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ANALYSIS OF THE SENSORY CHANGES AND CONDI-  
TIONS OF THE OCULAR APPARATUS AS FOUND  
IN IMBECILITY, EPILEPSY, AND GENERAL  
PARALYSIS OF THE INSANE.

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ANALYSIS OF THE SENSORY CHANGES  
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The present paper<sup>1</sup> is based upon a series of observations the result of five years' work at the State Hospital for the Insane at Norristown, Pa. The special character of research treated of in this communication, which has been carefully pursued by the aid of competent assistants, is here given as a series of concluding remarks upon those symptoms which have been deemed sufficiently proper for generalization and conclusion. It must be remembered, however, that the

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<sup>1</sup>This paper, which practically presents an epitome of the sensory peculiarities seen in these clinical groupings, terminates a series of studies which have been written upon by the writer from time to time during the past four years, and which have been more or less confirmed by later investigation. The first article appeared in the Philadelphia Medical Times for Feb. 5, 1887; the second was read before the American Ophthalmological Society in July of 1887; the third and fourth were read before the same body two and three years later; whilst the fifth, which contained the final report upon the motor symptoms, was published in the American Journal of the Medical Sciences for November of that year.



rors that might arise from additional ocular changes dependent upon diseases which are peculiar to the sex, would thus be avoided."

At first, among the epileptics, no differential diagnoses were attempted as to the causation of the convulsions, this being done so as to embrace the entire grouping of such cases into a common lot of subjects, in order to have the greatest variations of supposable differences present at one and the same time, and thus to give greater latitude to error. Later, however, as the subject became more familiar and finer differentiations became more visible, attempts were made to isolate the cases into specialized groupings.

During the examination of the imbeciles, the following precautions were observed:<sup>3</sup>

"1st. Care was taken to exclude all but the proper class of subjects, no one being admitted who could not be properly designated as one with decided loss of mental power of a minor degree than idiocy, from malformation or disease of the nervous system, either supervening in infancy or occurring before birth. This was done so as to avoid any error that might arise from the presence of ocular symptoms which might be dependent upon other malformation or disease, and to exclude any question as to the use of the eyes for prolonged near-work during the early years of life.

"2d. Subjects chosen whose eyes were free

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<sup>3</sup>See Transactions of the American Ophthalmological Society 1887.

from extraneous disease or inflammation. Sore eyes of inflammatory and traumatic types were avoided, so as to obtain as nearly as possible representative peripheral (end) organs of comparatively healthy functional activity.

" 3d. Young adults were used. This was done for two reasons: first, to have the eye at its full maturity, and thus not to allow any question of further development to enter into the argument; and, second, to have the tissues of the eye at their best before any of the processes of natural decay should have manifestly asserted themselves.

" 4th. Males have been taken. These were chosen so as to avoid any errors that might arise from additional ocular changes which might be associated with diseases peculiar to the female sex.

" 5th. Every subject was submitted to the same routine examination, thus preventing any seemingly gross changes to appear that might arise from differences in methods of study.

" The reasons for such rules must be obvious, as by their observance all faults in working and want of precision in method are reduced to a minimum, and the conclusions, which are the very import of the work, are thus rendered more valuable and less liable to grave and deceptive error.

" In the third series of cases great care was exercised that each subject was seemingly free from any extraneous general disease or local disorder, and that competent and authoritative med-

ical opinion had been given as to the type of the general complaint; besides, the entire study in this direction has been limited to the male sex, so as to escape any conflicting complicating changes that might appear in connection with the many diseases peculiar to the female sex."

#### OBSERVATIONS—EPILEPSY.

##### *Subjective.*

1. Direct vision for form as a rule normal in both emmetropia and corrected ametropia.
2. Direct vision for color slightly subnormal as shown by faulty selection of delicate tints and shades containing low percentages of green and red.
3. Visual fields for both form and color regularly reduced, without either transposition or reversion.

##### *Objective.*

4. Optic disc superficially overcapillary, the deeper layers being decidedly gray, showing a low grade of incipient optic nerve degeneration; this being more marked in the cases where the general convulsive seizures were the most frequent.
5. Scleral ring rather more sharply cut than in the healthy eye, especially to the temporal side of the disc; this being probably due to shrinkage of lowered nerve tissue.
6. Fibre-layer of retina increased in thickness, as shown by coarse and dense massings of stria-

tion which extend in all directions from the disc; these being the most pronounced superiorly and inferiorly.

7. Retinal vessels, especially the veins, large in size, and carrying rather dark colored blood.

8. Retinal veins very tortuous, and at times pulsating.

9. Retinal arteries frequently wavy, and sometimes tortuous, particularly the temporal and the macular twigs.

10. Retinal lymph channels generally visible, being recognized as glittering and yellowish-white opacities along the larger vessels and at the vessel entrance on the disc.

11. Granular condition of choroid in the macular region, this being found in the majority of cases.

#### IMBECILITY.

##### *Subjective.*

12. Direct vision for form, as a rule, normal.

13. Direct vision for color probably normal.

##### *Objective.*

14. Optic disc apparently more healthy than would be expected for age of patient.

15. Physiological excavation generally seen, usually small, shallow, oval in outline (its long axis bearing no definite relation to the long axis of the disc), and ordinarily occupying a position slightly to the temporal side of the centre of the disc.

16. Scleral ring, as a rule, visible all around

disc, it being slightly broader to the outer side.

