

## OPHTHALMIA NODOSA\*

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OPHTHALMIA nodosa is defined as an inflammatory reaction in the eye to hairs of certain insects or vegetable material and derives its name from the nodular conjunctival reaction which they produce.

Wagenmann (1890) first called it pseudotuberculosis, and it was renamed by Saemisch (1904). Three cases have been described in the British literature (Lawford, 1895; Foster Moore, 1929; Corkey, 1955); we should like to present four additional cases, three from Jerusalem and one from England.

### Case Reports

**Case 1.**—An adult male who was employed by the municipal authorities to cut down the nests of the pine processionary caterpillar (*Thaumtopoea pityocampa*) from the pine trees, presented at the St. John Ophthalmic Hospital, Jerusalem, in the early spring of 1964 with a three-day history of a sore red eye.

He had much lacrimation, but no discharge; the slit lamp revealed 15 hairs in the cornea. Around the superficial end of most of the hairs a nummular opacity had developed, the deeper ones being more opaque (Fig. 1). The superficial ones were removed with a fine needle, but as the hairs were very friable and difficult to remove, six deep ones were allowed to remain. At this stage, the anterior chamber was free from cells. No hairs were seen in the conjunctival fornices. The patient was treated with steroid and atropine drops, antibiotic ointment, and irrigation of the conjunctival sac. On this régime the eye became white and pain-free. On the third day, however, two of the remaining hairs passed into the anterior chamber. Immediately the eye became red and cells and flare were seen in the anterior chamber. Intensive local steroid therapy suppressed this activity, but the inflammation recurred on two subsequent occasions when further hairs passed into the anterior chamber. After one month the eye became quiet and no hairs could be seen in it. When the patient was last seen three months after the onset of the symptoms, the cornea showed several slight nebulae most marked where Bowman's membrane had been damaged by the needle. The anterior chamber was clear, the iris was normal, and gonioscopy revealed no abnormality of the angle.

**Case 2.**—A woman aged 42 years presented at the same hospital with what appeared to be a nodular episcleritis (Fig. 2). Four days previously she had experienced a sudden onset of pain and redness of the eye associated with photophobia. Upon questioning, she revealed that she had been burning the caterpillar nests of *Thaumtopoea pityocampa*.

There was a localized raised conjunctival and episcleral nodule about 5 mm. in diameter in the lower inner quadrant of the right eye. Examination with the slit lamp revealed three or four small

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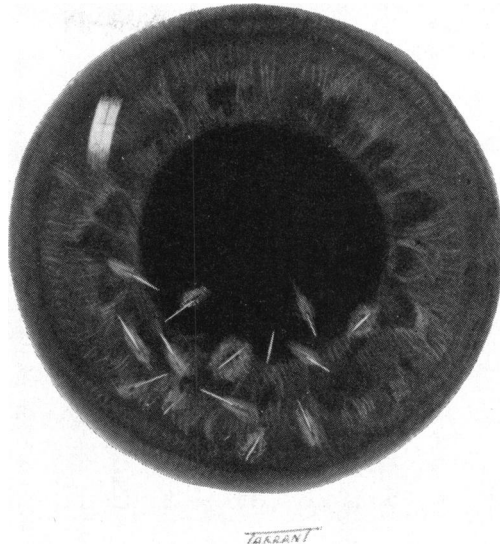


FIG. 1.—Case 1. Drawing of the cornea showing nummular opacities around most of the hairs of *Thaumato-poea pityocampa*.

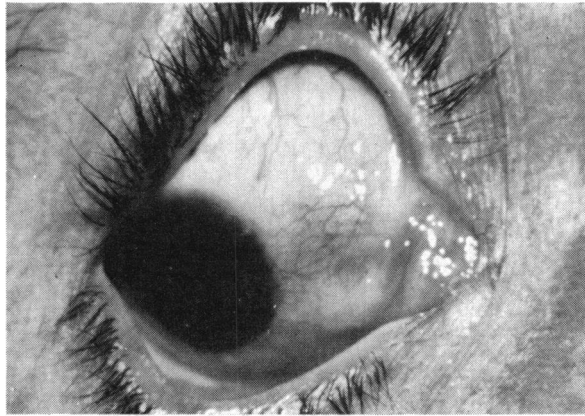


FIG. 2.—Case 2. Conjunctival and episcleral nodule containing the hairs of *Thaumato-poea pityocampa*.

hairs in the centre of the granuloma. No hairs were found free in the conjunctival fornices, the cornea was clear, and the anterior chamber was free from cells. The lesion was excised, but unfortunately the biopsy specimen was lost in the post.

