

Original Articles.

RESEARCHES ON THE PHYSIOLOGICAL, CHEMICAL, AND THERAPEUTIC PROPERTIES OF HAMAMELIS VIRGINICA.

BY DR. HECTOR GUY, OF PARIS, FRANCE.

I PROPOSE in this thesis to make a humble contribution to the study of a new medicament which comes to us from America, namely, the hamamelis virginica, or witch-hazel. I shall divide my subject into five parts: In the first I shall include the botanical description; the second will comprehend the medicinal history of hamamelis; the third will be devoted to the chemical analysis; in the fourth I shall study the physiological action; the fifth will be clinical and will comprise the therapeutic applications.

BOTANICAL DESCRIPTION.

Botanically, witch-hazel has been long known. It was Linnæus who gave to this shrub the name by which it is distinguished — hamamelis virginica.

The family of Hamamelaceæ (*hama*, at the same time; *melon*, fruit, that is, bearing simultaneously both flowers and fruit) contains a few species under the form of trees and shrubs growing in various parts of North America, China, Japan, India, and Persia. The hamamelis virginica (tribe hamameleæ) grows in abundance in almost all parts of the United States, especially in New England, Pennsylvania, and Virginia. It grows in damp woods, blossoming late in the fall, when the leaves are falling, and maturing its seeds the next summer. The witch-hazel is a tall shrub with straight-veined leaves and yellow, polygamous flowers. The fruit is a nut-like capsule not unlike the hazel-nut. The bark, which is the principal medicinal part, has a bitter, astringent, and somewhat pungent taste. According to some too credulous travelers, the witch-hazel possesses mysterious properties, its young twigs being employed by ignorant enthusiasts as divining-rods to indicate the site of metallic veins or underground streams of water. I need not enter further into the description of a shrub so familiar as this must be to the readers of an American journal of medicine.

HISTORY.

Hippocrates in his "De morbis Mulieb.," book i., mentions, under the name of hamamelis, a fruit, an emulsion of which was given to wet-nurses to increase the flow of milk. It is perhaps in the works of Greek physicians that Linnæus found the name of hamamelis, which he gave thereupon, perhaps from some fancied resemblance to the American witch-hazel.

In America the hamamelis has long been one of the most popular remedies. It was employed from time immemorial by the Indians, who used it as a sedative and discutient in painful tumors and swellings; they pulverized the bark and made poultices of it which they applied to the inflamed parts.

It is only within a few years that the hamamelis virginica has been made the subject of earnest study by American physicians.

The following references to American works and articles in American journals will not be without interest in this connection: —

(1) Durham, in *Atlanta Medical and Surgical Journal*, 1867. This writer attributes to the hamamelis the property of preventing abortion. He claims good results.

(2) R. Hughes, in "Elements pharmaco-dynamic," a homœopathic work, 1874. He urges the use of witch-hazel in chronic inflammations, in varicose dilatation of veins of the pharynx, and in bleeding hæmorrhoids.

(3) Ludlam, in *United States Medical and Surgical Journal*, recommends hamamelis externally and internally in ovaritis and in blennorrhagic orchitis.

(4) Hale — "Materia Medica," etc., 1879. Witch-hazel is recommended in all diseases of the venous system, varices, painful and bleeding hæmorrhoids, also in hæmorrhages generally.

(5) John King — *American Dispensatory*, 1872. Hamamelis virginica is declared tonic, astringent, hæmostatic. Recommended locally in ulcerative stomatitis, in tumors of bad character, in prolapse of the rectum and uterus, and in intractable conjunctivitis.

(6) Scudder and Howe, in *Eclectic Medical Journal*. These eclectic practitioners have found hamamelis very useful in venous stases of the mucous membranes, old, torpid, fetid sores, in metrorrhagias, and in hæmorrhages generally.

(7) *Philadelphia Medical Times*, September 20, 1883, *New York Medical Journal*, December 8, 1883. In these articles Dr. Musser calls attention to the use of hamamelis in varicose veins and their sequences. Internally in drachm doses of the fluid extract. Astonishing results are claimed.

(8) *American Druggist*, New York, January, 1884. An exhaustive study of this medicament. Cites Dr. Alfred Stillé, James Fountain, and Dr. W. S. Davis as authorities for the internal and local use of this remedy as a powerful styptic, astringent, and venous tonic.

