

Dupuy (E.)

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INHERITED EFFECTS OF LESIONS
OF THE
SYMPATHETIC NERVE AND CORPORA RESTIFORMIA
ON
THE EYE.

BY
EUGENE DUPIUY

NEW YORK,

M. D. PARIS UNIVERSITY; CORRESPONDING MEMBER OF THE SOCIÉTÉ DE BIOLOGIE
OF PARIS; MEMBER OF THE AMERICAN NEUROLOGICAL SOCIETY; FORMERLY
PROFESSOR OF PHYSIOLOGY IN LONDON, ETC.

[REPRINT FROM THE REPORT OF THE FIFTH INTERNATIONAL
OPHTHALMOLOGICAL CONGRESS, SEPTEMBER, 1876.]

NEW YORK:
D. APPLETON AND COMPANY,
549 & 551 BROADWAY.
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NOTE ON INHERITED EFFECTS OF LESIONS OF THE SYMPATHETIC NERVE AND CORPORA RESTIFORMIA ON THE EYE.

SOMEWHAT more than three years ago my friend and teacher, Dr. Brown-Séguard, undertook a series of experiments with the idea of ascertaining certain conditions of transmission of nerve-lesions from parents to offspring. We observed together, among many other interesting results published in the "Comptes Rendus" of the Société de Biologie of Paris, the fact that almost every lesion of the sympathetic in which the system of the eyeball is involved, directly or indirectly, is transmitted from parents to offspring.

I have since divided the sympathetic nerve in the neck on a pair of Guinea-pigs, and observed the usual effects of such an operation, i. e., semi-closing of the eyelids, hypersecretion of tears, contraction of the pupil, elevation of temperature on the side of the face operated upon, and drooping of the ear.

These animals very soon recovered from the effects of the lesions, so far as the wound was concerned. It closed very rapidly, and the elevation of temperature did not remain very appreciable; but the other effects of the section of the nerve remained permanent.

A few months after, this pair of animals, still presenting the same phenomena as above, gave birth to a number of young, which all presented the effects of the section of the sympathetic to such a remarkable degree that one would have said that they also had been operated upon. Their eyelids were half closed, the pupils of the eyes were very small, the ocular globe itself was smaller than it is in animals born from

parents not having suffered any operation; the ears were thicker and larger than usual, and covered with heavier hair. The only difference between these animals and their parents consisted in this, that the rudimentary nictitating membrane was not observed to be in a paralytic condition, and there was no abnormal secretion of tears, as with the parents, nor was there any elevation of temperature noticeable. There was in a number of cases opacity of the cornea, but never ulceration, and sometimes cataract.

I had operated on the right nerve in the male, and on the left in the female parent. The offspring showed the phenomena in both eyes. In another series of experiments I operated on the nerves of both the animals on the left side, and the offspring had the phenomena sometimes only in one eye, sometimes in both. I leave out purposely other symptoms observed in other parts of the head. When I operated on the nerves of the right side in both parents, the phenomena in the young always existed on both sides.

Those young which were born with the two eyes bearing hereditary deformity were put together and allowed to breed among themselves. I have followed thus through five generations the reproduction of these phenomena brought on in the original pair by section of the cervical sympathetic; and, at that time, a female with the two eyes affected, having through error been allowed in a cage where I kept animals not operated upon in any way, became pregnant and gave birth to three young which all had the same signs of lesion of the sympathetic as the mother, which had itself inherited the same. Dr. Brown-Séguard has observed a similar fact, which he published last year. I add that those last animals, being put to breed with the others with deformed eyes, continued to give birth to young like themselves.

I should state here that removal of the first cervical ganglion in all cases gives results identical with those following mere section of the nerve.

In another series of experiments, which I undertook after Dr. Brown-Séguard, I obtained the same results as he did: exophthalmos in animals born of parents in which an injury to the *restiform body* had produced protrusion of the eye-

ball. At that time, being his assistant in his laboratory at the Paris Faculty of Medicine, I saw those phenomena, which he recently reported in the *Lancet*, continue for four generations. In those cases the animals modified by heredity had the two eyes protruding, although in the parents usually one only showed exophthalmos; the lesion in the parents having mostly been made on one of the corpora restiformia. Some differences, however, existed in the experiments which I made soon after those related above. For instance, I found that it made no difference whether the lesion was made on the corpora restiformia or very little below. In all cases the lesion consisted in a mere prick. Lesions of the right corpus restiforme had more power of transmission when the two parents were operated on than those of the left corpus restiforme.

The exophthalmos in these cases was produced in the animals originally operated upon both by the hyperæmic state of the soft tissues contained in the orbital cavity and an active protrusion of the eyeball; but in the offspring the soft tissues of the orbit were not hyperæmic nor hypertrophied, the eyeballs themselves were larger chiefly in their antero-posterior axis and firmer in consistency, the pupils of the eyes did not appear to be abnormal in any way. In no case did I observe any morbid change in the cornea or the lens.

I may add, incidentally, as this will lead to an attempt at the explanation of these curious facts, that in three out of five cases the section of the sympathetic nerve, or of its first ganglion on one side, produces in the brain, on the side corresponding to the lesion, a condition of unmistakable atrophy. This fact has been seen by Prof. Brown-Séquard, myself, and Prof. Vulpian.

In trying to give an explanation of the phenomena which depend upon this alteration of the intimate nutrition of the tissues of the organs under consideration, Prof. Vulpian suggests that there has probably been first a dilatation of their blood-vessels, and then, after a certain time, those vessels may have contracted, hence, the nutrition being thus less active, the atrophy followed. This hypothesis might perhaps avail

to explain the atrophy of the brain, and, therefore, by analogy, of the eyes in the case of section of the sympathetic nerve, but it has the fault of being a mere hypothesis, as there is no plausible reason for admitting that a dilatation of blood-vessels, consequent upon section of their nerves, is followed by contraction; and, moreover, it does not explain the phenomena in the young, nor those of the second series of experiments, where lesion of the corpora restiformia has produced exophthalmos, and still more insufficient is it in the case of the young of the latter.

I do not pretend to explain how these results were obtained in four and five generations of animals through heredity. I have made it a point to register the facts accurately, and will only submit what parallel observations in other instances of different inherited nervous lesions appear to me to warrant, and what has already been advanced by Prof. Brown-Séguard; that is, that a morbid state of the nervous system is transmitted, and not only the results of the lesions—for, surely, in the two series of experiments, the sympathetic nerves and the corpora restiformia of the young animals must have undergone *in utero*, or very soon after birth, the whole series of alterations which have preceded the final results observed in their parents after the operation, in order to have produced in them the identical phenomena. The whole argument tends to show, therefore, that in animals low in the scale compared with man the tendencies develop almost fatally into realities.

I am able, moreover, to state that I have performed autopsies on nearly all my animals, several dozen, and thus satisfied myself that there was no lesion of the sympathetic nerve nor of the corpora restiformia appreciable. There was certainly some dynamical change, however, as the results were there to bear witness.

Although not engaged in the practice of ophthalmology, I have taken the opportunity of bringing these incomplete results before this Congress, prompted by the idea that, if some analogy exist between human pathology and that of lower animals, as I believe, the difference in degree being taken into consideration, they may prove of interest.