The patient has been completely free from symptoms since the removal of the nodule.

**Case 3.**—A young man presented with a history of a sore eye for three days. He had been working in a pine grove a few days previously, but had not come in contact with caterpillars. There was a small raised granuloma at the limbus with localized oedema and redness of the conjunctiva. This lesion, which contained two small hairs, was excised without sequelae to the conjunctiva. No other hairs were found.

**Case 4.**—This patient attended Moorfields Eye Hospital, London, in September, 1964. Four days previously she had been looking under a car when something blew into her eye. On the day before this she had been spraying the nests of *Euproctia chrysorrhoea* (browntail moth) on plum trees

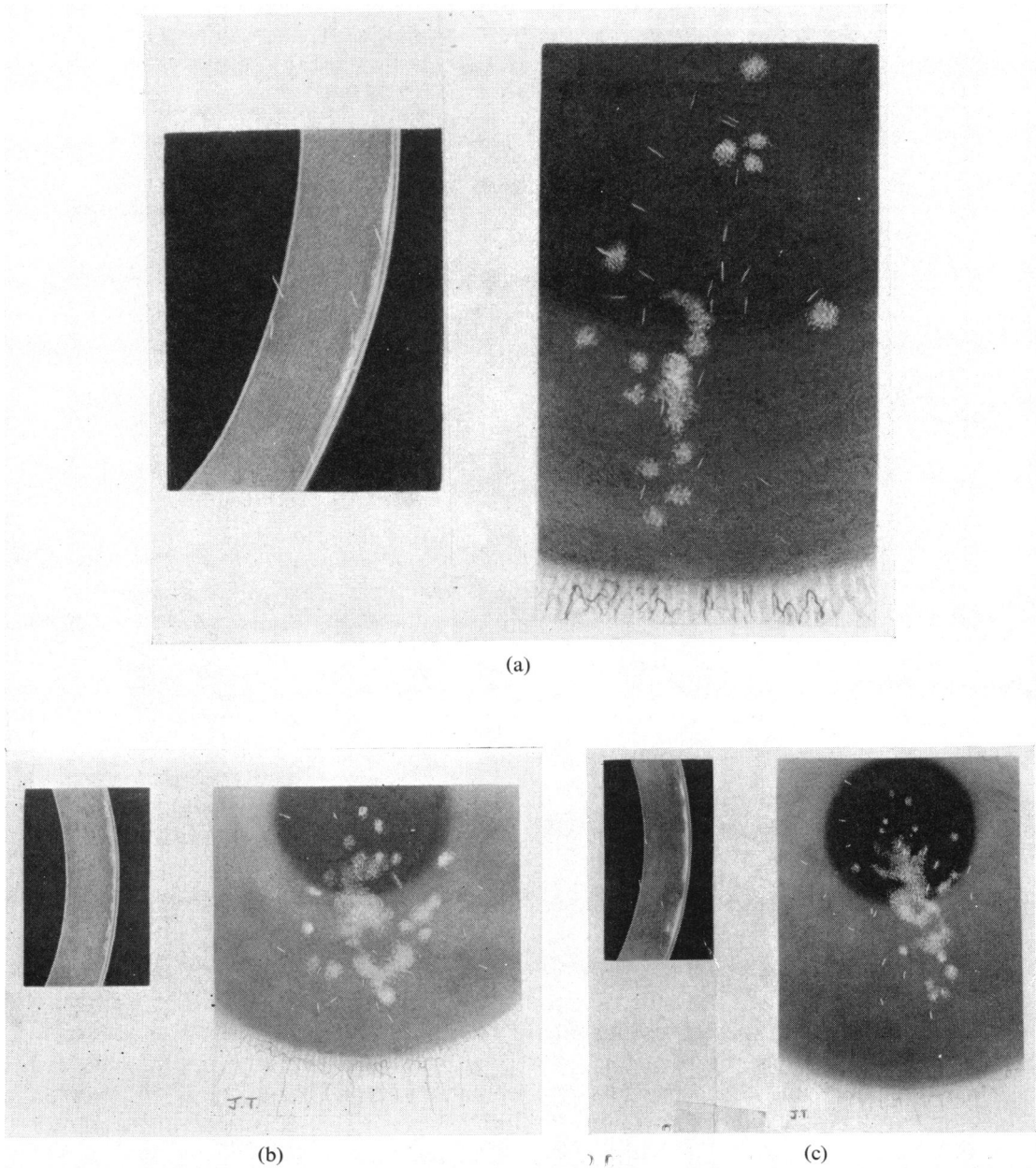


FIG. 3.—Case 4. (a) September 15, 1964. Drawing of hairs of *Euproctia chrysorrhoea* in cornea showing one hair projecting into the anterior chamber. Superficial nummular opacities surround some of the hairs. (b) January 12, 1965. The opacities have increased in number and density and the hairs have migrated circumferentially. (c) March 7, 1965. Showing alteration in position and density of the opacities and further migration of the hairs away from the opacities.

at her house in Canvey Island, Essex. There was no discomfort following this incident, but five or six days later the eye became red and painful and watered profusely.

On examination the visual acuity was reduced to 6/9 and there were numerous small hairs in the cornea, some of which were surrounded by an area of oedema; one fibre had just projected into the anterior chamber (Fig. 3a). Occasional cells were seen in the anterior chamber and there was moderate ciliary injection. Attempts to remove the hairs were unsuccessful. After a period of local steroid and antibiotic therapy the eye became quiet and at no time was there any severe inflammatory reaction. During three months' observation the fibres had moved circumferentially and had not penetrated the cornea, although the corneal opacities had increased in number and density (Fig. 3b, c); the visual acuity has remained unaltered.