(9) "Essays on new remedies," Dr. René Ser-rard, Paris, 1881. This writer has made eight trials of hamamelis and confirmed the conclusions of previous experimenters.

(10) *Bulletin Gén. de Thér.*, March 15, 1884. *Bulletin de la Soc. de Thér.*, May, 1884. In these articles Dr. Dujardin-Beaumetz treats extensively of the witch-hazel, to commend its use especially in hæmorrhoids; he thinks, however, that there has been great exaggeration as to its therapeutic properties. The above references comprehend in part the medical literature of this medicament.

CHEMICAL ANALYSIS OF THE HAMAMELIS.

I fail to find in the writings of American authorities any complete chemical analysis of the witch-hazel. Hughes has noted the presence of tannin. Lea, besides tannin, a bitter principle. On the Continent several chemists have attempted a more complete analysis; Van d'Espt, of Brussels, has found tannin in the bark, existing in the proportion of 10 per cent., a feeble percentage of gallic acid, waxy matters, a red coloring matter, lime, potassa, iron, and an aromatic substance. He arrives at the conclusion that there is no alkaloid in the bark. The aromatic substance which he discovered is, I believe, an essential oil.

As for the leaves, which are much used medicinally in the United States, entering into the preparation of most of the extracts and tinctures (see the last U. S. P.), I have made the following analysis: A certain quantity of the powdered leaves was treated with chloroform; after evaporation, I obtained a solid waxy mass. Then a similar quantity of the powder was placed in a percolator, and sulphuric ether and alcohol were added. The filtrate was evaporated, leaving a residue of astringent taste, soluble in water, precipitating tartrate of antimony and coloring the ferric salts black. This substance was evidently tannin. Wishing then to obtain an imitation of the fluid extract, I distilled twenty grammes of the powder with one hundred grammes of water; I thus got a *hydrolat* having the characteristic odor of hamamelis, though somewhat weaker than that of the American extracts. This odor becomes stronger with age.

This *hydrolat*, agitated with ether, left after evaporation of the ether a minute quantity of essential oil, greenish yellow, possessing the peculiar "Pond's extract" odor and very volatile. To sum up the results of our chemical investigation, we find in the leaves a waxy matter, tannin, an essential oil, and divers extractive matters.

There are various reasons for believing that in the essential oil (which we regret not having examined further; the small quantity of leaves at our disposal rendering such further study impossible) resides the active principle of the witch-hazel. It is a fact that the fluid extract the most popular, the most vaunted, the most in use everywhere (Pond's extract), which is an aqueous alcoholic distillation, contains no tannin or gallic acid, as we were easily able to prove. What then can be the principle of the therapeutic properties possessed, or supposed to be possessed, by this fluid preparation unless it be the essential oil?

PHYSIOLOGICAL ACTION.

No American or French physiologist, as far as I am aware, has performed any experiments on animals with the hamamelis. I have thought that it would be interesting to give the results of my physiological study. My experiments were made in the laboratory of Dr. Dujardin-Beaumetz, in the Hôpital Cochin.

Experiment I. Injection under the skin of a frog's back, by means of a Pravaz syringe, of about ten drops of tincture of hamamelis. There was no appreciable effect manifested, certainly no toxic symptom.

Experiments II., III., and IV. were of similar kind, performed on large, healthy frogs; the injection being made under the skin of the hip. The result, as in the first experiment, was nil.

Experiment V. The interdigital membrane of a frog was moistened and placed in the field of the microscope. After having noted the state of the circulation and the size of the vessels, an injection was made into the upper part of the leg of about two minims of the alcoholic tincture of hamamelis virginica. The interdigital membrane was examined anew; the state of the circulation did not seem to be much modified. The movement of the blood was

a little slowed in the capillaries and the volume of these vessels seemed diminished.

Experiment VI. The subject of this experiment was a large, healthy frog; the tongue of the animal was drawn from the mouth and fastened to a piece of cork; this was put under the microscope in such a way that a large artery with its accompanying vein was in full view. I then made an injection of ten minims of tincture of hamamelis into the posterior member and watched the appearance of the bloodvessels. At the end of fifteen minutes there was no perceptible effect; I made another injection of ten minims. For more than an hour I continued to watch the bloodvessels, which continued unchanged as before the injections.

Experiment VII. In this experiment, which was made under the same conditions as the preceding, I took care to have in the field of the microscope a network of capillaries; then I made an injection of ten drops of the tincture. Several seconds after the injection it seemed to me that the calibre of the capillaries was a little diminished; but this contraction did not become plainly evident till I had applied locally to the tongue of the frog (under the microscope) a little of the tincture, whereupon the circulation stopped completely.

