gained considerably in vision and in usefulness. The greatest gain in vision after trephining was from $\frac{2}{60}$ to $\frac{6}{12}$. The least gain was from $\frac{6}{12}$ to $\frac{6}{9}$, but this gain was greater than appears on its face, for it was the patient's remaining eye, the fellow having been already blinded by chronic simple glaucoma. To-day (after one year) this patient's optic nerve excavation remains just what it was one year ago. His field of vision is enlarged and the cicatrix is filtering nicely; we are therefore justified in feeling that the usefulness of this eye will be preserved to him for many years, which is all that can be claimed for any glaucoma condition. . . .

It is therefore our feeling that sclero-corneal trephining (sclerostomy) has come to stay; that it is by all odds the safest operation for glaucoma in the hands of the neophyte; that if this postulate is correct, many more prophylactic operations for glaucoma may be done now than have been done in the past. And if this operation is the safest one in the hands of the operator of small experience, is it not reasonable to push the argument further, and hold that it is therefore the operation of greatest safety under the guidance of the operator of large and long experience? Time only can bring a just and full judgement of this latest method for the surgical control of glaucoma.

Denig,[8] of New York, has himself trephined twenty-one eyes, and has an experience of 15 cases of the same operation in the practice of others. He prefers trephining to other operations in simple, in haemorrhagic, and in secondary glaucoma.

Peter,[9] speaking from an experience of 26 cases of trephining, says:

From the results thus far obtained, the operation promises to be the operation of the future in all forms of glaucoma. My oldest case, and one of the worst of the series, I trephined over eighteen months ago. Relief from pain was prompt, as in all cases, and visual acuity is as good and fields quite as large to-day as they were immediately after operation. . . . We approach a case of glaucoma *in extremis* to-day with much less doubt as to the outcome. . . . The value of the operation as a prophylactic cannot be over-estimated; . . . this is a measure which may save many eyes which otherwise might be doomed to blindness.

El Rasheed,[10] of Assiut, furnishes statistics of 125 eyes operated on by Drs. MacCallan, Oulton, and Sobhy, and by himself; the figures are as follows:

Operations for acute and subacute glaucoma, 17; for chronic glaucoma, 81; for glaucoma absolutum, 24; for secondary glaucoma, 3; vision was improved in 64, remained the same in 29, diminished in 8, and was absent from the commencement in 24. Tension was permanently reduced in 100, was reduced but again rose to above normal in 14, remained above normal throughout in 11; trephining was repeated with improvement in tension in 3. Simple trephining was done in 40; a buttonhole iridectomy was made in 7, and a complete iridectomy in 78. Iris prolapsed and had to be excised in 2 cases; the conjunctival flap required a stitch at the first dressing in 4; the conjunctiva was buttonholed once; vitreous prolapsed 4 times; retinal detachment occurred once; haemorrhage in yellow spot seen once; wound became septic in 2; eyes excised after operation to relieve pain or tension in 2.

(I am indebted to Dr. MacCallan for these figures, which embrace the cases operated on from October 20th, 1911, to February 15th, 1913.)

Zubizarreta,[11] of Buenos Aires, "thinks that Elliot's operation is the most simple and certain method of establishing a filtering scar, and that this is at the moment to be regarded as the operation of choice in cases of chronic glaucoma."

I have heard from a number of British surgeons who have been practising trephining practically since the operation was first described, and who, though, owing to pressure of work, etc., they have not been able to furnish me with exact statistics, have yet assured me that they have definitely adopted the operation in their practice, and that they continue to be well satisfied with their results therefrom. Amongst others may be mentioned Lawson of London, who has been trephining since 1910, and who has used the method on about 100 cases; Gray Clegg of Manchester, another of the pioneers of the method in England, who has over 110 cases on record; and Nimmo Walker of Liverpool, who has trephined more than 30 cases since April, 1910, and who has kindly furnished the following notes of his earliest case:

A case of acute glaucoma in which tension had twice returned after trephining; V. reduced to light perception; rose after trephining to $\frac{6}{9}$, and remained good till patient's death a few months ago from apoplexy (that is, a history of about three and a half years).

Maddox, of Bournemouth, who ranks amongst the first supporters of the operation, writes in a personal communication:

I still regard your operation as admirable in most cases of both chronic and acute glaucoma, except in the absence of tension. In one case of double acute glaucoma, iridectomy was done on the one eye and trephining on the other, and the trephining answered best.

In addition to the names which have already been mentioned, there are many distinguished Continental surgeons

who have performed a number of sclero-corneal trephinings, and have expressed their satisfaction with the method. Among such are: Barraquer, of Barcelona; Coppez, of Brussels; Fuchs, of Vienna; Kuhnt, of Bonn; Sattler, of Leipzig; Schnaudigel, of Frankfurt; Vogt, of Aarau (Switzerland); von Mende, of Mitau (Russia); and Wagenmann, of Heidelberg.

From Canada and America the volume of evidence is overwhelming. There a host of surgeons are freely using the trephine; amongst others the list includes: de Schweinitz, Webster Fox, Friedenwald, Gifford, Jackson, Knapp, Marple, McReynolds, Reeve, Todd, Weeks, and Wyler.

With the view of laying emphasis on the work and opinions of others I have given no statistics of my own cases in this article, although I have an experience of over 1,000 trephinings to speak from. The statistics derived from this mass of figures will, however, be dealt with before long elsewhere.

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ON THE MULTIPLICATION AND INFECTIVITY OF T. CRUZI IN CIMEX LECTULARIUS.

