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EYE DISEASES OF DOMESTIC ANIMALS,

By C. A. CARY.

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Page 6, line 7 of explanation of fig. 1, for "equeous" read *aqueous.*

Page 6, line 13 of explanation of fig. 1, for "samal" read *small.*

Page 10, lines 22, 24, 32 for "agueous" read *aqueous.*

Page 11, line 1 for "agueous" read *aqueous.*

Page 11, lines 23, 28 for "vitrious" read *vitreous.*

Page 11, line 33 for "Membrane" read *Membrana.*

Page 12, line 19 for "membrane" read *membrana.*

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Page 29, line 3 for "agueous" read *aqueous.*

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Page 43, line 1 of explanation of fig. 13, for "Luxuration" read *Luxation.*

Page 48, line 17 for "Exothalmus" read *Exopthalmus.*

Page 50, line 4 after "is" insert *found.*

Page 59, line 10 for "Wallach" read *Willach.*

Page 63, line 2 for "appearances" read *appearance.*

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ANATOMY OF THE HORSE'S EYE.

[When reading note the location of the parts of the eye as illustrated in Fig. 1.]

The eyeball or globe is a spherical shell whose interior is filled with liquid or semi-liquid parts, called the humors or refracting media of the eye.

The wall or shell of the eye is formed by three distinct coats—the external, the middle and the internal.

The outer or external coat is divided into two distinct parts—the sclerotica and the cornea.

The sclerotic is a very tough, white membrane, forming about four-fifths of the outer coat of the eye. The muscles that move the eyeball are attached to the back part and the outer surface of the sclerotica. Its internal surface is loosely united to the middle or choroid coat of the eye by small blood vessels, nerves and loose fibrous tissue. In front, the sclerotica shows an elliptical opening with its greatest diameter from side to side and shortest diameter from above to below; the edge or border of this opening is bevelled on the inner side, and the cornea fits in it as the watch crystal fits in the watch case.

The sclerotic is well supplied with blood vessels and nerves, and a little below the middle of the back part, the optic nerve passes through it and the choroid to form the retina or internal coat.

The cornea is a very transparent membrane forming the anterior part (about one-fifth) of the external coat of the eye. Its outline is elliptical, like the opening it closes. It consists, from without to within, of the following layers:

The external layer is the conjunctival epithelium spread over the outer surface of the cornea; in some animals this

layer is not separated from the middle layer by a thin elastic limitary membrane, called Bowman's membrane.

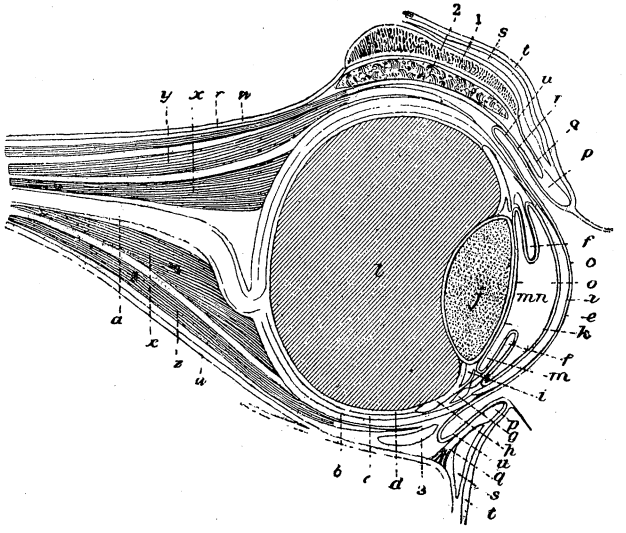

FIG. 1.

Diagramatic Section of the Horse's Eye (after D'Arboval) showing the relative position of the various parts. In reading the description of the anatomy of the eye frequent reference should be made to this cut.

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a, Optic nerve; *b*, Sclerotic; *c*, Choroid; *d*, Retina; *e*, Cornea; *f*, Iris; *g*, *h*, Ciliary circle, (or ligament) and processes given off by the choroid though represented as isolated from it, in order to indicate their limits more clearly; *i*, insertion of the ciliary processes on the crystalline lens; *j*, Crystalline lens; *k*, Crystalline capsule; *l*, Vitreous body; *m*, *n*, Anterior and posterior chambers; *o*, Theoretical indication of the membrane of the equeous humour; *p*, *p*, Tarsi; *q*, *q*, Fibrous membrane of the eyelids; *r*, Elevator muscle of the upper eyelid; *s*, *s*, Orbicularis muscle of the eyelids; *t*, *t*, Skin of the eyelids; *u*, Conjunctiva; *v*, Epidermic layer of this membrane covering the Cornea; *x*, Posterior rectus muscle; *y*, Superior rectus muscle; *z*, Inferior rectus muscle; *w*, Fibrous sheath of the orbit (or orbital membrane); 1, Section of orbital arch; 2, Lachrymal gland; 3, Section of samal oblique muscle.

The middle layer is the principal and the thickest part of the cornea; it is fibrous, tough, unyielding and continuous, with the sclerotic; its external surface, in most animals, is covered with Bowman's elastic limitary membrane and its

inner surface is separated from the internal layer of the cornea by Descemet's elastic limitary membrane.

The internal layer is composed of a single layer of many sided cells which contain large neuclei. The cornea has but few blood vessels. The vessels form loops around its border, and in the sheep they advance to the middle of its surface.

The middle coat of the eyeball consists of the choroid, the ciliary processes and the iris.

The choroid is a thin, vascular, dark colored membrane, spread over the inner surface of the sclerotic, investing the posterior four-fifths of the eyeball, and terminating, in front, at the ciliary ligament; there bending inward to form the ciliary processes.

The choroid is divided into two zones or unequal parts by the *ora serrata*—a zigzag line that corresponds to the point where the retina changes its character or near the anterior border of the retina. The posterior zone or part, in the horse, is not uniform in color, being perfectly black in the lower part; this is abruptly terminated at a horizontal line that passes about one-eighth of an inch above the place where the optic nerve passes through the sclerotic and choroid. From this line on the segment of a circle from two to three-fifths of an inch in height it shows most brilliant colors: at first blue, then an azure-blue, afterwards a brownish blue, and after this the remainder of the eye is occupied by an intense black. The bright portion, or upper half of the choroid is the *tapetum.* The anterior zone or ciliary part of the choroid includes the ciliary ligament and the ciliary body. The ciliary muscle circle or ligament is a grayish circular band of unstriped muscular fibres about one-sixteenth of an inch broad; the fibres are radial and circular, the former arises from the junction of the cornea and sclerotic to pass back to the choroid opposite the ciliary processes; the latter are internal and pursue a circular course arouud the place of attachment of the iris.

By the contractions of this muscle, it plays an important part in accommodating or adjusting the eye to the perception of objects at different distances.

The ciliary body forms a ring which overlaps before and behind the ciliary muscle and lies between the choroid and iris, or rather it connects the choroid to the iris.

The *ciliary processes* consist of 110 to 120 radiating folds formed by the plaiting and folding inward of the choroid at its anterior margin; these are received between the corresponding folds of the suspensory ligament of the lens.

The dark color of the choroid is due to the coloring matter, pigment in the cellular or internal layer of this membrane. The pigment absorbs the rays of light which pass through the retina and thus prevents their becoming reflected and confusing the vision. The brilliant metallic colored tapetum is generally observed in nocturnal animals (horse, etc.), and especially in the carnivora. It is believed that by reflecting rays of light a second time through the retina, it gives the animal a clearer and better vision at night.

This is the cause of the glare or "balls of fire" perceived in the eyes of the cat and other carnivora in the dark.

FIG. 2.
Normal Horses Eye (after Goubaux and Barrier).

The iris is elliptical in shape like the cornea; it is a thin, perforated, contractile curtain, suspended behind the cornea in the aqueous humor, in front of the crystalline lens, forming the anterior portion of the middle coat of the eyeball; it is composed of radiating and circular muscular fibres and a fibrous frame work. Its anterior surface is covered by a layer of polyhedral cells on a fine basement membrane; its posterior face is opposite the lens and ciliary processes, and is covered by a thick layer of pigment called the uvea; loose predunculated portions of this pigmented layer may project through the pupillary aperture; they most frequently project from the superior border of the pupil and extend into the anterior part of the aqueous chamber, where they are known as "soot balls" or *corpora nigra*. These black, spongy masses may obstruct the passing of the light into the eye, but if they are small, little harm is done by them. These "soot balls" are brownish black and are larger when along the upper border of the pupil than when at the lower border.

The color of the eye depends upon the quantity of pigment in the uveal layer of the iris. In man, the color of the iris varies with the different individuals; while in the horse it is generally of a brownish yellow hue; sometimes, however, it is nearly white or bright gray—the animal possessing such eyes is said to be "wall eyed." The aperture or elliptical central opening in the iris forms the pupil, which is expanded or enlarged when the radial muscular fibres of the iris contract; and it is contracted or decreased in size when the circular muscular fibres contract. Strong sunlight produces contraction of the pupil; while weak light or darkness causes the pupil to expand.

The internal coat of the eyeball or shell is the retina. It lies on the inner surface of the choroid to which it loosely adheres.

This most essential, delicate, grayish, transparent, nervous membrane is thicker behind than in front, and extends as far

forward as the ciliary body, terminating in a ragged edge—called the *ora serrata.* The retina is formed by the expansion of the optic nerve; the nervous elements are imbedded in and spread over a fibrous frame-work. At the point of entrance of the optic nerve is found, on the retina, a small oval elevation, known as *optic pupilla.* From its centre and its border emerge and radiate the blood vessels of the retina. This disc or elevation is the only portion of the retina where the sense of vision is wanting, and is, in consequence, called the *blind spot.* In the exact centre of the retina posteriorly corresponding to the axis of the eye, is a triangular yellow space called the *macula lutea*—the spot where vision is most distinct and perfect. The extreme complexity in the arrangement of the nervous elements of the retina may be partially comprehended by the fact that they are divided into ten different microscopic layers. These various nervous elements receive the impression of the inverted image or picture of the object or objects in the field of vision and the optic nerve conveys this impression or perception to the brain.

The humors or semiliquids of the eye are the Agueous Humor, the Vitreous Humor and the Crystalline Lens.

The agueous humor is a watery liquid that is found in the small chambers in front and behind the iris. It is secreted by Descemet's membrane, which lines the chambers containing the humor. This humor maintains the convexity of the cornea, facilitates movements of the iris and the lens, and, to some extent, assists in the refraction of the light passing through it to the lens and the retina.

If by surgical operation, accident or disease, this humor is permitted to escape from the agueous chambers, it is rapidly regenerated.

The crystalline lens is a double convex, clear, semi-solid body, and lies behind the pupil with its anterior surface

immersed in the agueous humor and its posterior face imbedded in the vitrious.

The suspensory ligament extends from its periphery to the ciliary body and thus assists in holding the lens in position and establishes a union between it and the ciliary muscle. The lens is enveloped by an elastic capsule very like Descemet's layer of the cornea. The proper tissue of the lens is arranged in concentric layers that under the microscope are found to be composed of fibres; the external layers of the lens are almost liquid, but they gradually increase in hardness toward the center. The lens receives neither blood vessels nor nerves; it absorbs its nutriment from its capsule through a delicate layer of cells on its surface.

The anterior surface of the lens is flatter or less convex than its posterior surface. By the contraction of the ciliary muscle the convexity of the lens is changed and the degree of refraction varies; thus the eye is adjusted for, or made to accommodate itself to, different distances. The chief use of the lens is to refract (change the direction of or bend) the rays of light, which enter the eye. It causes the rays to converge or unite or focus upon the retina.

The vitrious humor occupies about two-thirds of the interior of the eye—all of the cavity of the eye behind the crystalline lens. It is transparent, colorless, jelly-like in consistency and contains a few embryonic cells, while its major part is amorphous or without distinct parts. The hyaloid membrane envelopes the vitrious mass and is in contact externally with the retina and the posterior convex surface of the lens. This humor assists in the refraction of light. If it escapes, it is not regenerated.

The accessory organs of the eye are the Orbital Cavity, the Muscles of the Eye, the Eye Lids, the Membrane Nictitans and the Lachrymal Apparatus.

The orbital cavity is situated at the side of the head, near

the union of the cranium and face; it has the form of a long and fibrous cone open at the base or in front, with the optic nerve entering the small foramen at its apex or back part.

The muscles of the eye are seven in number: the posterior, the superior, the inferior, the external, the internal, the superior great oblique and the inferior small oblique. These muscles all lie in the orbital cavity behind the eyeball; their posterior ends are attached to bony walls of the posterior part of the orbital cavity; while their anterior ends are attached to the surface of the sclerotic—each one to that part of the sclerotic surface indicated by its special name.

The eyeball is turned upward, downward, outward, inward, etc., according the contraction of one of these special muscles. If the internal muscle is stronger or shorter than the external the eye is turned inward, and if held in that relative position constantly the condition of "cross eye" is produced.

The protective organs of the eye are the eye lids and the membrane nictitans. The eyelids are two movable curtains covering and protecting the front of the eye. They are attached by their external borders to the rim of the bony orbit; their external surfaces are covered by the skin; their internal faces are moulded on the anterior surface of the eye, and are lined by the conjunctiva—a mucous membrane which is also reflected above and below on the eyeball—(the conjunctiva is very sensitive and vascular and is painfully irritated by small seeds, particles of dirt, etc., that may get "into the eye"). The framework of the lids is formed by a fibrous plate attached to the orbital rim and terminating at the free border of each lid by a small tendinous arch called the tarsus. Attached to the outer surface of this fibrous plate, common to both lids, is the orbicular or sphincter muscle of the eyelids, which by its contraction "closes the eye" or brings the free borders of the eyelids together. The elevator muscle pulls the superior lid upward, and the lower lid drops

when the orbicular muscle ceases to contract; thus the eye is opened.

On the outer part of the free border of the upper lid are large eye lashes—but the lashes of the lower lid are fewer in number and smaller. On the inner part of the free border of each lid are little oil glands which lubricate the free margins of the lids and keep them from growing together or adhering to one another during sleep.

The membrana nictitans, third eyelid, the "haw," or the eye washer," is placed at the inner angle of the eye; its framework is a fibro-cartilage, elastic and irregular in shape, thick at its back part, and thin at its anterior or free part, which is covered by the conjunctiva. This lid is continued behind by a strong, fatty cushion, which insinuates itself between all the muscles of the eye. This lid is moved over the anterior surface of the eyeball to remove dust particles, small seeds, etc. It has no special muscle, but is pushed over the eye when the eyeball is drawn backward into the orbital cavity or socket by the posterior muscle of the eye. When this lid is continually drawn, or pushed out, over the eye, as in tetanus, lock jaw, etc., some persons say the horse is affected with the "hooks;" and occasionally the barbarous treatment of cutting off these protecting and useful lids is practiced. It would be about as sensible to cut off the hands of a man to keep him from rubbing his eye when it becomes irritated by dust, etc.