### Discussion

Fifty-two species of moths spanning ten families of Lepidoptera are known to cause urticaria; there are, however, only six varieties which are known to cause ophthalmia nodosa:

#### *Caterpillars known to cause Urticaria*

##### British Isles

<i>Arctia caja</i>	Garden tiger moth
<i>Orgyn antiqua</i>	Vapourer moth
<i>Euproctia similis</i>	Goldtail moth
<i>Euproctia chrysorrhoea</i>	Browntail moth
<i>Lasiocampa quercus</i>	Oak eggar
<i>Macrothylacia rubi</i>	Fox moth

##### Other Countries

46 species from the following families of the Lepidoptera:

*Lasiocampidae*  
*Thaumatopeoidea*  
*Arctiidae*

#### *Caterpillars known to cause Ophthalmia Nodosa*

##### British Isles

<i>Macrothylacia rubi</i>	Fox moth
<i>Arctia caja</i>	Tiger moth
(caterpillar named Woolly Bear)	

##### Other Countries

*Thaumatopeoa pityocampa*  
(pine processionary)  
*Thaumatopeoa jordana*  
*Isia isabella*  
*Dendrolimus pini*

In 1947–8 there was an outbreak of severe urticaria in Canvey Island, Essex, which was attributed to the caterpillar of *Euproctia chrysorrhoea* (brown-tail moth), the same species responsible for the injury in Case 4.

The eggs of this moth are laid in clusters on hawthorn, blackthorn, plum, apple, and cherry trees, and also occasionally on sea buckthorn and bramble. The caterpillars hatch in August and immediately build a shelter. They hibernate in this nest, which is about the size of the palm of the hand, and in the spring emerge to feed on the fresh foliage. The hairs of the caterpillar are highly toxic. They are woven into the cocoon and may retain their toxic qualities for as long as four years. During the early summer they weave individual cocoons to pupate. The moth which emerges in July is white with a very prominent brown end-tuft of hair.

The vapourer moth (*Orgyn antiqua*) is also important for it is common at times in the London parks. Kettlewell (1964) mentions that about thirty-five years ago

there was a disease called "nursemaid's disease", so called because of the frequency with which nursemaids who sat under the trees in Hyde Park as they watched their charges became afflicted with severe urticaria and conjunctivitis.