17. Pigment massings beyond scleral ring ordinarily limited to narrow concentric splotchings and double loops, which are more pronounced to the nasal and temporal border of the disc; the outer massings being generally crescentic.

18. Entire absence of so-called conus. In no instance could a broad crescentic area of bared sclera be distinctly seen; the temporal massings in those eyes which were presumably used the most being roughened and broken on their outer edge, and connected with small and narrow areas of disturbed retina and choroid.

19. Fibre layer of the retina but very slightly increased in thickness; the fine and oftentimes imperceptible striation being almost entirely limited to the superior and inferior portions of the nerve border, and extending but a short distance out into the retinal plane.

20. Lymph reflexes and opacities of the vascular sheaths very few, these being mostly confined to the main venous stems at their exit on the disc.

21. Retinal vessels about normal in comparative size, and in a few instances carrying impoverished blood.

22. Choroid devoid of change, except a somewhat granular condition, more pronounced in the macular region; this sometimes being accompanied by a slight absorption of epithelium (especially amongst the most intelligent).

23. Entire absence of any gross congenital malformation.

24. Almost equal degrees of hypermetropia with slight amount of astigmatism present in every case, the average amount of H. being about 2 dioptries.

25. The less imbecile the subject, the more common were the ordinary conditions seen in the used eyes of the mentally healthy.

#### GENERAL PARALYSIS OF THE INSANE.

##### *Subjective.*

26. Direct vision for form reduced in every instance where obtainable; this being in direct ratio, where there was any degree of certainty, to the stage of the disease.

27. Direct vision for color subnormal in the few instances in which it could be properly studied; this showing itself more particularly for green and red.

28. Visual fields more or less reduced in the few cases where any determinate answers could be obtained.

##### *Objective.*

29. Optic discs decidedly and unequally semi-atrophic, especially in the later stages of the disease; the degeneration being especially pronounced in the deeper layers and to the temporal side of the nerve head.

30. Capillarity of nerve substance materially lessened, the greatest amount of blood supply being recognized in rather narrow crescentic areas to the nasal side of the disc.

31. The disc, in a few cases seen in the third

stage of the disease, of a suffused and gelatinous appearance, its edges being plainly visible, and the surrounding retina being somewhat œdematous.

32. Physiological excavation frequent, it usually being seen to the temporal side of the disc, and extending to the lamina.

33. Scleral ring sharply cut and, as a rule, broad; this being more noticeable to the temporal side of the optic nerve head.

34. Blackish crescents of pigment, broken and more or less absorbed beyond the scleral ring, frequent at the outer edge of the disc.

35. Pigment lines of different widths and varying degrees of absorption beyond the scleral ring, at the inner edge of the optic nerve head.

36. Fibre layers of the retina, as a rule, diminished in thickness, the greatest amount of striation being seen at the superior and inferior borders of the optic disc.

37. Retinal striation, in a few instances seen during the third stage of the disease, very pronounced, rendering the disc edges quite hazy.

38. Retinal arteries reduced in size, and at times slightly tortuous.

39. Retinal veins, as a rule, undersized, tapering in some instances as they enter the disc, and quite tortuous in a number of cases.

40. Retinal blood currents apparently normal in tint.

41. Retinal lymph reflexes very few; these

being generally limited to the walls of the main vascular stems.

42. Fine pin-point opacities in the retina, between the disc and the macula, in a few cases.

43. Choroid granular and disturbed in the majority of cases.

#### CONCLUSIONS.

1. In idiopathic epilepsy as seen in the male adult, the low grade chronic retinitis and perivasculitis associated with partial red-gray degeneration of the optic nerve, causing decrease of physiological working power, are most probably explained in part by the presumption that every convulsive discharge leaves an additional pathological condition, by which such objective intra-ocular appearances are at last established, as the visible living results of a similar process which has *pari passu* been taking place within the intracranial substance, especially the cerebral cortex, and which may be readily seen post-mortem by careful microscopic examination.

2. In the lower grades of imbecility as seen in the male adult, which have resulted from malformation, or from disease of a minor degree than that producing so-called idiocy, that has supervened in infancy or has occurred before birth, the ophthalmoscopic findings of abnormally healthy eye-grounds, presenting pictures that are almost identical with those seen during infantile existence, indicate not only an almost absolute perfection of the visible constituents of the observed

tissues, which *per se* should be capable of proper functional activity, but plainly show, by reason of mental incapacity which has supervened in such subjects before the eyes have been brought into continued and constant action as instruments of accurate and delicate use, that the ordinary objective conditions known as: dirty red-gray appearance of the optic disc; irregularity of physiological excavation; non-visibility of the superior and of the inferior portions of the scleral ring; absorbing conuses in all of their varieties; increase in density and thickness of the retinal fibres; opacities of vascular lymph sheaths; disturbed states of the choroid; and gross errors in astigmatism, with changes in indices of refraction—which are so frequent in the used eye of the mentally healthy—must be considered as pathological changes expressive of low inflammatory action, with stretching and distortion from increased intra-ocular and extra-ocular pressure.

3. In general paralysis of the insane as seen in the male, the ophthalmoscopic appearances of the choroid, optic nerve and retina, are not only indicative of pronounced local disturbance and irritation which represent the results of wear and tear given to a delicate and greatly weakened organ, but are plainly expressive of a degenerate condition of the sensory portion of the ocular apparatus, with impairment of sensory nerve action, manifested as one of the many peripheral evidences of fast approaching degeneration and dissolution of nerve elements, most probably connected with related cortex disintegration and tissue death.