The Lachrymal Apparatus comprises the gland which secretes the tears and the canals which carry the extra tear fluid to the external openings of the nasal cavity. The lachrymal or tear gland is situated above the eyeball and below the rim of the orbit; it secretes the tear fluid which is carried to the surface of the eye by little ducts or canals that open in the inner surface of the eyelids. The tears are spread over the eye by the movement of the lids called winking. At the inner or nasal angle of the eye is a little

round body, usually black or brown; it is a fold of the conjunctiva and is designed to direct the tears toward the opening, located in each eyelid near the internal angle, by which the tears pass into the lachrymal ducts that carry the superfluous tears to the lachrymal sack. This tear sack is a little reservoir which receives the tears from the ducts of the upper and lower lids, and passes the tears into the lachrymal canal. The lachrymal canal passes downward and slightly inward, at first through a bony canal, and terminates on the inner surface of the outer wing of the nostril; the opening or orifice of this canal looks as if it were punched out of the tissues and is sometimes mistaken for an ulcer.

DISEASES OF THE EYELIDS.

TUMORS of various kinds are occasionally found on the eyelid. The upper lid is a favorite place for warts—diseased, excessive growths of the outer layers of the skin. The exciting cause of warty growths is at present thought to be a very minute plant or animal parasite. It is best to excise them with the knife; or, if small, to snip them off with the scissors, being careful not to cut deeper into the eyelid than the thickness of the skin. After the bleeding has partially ceased and the blood has been wiped away with a clean, moist sponge or cloth, the raw surface may be touched or cauterized with lunar caustic or a small pledged of cotton dipped in strong carbolic acid. Melanotic (black, pigmented) tumors are occasionally found on the eyelids of white horses. If they are small and are removed in the early stage of growth, they are not so liable to return; but if they involve considerable tissue or are of long existence, they are very liable to return after removal. All small tumors of the eyelids may be removed in a manner similar to that described for warts.

Pedunculated tumors may be ligated by tying a strong

cord around the pedicile close to the skin; if it does not fall off in a few days another strong thread may be tightly tied around it at the same place. Caustic medicines (Lunar Costic or Tri-Chlor-Acetic Acid) may be applied, once every four or five days, until the tumor can be pulled away by the fingers. Care must be taken not to get these caustics into the eye; it is best not to use caustics except on tumors with large, thick bases that cannot be ligated or excised.

WOUNDS OF THE EYELIDS.

These occur through bites, tearing on nails, harness, hooks of snaps, barbs of wire fences and other projecting points, about the stable or stall. If the wound is fresh the edges may be brought together by stiches one-third of an inch apart; ordinary white silk thread may be used.

INFLAMMATION OF THE EYELIDS.

Various injuries and bruises of the eyelids may occur when a horse is rolling or throwing his head during colic attacks, or other painful diseases; or neighboring tissues may be injured or bruised and the inflammation extend to the eyelids.

The writer has repeatedly observed the eyelids of cattle attacked by ringworm, a transmissable parasitic disease of the skin, causing not only inflammation of the eyelids but also of the conjunctiva, extending at times to the cornea.

Constitutional diseases (authrax, Texas fever, purpura) may be attended by swollen and inflamed eyelids. Small wounds may admit germs into the tissues of the eyelids and produce inflammatory swellings.

Inflammation, resulting from wounds, bruises, etc., may be reduced by bathing the eye in cold water and applying antiseptic solutions. In ringworm the crusts and scales must be washed and scraped from the skin and then a one per cent. solution of corrosive sublimate may be applied,

once per day for three or four days. Other parts of the body and other animals affected with ringworm must be treated in the same way; since this parasitic skin disease is transmissible. Inflamed, swollen eyelids from constitutional diseases may be remedied by treating the disease with which they are associated.

ENTHROPITM—FOLDING INWARD OF THE LID.

The free margin of the lid is folded in against the eye-ball; generally the entire margin of the lid is rolled inward, but, at times, only that half near the inner or nasal angle of the eye is thus affected.

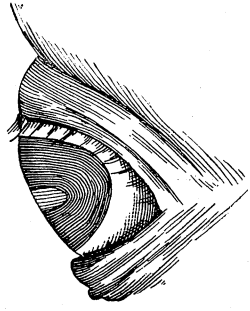

FIG. 3.

Entropium—Folding inward of the lower lid; the eye-lashes and hair rub over the conjunctiva and cornea, when the eye lid or eye-ball is moved, producing inflammation by constant friction.

This disease occurs most freqently in the dog but occurs also in the horse, the ox and the sheep. It has been observed in some animals at birth; and, no doubt, a tendency toward this disease is inherited—especially among dogs. Spasmodic contractions of the orbicular muscle that closes the eye, a relaxation or loose condition of the skin and an excessive development of the skin and tarsus of the lid, are said to be prominent factors in producing entropium. Scar tissue—resulting from wounds, ulcers, etc., on the inner surface of the lid—contract, or make tense, the con-

junctiva to such a degree that it pulls the free border of the lid inward; while the contraction of the orbicular muscle (in winking) would roll or fold the lid.

One or both lids of one or both eyes of the dog may be affected; but, as a rule, only the lower lid of one eye in the horse is so diseased. The constant friction, occasioned by the continual rubbing of the eyelashes over the conjunctiva and the cornea, produces great irritation, which, if long continued, results in inflammation. The conjunctiva becomes conjested, light red and slightly swollen; the cornea may be clouded and at times ulcers form on its surface; the tears flow in excess; and the animal constantly attempts to close the eye. As soon as the lid or lids are returned to their normal position, the inflammation, cloudiness, etc., begin to disappear and the eye to retain its normal condition. Treatment consists in removing by excision a portion of the relaxed and loose skin. In the horse a strip of skin, one-fourth to one-half inch broad, is cut away parallel to, and about one-half inch from, the margin of the lid. The elliptical strip may be removed by using small, sharp shears. The free edges of the skin are then brought together by silk stitches, about one-half inch from one another. As a rule, in the course of a week the stitches may be removed. In the dog the relaxed skin may be excised much farther from the margin of the lid and the gaping wound may be left to heal without bringing the edges of the skin together with stitches. It is, however, safer and better to stitch up the wound.

ECTROPIUM—ROLLING OUTWARD OF THE LID.

In this disease the eyelid is drawn away from the eyeball, the conjunctival surface turned outward, the free border (lower lid) downward; the eyelid is rolled outward and downward, leaving the eye unprotected, subject to constant irritation from air and dust and rapid evaporation of tears. This condition produces chronic inflammation of the con-

junctiva and leads to the formation of clouded spots and vascularity of the cornea. This disease also occurs most

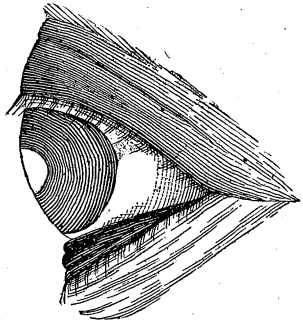

FIG. 4.
Ectropium—Folding outward of the lower lid.

frequently in dogs, but may appear in the horse, ox and sheep. It is caused mostly, in the horse, by scar tissue in the neighborhood of the lower eyelid; this makes the skin so tense that the traction pulls the lid from the eyeball. Inflammatory swellings and new growths on the conjunctiva may also cause it. Dogs with deep set eyes and in a poorly nourished condition suffer with this disease. Ectropium is treated by cutting away a narrow strip of the conjunctiva parellel with margin of the lid. The shears may be used, but no stitches are required.

PTOSIS—FALLING OF UPPER LID.

When the upper lid hangs abnormally downward and outward from the eyeball, without folding or rolling, it is called drooping of the lid or Ptosis. It is usually associated with paralysis of the facial nerve, and may occur on one or both sides. In paralysis of both nerves there is constant dribbling of saliva, paralysis of the lips, the nostrils and the upper eyelids. This is said to result from an injury of the facial nerve or some of its larger branches. The injury is usually produced by bruises or due to pressure of the bridle

or of a yoke. In the first stages of the paralysis, it may be improved by reducing the inflammation or by removing the pressure on the nerve or its branches. But, as a rule, paralysis of one or both facial nerves is incurable. Yet the drooping of the eyelid may be removed by a surgical operation too complicated and difficult for unskilled hands.

DISEASES OF THE HAW OR MEMBRANA NICTITANS.

The conjunctival mucous membrane which covers the haw may be inflamed when the other parts of the conjunctiva are diseased. Also the haw may be pushed out over the eye when the eyeball is drawn back into the socket, which is done in certain eye diseases and for protection. In such cases uninformed persons say the horse has the "hooks" and at once proceed to cruelly cut them out. It is scarcely necessary to remark that nearly every case of so-called "hooks" is only a symptom of another disease and would certainly disappear if the real disease were removed.

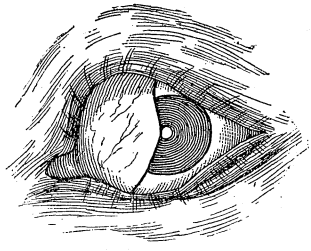

FIG. 5.

Abnormal extension of the haw or "eye-washer" as observed in tetanus (lockjaw) inflammation of the haw, etc. This continued projection of the haw, is many times called "hooks."

In some instances the haw is injured by being torn at the upper part of its free margin or it may be torn or cut in other places by injuries. Nearly all cases of injury recover without treatment, but should the separated or divided haw

continue to irritate other parts of the eye, it may be removed. Occasionally tumors appear on the haw or eye-washer; if small and harmless they may be left undisturbed or clipped off with the shears; but if large and harmful, the entire haw (if necessary) may be removed. In cutting away the torn haw, or the tumor and haw, the animal should be securely and safely confined (by casting or otherwise) and a few drops of a ten per cent. solution of cocaine may be put into the eye; after waiting a few minutes for the cocaine to take effect, the haw or tumor may be grasped with small forceps and completely excised with the shears; during the next few days cleanse the eye, two times per day, with warm water, and a one per cent. solution of carbolic acid. After repeated or severe attacks of inflammation of the conjunctiva, or repeated attacks of moonblindness, the haw remains more prominent and farther projected over the eyeball than normal. In tetanus, or lock-jaw, in horses, the haws are partially or completely extended over the eyeball—especially on exposure to strong light or when the head is elevated.

DISEASES OF THE TEAR APPARATUS.

In all cases where the tears are running down over the side of the cheek and there is no swelling or redness of the lids in their normal position, it is wise to examine carefully the lachrymal or tear apparatus. Most frequently the lachrymal canal is obstructed at its opening into the nostril; this may be relieved, as a rule, by removing the dirt and pus-like matter which clogs the opening.

Sometimes the canal is obstructed in its superior part near the tear sack; then it is best to inject by means of a small syringe, carbolized water or a two per cent. solution of boracic acid, into the canal at its lower or nasal opening. If the tear canal, tear sack and tear ducts are open or pervious, the water will pass out at the tear points near the inner angle

of the eye on the margin of each lid. Occasionally the canal or the tear ducts are obliterated, resulting from catarrhal or infectious inflammation and from fractures of bones along the course of the canal. In such cases it may be made pervious by forcing a small silver probe into the canal; but sometimes the canal is so completely obliterated that it is impossible to open the old passage way for the tears. When the conjunctiva or the eye lids are inflamed and when the under lid is everted in ectropium, the openings of the tear ducts are closed or are so displaced as to prevent the passing of the tears into the ducts. After recovery from these diseases, the tears cease to flow over the cheek.

DISEASES OF THE TISSUES SURROUNDING THE EYE AND IN THE ORBITAL CAVITY.

Fractures, bruises and wounds may take place in the bones and tissues surrounding the eye, and must be treated according to the conditions presented. Generally speaking, continual application of cold water baths or fomentations to the injured parts will materially reduce and prevent inflammation. Tumors or new growths of various kinds may appear in the orbital cavity outside of the eye ball. As a rule, they are very serious and eventually necessitate the removal of the eye ball with its surrounding tissues and sometimes requires excision of the eye lids and the skin with other tissues in the neighborhood of the eye. Whenever cancerous growths begin to spread or extend to the parts around the eye it is well to cut away all the parts involved. Such malignant growths are liable to return, even after several removals. Deep seated, spreading tumors of the orbital region should always be considered as very serious and as nearly always incurable without complete incision.

DISEASES OF THE CONJUNCTIVA.

CONJUNCTIVITIS.—Inflammation of the mucous membrane lining the eye lids and reflected over the eye ball around the cornea.

CAUSES.—1. Mechanical and chemical irritants.—Small seeds, pieces of hay, straw, glumes, wheat or barley beards, small insects, coal dust and other kinds of dust, sand, hair, smoke, entropium, parasites—all foreign bodies that act as mechanical or chemical irritants may produce conjunctivitis. Not infreqnently has the writer observed this disease in a very severe form, resulting from injudicious and ignorant application of caustic and blistering salves, liniments or quack eye washes. Striking the animal in the eye with a whip, or stick; bruising or wounding the eye lid or parts near the eye may excite inflammation in the conjunctiva. Cold, sharp or excessively dry winds may also cause it.

2. It is associated with other diseases, as—ulceration of the cornea, periodic opthalmia, occasionally with Texas fever and anthrax, influenza, strangles (distemper in horse), rinderpest, and, now and then, in the course of other infectious diseases; often it is associated with catarrhal inflammation of the mucous membrane of the nasal passages, sinuses of the head and of the lachrymal canal and ducts. Inflammation of the conjunctiva and the cornea is quite often observed in sheep when they are affected with "head scab," or parasitic skin disease, confined to the short wool regions of the sheep. Conjunctivitis is also associated with sheep pox. Cattle are attacked by an enzootic inflammation of the conjunctiva and cornea, which is considered in detail under diseases of the cornea. Diptheritic conjunctivitis appears in fowls.

SYMPTOMS.—On the irritated and inflamed spot of the conjunctiva there will be red streaks of strongly congested blood vessels, the mucous membrane will

be slightly swollen; this inflammation may in a short time extend to all parts of the conjunctiva and involve the circumference of the cornea; the eye is very sensitive to light, and is kept closed continually. During the early stages the secretion of tears is greatly increased and they flow in profusion over the cheek, but during the more intensive or severe inflammation a mucus exudate appears, which is of light gray color and contains small semi-transparent flaky particles. If the inflammation is still more severe the exudate or secretion appears as a grayish yellow or a green fluid which consists of pus cells and tears. At one time, in severe cases, the secretion may be pus mixed with serun, and at another it may be pus mixed with mucus. An organized membraneous exudate is present in diptheretic conjunctivitas and to a limited extent in fallicular conjunctivitis. The superficial layer may be involved in severe cases, while in other instances all the layers and the submucous tissue may be involved in the inflammation; these distinctions are not always well defined; but as a rule, great intensity and long duration of the inflammation indicate that the entire conjunctiva and submucous tissues are affected.

