The appearances in **Jackson's** case supported the view of Stock and others that a large part of cases of choroidal atrophy are due to tuberculosis.

OSSIFICATION OF THE CHOROID.—**Monbron** reports a series of 5 cases with histoanatomic examination of the

specimens, and a general review of the subject with a bibliography. He concludes contrary to the opinion generally received that only the choroid and more exactly the choriocapillaris is the starting point for intraocular ossification.

SYMPATHETIC DISEASES

HANS BARKAN, M. D.

SAN FRANCISCO.

A review of the literature relating to sympathetic diseases of the eye appearing during 1917 and to February 1st, 1918. Allied topics are reviewed in the section on the Uveal Tract, or will be taken up in the section on Injuries.

OCULAR ANAPHYLAXIS.—**Woods** refers to the mycotic theory, as to the pathogenesis of sympathetic ophthalmia, advocated by Roemer and Fuchs, to the cytotoxic theory of Golowin; and to the theory of Elschnig, who assumed sympathetic ophthalmia to be an anaphylactic uveitis. In order to determine the fundamental points of the anaphylactic theory, the author endeavored to test the following: 1. The antigenic properties of homologous uvea-organ specificity. 2. The ability of one eye to react to perfusion in animals previously sensitized by intraocular injection of the other eye. 3. What constituent of the uveal tract is responsible for such antigenic properties as are possessed by homologous uvea.

The technic of his experiments is given, and a summary of his results. He concludes as follows: 1. Homologous uvea has the power of acting as antigen, and producing an ocular hypersensitiveness. 2. Homologous uvea possesses a strong specificity. 3. Intraocular injection of a small amount of either homologous or heterologous uveal emulsion can produce a hypersensitiveness in the second eye. 4. From the evidence at hand, it seems probable that the peculiar antigen properties of uveal emulsion are due to the pigment epithelium. A bibliography is added.

The anaphylactic theory of sympathetic ophthalmia has also been fully

discussed by **Schieck**, who questions whether the theory propounded by Elschnig is at all clinically applicable, or meets with important objections, so that it must be repudiated. Elschnig advanced the hypothesis, that sympathetic ophthalmia is an expression of local anaphylaxis, utilizing Bail's theory. Bail's theory says that by antigenous resorption of injured uveal tissue an over-sensitiveness is produced in the organism, especially the homologous organ, viz., the second eye.

As in von Pirquet's experiments inflammations occur in consequence of increased capability of reaction through introduction of the anaphylactogen from outside, in our case an inflammation would have to arise, with the serious sequelae due to the vulnerability of the organ, by the least disturbance in the over-sensitive eye, by the disintegration of even one uveal cell or pigment epithelium.

Schieck points out, that for applying this assumption to the clinical facts it must be proven: 1. That the uvea contains an organ-specific, anaphylactogenous albumin, which is absorbed as antigen; 2, whether an organism produces antibodies against its own, although serum-heterogenous, albumin, and whether it can be sensitized against its own products, in other words, whether an autoanaphylaxis exists; 3, how a spontaneous disintegration of uveal cells occurs in the second eye and

how the introduction of the anaphylactogen takes place locally; 4, the main point is that the clinical facts must be brought in accord with the essence of anaphylaxis.

Leaving the first three points aside, Schieck considers the course and peculiarities of the disease as such and whether they fit into the established scheme of anaphylaxis. He emphasizes that the protective effect of enucleation has not been sufficiently considered in judging the validity of the anaphylactic theory. Zade showed experimentally that the anaphylactogen from the eye after injection of the antigen into the anterior chamber is communicated to the whole organism after three hours. Perhaps the sensibilization of the body occurs even earlier. What good, then, Schieck asks, can removal of the injured eye do, if in the meantime uveal pigment, in a form acting as antigen, has entered the circulation, and the process of sensibilization takes place outside of the eye in the vascular system or the bone marrow, and, at the latest 14 days afterwards, the organism contains the dreaded anaphylactogenous antibodies against uveal pigment, and the least anomaly in the other eye may elicit the reactive process? If sympathetic ophthalmia were a process of anaphylactic reaction, all our prophylaxis would be in vain and the other eye even after preventive enucleation of the injured eye would be endangered for weeks, occasionally for years or for the whole life. Since fortunately this is not the case, sympathetic ophthalmia can have nothing to do with a sensibilization against uveal pigment, and the theory must fall. The certain protective effect of enucleation is not conceivable if the anaphylactic theory is accepted. In that respect bilateral idiopathic iritis and parenchymatous keratitis, which as a rule also occurs in both eyes, are generally entirely different from sympathetic ophthalmia.