The highly toxic hairs of the goldtail moth (*Euproctia similis*) are similarly woven into the cocoon from which the pupa gets protection. Before leaving the cocoon the female revolves her abdominal tuft around the inside of the cocoon, picking up a large number of the larval hairs in the process. When she lays her eggs, the hair tufts containing the larval hairs are spread over her egg batches, and so anyone touching them is affected.

The oak eggar caterpillar (*Lasiocampa quercus*) is also highly irritant, as are its cocoons.

*Thaumatopeoa pityocampa*, responsible for the lesion in Case 1, is a brown, rather uninteresting-looking moth. The eggs are laid on the outer branches of the pine tree and hatch out into small caterpillars which weave a silk nest round the branch. This caterpillar has five optic spots, but little or no vision, and is active only at night. It finds its way to the feeding ground and back by spinning a silk thread which all the caterpillars follow, forming a line, nose to tail, when they leave the nest. The hairs of the caterpillar are barbed from the fourth to the eleventh segments, are readily detached by the wind or by being handled, and are particularly abundant in the nest when the caterpillar moults.

The caterpillar of *Arctia caja* (garden tiger moth) caused both Foster Moore's (1929) and Corkey's (1955) cases. Lawford's (1895) case was caused by *Macrothylacia rubi* (fox moth).

There have been no cases described of intra-ocular or intracorneal lesions caused by vegetable hairs. Conjunctival nodules have been reported, but have always been of a papillomatous nature. (Adams, 1893; Markus, 1899; Schmidt-Rimpler, 1899; Kraupa, 1914; Merz-Weigandt, 1919; Karbe, 1923; Jakowlewa, 1924.)

Caterpillar hairs may be blown into the conjunctival fornices by the wind, may penetrate the conjunctiva or cornea forcibly as a missile, by direct contact, or by being rubbed in when a towel is used (Fig. 4). Initially, there is an intense inflammatory reaction which is particularly well marked in the loose tissues of the lid,

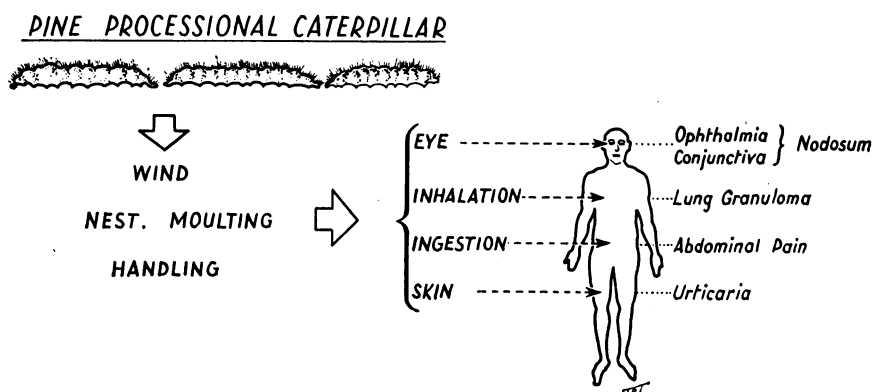


FIG. 4.—Diagram of systemic conditions in man caused by the hairs of the pine processionary caterpillar (*Thaumatopeoa pityocampa*).

giving a marked peri-orbital oedema and allergic dermatitis. In the conjunctiva this response takes the form of a catarrhal conjunctivitis and marginal keratitis which may possibly be caused by a toxin.

Penetration of the cornea results in a localized or nummular keratitis, depending on the number of hairs involved. This is followed by a quiescent interval lasting for a few days or several months, which is presumably the period during which foreign material migrates through the cornea and outer eye. It is followed by a phase of intense inflammation occurring when the hair is free in the anterior chamber or is irritating the anterior uvea. This reaction may be sufficiently severe to produce a hypopyon and nodules on the iris or flat yellow and oval nodules in the conjunctiva (Fig. 5).