TREATMENT.—The first thing to do is to remove the cause if it can be discovered. If the animal is very sensitive about having the eye examined, it is best to put a twitch on his nose. Place the thumb on the lower lid and the index finger on the upper; by gradual and firm pressure, open the eye and look carefully for a hay seed or any foreign body or irritating particles that may be in view. After completely cleansing the index finger and removing the long, rough or sharp margin of the finger nail, it may be pushed around under the lids and under the haw in search of the irritant; this must be done with great care, and it is always best to put a few drops of a three per cent. solution of cocaine into the eye before introducing

the finger. Following this search and the removal of the irritant, the eye may be washed with pure cold water or with a solution of corrosive sublimate 1 part and pure water 5000 parts. Bathing the eye in very warm water will relieve the pain and sensitiveness; while cold water fomentations will remove the fever. A great many cases of conjunctivitis readily yield to the simple method of adjusting a large, clean wet cloth over the eye, keeping it moist by pouring cold water on it every hour. It is generally best to put the animal in a dark stall, but unless such a place is well ventilated I prefer the open and well ventilated box stall. The following prescription has met with great favor in Germany:

Borax, 6 grains; Aqua Amygdalæ Amaræ, 2 drachms; Gum Arabic, 2 drachms; Pure Water, 2 ounces. Apply to the conjunctiva by putting several drops into the eye twice per day.

In purulent conjunctivitis, when pus is present in the eye secretion, one may employ corrosive sublimate 1 part, water 1000; or nitrate of silver 4 grains and water 1 ounce. In a few seconds after applying the nitrate of silver solution, the eye may be washed with a weak watery solution of common salt; this checks the burning irritation of the silver nitrate. It is safer to use the solution of corrosive sublimate. Diptheritic conjunctivitis develops in chickens, doves and other fowls that are affected with diptheria of the mouth, the throat and the nose. The healthy should be separated from the diseased fowls; the diptheritic membranes should be removed from the mouth and eye; and the mucous membranes should be covered or penciled over (by means of a feather or small brush) with a 1 to 2 per cent. solution of corrosive sublimate or with 1 to 2 per cent. solution of silver nitrate. In 20 to 30 seconds after applying the nitrate of silver solution, bathe the eye and other affected parts with a weak solution of salt water. When chronic inflammation of the follicles of the inner surface of the haw is present, it

may be relieved by using a 1 per cent. solution of corrosive sublimate; this should be applied as previously directed, being very careful that the fluid does not come in contact with other parts of the eye. As a rule, follicular conjunctivitis occurs only in dogs. When it will not yield to medical treatment, the inflamed follicular spots are clipped off; or part or all of the haw may be removed. Nitrate of silver solutions should be discarded in all cases where the cornea is also involved, since it is liable to leave permanent opacities of the cornea.

DISEASES OF THE CORNEA.

WOUNDS.

The transparent cornea may be injured by a stroke of the whip, by hard straw or hay stems, by thistles, and occasionally by sharp objects—glass, nails, splinters, hedge thorns, and wire barbs. Small rough or sharp objects that get into the eye not only injure the conjunctiva but also may scratch or even penetrate the cornea. In fact, many of the chemical and physical causes of injuries to the conjunctiva in like manner effect the cornea.

The shunning of light by closing the eye and an extra secretion of tears are always present during the active stages of the inflammation. The seriousness or severity of an injury depends upon the extent of surface affected and whether the outer or middle layers are separately or conjointly injured; or whether the entire thickness of the cornea is perforated. If there be but a small spot of the outer layer injured, recovery takes place in a few days, by keeping the eye covered with a clean cotton or linen cloth saturated in a solution of 1 part carbolic acid to 100 parts of water. If the deeper or middle layer of the cornea be injured, it will require more time for healing and is liable, in the horse, to leave a scar—a whitish upaque spot. Treatment may con-

sist in the continued application of the 1 per cent. carbolic acid solution, or in applying continually a cloth saturated with a solution of 5 to 10 parts of antipyrine and 100 parts of water. After the painful and feverish stage is past a few drops of a solution of 2 parts of potassium iodide and 100 parts of water may be used two times per day. If the cornea be perforated the aqueous humor escapes, and this leads, in most cases, to inflammation of the entire eye, resulting in loss of sight and generally in the destruction of the eye-ball.

Occasionally a perforating wound heals by granulation, the iris becomes free and sight is restored. But most frequently in such cases the iris remains attached to the wound or scar tissue of the cornea and prohibits the light from passing into the eye. If the perforation is near the margin of the cornea, a few drops of a solution of 1 gr. of eserine to 1 ounce of water may be applied, two times per day. But if the perforation is near the centre of the cornea a few drops of a solution of atropine 1 gr. to water 1 oz. may be used, night and morning. By the use of eserine the pupil is contracted and the free borders of the iris are taken away from the marginal wound in the cornea. By the use of atripine the pupil is expanded and the borders of the iris are removed from the edges of the central corneal wound. Infectious and general inflammation of the eye may be obviated by adjusting over the eye a cotton or linen cloth moistened every half hour with a solution of carbolic acid 1 part to water 100 parts; or corrosive sublimate 1 part and water 1000 parts.

KERATITIS OR CORNEITIS.

INFLAMMATION OF THE CORNEA may involve the superficial layer, or the middle layer of the cornea; it may embrace only part of the cornea or may be diffuse—extend over the entire cornea. The partial or limited form is generally

the result of injuries of the cornea. The friction of the eyelashes in entropium, small sharp substances, and irritating salves, are common causes of local inflammation of the cornea. Diffuse inflammation is associated, as a rule, with infectious conjunctivitis in cattle and sheep; and, at times, appears in the course of cow-pox and sheep-pox, and of diptheria in fowls; and in the course of influenza and the acute attacks of moon-blindness, in the horse.

Symptoms when the outer layer alone is affected: As soon as the cornea becomes inflamed, the animal avoids the irritating light by partially or entirely closing the eye, and tears flow down over the cheek. The cornea becomes opaque at a not sharply limited spot or over its entire surface; this opacity may be grayish blue, gray or light gray in color. One may see this opacity best by viewing it, not from directly in front of the eye, but from one side. If the inflammation is of long duration blood vessels will be found in the cornea, which may be seen in their conjested condition near its border. When the opacity and the other symptoms appear suddenly (without blood vessels forming in the cornea), recovery is quite certain to occur in a few days. The darker the opacity or cloudiness the weaker the infiltration or the less damage in the cornea to be repaired. Light gray and white colored opacities denote intensive changes which require eight to ten days for their complete removal. If blood vessels form in the cornea of the horse, a permanent opaque spot may remain; but in the dog the complete removal of the opacity will usually occur.

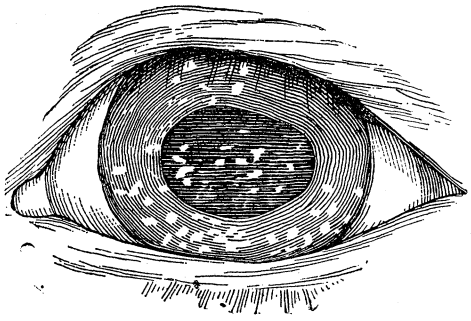

FIG. 6.

KERATITIS PUNCTATA—Inflammation of the internal or posterior layer of the cornea produces a spotted apacity; the dots or opaque white spots may be larger or smaller than those in the cut and may extend over the entire surface of the cornea. Another form of keratitis punctata is developed as mentioned in the text.

If the middle layer or principal part of the cornea be inflamed, the opacity develops slowly, is grayish blue, gray or light gray in color. The opacity is generally irregular in form—cloudy, striped or ray shaped; these points or spots extend over the entire cornea. When inflammation produces such spotted or irregular dotted opacity, it is designated *keratitis punctata* (see Fig. 6). This spotted appearance of the cornea is due to the dotted opacities in the outer layer while the inner layer may be evenly clouded in all its parts. The deeper seated opacity may be observed by viewing the cornea from one side; this is perceived best by illuminating the eye in a dark stall or room. A yellow colored, sharply limited opacity, announces the formation of a corneal abscess.

Shunning the light and an excessive flow of tears are always present during inflammation of the outer surface of the cornea or the formation of an abscess. In acute cases the opacity may entirely or partially disappear in three to six weeks. Should the opacity continue longer, from improper treatment or non-disappearance of the cause, vascularization (formation of blood vessels) with abscess formation or ulcer-

ation of the cornea appears; thus the prospects of recovery are decreased, while the danger of a pus-like exudate appearing in the agueous humor or the perforation of the cornea increases. Not infrequently do these bad results appear in cow-pox, sheep-pox or infectious conjunctivitis and keritits among cattle and sheep.

TREATMENT.—Examine the eye critically, being especially careful to discover and remove any irritating foreign body or particles. Bathing the eye in very warm water twice per day and then adjusting over it a clean cloth, saturated with a 1 per cent. solution of carbolic acid, will, in most cases, be sufficient. But, should there be an abscess or an ulcer present, the cloth might be saturated with a solution of corrosive sublimate 1 part and water 1000 parts; and during the reparative stages warm water baths night and morning, and the application of the following salve, will aid in the removal of the opacity: Calomel, 30 grains; iodoform, 30 grains; vaseline, 5 drachms. Instead of this salve one may apply with a feather a small quantity of equal parts of pulverized calomel and iodoform.

INFECTIOUS CONJUNCTIVITIS AND KERATITIS, OR INFECTIOUS INFLAMMATION OF THE CONJUNCTIVA AND CORNEA.

This eye disease is most frequently found in cattle, but may appear in sheep, horses and goats. It is said to occur only during the summer months, but the writer saw it in a herd of cattle in February and March in south-eastern Iowa. That winter was exceptionally warm. It attacked cattle of all ages; but calves and the young cattle seemed to be predisposed to it. A number of young colts, running in the same field with the cattle, were similarly affected. Several outbreaks of this eye disease have been reported to me as occurring during the spring and summer months of 1892, in Alabama.

The disease announces its presence by an increased flow

of tears; the eyelids are closed and slightly swollen. The conjunctiva becomes swollen, its blood vessels conjested and, in severe cases, a purulent discharge appears.

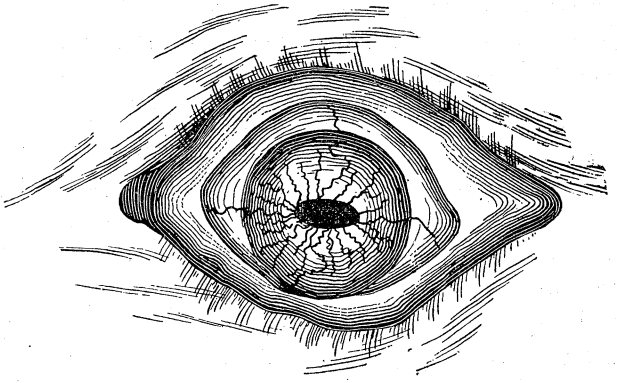

FIG. 7.

An illustration of an abscess and the attending vascularization of the cornea as observed in infectious keratitis and conjunctivitis in cattle. The black spot in the cut represents the yellow abscess and the radiating lines the blood vessels in the cornea.

Young animals seem to have a general fever, hanging of head, loss of appetite, and consequent emaciation; loss of appetite, etc., is most probably the result of pain instead of fever. These symptoms continue to increase for the first eight or ten days. About the third day from the first appearance of the disease, the cornea will exhibit a small delicately clouded spot, near its centre, which will gradually extend over the entire cornea, giving it a milk white appearance. The centre of the opaque cornea is at first pearly white in color, but in a short time a straw colored or yellow spot appears; this spot signals the formation of an abscess. The cornea at the yellow spot is rough and surrounded by a wall of thick, swollen, pearly white tissue. From this yellow centre (see Fig. 7) numerous blood vessels take their course toward the sclerotic border of the cornea. The yellow centre is generally longer from side to side, shorter from above to below, and is said to be occasionally mistaken for

"an oat grain in the eye" by uninformed laymen. The abscess generally erupts or breaks open on the outer corneal surface leaving an ulcer to heal by granulations forming over its sides and bottom. In cattle, as a rule, the scar tissue is entirely removed and the cornea becomes clear and completely normal. However, in horses and occasionally in cattle a permanent pearly white opacity remains, causing partial or complete blindness. Some cases do not advance to the stage of abscess formation; in others the abscess may not erupt; while in still others the abscess may be so large that when it breaks open, the pressure of the aqueous humor against the remaining thin portion of the cornea will perforate it; this sudden removal of pressure on the lens may rupture the capsule of the lens and permit it to escape; the entire eye is thus involved, resulting in total loss of sight and of the eyeball.

The cause of this spreading eye disease is unknown, yet there are indications that point towards a germ or a micro-organism as an exciting cause. Billings claims that it slowly extends over a herd from one animal to another; one eye may be at first affected, but in a short time the other eye is attacked. According to some of the German authorities the disease spreads quite rapidly—in a few days attacking 50 in a herd of 300; in 7 days attacking 20 in a herd of 40.

TREATMENT.—Separate the sick from the healthy; apply a solution of corrosive sublimate 1 part, water 2,000 parts; saturate a clean cotton cloth with the above solution and adjust the cloth over the eye; keep the cloth moist with the solution. During the purulent discharge from the conjunctival sack, the eye may be washed night and morning with warm water.

ULCER OF THE CORNEA.

Loss of substance or destruction of a limited portion of the cornea may result from the erupting of a corneal abscess,

as in infectious keratitis; it may also appear in suppurative inflammation of the conjunctiva or cornea, and it is occasionally found associated with influenza in the horse; very often it is observed in the course of influenza (distemper) in the dog.

Ulceration of the cornea appears to be caused by an infectious or contagious microbe, since the disease is transmitted from one eye to the other, and occasionally appears as a disease that may extend to a number of animals in a locality.

An ulcer may appear near the center of the cornea or near its border; the cornea surrounding it is generally opaque; the bottom of the ulcer may be greenish yellow or gray white in color; the borders of the ulcer are, in the early stage, so abrupt that it appears as if it had been cut out with an iron punch. It may extend in depth to the internal layer of the cornea, then the reparative process may begin. Shortly after the formation of the ulcer, the cornea becomes vascular; the blood vessels give the opaque cornea around the ulcer a reddish tinge. As soon as the developing blood vessels reach the advancing borders of the ulcer the process of repair begins and continues slowly until the ulcer completely disappears, leaving behind a pearly white scar in the horse, but in the ox and the dog this opacity is, as a rule, removed.

If the ulcer is located near the border, the healing process progresses more rapidly than when it is in the centre of the cornea, because the developing blood vessels can reach the ulcer sooner and thus check its advancement. If the internal layer of the cornea is destroyed by the penetrating ulcer, the inflammation extends to all parts of the eye ball and generally results in loss of the entire organ.