PATHOGENESIS OF SYMPATHETIC OPHTHALMITIS.—**Van Schevensteen** refers again to the early theory of sympathetic ophthalmia by noting in several cases an early papilloretinitis with fine vitreous opacities, and he has seen these

repeatedly when the sympathizing eye has been observed carefully during the entire course of the affection of the originally injured one.

While all investigators agree that the typical anatomic picture as described by Fuchs is pathognomonic of sympathetic ophthalmia, **Morax** has gone even further and in a very careful pathologic study, in which he was assisted by Landolt, shows that this process takes place in a different fashion, according as to whether the wound of entry is in the anterior portion of the ball (especially in the region of the ciliary body), or as to whether the inciting foreign body or injury is located in the posterior part of the ball. The sympathetic ophthalmia set up by the latter injury he considers a great rarity. The lesions caused by either one of these two localizations as regards injury are nodular infiltrations of the choroid and of the subchoroidal space by lymphocytes. They vary, however, in that those caused by anterior trauma, are inclined to give rise to greater infiltration in the deep ciliary layers; whereas those in the posterior part cause a rather marked infiltration about the entrance of the optic nerve.

CLINICAL REPORTS.—**Brown** reports an unusual case of sympathetic inflammation developing in the fellow eye in the eleventh week, in which the picture (noted a few times before), of depigmentation of the cilia of all four lids was quite marked. This might be ascribed to a pigment antigen. Section of the primary eye showed typical findings.

In two cases reported by **Russ Wood** injections of old tuberculin were given and were followed in each case by a marked focal reaction in the sympathizing eye. But no such reaction occurred in the primarily injured or exciting eye. In neither case was the use of the tuberculin followed by any apparent benefit. In both cases injections of salvarsan had been used without benefit, and after the tuberculin injections steady deterioration of vision continued. This author suggests the possibility that sympathetic ophthalmitis may be due to symbiosis, there

being a cooperation between the tubercle bacillus and some unknown protozoan.

Darling reports two clinical cases of sympathetic ophthalmia. In the first, while examination and history were significant, there was on anatomic examination, no sign of typical sympathetic disease, but a degenerated eyeball with bone formation. The second case is remarkable by the fact that there was at no time a keratitis punctata of the sympathizing eye, although in every other respect it showed the classical picture.

PROPHYLAXIS.—Prevention, and the reasons why sympathetic ophthalmia is relatively rare in the present war, in spite of many ocular injuries, have been extensively discussed by **Weekers** who, in upward of 800 eye injuries, has not met with a single case, and he contrasts this state of affairs with that of former wars, where the disease was common. In order to show the danger in times of peace, he points to the statistics of Ohleman who found sympathetic ophthalmitis in 0.7 per cent.; Knies, 3 per cent. in wounds of the eye; and Hobby, 11.6 per cent.; after removal of cataract. Everbusch had 1.3 per cent; Agnew 2 per cent; and Steffan no less than 21 per cent.

Dimmer also comments on the rarity of sympathetic ophthalmia following war injuries, and thinks the difference between the percentage and that seen in times of peace is worthy of investigation.

In order to prevent its occurrence, **Weekers** urges waiting for at least a few days before enucleation whenever the wound is such as to allow of the hope that the eyeball will keep its shape. He maintains, however, that the classical dictum of removing the eye if it remains painful and irritable for a month or six weeks after the injury should be followed, and not even to wait as long as this if the globe appears to be on the way to atrophy, or if exudative iridocyclitis develops in the injured eye. He is inclined to ascribe the rarity of sympathetic ophthalmia nowadays to the asepsis and antiseptics which are now so general, adding that

when operators will take as many precautions before opening an eye as for a laparotomy, postoperative sympathetic ophthalmia will very nearly disappear.