BY

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THE experiments described here were undertaken in order to ascertain whether *T. cruzi* is capable of existing and developing in *Cimex lectularius*, and if so, whether the forms found in the bed-bug are capable of infecting laboratory animals when injected into them, or when the bugs feed on the animals. Where not otherwise stated, the bugs used were not laboratory-bred, but were collected from infested houses. In order to exclude as far as practicable the possibility of natural infection with flagellates occurring in the insects examinations were made of the following:

1. A hundred and four unfed adults kept at laboratory temperature.
2. A hundred adults kept at 27° C.
3. Twelve adults fed once on a healthy mouse and thereafter kept at laboratory temperature.
4. (*a*) Twenty larvae taken from collecting jar and kept unfed at laboratory temperature; (*b*) 62 laboratory-bred larvae, once fed on a healthy guinea-pig and examined at intervals, kept at laboratory temperature.

The alimentary canal (stomach, gut, and rectum) was carefully examined for the presence of flagellates, but with a uniformly negative result, and the blood of the animals upon which adults and larvae were fed—mouse and guinea-pig—remained free from flagellates.

First Series of Experiments.

Having excluded natural infection in the bugs as far as was possible with the numbers available, adults were fed on a mouse infected with *T. cruzi*, and showing ten parasites to the field (Leitz obj. 6, oc. No. 4). The bugs were kept at laboratory temperature without being fed, and dissected at intervals. Several inoculations were made, with results as shown in Table I, from which it will be observed that the parasites proved infective on inoculation twenty-one and seventy-two hours after ingestion by *Cimex lectularius*. Crithidial forms with short flagellum were found in the stomach within twenty-four hours of the feed. Many of the inoculated mice died early of acute septicaemic infection. Several animals failed to become infected, although they were inoculated with bug contents containing large numbers of living parasites.

TABLE I.—*Results of Examination and Inoculation of Intestinal Contents of Bugs fed once on an Infected Animal and then Starved.*

No. of Experiment.	Time since Infecting Feed.	Parasites present in Material Injected (+).	Animal Inoculated.	Result of Inoculation.	Remarks.
1	6 hours	Stomach (+)	—	—	No inoculation done
	21 ,,	Stomach (+)	Mouse	Pos.	—
3	30 ,,	Stomach, gut, rectum, negative	—	—	No inoculation done
4	31 ,,	Stomach (+)	—	—	No inoculation done
5	46 ,,	Stomach (+)	Mouse	Neg.	—
6	72 ,,	Stomach, gut, rectum, negative	,,	Pos.	—
7	72 ,,	Stomach, gut, rectum, negative	—	—	—
8	4 days	Stomach, gut, rectum, negative	—	—	No inoculation done
9	4 ,,	Stomach, gut, rectum, negative	—	—	No inoculation done
10	7 ,,	Stomach (+), gut (+)	Mouse	—	Died in 48 hrs.
11	8 ,,	Stomach, gut, rectum, negative	—	—	No inoculation
12	9 ,,	Stomach, gut, rectum, negative	—	—	No inoculation bug dead
13	10 ,,	Stomach, gut, rectum, negative	Mouse	—	Died next day
14	10 ,,	Gut (+)	,,	Neg.	—
15	11 ,,	Gut (+)	,,	,,	—
16	12 ,,	Gut (+) rect. (+)	,,	—	Died in 5 days
17	13 ,,	Gut (+)	,,	Neg.	—

Second Series of Experiments.

In this series of experiments bugs fed once on an infected animal were subsequently fed upon healthy animals. Laboratory animals were inoculated at intervals either with faeces passed by the bugs or with bug contents. Such inoculations were only made when flagellates were found to be

TABLE II.—*Results of Examination and Inoculation of Contents of Bugs once fed upon an Infected Animal and subsequently upon Healthy Animals.*

No. of Experiment.	Time since Injecting Feed.	Parasites present in Material Injected (+).	Animal Inoculated.	Result of Inoculation.	Remarks.
1	11 days	Rectum (+), faeces	Mouse	Pos.	
2	11 ,,	Rectum (+), faeces	,,	Neg.	
3	11 ,,	Rectum (+), faeces	,,	,,	
4	20 ,,	Faeces (+)	Guinea-pig	,,	
5	25 ,,	Rectum (+), gut	,,	,,	Bug dead; forms like "blood forms" found.
6	26 ,,	Rectum (+), gut (+), stomach	,,	Pos.	
7	38 ,,	Serum (+)	Mouse	Neg.	
8	38 ,,	Serum (+)	,,	,,	Bug dead; forms like "blood forms" found.
9	38 ,,	Rectum (+), gut	,,	Pos.	
10	38 ,,	Faeces (+)	,,	Neg.	
11	38 ,,	Faeces (+)	,,	,,	Bug dead; forms like "blood forms" found.
12	38 ,,	Rectum (+), gut (+)	,,	Pos.	
13	39 ,,	Rectum (+), gut (+), stomach (+)	,,	Neg.	
14	39 ,,	Rectum (+), gut (+), stomach (+)	,,	Pos.	
15	42 ,,	Rectum (+), gut (+), stomach (+)	,,	Neg.	
16	42 ,,	Rectum (+), gut (+), stomach (+)	,,	,,	
17	43 ,,	Faeces (+)	,,	Pos.	
18	58 ,,	Rectum (+)	,,	Neg.	
19	69 ,,	Gut (+)	,,	,,	
20	69 ,,	Gut (+)	,,	,,	
21	77 ,,	Rectum (+)	Guinea-pig	Pos.	
22	77 ,,	Rectum (+)	,,	Neg.	
23	79 ,,	Rectum (+)	,,	,,	Bug dead.