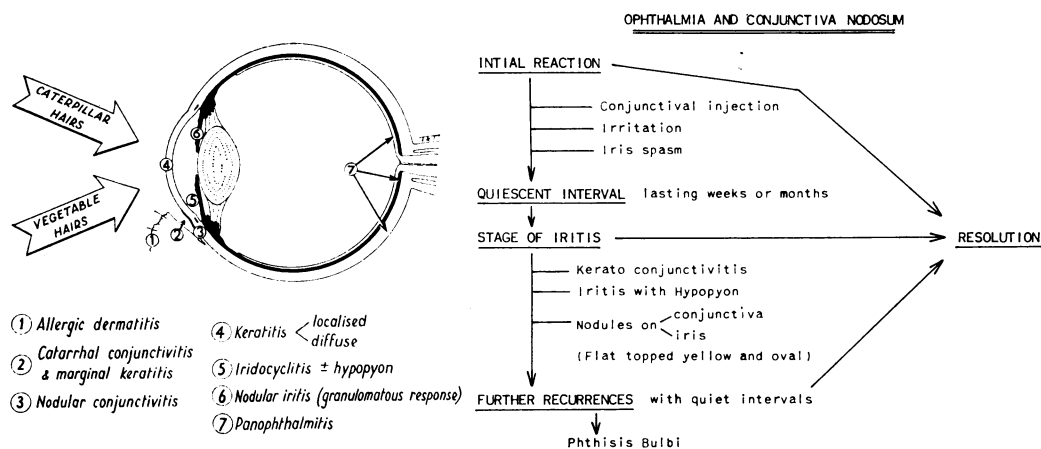


FIG. 5.—Diagram of the ocular conditions caused by caterpillar hairs.

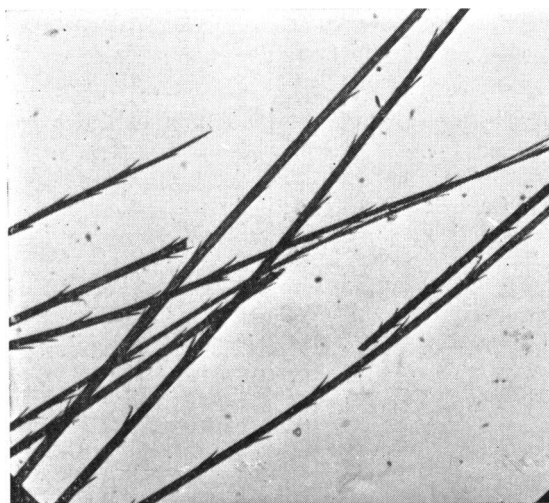


FIG. 6.—Caterpillar hair (*Arctia caja*) × 40.

Caterpillar hairs are sharp and barbed (Fig. 6) and usually travel base forward, because of the direction of the barbs. The hairs are brittle and fracture easily once

they have penetrated the eye. They have the ability to travel in the eye, perhaps because of the shape of the hair and stresses from lid and ocular movements, or even possibly from vascular pulsations.

Pathologically, there is an acute inflammation followed by a granulomatous reaction around the hair. This is characterized by a lymphocytic infiltration which is later followed by histiocytic macrophages such as epithelioid cells and giant cells.

The lids, conjunctival fornices, subconjunctival space, cornea, and iris are most commonly involved. Gundersen, Heath, and Garron (1950) describe a form in which there is marked liquefactive necrosis most apparent in the iris. They also



FIG. 7.—(a) Anterior segment of eye showing granulomatous nodule in the iris.  $\times 7$ . (b) Granulomatous reaction around hair embedded in the iris.  $\times 6$ . (c) Giant cell and chronic inflammatory reaction in relation to caterpillar hair.  $\times 296$ . (Corkey's (1955) case.)

observed occasional eosinophils in the neighbourhood of the lesion, which might indicate the presence of an allergic factor. In the more severe reactions there is a perivascular infiltration of chronic inflammatory cells in the retina, extending into the scleral channels and the episcleral tissues (Gundersen and others, 1950). Hairs have been observed in the optic nerve (Villard and Dejean, 1934; and Stallard, 1951). The typical granulomatous nodule is caused either by a chemical irritant or by the mechanical effect of the hair (Fig. 7a, b, c).