As is quite natural, in these times of attention to treatment, there is not as much time to devote to questions of etiology. A great deal has been written on treatment of cases of sympathetic ophthalmia. **Weekers** maintains that the early removal of the wounded eye, even though lost as to function, is not justified as a prophylactic measure against sympathetic ophthalmia. There is no urgency for such removal for several days, especially as the danger of sympathetic disease seems to be diminishing; he urges temporizing, as delay may enable us to save eyes that at first sight seem doomed to enucleation.

When radical operation on the wounded eye is necessary, **Weekers** gives the preference to evisceration, believing it to be as good a guarantee as enucleation in regard to the development of disease in the second eye, and for it he claims far superior results as regards prosthesis. This view is not shared by **Orlow**, who maintains that neither one nor the other is an absolute preventive, and that of the two enucleation is decidedly the more so. He has seen some cases develop in spite of these procedures, and advises caution as regards the definite statement to the injured man that the second eye will surely be saved by these operations.

Verwey has written a most interesting paper on the conservative treatment of an injured eye suspected of possibly becoming the exciting agent of a sympathetic ophthalmia. He excises whatever may have prolapsed thru the wound of entry, dissects the conjunctiva off the limbus, and performs a tobacco pouch suture, a proceeding which is simple and effective. The patients generally do not have to lie down and the injured eye stays fairly tranquil. He believes that this procedure does not militate against any sight which the eye otherwise might have kept if the procedure had not been adopted. He has performed it in eight

cases of lacerations of the cornea; four cases of lacerations of the sclera; and in twelve cases of combined lacerations. A fair degree of vision was maintained in seven of the above. In one case the cornea and sclera had been widely lacerated, almost the entire iris had prolapsed, including the ciliary body, vitreous and lens. These were excised, and a tobacco-pouch suture applied to the conjunctiva. Twenty-four hours afterward, the uninjured eye showed slight iritis, which was controlled with atropin. He has enucleated the injured eye in a number of cases about 32 days after the accident, when the iritis of the second eye was just commencing and was well controlled with atropin and the administration of sublimat by mouth. In all these cases the sympathizing eye recovered very promptly.

TREATMENT OF SYMPATHETIC OPHTHALMITIS.—**Brown** has noticed a marked improvement in the course of the sympathizing eye with the use of mercury and benzosalin, combined with a tuberculin course. This improvement, however, was not very rapid until the infected tonsils in the case were removed, when vision cleared up to 4/10 and has remained this acute for 14 months. **Darling** also has seen improvement of the sympathizing eye follow almost immediately after removal of the tonsils, although in his case the vision fell again five days later to 20/200.

Wilder, in discussion of **Brown's** paper, maintains that operation in cases of increased tension in the course of sympathetic ophthalmia is something that should be refrained from if at all possible. He thinks it is a point which is well worth considering in connection with any case of sympathetic ophthalmia in any stage, for the reason that the inexperienced ophthalmologist, who had not seen a number of these cases through long periods of time, might easily be tempted too early to operative interference. If there is any one thing in connection with the treatment of these important cases which should be emphasized, it is to absolutely refrain from operative interference even

months and months after the subsidence of the last symptom. He thinks the most that might be done would be paracentesis, which might be accomplished with safety; but if there is anything brought home to him in the treatment of this disease, it is that one should not jump in "where angels fear to tread." He is convinced that no operation should be attempted for restoration of the vision until two or three years after the subsidence of all symptoms.

SYMPATHETIC DISEASES OTHER THAN OPHTHALMITIS.—The terminology "sympathetic irritation," "sympathetic amblyopia" and "sympathetic ophthalmitis" is, according to **Cousin**, one which should be adhered to strictly, and which has in each instance a definite reason for existence. He believes that there exists a group of signs, which cannot be accurately described as sympathetic ophthalmitis, but which should be carefully differentiated from sympathetic irritation. He terms this group that of "sympathetic reaction," and claims that it occurs every frequently among the wounded of the French Army.

