

same procedure is to be adopted for wounds of the cornea, the edges of which should be sutured in accurate apposition in order to avoid subsequent irregular astigmatism. When an adherent leucoma is already present, one should proceed as recommended by SACHS of Vienna, *i.e.*, the cornea in front of the adherent iris is incised with a corneal trephine applied obliquely, so as to cut an incomplete disc attached by a pedicle; the iris is then freed from the cornea by pulling on the adherent part and cutting it; the corneal disc is finally reposed with or without the insertion of sutures. A deep perforating keratoplasty may be necessary later for optical reasons. When Lindner's method does not bring attenuation of the ectasia of conical cornea, deep perforating keratoplasty is applied. Ectatic irregularity on the anterior surface of the cornea should be corrected by partial or total staphylectomy, and a better cosmetic effect is obtained by fitting a contact glass (Jena glass—Zeiss) on the corneal part of which an appropriate iris pattern and pupil are drawn. This is preferable to excision of the globe and the wearing of an artificial eye.

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## INJECTION OF THE RETINAL VASCULAR SYSTEM IN ENUCLEATED EYES \*

BY

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So far as we know, studies of the injected retinal vascular system in man and animals have been dependent on injections given into the heart, internal carotid or ophthalmic arteries when the globe is *in situ*. This method does not permit the study of the injected retinae of eyes enucleated because of pathological conditions. To overcome this the following technique has been devised whereby an injection of the retinal capillaries of the freshly enucleated eye may be obtained.

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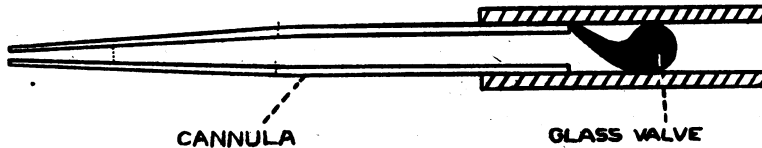
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### Material and apparatus

A wash bottle or related container is used to hold the injection medium. It is supplied with air from a hand or foot pump, and is much more satisfactory than a syringe. The use of such a pressure bottle enables injections to be made in comfort and without an assistant. A Drechsel gas washing bottle is convenient. A mercury manometer should be incorporated in the system.

The outflow tube of the bottle is connected by rubber tubing to a cannula made by drawing out glass tubing.

An essential device in the apparatus is a glass valve in rubber tubing touching the cannula as shown in the following diagram.



Both the cannula and the valve are held between the finger and thumb so that when the cannula is inserted into the central retinal artery pressure of the thumb and finger allows the injection fluid to flow.

It is normal for erythrocytes to proceed through capillaries in single file and frequently under a certain degree of compression. It is therefore necessary that any suspension used for injection should have a particle size of less than  $8 \mu$ . It is also important that such particles should not flocculate, as otherwise both the cannula and the capillaries would become blocked. A material which is suitable for an injection of this type is Monastral Fast Blue, BVS paste produced by the Imperial Chemical Industries. The pigment paste should be diluted with water in the ratio of three parts water to one part paste. Indian ink was also found to be suitable.

In the freshly enucleated eye it is impossible to insert the cannula into the central retinal artery because the optic nerve is so soft that it moves away from the cannula. A certain amount of fixation is therefore necessary before attempting the injection. The pressure in the apparatus must clearly exceed the intra-ocular pressure and in practice a considerable excess of pressure is an advantage. The most desirable pressure is that which will give the fastest injection with the least chance of bursting the capillaries. In this connection the pressure, the bore of the cannula and the viscosity of the injection fluid are all related. For the sake of convenience the relevant figures follow in table form.

Glass tubing for cannula, ext. diam.	...	...	3 mm.
Glass tubing for cannula, bore	...	...	1 mm.
Cannula point, ext. diam.	...	...	270 microns.
Cannula point, bore	...	...	90 microns.
Injection pressure	...	...	300 mm. mercury.
Injection time	...	...	5-15 seconds.
Room temperature	...	...	65° F.

### Method

1. Fix the fresh eye in 5 per cent. formol for 30 minutes to two hours.
2. Wash in tap water 10-30 minutes.
3. Arrange the eye in a plasticine ring optic nerve uppermost, on the stage of a binocular microscope. Eyepiece  $\times 6$ , objective 49 mm.

4. Cut a thin slice from the end of the optic nerve so that a new, smooth surface is exposed.
5. Insert the cannula into the artery or vein and inject.
6. Place the globe in 10 per cent. formol for 24-48 hours.

### Results

Although the injection is not successful in all cases the results generally are satisfactory. After the second fixation is complete the globe is bisected coronally about the region of the ora serrata



FIG. 1.

and the vitreous is gently swabbed from the posterior portion. This portion is then mounted in a special holder and examined with the slit-lamp. As an example of the appearances which may be obtained in this way, Fig. 1 illustrates an injected rete mirabile

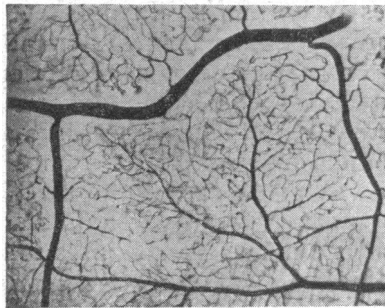


FIG. 2.

Portion of mounted retina of human eye injected after enucleation showing normal vascular system.

lying in front of the optic disc in a case of venous obstruction. The retina is subsequently peeled away from the choroidal bed and mounted on a slide in glycerine. The appearance of a portion of injected retina mounted in the manner described is illustrated in Fig. 2.

This method of examining the retinal vascular system would appear to open new possibilities in the investigation of various fundal states including the relationship between the colour of the optic disc and its capillary content, the state of the capillary bed especially at the edge of the disc in glaucoma, and its relationship to visual field defects, new-vessel formation in the retina and vitreous, the extent of the capillary free zone at the macula in various conditions, etc.

It also affords an opportunity of investigating the degree of collateral circulation existing in the optic nerve head and choroid.

### Summary

1. A method is described of injecting the retinal vascular system in the freshly enucleated eye.
2. Indication is given of the possible usefulness of this new technique.

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## SEVERE LESION OF THE VISUAL PATH IN PREGNANCY\*

BY

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RECENTLY I had the opportunity to review the condition of a patient whom I saw for the first time nearly 20 years ago. The case seems to be a very rare one. The case described by Lawford Knaggs more than half a century ago is closely similar to the one I am going to relate, but in the literature of the last years, as far as I had access to it, I could not trace another of that kind.

*Case history.*—The patient was sent in 1930 by the ophthalmologist to the First Medical Clinic of the University of Budapest for consultation on account of the rapid deterioration of the vision of her left eye. She was at that time 40 years of age and in the fourth month of her sixth pregnancy. She had already gone through three pregnancies when she accidentally became aware of the complete loss of the vision of her right eye. This happened six years earlier. In her earlier history there was nothing which could have been brought into relationship with her condition at that time, except for an apparently insignificant, slight headache which she had sometimes since her 'teens. The medical examination revealed a normal physical condition, including blood-pressure, urine and blood picture. The Wassermann test was negative. The ophthalmological data were as follows: The right pupil reacted to light only consensually, the left one only directly. Amaurosis and primary optic atrophy were found in the right eye. With the left eye she could count fingers at seven feet. The margin of the left optic disc was sharp,

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