The toxins which have been described are produced either by unicellular glands connected to the hair cavity or by the cervical glands. Shelley and Arthur (1955) investigated cowhage (*Mucuna pruriens*)—itching powder. It had previously been thought that the spicules caused pruritus by mechanical damage, but this view is untenable because the pruritic action of cowhage is inactivated by autoclaving the plant at 250°C. for 30 minutes. Imitation spicules of the same size did not produce pruritus. The active pruritogenic principle is a plant proteolytic enzyme, mucinase. Emmelin and Feldberg (1947) found that the nettle hair contains histamine, acetylcholine, and another substance which proved to be 5-hydroxytryptamine. On their own, these toxins are not capable of producing the typical granulomatous picture already described. This is therefore a foreign-body reaction to the hair.

The intensity of the reaction and the final result probably depend upon the number of hairs or the amount of foreign material gaining entry into the eye. In Case 1 reported here, the inflammatory phase was readily suppressed with local steroid and mydriatic therapy, but recurred when further hairs entered the eye from the cornea. It would appear therefore, that in cases caused by caterpillar hairs, as many as possible should be removed at the earliest opportunity. Although these hairs are quite difficult to remove from the cornea, the superficial ones can be removed by using a fine needle with the aid of a slit lamp. There would seem to be ample justification for performing either a penetrating or deep lamellar corneal graft, should the hairs be very numerous, very friable, and suitably localized in the cornea. In Case 4 of this series this course of action was contemplated; however, after a period of observation, it became clear that the fibres were not migrating through the cornea, so management was conservative.

There have been four case histories reported in the literature, and one additional case (Stallard, 1951), in which caterpillar hairs have caused severe damage to the eye, necessitating enucleation. In Jordan, however, there are several cases a year of ophthalmia nodosa which apparently come to no harm. Villard and Dejean (1934) describe a patient in whom the vision had been initially reduced to hand movements and who recovered sufficiently to see 6/18. Accordingly, they advise that the eye be removed only if it becomes phthisical.

### Summary

Four cases of ophthalmia nodosa are reported. Three cases in Jordan were caused by the pine processionary caterpillar, the fourth, in England, by the caterpillar of the browntail moth.

The pathology and treatment of the cases are described.

Caterpillars known to produce this disease in England are briefly described. It is noted that a similar disease has not been recorded with vegetable hairs.



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## REFERENCES

- ADAMS, P. T. (1893). *Brit. med. J.*, **1**, 1000.  
 CORKEY, J. A. (1955). *Brit. J. Ophthal.*, **39**, 301.  
 DUKE-ELDER, S. (1938). "Text-book of Ophthalmology", vol. 2, p. 1718. Kimpton, London.  
 EMMELIN, N., and FELDBERG, W. (1947). *J. Physiol. (Lond.)*, **106**, 440.  
 GUNDERSEN, T., HEATH, P., and GARRON, L. K. (1950). *Trans. Amer. ophthal. Soc.*, **48**, 151.  
 JAKOWLEWA, A. A. (1924). *Virchows Arch. path. Anat.*, **252**, 716.  
 KARBE, M. (1923). *Arch. Augenheilk.*, **93**, 160.  
 KETTLEWELL, H. B. D. (1964). Personal communication.  
 KRAUPA, E. (1914). *Z. Augenheilk.*, **31**, 149.  
 LAWFORD, J. B. (1895). *Trans. ophthal. Soc. U.K.*, **15**, 210.  
 MARKUS, C. (1899). *Ibid.*, **2**, 34.  
 MERZ-WEIGANDT (1919). *Zbl. prakt. Augenheilk.*, **43**, 202.  
 MOORE, R. FOSTER (1929). *Brit. J. Ophthal.*, **13**, 57.  
 SAEMISCH, T. (1904). "Graefe-Saemisch Handbuch der gesamten Augenheilkunde", 2nd ed., vol. 5, pt 1, p. 548. Engelmann, Leipzig.  
 SCHMIDT-RIMPLER (1899). *Dtsch. med. Wschr.*, **25**, Vereins-Beilage, p.143.  
 SHELLEY, W. B., and ARTHUR, R. P. (1955). *A.M.A. Arch. Derm.*, **72**, 399.  
 STALLARD, H. B. (1951). Personal communication.  
 VILLARD, H., and DEJEAN, C. (1934). *Arch. Ophtal. (Paris)*, **51**, 719.  
 WAGENMANN, A. (1890). *Albrecht v. Graefes Arch. Ophthal.*, **36**, 126.