Experiment VIII. As the results of the previous experiment might be attributed to the alcohol contained in the tincture, I repeated this experiment several times, using not the tincture of hamamelis but the aqueous extract dissolved in water. After the subcutaneous injection I noticed no appreciable result, but on making local applications to the tongue which, as in the previous experiment, was the subject of observation, I obtained a little contraction of the capillaries, but much less marked than before.

I have repeated these experiments from the point of view of modifications of the circulation with other preparations of the hamamelis, notably with the fluid extracts. The results obtained have been much inferior to those which the tinctures gave me.

I have made similar experiments on hares; giving these animals, by mouth and subcutaneously, considerable quantities of various preparations of hamamelis. I have never observed any toxic effect or any modification of the circulation. These experiments seem to me to demonstrate the following facts: Hamamelis is not toxic even in large doses. This conclusion is confirmed by the fact that no case of poisoning by this medicament has ever been recorded.

Hamamelis has no very characteristic action on the vascular system. The phenomena of contraction of the capillaries may be attributed to the tannin in the tincture or aqueous extract; they were not produced when the distilled extract, which is free from tannin, was used.

Nevertheless, from its therapeutic effects there is reason to believe that the action of this medicament is exercised on the venous system and particularly on the muscular coat of the veins. The fact that this drug has no very well-defined physiological properties is not sufficient to warrant its banishment from the *materia medica*, for many medicines much used in practice have no characteristic physiological action.

CLINICAL OBSERVATIONS.

I have brief reports of twenty-one cases, thirteen of which were in the service of Dr. Dujardin-Beaumont, two were patients under the care of M. Camperdon, and six were Dr. Serrard's patients; in all the hamamelis was used with varying success.

CASE I. This patient, Charles Martin by name, was afflicted with ulcerous gastritis. Entered the Hôpital Cochin in January, 1884, mainly to be treated for internal bleeding hæmorrhoids, which protruded on defæcation in the form of little rounded, livid, half-strangulated tumors. These were treated locally by compresses wet with the fluid extract of witch-hazel. The greatest relief followed these applications; the bleeding ceased, and the pain disappeared with the swelling. The patient left the hospital after six days of treatment, almost well of his hæmorrhoids, though no better of his gastritis.

CASE II. This was also a case of internal proident hæmorrhoids; these were voluminous, painful, and attended with bleeding. Drachm doses of fluid extract of hamamelis were administered every two hours; the same remedy was also locally applied in the form of compresses soaked in the fluid extract. There was sensible amelioration after two days of treatment, and in less than a week both pain and hæmorrhage had disappeared. Patient passed from under observation.

CASE III. was also one of bleeding piles; the treatment was similar to that of the above, and was equally gratifying, the patient after eight days of treatment being entirely relieved of the distress and inconvenience from which he had previously suffered.

CASE IV. (also in the service of Dr. Dujardin-Beaumont) was one of varicose veins. A. G. entered Cochin March 15, 1884, for varices of both inferior extremities. These were especially marked in veins of left leg; the dilated and flexuous vessels felt like hard cords and bunches under the skin. The left internal saphenous was remarkable for its varicosities.

March 20th. Fluid extract of hamamelis virginica was administered in teaspoonful doses every two hours. March 22d. The size of the varices is not sensibly modified. They have, indeed, shrunk away a little, but the patient has kept at rest all this time. March 26th. The varicosities of both legs are much less salient; the clusters below the left knee have notably diminished in volume. March 28th. The patient is walking around the hospital, but the amelioration continues. The veins are less tense and voluminous. March 30th. Patient is still better. The varices have perceptibly shrunk. The cordy swellings over the left tibia have almost disappeared. Previously to treatment the patient could not walk without pain; now he can take quite long walks without any inconvenience. Left hospital March 30th. Two months afterward A. G. again presented himself at the hospital for another disease; I examined him thoroughly with reference to his varices. The amendment had continued; he had been able to pursue his daily tasks without fatigue and pain. There now remained only a few dilatations of trifling nature.

CASE V. was a case of varicose veins with ulcers

over the tibia. The same treatment was pursued, with considerable relief from the pain, though the varices remained unchanged.