TREATMENT.—Prof. Moeller very highly recommends aqua chlorata diluted with 2 or 3 parts of water. A solution of corrosive sublimate 1 part and water 1,000 parts may be employed; or a 2 to 4 per cent. solution of boracic acid. It is not ad-

visable to use silver nitrate as it generally leaves a permanent opacity in the cornea. In examing the eye care should be exercised to prevent transmitting the purulent irritating discharge with its microbes, from the diseased eye to the healthy one. It is also best to separate the diseased animal from all others. If the cornea is perforated, a 1 per cent. solution of eserine or atropine may be used as advised in perforations of the cornea under the head of corneal wounds.

OPACITIES OF THE CORNEA.

Scar tissue, infiltrations and organized exudates that supervene or result from injuries, inflammation, ulcerations and abcesses are termed opacities. These opacities remain after the inflammation has subsided or after the wound or ulcer has healed, and are not to be confounded with the opacities attending active inflammation. Slightly foggy, weakly clouded, translucent, grayish blue or gray spots, not sharply limited, are mostly found in the outer layer of the cornea and are sometimes called *nebulæ*. If the opacity is semi-transparent, sharply limited, gray or milk white, it is designated *macula*. If the opacity is a dense, completely opaque, pearl white, gray or white, regularly distributed or in large spots or stripes, it is called a *leucoma*. There are also chalk-like, well defined opaque spots which are formed by using acetate of lead or silver nitrate with common salt, calomel or corrosive sublimate; insoluble precipitates are thus deposited in the corneal tissue. Black colored opacities may be spotted or cloudy and are due to bleeding from the vessels in the vascular cornea, or to adhesions of detachments of the pigmented iris; the latter may occur as a result of the attachment of the outer surface of the iris with the inner surface of the cornea.

The harm produced by opacities depend upon their location; an opaque spot in the center of the cornea cuts off more light than one located near the border. Total blind-

ness is better (more safe) than partial blindness; hence, large and dense opacities are preferable to weak and diffuse opacities, unless the latter can be removed. Scar tissue, from ulcers, wounds or abscesses, can not be removed in the horse; it may in some instances disappear in the ox, but in the dog, it is, as a rule, entirely removed. Chalk spots, streaks or stripes, as a rule, are permanent—not amenable to treatment. Weak and superficial opacities may be improved and many times can be removed by judicious treatment.

The following ointment may be employed: Yellow oxide of mercury, 4 grains; atropine, 1 grain; vaseline 4 drachms. Put a small quantity under the eye lid; then with fingers on the outer surface of the lids work or move them around over the cornea in radial and circular directions. Finely pulverized calomel may be thrown into the eye by placing a small quantity in a quill and blowing it into the eye. This should not be repeated oftener than once per week. In case the horse will not permit the blowing of the calomel into the eye, it may be used in the form of a salve, by mixing it with vaseline. A salve of potassum iodide 10 grains and vaseline 1 ounce may be employed. Some authorities recommend massage treatment—placing two fingers upon the upper eye lid and with slight pressure moving it in a circular direction over the opacity. This massage treatment may be repeated daily unless signs of inflammation should appear.

STAPHYLOMA OF THE CORNEA.

The bulging forward and outward of the cornea is designated staphyloma. It may be partial or complete, depending upon whether a part or all of the cornea is involved. Thinning of the cornea by ulceration and eruption of large abscesses, so reduce the resisting power of the cornea that the intra ocular pressure (pressure of the aqueous humor, etc.) distends, projects or pushes the cornea outward. The

scar tissue resulting from ulceration is also unable to withstand the intra ocular pressure and the cornea bulges forward, forming a partial staphyloma. A staphyloma from either of the foregoing causes is generally opaque, gray or white colored. In the healing of perforating wounds, the iris may adhere to the scar tissue, should the corneal scar then become distended it would carry with it the iris and the result would be called an Iris-staphyloma.

Occasionally intra ocular pressure pushes forward the entire transparent cornea.

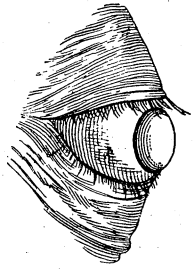

FIG. 8.
Total Corneal Stophyloma (after Armatage).

The treatment of staphyloma is mainly preventative. In impending perforations of the cornea from ulceration, wounds or abscesses, a compress bandage and a 1 per cent. solution of eserine may be employed. In cases of established perforation the eserine or atropine may be used as before directed for perforating wounds of the cornea. Proper treatment of abscesses, ulcerations and wounds of the cornea will also prevent the formation of a staphyloma.

NEW GROWTHS ON THE CORNEA.

PTERYGIUM (see fig. 9) is a peculiar fleshy growth consisting of an abnormal development from the conjunctiva. It has been observed in horses, dogs and cattle. Its usual situation is at the inner side of the eye ball; it is triangular, or fan-shaped, with the apex extending almost to the center of the cornea; generally it is loosely attached to the cornea

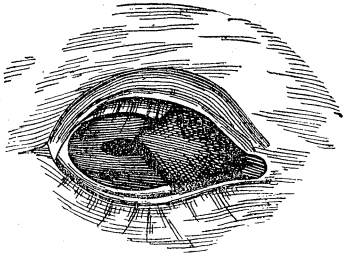

FIG. 9.

PTERYGIUM.—Fleshy growth on the conjunctiva and cornea (after DeSchweinitz).

and the conjunctiva. Sometimes it is present at birth and at times it results from the repairing of an ulcer near the border of the cornea. It is believed that animals exposed to smoke, dust, heat and slight injuries to the cornea are predisposed to its development. Treatment consists in removing the loose pterygium with the knife or shears; this should be done by a surgeon after the animal is cast or confined and a solution of cocaine is applied to the eye. The cornea usually remains opaque at the spot from which the tissue is removed. When a pterygium results from the contracting scar tissue pulling the conjunctiva over a part of the cornea, it should be left undisturbed.

A DERMOID is a small, skin-like growth, which usually appears on the nasal side of the eye ball, partly on the cornea and partly on the conjunctiva. The outer surface is gener-

ally covered with long hair that project outward between the lids. (See fig. 10).

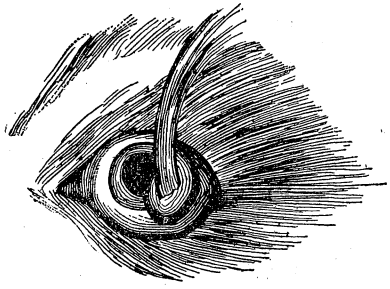

FIG. 10.

DERMOID.—Left eye of dog (after Gurlt).

It occurs in calves, pups, colts and lambs and is most frequently present at birth; but, according to some authors, it may be acquired after birth. The hairs interfere with the rays of light and the dermoid, as a whole, irritates the cornea and conjunctiva. Treatment consists in removing the dermoid by means of the knife or shears. The animal is cast and the eye is anesthized with cocaine; then the loosely attached skin-like growth is carefully dissected from the cornea and conjunctiva; a permanent opaque spot remains, but the constant irritating action is removed.

DISEASES OF THE IRIS.

IRITIS or inflammation of the iris is generally associated with diseased conditions of the ciliary bodies, or the choroid coat; because, a close connection exists between these parts of the eye, in location, attachments and blood supply.

Iritis also appears in the course of inflammation of the entire eye ball, in periodic opthalmia (moon-blindness); it occurs also, in some instances, in connection with influenza, strangles (distemper), infectious inflammation of the lungs

and pleura, in acute muscular rheumatism, in inflammation of the navel in young animals and occasionally in connection with catarrhal inflammation of the conjunctiva or ulceration of the cornea. Penetrating wounds or injuries near the margin of the cornea excite inflammation in the iris. Very rarely does iritis appear alone—without other parts being involved at the same time.

Owing to the fact that the iris is richly supplied with blood vessels, it is disposed to produce exudates, or to bleeding from its surfaces. The exudate may be flaky and gray, floating in the aqueous humor; or it may be pus-like and form a yellowish sediment at the bottom of the aqueous chamber.

These exudates may be tinged with blood or the entire aqueous humor may be colored by blood from the vessels of the iris. The exudates from the posterior surface of the iris falls between the iris and anterior or front surface of the lens; this pushes the iris forward; unless the iris is moved by the expansion of the pupil, the back or posterior surface of the iris becomes firmly attached to the capsule of the lens. The iris may, also, become attached to the posterior surface of the cornea; this frequently results from perforating wounds or ulcers of the cornea. The discoloration, swollen condition of the iris, and the flaky, purulent or bloody exudates can not be observed in many cases, because the cornea is so clouded or opaque. However, in the first or the last stage of such cases, one may be able to view the iris. During the "clearing up" period in moon-blindness one may observe the iris, faded somewhat in color, with its pupillary margin more or less ragged and irregular. Generally the tears flow in excess, dread of light and extreme sensitiveness are present during the active stage of iritis.

In the treatment of iritis the chief aim is to prevent the pupillary or free margin of the iris from forming attachments to the capsule of the lens or the posterior surface of

the cornea. For perforations of the cornea directions for treatment have been given. To prevent adhesions to the capsule of the lens, the pupil may be kept expanded, during the active stage of the inflammation, by the use of atropine. The following has proven very beneficial in the hands of the writer: atropine 1 grain; potassium iodide 5 grains; pure water 1 ounce. A few drops may be put between the lids two times per day. The application of hot water will stimulate the absorbents and hasten the removal of the exudates and, at the same time, reduce the pain; while cold water fomentations will best reduce fever and inflammation.

CLOSURE OF THE PUPIL.

If the iris, *during the extreme contraction of the pupil*, becomes bound down to the capsule of the lens throughout its entire pupillary margin, it may leave a small, clear pupillary opening; this condition is denominated *exclusion of the pupil.* But if the pupil be completely obliterated during extreme contraction of the pupil when the iris is attached to the capsule of the lens, or the small pupil becomes filled in with an opaque, inflammatory deposit or exudate, the condition is termed *occlusion of the pupil.* The destruction of the pupillary attachment of the iris to the lens capsule is soon followed by the formation of a cataract—opacity of the lens. The anterior division of the aqueous chamber is completely separated from the posterior and the iris is bulged forward at all parts except at its marginal attachments to the lens capsule.

If the attachments of the iris to the capsule are not firm and solid, the iris may be torn loose by the use of atropine. In case that does not succeed, the iris may be mechanically separated or detached by a surgical operation; or a new pupillary opening may be made by the operation known as irodectomy. These operations can only be performed by a

skilled surgeon and are, many times, done after the lens has become opaque or the operation is followed by opacity of the lens, destroying the vision. The writer observed a case of occlusion of the pupil in both eyes of a three year old horse that was brought to the free clinic at the experiment station in Auburn. The cornea and aqueous humor were transparent, and the occlusion was very probably a result of acute iritis. A strong solution of atropine was dropped into the eye but the iris was so firmly fixed it could not be detached.

Excessively developed or large "soot balls" "grape-like bodies," hanging from the inner aspect of the superior part of the free margin of the iris, interfere with, or obstruct, the passage of light into the eye. The large, brown, flake-like bodies are quite frequently the cause of shying and cases have been recorded where complete blindness appeared as a result of these "soot balls" entirely closing the pupil. By a surgical operation they could be removed; this should be attempted only by a skillful operator.

Some white horses possess such a high degree of sensitiveness of the eye to light that in clear sunshine the pupil is closed by complete conntraction and the animal cannot see until the sun sets.

CATARACT.

All opacities of the crystalline lens, regardless of size, origin or condition, are embraced by the general name cataract. A false or spurious cataract is produced by collections of pigment on the capsule of the lens, resulting from the tearing loose of the attachment of the iris to the capsule. It appears in dark, almost black, colored spots on the anterior surface of the capsule. True cataract means that there must be opacity in the substance of the lens or its capsule. If the opacity is in the substance of the capsule it is known as capsular cataract, and when in the substance of the lens, it

is designated lenticular cataract. Lentiular cataract may be partial or complete; the former when a small portion of the lens substance is involved and the latter when the entire lens becomes opaque. The causes of cataract are various; and in some cases are not distinctly understood. Occasionally a cataract may be present in one or both eyes

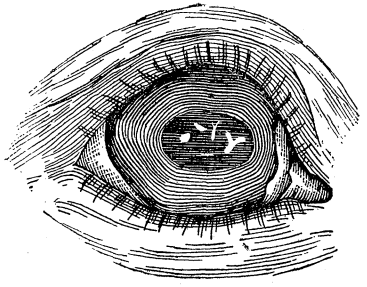

FIG. 11.

PARTIAL CATARACT (after Armatage).—The opaque spot or spots in the lens or its capsule may be seen through the pupillary opening. Spots in the cornea should not be mistaken for the deeply located opacities in the lens.

at birth. Heredity, no doubt, exercises a great influence in the production of cataracts during fœtal life and also predisposes an offspring to the disease in later life. Cataract frequently manifests itself in the course of diabetes mellitis (sugar in the urine) but there is no positive proof that the sugar in the system causes the cataract. Hemorrhages (bleeding) in the aqueous chamber lead to straining of the capsule; the coloring matter of the blood is deposited in the capsule and the dark colored opacity remains after the blood is absorbed or removed from the aqueous chamber. Disturbances in the nutrition of the lens in old age is said to be the cause of senile cataract. In old age the lens substance becomes more and more solid; this leads to irregularity in its density; also prevents changes in the curvature of the lens that are necessary in the adjustment, or its accommodation, to different distances. The constant straining of the eye to bring a hardened lens to the various positions or forms

for different distances, would lead to perverted nutrition and possibly to inflammation, in the capsule, the lens, the ciliary ligament or ciliary bodies. The nutrition of the lens may

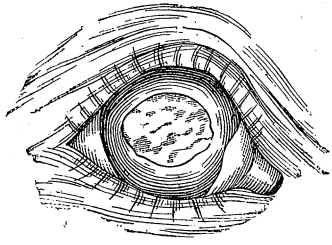

FIG. 12.

TOTAL CATARACT (after Armatage).—The opaque lens gives the entire pupil a grayish white color.

also be perverted by inflammation primarily in the lens itself or from extension of inflammation in the iris, the ciliary bodies or the ciliary ligament, to the lens. Active inflammation in the lens or the surrounding parts, (from wounds, injuries or other diseases) generally leaves inflammatory products or deposits in the substance of the lens or its capsule, which form permanent opacities. Strokes on the head that produce sudden concussion are said to cause opacities in the lens. There are many cases of cataract, the cause of which cannot be determined; but the most prolific cause of cataract in the horse is periodic opthalmia (moon blindness). Straining the eyes to see objects in imperfectly lighted barns or stalls, no doubt, plays an important part in producing cataracts as well as other eye diseases.