In the wounded eye the symptoms are pain, tenderness on pressure, lacrimation, conjunctival injection. Photophobia is a less constant symptom. These symptoms date usually from the time of the injury, which in most cases is a perforating wound, and persist after cicatrization is complete. The pain is usually persistent, although not severe, and is occasionally liable to short exacerbations. Pain and tenderness have never been absent from the cases under the author's observation. Lacrimation and conjunctival injection vary greatly in degree.

In the unwounded eye, the symptoms present considerable resemblance to those already described, but are, as a rule, less marked. Their onset is later; in some instances 36 to 48 hours, but more commonly seven to ten days after the injury. The writer mentions four symptoms as characteristic: photophobia, lacrimation, discomfort in reading, slight lowering of visual acuity. Photophobia is the most frequent symptom, and is usually well-marked,

but relieved by the use of tinted glasses. Lacrimation is of very variable intensity. Discomfort induced by reading, or by any occupation requiring accurate and prolonged use of the eye, is often the symptom which leads the patient to seek advice.

The loss in visual acuity, always slight, is difficult to estimate accurately; in most cases no record of the vision before the accident is obtainable. Cousin states that he has found a reduction in acuity varying from 1/10 to 5/10. Ophthalmoscopic signs are negative; pain is absent. These symptoms, while resistant to ameliorative treatment, all disappear shortly after removal of the wounded eye; the defect in vision being the most tardy. Enucleation of the wounded eye is the treatment recommended. Notes of eight cases are included in the paper.

Shoemaker and **Alt** report a case which can very well be referred to in relation to the type of cases described above by Cousin. The diagnosis of sympathetic ophthalmia was made, the injured eye having lost the sight 13 years before, after injury with a pair of scissors. While the blind eye was not giving any discomfort, the wound on

the limbus and the sympathizing eye had shown for the last four days a severe neuro-retinitis, with a few small exudates in the retina and minute hemorrhages. The positive diagnosis of sympathetic ophthalmia did not seem justified, especially as Sluder reported a left hyperplastic and a right purulent sphenoiditis. It was agreed, however, as the injured eye was blind, to remove the same. Mercurial inunctions were continued, but though there was marked improvement, the neuro-retinitis persisted. The examination of the removed eye showed simply the results of a severe infectious inflammatory process following the original injury. The peculiar signs given by Fuchs as characteristic of sympathetic ophthalmia were altogether wanting.

In this case, as undoubtedly in many seen in practice in which the diagnosis of sympathetic ophthalmia is made, the chances are that the case is much more likely to fall into the classification described by Cousin as sympathetic reaction, and more of the enucleated eyes examined in the laboratory would show a freedom from the specific changes described by Fuchs.

GLAUCOMA.

JOHN ALEXANDER McCaw, M. D., Oph. D.

DENVER, COLO.

A digest of the literature relating to intraocular tension and glaucoma for the year 1917 and until March 1st, 1918. Some related subjects will be found mentioned under **Diagnosis** and **Injuries**.

ANATOMY OF THE FILTRATION CHANNELS.—**Maggiore** concludes that the canal of Schlemm in man is a vascular structure; that the canal is joined to a closed vascular plexus formed of numerous veins with a few arterial twigs. The connections between that plexus and the canal are formed by a small number of collecting trunks, about 20 or 30 in number, with very small lumen. He found that there was no connection between the canal and the anterior chamber, and that the canal had a complete endothelial lining. Under normal conditions the canal contains only lymph.

PHYSIOLOGY.—**Magitot's** work on physiologic intraocular pressure concludes as follows: That, (1) the normal intraocular pressure in man oscillates between 15 mm. and 25 mm. Hg.; (2) the pressure varies along with arterial pressure; (3) the factors influencing pressure are the general and local blood circulation, and the walls of the eye; (4) the eyeball is distensible in the adult due to elastic fibers in the sclera; (5) the uveal tract is an erectile tissue, a blood reservoir, which regulates the pressure; (6) the variations of pressure within the normal limits are due chiefly to variations