CASES VI., VII., VIII., and IX. were also patients in the service of Dr. Dujardin-Beaumont; all were afflicted with varices. In all the hamamelis was given internally, in doses varying from ten drops of the tincture¹ every two hours to a teaspoonful of the tincture or fluid extract three times a day. Case VI. was attended with some positive shrinkage of the varices and relief of the pain. Case VII. seemed to be especially benefited in disappearance of the pain; there was also cicatrization of certain varicose ulcers during the use of the remedy. Case VIII. was a bad one on account of mitral heart disease and dropsy. No benefit from hamamelis. Case IX., varicose veins and ulcers; no benefit.

CASES X. and XI. were patients of Dr. Camperdon. Enormous varices; in Case XI. there were ulcerations. The tincture of hamamelis was given in doses of from five to ten drops at more or less frequent intervals during the day; dose was gradually increased. In Case X., after five weeks of treatment, the engorged tissues began little by little to regain their normal aspect, and the pains disappeared. Dose was increased to twelve drops twice a day. Dr. Camperdon noted certain symptoms which he regarded as toxic, from overdose; these were disturbance of vision, difficulty in walking, and some paralysis, with numbness, of the forearms, hands, and fingers; dose was reduced. The ultimate result was almost complete cure of the varices. Case XI. was a still more unfavorable case for treatment. Enormous varices, ulcerated in places. Tincture of hamamelis (one part of leaves to five of proof spirit), five drops morning and night, for first week; then five drops three times a day for second week, etc. There was gradual improvement, with healing of the ulcers and disappearance of the pain and swelling. After some five weeks of treatment the patient, an unmarried woman of forty, was able, without any inconvenience, to resume her occupation of saleswoman in a store.

CASES XII. to XVI. inclusive were patients of Dr. Serrard. The first case was a Parisian lady, aged twenty, who was suffering from chronic catarrhal pharyngo-laryngitis, with localization of the signs of congestion in the left vocal cord. This was in a varicose condition. Other treatments having failed, Dr. Serrard resorted to the tincture of hamamelis, giving two drops in a teaspoonful of water every two hours. The hamamelis was also employed in the form of inhalation, forty-five drops being added to half a pint of boiling water kept boiling, the patient being required to inhale the vapor fifteen minutes at a time. This treatment was persevered with for a fortnight; there was marked amelioration; the tumefaction and redness of the vocal cord disappeared; the voice recovered from its hoarseness and became natural, so that the patient (who was a vocalist) could sing; there was notable improvement in the condition of the pharynx.

¹ The tincture is made in the following way: Take of witch-hazel bark, one ounce; alcohol, ten ounces. Macerate and filter. Dose, two to five drops, and more. The United States Pharmacopœia of 1883 gives a ready formula for the fluid extract.

geal mucosa and that of the vestibule of the larynx, which were highly injected and swollen. The amendment was both gratifying and permanent.

CASE XIII., a lady, aged thirty-nine, was a sufferer from chronic sore throat; the tonsils being congested and tumefied, the half arches and the pharynx participating in a condition of catarrhal hyperæmia which also to some extent involved the larynx. Tincture of hamamelis was prescribed in the same doses as in the previous case. The same inhalation was also practised. A watery solution of the hamamelis was also ordered as a gargle. The amendment was immediate, and cure was gradually effected. In this case benefit was derived from touching the tonsils occasionally with a mixture of 1 part tincture of hamamelis to 2 of glycerin.

CASE XIV. was one of catarrhal conjunctivitis. The hamamelis was given in doses similar to those prescribed in the other two cases, and the patient (an elderly lady) was ordered to bathe her eyes every two hours with a lotion composed of twenty drops of tincture of hamamelis virginica in four ounces of water. This case, which was one of chronicity and great obstinacy, was singularly benefited under this treatment; in fact, in a month's time the patient was discharged cured.

CASE XV. was one of glandular blepharitis in a patient aged fifty, of nervous temperament and arthritic habit. *Symptoms*: since 1880 epiphora, sensation as of grains of sand under the lids, redness of palpebral conjunctival borders, hypertrophy of Meibomian glands. *Treatment*: an eye wash to be used every three hours of tincture of hamamelis half a fluidrachm, warm water a wineglassful. *Results*: almost immediate relief from the uncomfortable sensation and epiphora; ultimate cure. The strength of the lotion was finally increased to tincture of hamamelis virginica two thirds, warm water one third.