Occasionally small spurious cataracts of the capsule disappear, because of the great activity of the cells of the capsule. But opacity of the lens substance very rarely disappear; because changes in its structure take place very slowly for it contains no blood vessels or nerves.

Sometimes small gray specks may remain unchanged; but, as a rule, the little gray star like opacity gradually increases unil total lenticular or capsular opacity appears.

In examining the eye for a cataract one may readily see a gray, a bluish gray, a greenish yellow, a brown or a pearl white reflection in the pupillary opening; the form (star-shaped, cloudy, fog-like, feathery, streaked, or scattered dots, ball-shaped, etc.,) can be determined if the opacity be sufficiently developed. The exact location and form or the small, beginning white speck may not be visible to the observers unaided eye, especially out in the clear sunshine or when the ground is covered with snow. The animal should be placed so that the light falls upon the affected eye from a clear window or an open door in front of the animal. The observer then looks into the pupillary opening, standing in in front or to one side; it is well to observe the eye from various points of view. If the pupil is contracted or too small to admit of sufficient examination, a few drops of a solution of atropine (1 gr. atropine to 1 ounce of water) may be put into the eye to expand the pupil. The lens may, also, be examined by placing the animal in a dark room and illuminating the eye with a candle, or a candle and a double convex lens, or with a candle and a small concave mirror (see methods of examining the eye).

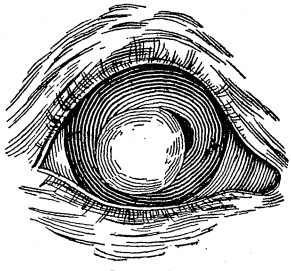

FIG. 13.

Luxuration (dislocation) of the opaque lens into aqueous chamber; the lens lies in front of the iris, almost completely obstructing the passage of the light through the pupil.

Treatment of cataracts in domestic animals consists chiefly in prevention. The reducing of all inflammations of the eye, the prevention of periodic opthalmia, keeping the sur-

roundings of the animal in proper condition and maintaining sufficient light for the animal to see distinctly in all parts of the stall without straining the eyes. As a rule it is best to have the light enter the stall or barn from behind the animal, or from both sides. In man the opaque lens is removed by a surgical operation, and a double convex lens is adjusted in front of the eye thereafter. But this is impracticable among domestic animals, since the double convex lens can not be adjustad to the eye, and the eye would always be hypermetropic (farsighted), permitting the animal to see close objects indistinctly and therefore inducing it to shy or become frightened. However the opaque lens is occasionally removed in horses and dogs to eliminate the unsightliness of the cataract; but there is always more or less danger of losing the entire eye ball.

AMAUROSIS.

Paralysis (palsy) of the retina or optic nerve has been technically named amaurosis. This condition may depend upon tumors in the brain, injury to the optic nerve between the brain and the eye-ball, or inflammation of the retina. Parasitic cysts quite often appear in the brain of sheep and the amaurotic condition of the eye is a characteristic symptom.

Abscesses sometimes implicate the roots of the optic nerve and amaurosis supervenes. Temporary amaurosis is present during the intoxication period of lead poisoning; poisoning from *Kalmia latifolia* ("ivy"); during the comatose condition of the cow in parturient apoplexy (milk fever); and in congestion of the brain. Inflammation of the retina is nearly always present in moon blindness and occasionally it termi- in paralysis of the retina—amourosis. Detachment of the retina from the choroid, hemorrhage from the retinal blood vessels, and emboli (plugging by clotted blood) of retinal blood vessels and excessive loss of blood, cause temporary

or permanent amaurosis. If, in the course of inflamation, if the retina pigment is deposited in the retina, it produces night blindness—a condition that prevents the animal seeing at night. Extreme sensitiveness of the retina, as observed in Albinos and in some white horses, leads to day blindness. In such cases, the pupil is so nearly or completely closed that the animal can not see in clear sunshine, or when the ground is covered with snow; but during twilight, on cloudy days, and at night vision is normal. Amaurosis sometimes results from castration.

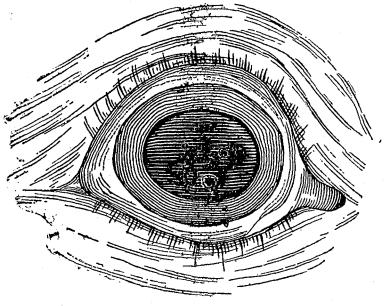

FIG. 14.

AMAUROSIS.—The pupil is greatly expanded, gray-blue in color and the eye appears bright, glassy, very clear (after Armatage .

In well established cases of amaurosis there is total blindness; yet there are no opacities in any of the tissues or humors of the eye. The eye is bright, clear, and perfectly transparent. The animal steps high, stumbles over, and runs against objects in its way. If, at a short distance, you noiselessly threaten to strike it, there is no winking or manifestations of fear. The ears are very sensitive to sound, and the outer ears are constantly on the alert to catch all noises. The pupil is expanded to its extreme limit; the iris is immovable and insensitive to light. Leading the animal from the dark into the light, or from the light into the dark, does not change the size of the pupil or move the iris; while in the normal eye the pupil expands in darkness

and contracts on being brought to light. The pupillary reflex (the light reflected from the retina outward through the pupil) is, as a rule, grayish-blue; but may, at times, appear more gray than blue, or present a more or less distinctly green color.

TREATMENT.—When amaurosis is a result of another disease, it is evident that the disease of which it is a symptom should be treated. In cases of recent standing, good nutitive food, extra care and a nerve tonic (drachm doses of nux vomica two times per day) may be employed with advantage. But treatment of long standing cases always proves valueless.

GLAUCOMA.

This name is applied to several varieties of a disease whose chief symptom is increased ocular tension. The increased intro-ocular pressure is a direct result of the jelly-like vitrious humor becoming thin, more watery and greater in quantity. This condition may appear independent of any other disease, but it generally appears, accompanied by, or as a sequel of, inflammation in the choroid or the ciliary bodies. However, the exact cause in many instances is unknown. The extra amount of lymph or watery secretion within the eye has been explained in various ways. Some have claimed that it was due to obstructions in the intro-ocular lymph vessels, which carry off the extra amount of lymph; others have suggested that the extra supply of water was due to excessive secretion by the choroid, and especially the ciliary bodies. The development of glaucoma is slow, its course is nearly always chronic and of a more or less intermittent form. Old animals which have far-sighted (hypermetropic) eyes are predisposed to glaucoma.

SYMPTOMS.—Increased hardness of the eye-ball, or rise of intra-ocular tension, is the most prominent symptom. These

conditions may be determined by placing the index finger of the right hand upon the upper lid of the left eye and the index finger of the left hand upon the upper lid of the right eye; then compare the tension or hardness of one eye with the other by palpating with the tips of the fingers; in increased hardness, firm pressure of the finger tip produces no impression; but the tension may be doubtful unless there is a marked difference in the impressions made upon the two eyes. The pupil is generally greatly expanded and the lens, as a rule, remains transparent, but may in rare instances be opaque. The depth of the anterior part of the aqueous chamber is diminished; the front surface of the iris is almost in contact with the internal surface of the cornea. The iris in some cases appears swollen and it is sluggish in movement or entirely inactive. The slight diffuse cloudiness of the cornea and the aqueous humor produces the sea green (glaucoma) color of the pupil. The episcleral and conjunctival vessels are more or less congested. But the excavation or sinking or depression of the optic nerve can not be seen without the aid of an opthalmoscope; this cupping of the optic disc is due to the intraocular pressure; the cup is called the glaucomatous cup and the yellow halo around it is known as the glaucomatous ring.

Treatment consists in preventing inflammatory adhesions between the iris and cornea by using eserine. Also, reduce inflammation of the iris, ciliary bodies and choroid, that may lead to glaucoma; this may be accomplished by using hot or cold water fomentations. A well developed case can only be relieved by irodectomy. If eserine is used constantly it must be in a weak solution (1-10 to 1-16th grain to one ounce of water.) Irodectomy consists in removing a portion of the iris; in glaucoma one-fifth to one-fourth of the iris should be removed; or what is known as the broad peripheral irodectomy can be done only by a skilled surgeon.

HYDROPTHALMUS.

This is an enlargement of the eye ball due mainly to an increased secretion of the aqueous humor, as in glaucoma. Sometimes the eye ball becomes twice its normal size; the cornea is generally so opaque that one cannot see the inner parts of the eye. In consequence of the enlarging of the eye ball the attachments of the lens are partially or entirely torn loose and the lens may float in the vitreous or the aqueous humor. The enlargement of the eye may appear suddenly, in twenty-four hours; or may advance slowly. Seldom is it relieved by treatment. Occasionally the cornea is ruptured and the eye ball lost. In the early stage, the cornea may be punctured, thus allowing the extra amount of aqueous secretion to escape; this has, in some cases, proven beneficial; however, it cannot be done by the novice or the inexperienced.

DISLOCATION OF EYE BALL—EXOTHALMUS.

The eye-ball may be pushed out of its socket by tumors that originate behind the ball; sometimes by bleeding, from deep penetrating injuries, congestion of blood vessels; by horns of cattle, by biting and scratching among dogs and cats, also by dislocation of the lower jaw in the smaller animals. Occasionally an animal has its eye dislocated by having it crowded out with a blunt stick or club in the hands of a cruel boy or attendant. If the eye is not lacerated, bruised or seriously injured and the optic nerve is not torn, the ball may be returned to its cavity and a compress bandage applied over it to keep it in place. This should be done as early as possible or the swelling of the parts around the eye will prevent returning it to its proper place. However, the outer angle of the eye may be divided if necessary to admit the eye ball to the socket. Should the eye ball be

badly injured or in case it is impossible to return it to the socket the entire protruding parts may be cut away as deeply within the eye socket as possible; a pledget of cotton, saturated with a one per cent. solution of carbolic acid er corrosive sublimate may be pressed into the cavity; a compress bandage should then be placed over the eye.

When the eye is dislocated by growing tumors in its socket, or if there are malignant or fungoid tumors within the eye, or if the eye is very badly injured, it may be necessary to extirpate the eye ball, its muscles and the surrounding tissues. For this the animal must be cast, anæsthised with chloroform or some other anæsthetic; an assistant holds the eye lids apart; the operator grasps the cornea or the internal or external rectus muscle with the forceps in his left hand; the eye ball, the tumor, or the entire contents of the orbital cavity, if necessary, are then removed, with the shears or knife. The bleeding is checked by applying a pledget of cotton, and a compress bandage as before described.

ANIMAL PARASITES OF THE EYE.

Filaria papilosa is a small, round, white worm that is found most frequently in the vitreous humor; but is occasionally observed in the aqueous humor and commonly spoken of as the "snake in the eye." It is from one-half to two inches in length, and it is very probable that the young filaria reach the eye by way of the blood vessels, and develop in the humors of the eye. However it is scarcely probable that the humors of the eye are the natural habitat or home of this parasite, since the same worm has been found in other parts of the body. One man reports that he observed a worm in the aqueous humor during a period of six years. But a few months is usually the length of time this parasite lives in the eye. A number of cases are recorded where this parasite has produced inflammation of the cornea and

iris, with an extra flow of tears and opacities of the cornea and aqueous humor; these conditions may subside in a short time and leave a slight cloudiness of the cornea and aqueous humor. In certain districts in India this parasite is very frequently in the eye of the horse and if not removed the eye goes blind. This worm has also been observed in the eyes of cattle. The worm may be removed from the aqueous chamber by cutting a small opening in the cornea at its upper border near the sclerotic margin; then remove the worm with small forceps. Before operating it is necessary to cast the horse or ox; anæsthise it with chloroform or æther and apply a ten per cent. solution of cocaine to the eye. After operating keep the eye moist and cool by frequent or constant cold water applications, and occasionally put into the eye a few drops of a one per cent. solution of carbolic acid or boracic acid, or a weak solution of corrosive sublimate.

Filaria lachrymalis is a small, white, round worm one-half to one inch long; it lives in the lachrymal ducts, under the haw or eye-washer and sometimes under the eyelids; it causes inflammation of the conjunctiva and lachrymal ducts and may close the tear ducts Remove the worms from the tear ducts and the conjunctival surfaces by using small forceps; then apply, two or three times per day, a few drops of a corosive sublimate solution (1 part c. s. to 1000 parts of pure water).

As elsewhere mentioned, Willach has discovered in the eye the young forms of various round and flat worms, and he claims that these animal parasites play an important part in producing periodic opthalmia.

Since nearly all parasites gain admission into the system by way of the alimentary canal, infection may be prevented by observing a few precautions. Impure drinking water is probably the most common carrier of the various animal parasites. Hence always give animals water from deep wells or pure springs, and never from ponds, rivers, or stagnant

lakes. The digestive tract may become infected with these parasites by ingesting infected food. In all cases where parasites are found in the alimentary canal (manifested by the occasional passing of parasites with the feces), it is advisable to give one-half to one drachm doses of sulphate of iron or sulphate of copper in the ground food two times per day for one week; then give a purgative, consisting of one pint of raw linseed oil or one ounce of Barbadoes aloes.

STRABISMUS, SQUINTING OR CROSSEYE.

In this defect the visual axis or line of one or both eyes deviates from the normal. In other words, the eye ball is turned inward, outward, upward or downward by the excessive contraction of a muscle or as a result of the paralysis of one of the muscles of the eye. In converging (inward) strabismus, the external rectus muscle may be paralysed and thus be unable to counteract the contractions of the internal rectus, its antagonist. This weakness, partial or complete paralysis of one or more muscles of the eye may be due to the pressure of tumors on the nerve of the muscle, rheumatism, tumors at the base of the brain or injuries of the muscle. Squinting or crosseye may be treated by section of the antagonistic muscle, but this can be done only by a skilled veterinarian. However this defect is rare in domestic animals aud may be detected by noting the squinting appearance and carefully comparing one eye with the other. When strabismus is present it causes considerable shying, which is especially annoying in nervous animals.

SOME OF THE CAUSES OF INDISTINCT VISION AND SHYING.

Hypermetropia or farsightedness is that defective condition of the eye which causes the principal focus to fall be-

bind the retina, as illustrated in figure 15—H. In other words, the parallel rays which enter the eye come to a focus behind the retina. As a rule, the axis of the eye or the diameter from before to behind is too short and the cornea may appear less convex or flatter than normal. Removal of the crystalline lens (as is sometimes done in cataract) produces farsightedness. Convex glasses are used in hypermetropia in man, but are impractical with animals. Distant objects may be seen distinctly but the images of objects at a short distance are blurred and sometimes distorted into frightful forms. Hence farsighted horses are frequently frightened, or are caused to shy as a result of indistinct vision.

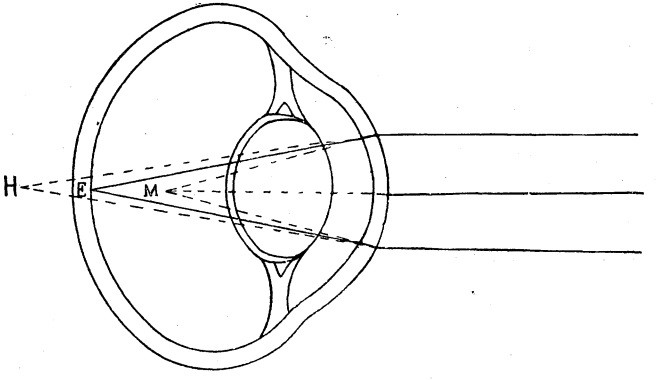

FIG. 15.

Diagramatic section of an eye (after Mœller) to show:
That the parallel rays of light, which enter the normal eye, converge or focus on the retina, making a distinct image.
That, in the farsighted eye, the parallel rays focus at H behind the retina, forming a blurred image on the retina.
That, in the shortsighted eye, the parallel rays converge at M in front of the retina, forming a very indistinct image on the retina.

Myopia or shortsightedness is a condition in which the refractive index of the eye is too great or the axis of the eye is too long; the parallel rays come to a focus in front of the retina (as in fig. 15—M.); or the principal focus falls in front of the retina. In shortsightedness the cornea may appear very convex or conical as it frequently appears in cattle.

Close or near objects can be seen distinctly but distant objects may be distorted or become very indistinct. Concave glasses are used by farsighted persons; but since the use of glasses is impractical for animals, shortsightedness, therefore, becomes a permanent cause of shying and fright.

In the Normal or Emmetropic eye, the principal focus falls on the retina, and distinct images of all objects, at near or far distances, form on the retina (fig. 15—E). The cornea, the aqueous humor, the lens and the vitreous humor take part in the formation of the image—the refraction and collection of the rays of light. The cornea is the principal refracting medium when the eye is at rest; but the changes in the convexity of the lens (caused by the contractions of the ciliary muscle) are the means by which the eye is adjusted, or accommodates itself, to different distances.

In the far-sighted, short-sigted and normal eye the curvature of the cornea and of the lens is regular; but sometimes the curvature of the cornea may be so irregular that one part or meridian may produce short sightedness, another part produce far-sightedness while still another meridian may be normal. This condition produces a very much distorted image and is a fruitful source of shying or the cause of fear and fright. Irregularities in the meridians of the cornea produce the condition known as astigmatism. This defective vision may also be caused by an oblique position of the lens. There are several kinds and degrees of astigmatism, all of which are very difficult to distinguish and can only be relieved by the use of proper glasses which are inapplicable to animals.

Slight cloudiness or opaque spots in the cornea, weak cloudiness of the aqueous humor, beginning cataract, beginning amaurosis or beginning glaucoma are accompanied by indistinct vision, and consequently produce frequent shying. In fact, partial blindness from any cause is always attended by indistinct vision and shying, fear or fright.

PERIODIC OPTHALMIA—MOONBLINDNESS.

This is an eye disease peculiar to horses and mules. Before the development of veterinary science the belief was prevalent that the moon exerted a direct or indirect influence upon the eyes; because the inflammatory attacks recurred at monthly or somewhat regular periods. Thus the names "moon blindness" and "mooneyed horses" originated. But as veterinary science progressed, extensive clinical and anatomical investigations made known the fact that moonblindness was a periodic or recurring inflammatory disease of the entire eye, involving primarily the iris, the choroid coat and the ciliary bodies.

SYMPTOMS.—This disease makes its appearance very suddenly—generally beginning in the night; in the morning the eye is found closed, extremely sensitive to light with a very great flow of tears down over the cheek. In some instances there is systemic fever, while in other milder cases, it is not manifest; but, as a rule, the horse or mule is dull, wanting in vigor, and energy, indicating constitutional disturbance. The eye ball is drawn backward into the orbital cavity, by the retractor muscle; this makes it appear smaller than the healthy eye; after several attacks the eye ball is said to shrink in size—decrease in actual volume. The conjunctiva exhibits slight swelling and diffuse reddening; the surface

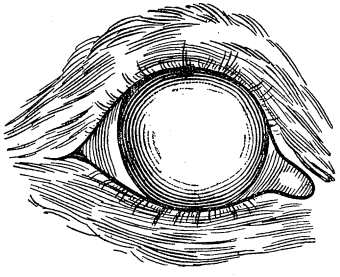

FIG. 16.

Diffuse cloudiness of the cornea as observed in moon blindness and in inflammation of the cornea. The internal structures of the eye are cut off from view by the total opacity of the cornea (after Armatage).

blood vessels of the sclerotic are congested; this produces a light red ring, or seam around the cornea (pericorneal injection.) The cornea near its outer border exhibits a weak, diffuse cloudiness, which soon extends over the entire cornea; in the beginning this cloudiness is weakly marked and the cornea appears as if it were glass with a thin layer of fat spread over it. In the advancement of the disease the middle or principal layer of the cornea becomes affected, which leads to intense, diffuse cloudiness and occasionally to vascularization of the cornea; the latter is distinctly visible at its border in a few days after the beginning of the attack. Sometimes a pearl white opacity may appear at some spot on the outer surface of the cornea. In the beginning the slight cloudiness of the cornea does not prevent one from viewing the iris, the lens and sometimes the vitreous humor and the retina. The purulent or flakey exudate in the aqueous humor and the excessive contraction (almost entire

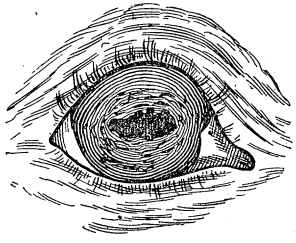

FIG. 17.

This cut represents the free border of the iris attached at points to the capsule of the lens, producing an irregular, ragged outline of the pupil and wrinkling of the iris. This may be observed after several attacks in periodic opthalmia (modified from Armatage).

obliteration) of the pupil hide from view all the internal parts of the eye. The iris appears rough on its outer surface, slightly glazed, lighter colored than normal; at times it is covered with a grey exudate. The ciliary portion of the iris is bulged forward and outward; the movements of the iris are slow and weak; it is quite insensible to variations in light, and the pupil does not expand in the dark. The

color of the pupil when visible during its contraction is greyish green. Atropine causes the iris to expand slowly, weakly and irregularly; at points the pupillary border of the iris adheres to the capsule of the lens; the remaining parts are free; expansion of the pupil under such conditions produce irregularities in the iris and in the outline of the pupil (see fig. 17). At the lower part of the aqueous humor, in the anterior chamber, there is a gray-yellow, partly sedimentary, partly flocculent exudate, which sometimes is colored with blood. The quantity of the exudate varies; in the early stage of the attack—especially in the later attacks—it is visible by focal illumination as a slight cloudiness; at the height, or severest stage, of the attack the aqueous chamber is almost entirely filled; the exudate settles to the lower part of the aqueous humor, and is gradually absorbed and entirely disappears in the course of ten to fifteen days.

No prominent changes are exhibited in the conjunctiva; however, the pigmentation of the conjunctiva of the eye ball makes it difficult to observe variations in its blood vessels. Occasionally the conjunctiva becomes swollen and produces a slimy, serous secretion. In cases where the vitreous humor can be observed in the early stage of the attack it is found to be clouded. In the active, inflammatory stage, the eye ball is found, by palpation, to be sensitive and hard. Opacity of the lens appears during the later attacks, and, as a rule, when the lens become entirely opaque (total cataract) the periodic attacks cease in that eye. In six to eight days after the beginning of the attack the inflammatory appearances begin to subside, the sensitiveness to light and extra flow of tears abate; the exudate in the anterior eye-chamber begins to disappear; the pupil begins to expand and the iris may react with regularity. After about fourteen days from the beginning of one of the early attacks the inflammatory changes will have so completely disappeared that casual observation fails to discover anything abnormal in the re-

cently diseased eye. However, a careful and critical examination discovers that the iris is still attached to the capsule of the lens; or one may find on the capsule pigment masses which were left there in the breaking away of the iris from the capsule; the iris is lighter in color—lighter brown, very like the color of dead leaves. Occasionally the iris is so pressed forward that it comes in contact with the cornea and the anterior division of the aqueous chamber appears obliterated. The pale green appearance of the pupil indicates more or less cloudiness of the lens or vitreous humor. In most cases, especially after the later attacks, there remains a bluish ring around the margin of the cornea—a diffuse cloudiness—the upper eyelid, instead of presenting a continuous arch, exhibits an abrupt bend a short distance from the inner angle; the upper lid and the eyebrow are also more wrinkled than usual; after a few attacks the eye ball shrinks in volume, is smaller than normal, and in the interval between attacks the eye ball, by palpation, exhibits uncommon softness. In most instances cloudiness of the vitreous humor and detachment of the retina can only be discovered by first expanding the pupil with atropine and then examining the eye with the opthalmoscope. After the disappearance of the acute inflammatory symptoms, or after the inflammation has subsided and all damages are partially repaired, or the eye has "cleared up," it may remain free from another attack for a month, for two or three months or even for a year. However, as a rule, the attacks occur somewhat regularly every four or six weeks until the eye becomes entirely blind. This disease generally results in the formation of a total cataract and occasionally in paralysis of the retina or optic nerve—amaurosis. The attacks may vary in severity in the different cases, but the successive attacks in each case grow more severe and leave behind more distinct and prominent signs of approaching total blindness. Five to seven attacks, as a rule, completely destroys the

sight; thereafter that eye remains free from periodic inflammatory attacks; the other eye is then liable to become similarly affected until it goes blind. Rarely are both eyes thus diseased at the same time, but they may be attacked alternately until each one becomes blind.

The diagnosis of periodic opthalmia is not difficult. The previously mentioned symptoms and course of the disease are generally quite distinct. There are exceptional conditions and times when the owner or observer will be in doubt. During the first attack, when the cornea and the aqueous humor are so badly clouded that the pupil, the iris and all internal parts of the eye are invisible, one can not determine beyond question whether it is a case of simple iritis or iritis associated with some form of influenza. In some attacks the cornea may be so opaque for a time that one is unable to discover whether the aqueous humor is clouded or not; in such a case the owner may believe that the cornea is injured in some way. Time alone will bring forth or make clear the other symptoms. Again, during the interval between the first and second or between the second and third attacks, the before mentioned symptoms may be indistinctly marked; it will then be necessary to wait for the appearance of another attack. But in all the doubtful, indistinct cases, the characteristic fact of its recurrence in the same eye will remove all doubts in the mind of the owner if not in the mind of the buyer.

CAUSES.—A number of different microbes have been found in the tissues and humors of eyes affected with moon blindness. Vigezzi has found a micrococcus which he believes to be the direct cause of the disease; Trinchera discovered an immovable, curved bacillus; R. Koch found a short bacillus, rounded at its ends; Richter found a diplococcus and a triplococcus. However, no positive proofs have as yet been discovered, by experimentation or otherwise, that would justify a positive declaration in favor of any microbe. In fact

the investigators have found a germ associated with the disease; but, if the microbe has been cultivated on artificial media, the eye disease has never been artificially transmitted or produced by means of the germ.

Willach examined 37 eyes from 24 horses and has discovered a variety of forms and kinds of round and flat worms; most of them were found in the humors and represented the young stage in their development. Similar parasites were also discovered in the alimentary canal, the liver and the lungs. Wallach believes that these worm-like parasites migrate from the alimentary canal during their early life—chiefly by way of the blood vessels—and thus reach the eye; these migrations take place periodically or at such times as the egg or young forms of the parasites reach the alimentary canal in the food or water. This theory would, of course, explain the periodic nature of the disease and many other phenomena connected with it. But the worm-like forms were found only in the examination of dead eyes, whereas the limited number of cases and want of transmission or actual production of the disease by experiment will not justify, beyond question, the 'far-fetched' conclusions.

On river bottoms, on moist clay soils, on marshy grounds, on moist coast lands of seas and lakes, in malarial districts, this disease is said to be most prevalent. In 1875, a regiment was moved from Frankfurt on the Main to Hofgeismar; at the former place moon blindness never appeared; during the first year, at the latter place, 5 cases appeared among the horses of the regiment; the second year 12; the third year 11; the fourth year 14, and the fifth year 42. The regiment that was stationed at Hofgeismar was moved to Frankfurt; during the last five years of this regiment at Hofgeismar there were 130 cases of periodic opthalmia, and during the first five years at Frankfurt not a single case appeared. Hofgeismar, Saarburg, St. Avold and other places in Germany seem to be peculiarly adapted, by

their moist clay soils, to the development of the microbe, the parasite, the gas or miasmatic factor that causes this disease. Records also show that on certain low lands of Belgium, France, Spain, Italy. Austria and England, this eye disease prevails extensively. Likewise in our own country certain localities have more cases of moonblindness than others.

The writer has observed that this disease is more prevalent in the southern states, than in the central or northwestern states. Compare the number of cases in the dry, cool climate of South Dakota with the moist, warm climate of Alabama and the result shows the extremes—the almost complete absence in the former State and the unpleasant prevalence in the latter. It is said to occur less frequenly on lime soils. Clay soils will retain moisture longer and as a rule are richer in organic materials than sandy soils; consequenly germs, malarial parasites, etc., will grow abundantly on the moist clay soil.

The disease appears on sandy soil if there is sufficient moisture; it will also appear on moderately high rolling land irrespective of the kind of soil if there be sufficient moisture—as a rainy season followed by a warm season with occasional heavy rains. A number of cases have been observed at Auburn, 800 feet above the sea level, with a gray sandy soil; however, there are red clay districts not far from Auburn. I, also, have reports of its appearance on sandy soils in other parts of this state.

In the period from 1879 to 1890, appeared 2183 cases of periodic opthalmia among the horses of the Prussian army. Of this number 585 were in the 15th army corps; 358 in the first; 339 in the 11th; 145 in the 10th; 135 in the 5th; about 80 in the 2nd, the third and the 8th; about 70 in the 7th; about 60 in the 4th, the 6th, the 9th and the 14th; 49 in the guard corps. It will be observed from the above records that the disease prevailed quite extensively in the

respective localities of the first five of the army corps above mentioned; while in the districts of those last mentioned the disease was comparatively rare.

Cloudy weather, or moist air, so common and constant on wet lands, is said to be a factor in causing this disease. Rank, succulent fodders, grown on wet lands, associated with a damp, sultry atmosphere, is conducive to the production of a lymphatic temperament or constitution—a horse with a coarse open texture of bones and muscles, with an excess of connective tissue, with thick skin, legs covered with an abundance of long hair and with labored, sluggish movements. No doubt, such animals are predisposed to moonblindness. Fodder, hay or grass, from low, swampy or wet soils may also contain the germs or malarial parasites which are believed by some to cause this disease. In some localities of Europe the hay and fodders, grown upon certain soils, are said to be the cause, or the carriers of the cause from the soil to the animal.