CASE XVI. was one of chronic parenchymatous metritis, in a married woman aged thirty. *Cause*: imperfect involution following an accouchement in 1875. *Symptoms*: easily provoked fatigue, pelvic pain radiating into stomach and back, shooting down thighs, heavy pressing weight on walking, no ease except when lying, dyspeptic troubles. *Vaginal examination*: vaginal cul-de-sac free, uterus enlarged and heavy, low down in pelvis, in anteversion, the cervix resting posteriorly on the vaginal floor. The speculum shows the neck large and of violaceous appearance; the two lips œdematous and largely everted (areolar hyperplasia). *Treatment*: every morning to the os and cervix a tampon of wadding saturated in a mixture of 1 part tincture of hamamelis, 2 parts of glycerin. This tampon was packed in the vagina and was kept in till the next morning. The tincture of hamamelis was also used externally as a liniment to the back. This treatment was continued nearly two months. *Results*: slow and effectual amelioration; reduction of the hypertrophy, the uterus the last week of treatment having diminished in size to normal; abatement and disappearance of the pain and reflex phenomena.

CASE XVII. was a patient in the care of Dr. Dujardin-Beaumetz. Disease, metro-peritonitis. Entered Hôpital Cochin February 21, 1884. There had been a previous history of a painful abdominal

affection, attended with vomiting and constipation and metrorrhagia.

Present state.—Pain in hypogastrium and left iliac fossa, radiating to the loins and thighs. *Vaginal examination*.—Heavy globular uterus, with neck effaced and carried to the left; culs-de-sac (except the posterior) obliterated; fixity of the uterus which by abdominal palpation is felt above the pubes. Reflex gastric and intestinal disturbances were marked.

The tincture of hamamelis was administered internally with no relief whatever.

CASE XVIII. was one of chronic parenchymatous metritis, under care of Dr. Serrard. It was complicated with endometritis with ulceration of the cervix, consecutive to arrest of involution after confinement. The treatment was like that of case XVI. and was attended with equally successful results; it should be remarked, however, that mineral sulphur waters were used at the same time, and "Scotch pin douches" (*douches à épingles écossaises*) over the lumbar region.

The three following cases were in the service of Dr. Beaumetz. The first was one of chronic enteritis; from three to twelve mucous, sanguinolent stools a day, with pain. After failure of other remedies, hamamelis was tried in the form of two-grain pills of the solid extract; dose: two pills a day. This dose was increased to nine pills a day; the result was nil.

CASE XX. was one of blennorrhagic orchitis. Tincture of hamamelis was given in ten-drop doses every two hours with rapid diminution of the size of the testicle and disappearance of the pain.

CASE XXI. was one of hæmoptysis in a patient in the last stage of phthisis. Tincture of hamamelis was given in teaspoonful doses every two hours. There was at first amendment under the treatment, but the hæmoptysis soon returned and the patient succumbed to the excessive loss of blood. The autopsy revealed a cavity with a miliary aneurism, whose rupture had caused the fatal hæmorrhage.

ANALYSIS OF THE CASES.

The first three cases pertain to hæmorrhoids. Has the hamamelis any special action in these cases? Certain American writers have claimed it as a specific. I am not prepared to indorse this claim, but the topical effects of the medicament seemed to be good in these three cases, an amelioration following the very first application. It is, however, presumable that whenever there is a mechanical obstacle to the circulation in the veins of the rectum, and whenever the hæmorrhoidal tumors are accompanied with anal spasm, the hamamelis will be without efficacy. In observations II. and III. the external employment of the hamamelis was associated with its internal administration. I am inclined to think that there is a good deal of testimony in favor of the internal use of the witch-hazel in piles.

In the eight following cases we have to do with varices. The employment of hamamelis has not given results as conclusive and as certain as those announced by Dr. Musser, of the Philadelphia County Medical Society. Moreover, the appreciation of facts at their just value is here very difficult,

and it is easy to attribute to the medicine effects which are due to rest. These cases are almost always persons easily fatigued, whose occupation requires prolonged standing, and whose varices, in consequence, take an exaggerated development by the force of gravity. A few days of rest in the hospital suffice to calm the pain and render the varicose swellings less apparent. This is what case VI. taught us. The patient who after ten days of treatment was considerably better went walking about the hospital; the next day the varices were as bad as ever.