A constant stimulating diet of corn, rye or barley grain—especially in summer or when given to the growing colt—contain too much of the fat and heat producing food and not sufficient proportion of the muscle and bone forming food; the horse so fed may be very fat but less able to resist the germs of disease, more liable not only to moonblindness but also to "big head" and other constitutional diseases. Constant feeding of corn will certainly make the periodic attacks occur more frequently and also augment their intensity. This has been proven by a number of trials. A reliable farmer living near Auburn had a fine young mare that had been attacked two or three times; he believed the corn was making the disease worse; hence he withheld the corn and thereafter fed her upon oats; the eyes were not again attacked, and they recovered so completely that her owner could never observe anything wrong with them. Certainly the feeding of corn alone did not produce the disease, but

after the real exciting cause had established it, the corn either maintained a supply of food for the microbe or diminished the general vigor of the animal or the resisting power of the leucocytes—germ destroying cells of the body. High feeding associated with irregular exercise, feeding irregularly and using unwholesome, decayed or partially rotten hay, fodder or grain; also the surface water of runs, ditches, ponds and shallow wells receiving the impurities from barns, barn yards or outhouses—all these are contributing causes and many times the impure water may convey the microbe, the originating cause, into the system.

Overworking an animal, no doubt, depresses the vigor and resisting power of the animal; thus attacks are more liable to begin or recur during the severe, exhausting spring plowing and summer work. During the time of breaking the colt and of the eruption of permanent teeth the attacks are excited to greater severity and are called forth more frequently. The eruption of nearly all the permanent teeth occur during the last half of the third, fourth and fifth years of age. The small teeth that usually appear just in front of the first molar on either side of the upper jaw, very rarely in lower jaw, are commonly called wolf teeth or "blind teeth." Many people believe that this little tooth in some mysterious way affects the eye, causes it to go blind "by pressing on the nerve of the eye." This is, to say the least, very unreasonable if not nonsensical. Those little teeth never affect the eye. No doubt they are broken off many times when a horse has an attack of periodic opthalmia and the eye "clears up" in ten to fifteen days—not because the little tooth was pulled or broken off with a punch—but because that eye disease appears and disappears periodically. Heredity is certainly a strong predisposing cause of the disease. It does not originate the disease but the offspring inherits the tendency or weakness of the eyes, that permits the originating excitant to call forth the disease with little resistance. This trans-

mission, from sire or dam to the offspring, of defective tendencies is, no doubt, responsible for the appearances of periodic opthalmia in certain families when the original blood was so contaminated. In France the government discourages, and prohibits when possible, the use of blind stallions or mares for breeding purposes. The farmers and stockmen of the country have observed and noted the influence of heredity in the production of moonblindness. From the replies to a circular letter which I sent to farmers and stockmen in all the counties of Alabama, twenty-one stated that heredity was a primary or secondary factor in the cause of periodic opthalmia.

Poor or badly ventilated and improperly lighted stalls or barns are also causal factors. Prof. Williams of Edinburgh says: "Fifty years ago thousands of horses became annually blind from opthalmia; now-a-days one seldom sees a case of blindness from this cause. This happy result is due to the enlightened writings of Coleman on ventilation and the advance of veterinary science—facts which the public seem to ignore." In improperly lighted stalls or barns the light is so weak, or small in quantity, that the eyes are continually strained in order to see distinctly; or the light enters from a small window directly in front of the horse, placing the horse on the shady side of the objects in front of him, and this in combination, or contrast, with the constant glare of the window, is certainly as trying on the eyes as insufficient light. The light should come from behind or from either side of the animal in quantity sufficient to make all objects in the stall distinctly visible. It has been suggested that exposure to cold, or to any of the atmospheric influences which ordinarily produce acute catarrh or cold in the head, will cause an attack of moonblindness. The records of the disease in the German army show that more cases occur in winter than during any other season. But in this State the majority of cases appear in the spring and summer.

A rheumatic condition of the system is said to play an important part among the long list of causes of moon-blindness. It, however, like many other depressing diseases and influences, is only a preparing or predisposing cause or condition which can not originate the disease but may excite frequent attacks and increase its severity. Smoke, pungent vapors, hayseeds, dust or any local irritants or injuries may awake the latent tendency or augment the intensity of an attack. In short, whatever depresses the vigor or debilitates the system will aid in originating the disease and will also increase the intensity and frequency of the attscks; anything that strengthens the constitution or improves the animal vigor will be a protective or assist in preventing periodic opthalmia.

The essential and originating cause is very probably a microbe, a miasmatic germ, an animal, worm-like parasite or the poisonous product of a germ. The natural habitat or its native place of propagation and development seems to be on moist lands that are, during one season, extremely wet and at other times dry enough to bring forth crops. The surface water of such districts, and the fodders, grasses and hays grown on such lands, transmit or carry the germs into the system of the animal.

During January, 1893, the veterinary department issued about two hundred circular letters containing questions relative to eye diseases among domestic animals; these were mailed to farmers and stockmen in all the counties of Alabama, and they were also published in many of the daily and weekly papers of the State. The principal question in the circular letter read as follows:

"Are horses and mules in your beat or county affected with what is commonly called moonblindness? If you have such an eye disease please state how frequently it occurs, and what is your view of the cause of it."

I received in all nearly 125 replies. From these replies I have obtained the following records on periodic opthalmia or moonblindness:

Eighty (80) cases were reported in such a manner as to leave in doubt just when they occurred; 33 cases were reported as being in existence at the time (January and February) of replying; 7 parties report that the disease was prevalent in their respective beats ten to twenty years ago, but not of late years. During the first three months of 1892 and during the same time in 1893, 21 cases have come under my observation at the free Saturday clinic; these cases were from the country and towns surrounding Auburn, and represent fully ten per cent. of all the diseased cases that appeared at the free clinic during the same time. The above records certainly indicate that periodic opthalmia is a common disease among horses and mules of Alabama; and according to the reports on other eye diseases it is the most prevalent and frequent cause of blindness.

The reports do not give data sufficient for one to state in just what beats it occurs, but they do show that moonblindness has been, or is at present, in nearly every county in the State; that annually a great many valuable horses go blind as a result of it. Generally speaking, the reports seem to indicate that the disease is most prevalent in the low lands or malarial districts of the State; yet the knowledge given of the local geography of the places from which the reports come, is not sufficient for one to make an accurate comparison.

From the replies I find that a variety of opinions were expressed as to the cause, and a great many failed to express their views, while others said they did not know. Let me now give a concensus of the opinions expressed. Six parties believed that improper and irregular feeding are important factors in the cause of moonblindness; 3 say "not enough variety in diet;" 4 believe "too much fodder and grain and not enough hay" is the cause; 1 says "feeding corn to colts;" 9 claim "feeding corn as an exclusive grain diet" is the direct cause; 3 give "exposure to cold" the credit; 1 says the "eruption of permanent teeth and the shedding of colt teeth;" 1 says "blind teeth;" 1 makes

"high feeding and irregular exercise" responsible; 11 claim that "overwork" in various ways is a potent causal factor; and 21 say heredity, especially in blind or "weak-eyed" breeds, is the chief cause; six (6) parties traced the history directly to a blind sire or dam. Surely the above ideas, relative to the cause of periodic opthalmia, show that the stock owners of Alabama have been searching for the cause; and if they have not discovered the actual originating cause, they have found factors that intensify or conditions that make the disease worse. Some have suggested that home-bred horses are more disposed to this disease than horses or mules brought here from other states; yet others claim that the opposite is true. I am of the opinion that the animals freighted here from Kentucky, Missouri, Illinois, etc., are far more liable to contract periodic opthalmia than home-bred horses; because the diet of the northern horse is very greatly changed and he must also become acclimated —his system must be adjusted to new climatic conditions.

The susceptibility of an animal is determined to some extent by age. From the reports of cases where age was mentioned, and also from the records of European authorities, the period of greatest frequency is from 3 to 9 years of age. Some have placed this danger period from 2 to 7. Yet it should be remembered that periodic opthalmia does occur outside of the above age limits, for I have reports of cases 12, 13 and 15 years old.

Treatment.—Taking into consideration our indefinite knowledge of the originating cause and the numerous attending, exciting and predisposing causes, and the fact that the disease generally results in total blindness in one or both eyes, it is evident that preventative treatment is the most profitable and reasonable. The drainage, ventilation and light in most barns are sadly neglected and generally very defective. The barn is usually resting on the ground and the stalls are filled with clay which becomes saturated with urine. The clay allows very little moisture to pass through it; the urine, which falls upon it and with which it becomes

saturated, passes off mainly by evaporation. With little ventilation or drainage below it, the clay rarely becomes dry and the atmosphere of the stall is constantly saturated with unhealthy gases (ammonia, etc.,) from the fermenting urine and decomposing organic matter of the feces. Such unhealthy conditions can be greatly improved by following the methods usually adopted in building houses in this climate. The floor of the barn should be from two to three feet above the ground; this may be accomplished by making the brick or stone pillars for underpinning the required height and using strong plank two inches thick for flooring.

Lattice work between the outside pillars will permit free circulation of air under the barn and prevent the use of the basement for a dog house, pig pen or as a place for fowls. This will give good, cheap drainage below with excellent under ventilation. The ventilation of the box stall (the best and healthiest kind of stall) should be so arranged that the hot and light air may escape through an opening or series of openings in the upper part of the outer wall, permitting it to pass directly out of the barn. Similar openings should be located in the outer wall near the floor to allow the heavy gases (carbonic acid gas exhaled by the lungs, etc.) to escape. Besides these openings lattice box stall doors and lattice outer hall doors and windows should always be in use for summer ventilation. There may be objections (its hardness and the drying out of the feet) to standing a horse on a plank floor; but these may be overcome by bedding or littering the box stall; by occasionally soaking the feet in water, and, when nearly dry, oiling them with an ointment made of one part of pine tar to eight or ten parts of lard or cotton seed oil. The light should, as before mentioned, enter from behind or from both sides of the animal; in the box stall the light should thus enter when the horse is standing at the manger. Furthermore, the light should be so arranged and of sufficient quantity to enable the horse to see distinctly in all parts of the stall.

The water supply and time of giving water to horses

should be carefully considered. All surface water, from ponds, brooks, rivers and shallow wells should be avoided. Spring water, taken directly from the spring, filtered rain water or other kinds of filtered water, or water from deep wells are best, and less liable to contain disease-producing germs. The horse and the mule should always be given warter before feeding grain—never after, unless it be given two hours after feeding.

A constant corn diet is to be avoided, especially as a food for colts. It is extremely doubtful if corn for colts is ever advisable. Furthermore, it is injudicious to feed horses or mules upon corn as the only grain food at any other time except in the cold period of winter. In fact, there is no time in this climate when corn alone is really needed or demanded by the system. Far better results will be obtained by using oats as the staple or chief grain food; and, at times, equal parts of ground corn and cow peas, or equal parts of ground corn, cow peas and oats, or equal parts of ground corn and wheat bran, may be substituted for oats alone. Corn should never be fed to horses with weak eyes or with diseased eyes. Corn and fodder (leaves) form the staple articles of food, for horses and mules, in some parts of this State with a climate that will produce green rye for soiling during the entire winter and green sorghum and green millet for summer. Corn is too stimulating and contains too much heat-producing material; the corn fodder is a dry, rough food, which in combination with corn is liable to lead to attacks of constipation, producing passive congestion of the blood vessels of the brain and the eyes. To be sure this does not always occur, but many times an attack of periodic opthalmia may thus be called forth. Variety in rations should always be considered, and extended according to local food supply; watch the effects of the quality and the quantity of the various foods, and many times you will be able to regulate the diet of the animal according to your experience in feeding it. No fixed or absolute laws can be made to fit all cases; horses have their individual peculiarities as well as persons.

High feeding, with irregular exercise; excessive and exhausting work; exposure to cold (rheumatic influences) are to be avoided as far as possible, especially with animals affected with periodic opthalmia or predisposed to it.

The indiscriminate use of blind animals for breeding purposes can not be too strongly condemned. Heridity is certainly the most potent predisposing cause of periodic opthalmia. Mares with weak eyes and with a lymphatic temperment and structure should not be bred to stallions of similar temperment and form.

Proper *curative treatment* will sometimes check the progress of the disease, and may, in rare instances, result in permanent relief. During the active inflammatory stage bathe the eye in cold or hot water for 1 to 2 hours morning and evening; after each bathing put into the eye a few drops of the following solution: Potassium Iodide, 10 grains; Atropia Sulphate, 1 grain; Boracic Acid, 10 grains; Pure Water, 2 ounces. This medicine may be used for 6 or 8 days until the eye begins to clear up; then use the same prescription, omitting the Atropia Sulphate. When possible adjust over the eye a cotton cloth or small bag of cotton, kept constantly wet with cold or hot water. It is well to keep the horse, during the inflammatory stage, in a dark box stall if the ventilation, cleanliness and drainage of the stall is healthful and good. If the horse is constipated a mild purgative (one-half pound of Glauber's salts or one-half pint of raw linseed oil) may be given. Constipation may be thereafter avoided by giving a bran mash once or twice per week. Moderate and regular exercise or easy work is beneficial, but keeping the affected horse or mule at hard work is decidedly injurious. In every instance it is wise to remove, when possible, all predisposing or attending causes.

As indicated in several reports from different parts of the State, periodic opthalma seems to be disappearing in certain localities. It will certainly decrease in frequency, or entirely disappear, in nearly every beat in Alabama when the stock raisers comply with the hygienic laws, govern-

ing the health of horses and mules. The principles of feeding, ventilation, drainage, breeding and sanitation in general must be studied and practiced, from a scientific stand point. Besides Alabama can and should raise her own mules and horses. Healthier, better and cheaper animals can be bred and raised in this State than the majority of those that are annually shipped here from other States.

METHODS OF EXAMINING THE EYES.

Remove the blind bridle or any harness obstructions to free vision. Tie a cloth over one eye and then lead the animal over obstructions that will cause stumbling or high stepping. Repeat this test with the other eye blindfolded. If the animal with one eye blindfolded stumbles over low objects the vision of the other eye is defective. Note the attentive and erect position of the ears indicating that they are attempting to compensate for the defective sight. Carefully compare the fullness or prominence of one orbital region with the other; note that in fat or young animals the orbital cavity is full and that in poor or old animals the eye socket is not completely filled and the orbital rim or bony border is prominent. Excessive fullness of one orbital region would indicate that the eye lids or the tissues, surrounding the eye ball, are swollen, or it would indicate the presence of a tumor in the orbital cavity. Closely observe the form, position and condition of the eye-lids; the presence and position of the eye lashes; also, compare the curve of the free border of one upper lid with the same lid of the other eye. Examine carefully the secretion at the miner angle of the eye. The tears are like water; mucus appears gray and flocculent; pus mixes with the tears and appears yellow and cloudy; in the dog pus sometimes is colored green. If the mucus and pus are mixed the mucus flakes are colored yellow. An excessive quantity of tears, mucus or pus is manifest by the flowing of the secretions down over the cheek. The presence of the mucus, pus or an extra quantity of tears flowing over the cheek should induce the observer to look closely for

foreign particles in the eye, inflammation of the conjunctiva, abscess or ulceration of the cornea and closure of the lachrymal ducts. For further examination the animal should be taken to a barn or stall. It is best to use a stall with one window or one door; the animals head should be turned to the open door or to the window, allowing the light to fall on the eye from directly in front or from an angle to the right or left of the front. The eye may be opened by gently and firmly pressing the lids apart with the thumb and index finger, using the right hand with the left eye, and the left hand with the right eye. To see the conjunctiva of the upper lid, it may be everted by grasping the eye lashes with one hand and everting the lid over the fore finger of the other hand. Examine closely the haw or "eyewasher" and all parts of the conjunctiva for signs of injury, inflammation and irritating particles. Examine also the opening of the tear ducts.