Case IV., however, seems to me an exception. This patient had had varices for nearly ten years. After ten days of treatment the enormous varicose veins were quite perceptibly shrunken and the knotty tumor of dilated veins over the tibia had almost disappeared. The benefit in the case of this patient was lasting, as was shown by the fact that two months afterward, on returning to the hospital, he was found to be entirely well of his varices.

In Cases V. and VI. no marked benefit was noted. Case VII. (varicose ulcers) was attended with notable amelioration.

Case VIII. is not conclusive; the varicosity was complicated with œdema of the lower extremities from mitral valvular disease.

In Case IX. no amelioration.

In Cases X. and XI. the use of the hamamelis seemed to be attended with fairly good results.

The witch-hazel does not, then, seem to have any constant action in this affection. In some cases it seemed to do good; in others the effect was nil. It seems to be more beneficial when the veins are simply dilated, and little if at all hypertrophied. There is, however, a fact to which I wish to call attention, namely, to the decided analgesic action of hamamelis in varices, as well as in hæmorrhoids and pharyngeal, laryngeal diseases, etc., and this effect is often observed even when no perceptible amount of shrinkage is seen in the enlarged veins or other swellings.

Cases XII. and XIII. show the advantage which may be derived from the internal and local use of tincture of hamamelis in chronic laryngeal and pharyngeal congestions with varicose dilatations of the veins of the region.

Cases XIV. and XV. illustrate the de-congesting action of hamamelis in conjunctivitis and blepharitis. Hamamelis has also been employed with success in two cases of chronic parenchymatous metritis, as seen in the report of cases XVI. and XVIII. Its efficacy in this disease is especially noticed in the first phase of the disease, when the uterus is congested and engorged and the cervix is voluminous, deformed, patulous, but not indurated.

Case XIX. did not seem to be a fair case for trial of the medicine in chronic enteritis. The disease was probably tuberculous and little amenable to therapeutic agents.

Case XX. (blenorragic orchitis) seemed to be remarkably alleviated and helped toward a favorable issue by the internal use of hamamelis. The analgesic action was almost instantaneous.

It remains to speak of the hæmostatic properties of the witch-hazel. Case XXI. is not a good test

case; the patient was in the last stage of phthisis, and no medicine could have stayed the aneurismal rupture. In America good results have been reported from the hamamelis in hæmoptysis. In the two following cases, communicated to me by an eminent Paris physician, the benefit was unquestionable. The first was a hæmophilic infant, brought to death's door by repeated attacks of epistaxis. The internal and local use of hamamelis promptly arrested the hæmorrhages the first and every succeeding time.

The second case was of metrorrhagia from uterine fibroids. The internal use of fluid extract of hamamelis completely controlled the hæmorrhage and proved a boon to the patient.

CONCLUSIONS.

(1) Hamamelis Virginica is not toxic. Employed in very large doses it produces no symptoms of poisoning in the inferior animals. It does not appear to be toxic to man, despite the fact recorded by Dr. Camperdon, concerning which there would seem to have been some mistake.

(2) It does not appear to have any special physiological action on the vascular system, heart, veins, or arteries.

(3) We have not noted any alkaloid in the bark or leaves; the active principle is probably the essential oil.

(4) Therapeutically hamamelis has an uncertain action. It has, nevertheless, given good results in certain cases of hæmorrhoids. As a hæmostatic its action has seemed demonstrated in some circumstances. The results obtained in varices are not conclusive.

(5) Hamamelis Virginica does not seem to merit the enthusiasm bestowed on it by certain American physicians. It has no clearly defined special action. At the same time, in certain cases, its employment may be attended with success.

NOTE ON A HITHERTO UNRECOGNIZED FEATURE OF THE TEGMENTUM.

BY E. C. SPITZKA, M.D., OF NEW YORK.

THE study of a series of microscopic sections, prepared from the brain of a kitten, in which I had succeeded in inducing complete atrophy of the left cerebral hemisphere, left thalamus, and optic tract (the animal being killed three months after the necessary operation), revealed the following striking and important conditions:—

(1) The anterior commissure is present, and of about half the size of the same part in a normal kitten of the same age. (2) The detachment of fibres which connect the commissure with the thalamus is well developed on the right side and absent on the left. In Fuchsin-stained sections this difference is particularly well marked. (3) The continuation of the commissural fibres ventro-caudal is present on the left side and absent on the right side; owing to the secondary atrophy on the left side of the other structures—particularly the tracts—it comes out with abnormal distinctness. (4) The bundle in question moves along the side of the central tubular gray, gradually approaching the