The observers attention is next directed to the size, form and position of the eye ball. It is always advisable to compare one eye with the other that the abnormal may be judged by its deviation from the normal. If the eye ball projects outward and forward excessively, dislocation of the eye ball, hydropthalmus (excess of water in the aqueous humor) or a tumor in or behind the eye may be suspected. If the eye ball is drawn backward into the eye socket, severe inflammation is present, attended by extreme sensitiveness to light, as in the beginning of an attack of moon blindness. A decrease in volume or size of the eye ball, (after repeated attacks of periodic opthalmia and in tuberculosis of the eye ball) is manifest by apparent drawing of the eye into the socket and the more or less infolding of the upper lid near the inner angle of the eye. The tension and hardness of the eye ball may be tested by palpation upon the upper eye lid, with the index finger; both eyes should be tested at the same time that one may be compared with the other. Note the presence or absence of the congestion of the pericorneal bloodvessels; its presence indicates inflammation of the ciliary bodies, the iris and sometimes the choroid coat,

The cornea may be next viewed from various positions, noting carefully its curvature, its opacities, the presence or absence of ulcers, abscesses, vascularization, swellings or new growths. The location, color and limitations of the opacities should first be determined. The weaker the opacity or cloudiness the more blue the color; intense opacities are white. Black opacities of the cornea signify pigmentation from iris adhesions or from blood stains. Striped and pearl like opacities, with sharp limitations, point to scars or chronic changes in the cornea; chalk spots result from the employment of silver and lead salts in wounds and ulcers of the cornea. Viewing the cornea in profile, or from one side, will enable one to locate the opacity, revealing in a degree what layers of the cornea are involved; and to a certain extent enables one to determine the curvature of the cornea, especially in partial or total staphyloma and extremely flat or very conical forms of the cornea. If the transparency of the cornea will permit, investigate the aqueous humor, searching for the gray, floculent exudate or the yellow, sedimentary pus exudate, or the red colored exudate in blood effusions; these may be present in penetrating wounds of the cornea, iritis and moonblindness.

The color, condition of the outer surface, movements and attachments of the iris should next be examined. The iris may become grayish brown by the deposition of inflammatory products in its substance, or become gray from the deposit of an exudate on its surface. The bluish-green color of the iris, manifest after one or two attacks of periodic opthalmia, is due to an atrophied (shrinking) condition of the iris. Occasionally in cattle a tubercular growth develops from the iris and completely fills the aqueous chamber of the eye. The iris may be attached by inflammatory adhesions to the capsule of the lens (as in iritis or moonblindness); or it may thus adhere to the posterior surface of the cornea (a result of penetrating wounds and ulcers). By the use of atropine, if the pupil is small or contracted, or eserine if the pupil is large or expanded, these adhesions may

be destroyed or their permanent presence made known by the immovable iris and unchangeable form of the pupil. The iris, when attached to the capsule of the lens or to the cornea, may appear rough on its outer surface and its pupillary border is more or less irregular. The ragged, irregular border of the pupil should not be mistaken for the large brown "soot balls" that appear so frequently along the upper and lower parts of the pupillary border of the iris. The movements of the iris should also be watched when the animal is taken from the sunlight into the barn, or from the dark stall into the sunshine. If the pupil contracts regularly in bright light and expands regularly in partial darkness, the action of the iris is normal. But should the pupil remain greatly expanded under all conditions of light and darkness, one would suspect partial or total amaurosis. If the pupil remains partially or greatly contracted under all conditions of light and darkness, one should suspect adhesion of the iris to the capsule of the lens.

The pupillary reflex or color of the pupil is the reflection of light from the retina and the choroid. The normal color of the pupil varies with the variations in its size or in its degrees of expansion or contraction; its color also changes with the variations in the light. By great expansion of the pupil it appears blue-green; by medium expansion it appears blue-black; by great contraction it appears black. The color of the pupil in amaurosis is generally lighter, more clear and glassy than in the normal eye. When the pupil is small atropine should be used to produce maximum expansion. Or, the animal may be taken into a moderately dark stall where the color of the light reflected from the upper part of the retina and choroid will be green, and that reflected from the optic papilla (spot where the optic nerve enters the eye ball) will appear light red. This light red color is very distinct in carnivorous animals.

Cloudiness of the lens or the vitreous humor changes the color of the pupil according to the intensity of the cloudiness. Total cataract gives the pupil a gray, a white or a whitish-

yellow color; while by a partial cataract the normal color of the pupil is cut off at the points or places of local opacities of the lens or its capsule. In cloudiness of the vitreous humor the pupil becomes more or less distinctly green. A liquid condition of the vitreous humor combined with cloudiness of the same also produces a distinct green pupil. Sudden or great movement of the cloudy vitreous humor, is a certain proof of its fluidity. The observer should view the pupil from various positions; by the use of the hand or a black hat the superfluous rays of light, or those coming from certain directions, may be cut off. The observer should not mistake the images of white objects (white shirt fronts, windows, holes in the building), for white or gray opacities in the lens or other parts of the eye.

Dislocation of the lens, falling of the opaque lens into the anterior or aqueous chamber of the eye has its appearance suggested by figure 13. But if the opaque lens should fall into the vitreous humor, the upper part of the pupil may remain transparent, and the small appearing optic papilla might be visible; yet a portion of the white or gray opaque lens could be seen through the lower part of the pupil; as a rule, the iris remains passively inactive and its pupillary border floats in the aqueous humor. Sometimes the lens may be partially dislocated or may have some shred-like, or hanging thread-like, attachments to its old location; these conditions would present different views in the pupil.

In order to be more accurate in locating and discovering opacities, the animal should be placed in a dark room where the eye may be illuminated by the use of a lamp or candle. The lamp may be placed in different locations, in front of, and outward from, the eye to be inspected; opacities will then be made more distinct. Three images of the flame may be seen as illustrated in figure 18. In the normal eye the first image is the largest, upright, the most distinct and reflected from the front surface of the cornea; the second image is smaller, upright and reflected from the anterior surface of the lens; the third one is the smallest, inverted

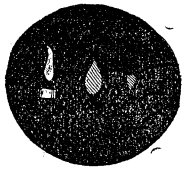

FIG. 18.

This cut (after Schlampp) shows the images of the candle's flame. The animal should be placed in a dark room or stall, or the test may be made at night in an ordinary stall; the candle is held a short distance in front of the eye to be examined and the following images, as above illustrated, will be seen. The first upright image is reflected from the cornea; the second upright image of the flame is reflected from the capsule on the anterior surface of the lens; the third or inverted and small image of the flame is reflected from the capsule on the posterior surface of the lens. The dark back-ground of the cut represents the pupil.

and reflected from the posterior surface of the lens. In the normal eye it will be noticed that these images are more or less distinct and that, as the lamp or candle is moved, the first two images of the flame will move in the same direction that the candle moves, but the third or inverted image moves in an opposite direction to that of the candle. As the candle is moved about in front of the eye, it may reach a place where the first two upright images remain clear and distinct, but the smallest and inverted image becomes cloudy and indistinct; this would indicate that the substance of the lens or the posterior part of the capsule is opaque at the point or spot where the candle's rays attempt to pass through. If the second image becomes indistinct the opacity lies in the anterior part of the capsule; if the first image becomes hazy and diffuse the cloudiness is in the cornea. Total cloudiness of the cornea would obliterate all three images, and the diffuse cloudiness of the aqueous humor obliterates the second and the third image.

A small double convex lens may be used, as illustrated in figure 19, to focus or collect the rays from a candle or lamp in a dark room or stall. Or, a concave mirror (with a small, round opening in its center for the observer to look through) can be used to collect and reflect the rays from a candle or from an open door or window; in using the mirror the candle

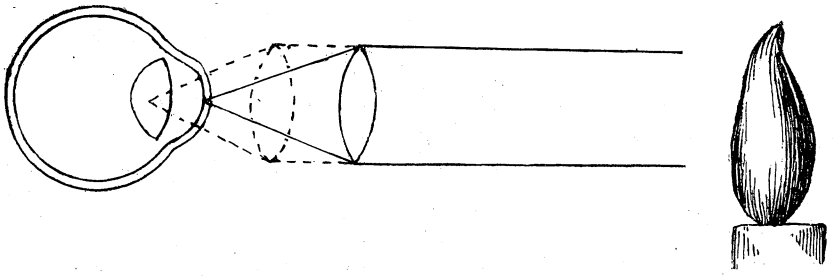

FIG. 19.

This cut (after Schlampp) illustrates how the double convex lens is employed in illuminating the eye or parts of the eye for the purpose of examination. The examination is made in a dark room or at night; the glass lens is moved forward and backward until the candle's rays are focussed upon the desired part or various parts, as it is upon the cornea and lens in the above cut.

or window should be backward from the head and outward from the shoulder or body. By employing the double convex lens or concave mirror, the transparent or opaque condition of the cornea and the aqueous humor may be distinctly observed and many opacities can thus be seen that are invisible in ordinary daylight. By employing atropine to expand the pupil, slight opacities of the lens may be made distinct and cloudiness of the vitreous humor may be observed. These methods of illuminating the eye also enables one to carefully examine the condition of the iris.

The opthalmoscope is an instrument that is used by oculists to look at the retina, its bloodvessels, the papilla optica, and to determine the degrees of farsightedness, shortsightedness, astigmatism, etc. Its use, however, requires great skill and much practice; hence, directions for using it will be omitted, since they would be of little value to the average man.

In preparing this bulletin, the writer has made frequent and extended references to the following books, pamphlets, and medical journals:

Mœller's—"Augenheilkunde."
Schlampp's—"Augenuntersuchungen."
Ellenberger-Shütz—"Jahresbericht über Veterinär Medicin. Jahr 1891."

Bayer's—"Bildliche Darstellung des Gesunden und Kranken Auges Unserer Hausthiere."
Williams—"Principles and Practice of Veterinary Surgery."
Reports of Bureau of Animal Industry on "Diseases of the Horse" and "Diseases of Cattle."
De Schweinitz's—"Diseases of the Eye."
Chauveau's—"Comparative Anatomy of Domestic Animals."
"Berliner Threrärztliche Wockenschrift."
Billings—"Bulletin of the Nebraska Experiment Station, June, 1889."

APPENDIX.

The following are some of the diseases that have been reported to this department as occurring in different parts of this State:

"Pink-Eye" has been reported as occurring among horses, mules and cattle. A large number of the cases of so-called "Pink-Eye," among horses and mules, was due to inflammation of the conjunctiva and sometimes of the cornea, associated with influenza, cold in the head, or strangles (distemper). An inflammation of the mucous membrane of the nasal passages may extend to the mucous membrane (the conjunctiva) of the eye by way of the tear canal and the tear ducts; or, some of the mucous discharge from the nostril may accidentally get into the eye. A few cases of "Pink-Eye" among cattle were associated with malignant catarrh; while nearly all "Pink Eye" cases among cattle have been outbreaks of infectious conjunctivitis and keratitis.

"Hooks" have been reported, in a number of instances, as a prolific cause of blindness. One man spoke of "bone hooks" and "fat hooks," but failed to explain the technical meaning of these terms. However, the indiscriminate practice of cutting out the haw or "eye washer" when the eye is affected with conjunctivitis, moon blindness, or tetanus (lockjaw) is certainly useless, if not barbarous.

One case of night blindness; and as previously mentioned, 134 cases of periodic opthalmia have also been reported.

Reports of four outbreaks of head scab among sheep have been received. This is a disease of the skin, and is caused by a mite (sarcoptes scabiei, var. ovis) which attacks the skin of the short wool regions of the head and legs. In attacking the skin of the eyelids, it produces entropium which leads to inflammation of the conjunctiva and cornea. Scrape the crusts from the affected places and apply any good sheep dip, once every eight days for one month.

The writer has also observed a few cases of diphtheritic conjunctivitis among turkeys and chickens. Separate the sick ones from the healthy and wash the eyes and the diseased surfaces of the mouth and throat with a weak solution of corrosive sublimate (1 to 500).

CEREBRITIS (Blind Staggers) has occurred in several counties of Alabama during the past winter and early spring. It has occurred, in nearly every instance, as a result of feeding rotten or mouldy corn. Curative treatment is usually ineffectual; it is best to prevent it by ceasing to feed damaged, mouldy corn.

The writer has received a great many reports, and has also observed cases, of "Big Head," (*osteo porosis*)—a disease of the bones, manifest by enlargement of the facial bones, of the lower jaw bone and the bones of the limbs, and nearly always leading to the "breaking down" of the horse after a long period of more or less severe rheumatic lameness. This disease is generally fatal. Excellent care with the variety in diet, as suggested to prevent moonblindness, will be good preventative, as well as palliative, treatment in this disease.

A few cases of malignant catarrh ("hollow horn?") have been reported and also a few cases of Parturient Apoplexy ("milk fever") among cattle.

Hog cholera raged in several counties last year, and has appeared in some counties this year. The disease has done the most damage in beats and counties where hogs have

been allowed to run at large. To be sure it occurs in stock-law districts, but it does not there spread so rapidly; and in some instances the spreading of the disease has been checked or stopped at the border line between stock-law and non-stock-law districts. Since the germs of this disease are propagated mainly by filth and bad sanitary conditions, it pays best to work along the line of prevention. Keep hogs and pigs confined to a certain pasture, or lot; see that these places are kept free from stagnant pools or filthy holes and that the water supply is pure. Also remember that the omniverous hog can not live under any condition or eat all things with impunity. It is well to keep a mixture of equal parts of charcoal, wood ashes, sulphur and common salt (pulverized and thoroughly mixed) constantly in reach of the hogs; also, keep a small box of nut coal in the hog lot continually.

This department is desirous of receiving reports of all diseases among domestic animals, especially all outbreaks of infectious, contagious, or spreading diseases that appear in Alabama. Questions relating to animal diseases will be gladly received and promptly answered. Address all such communications to the Veterinarian of the A. & M. College and Experiment Station.