January 1935 Issue
Vol. 2, No. 11

NEUROLOGY OF SNTONICS

Dr. C. H. Armesy, O.D., F.C.S.O.

A. INTRODUCTION
B. PHYLOGENETIC DEVELOPMENT OF THE EYE
C. EMBRYOLOGY OF THE HUMAN EYE AND ADULT STRUCTURE
D. EMBRYOLOGY OF THE NERVOUS SYSTEM
E. STRUCTURAL ANATOMY AND PHYSIOLOGY OF THE NERVOUS SYTEM
F. AUMARY OF INTERCONNECTION BETWEEN THE EYES, BRAIN, AND NERVOUS SYSTEM
G. CONCLUSION

A. As an introduction, preceding the presentation of the subject, may I bring to your careful consideration the thought and purpose of the writer, a preparation for better service to our patients, carefully analyzing the symptoms and complaints by seeing a true picture, before a hasty application in the field of science which is truly optometric, with the advanced or specialized means we know as Syntonics.

Our objective as public servants should be to use all means at our command to normalize or void conditions not normal within the field of optometric science that we may make manifest that the brotherhood and fellowship of man the privilege of enjoying life in the greatest fullness.

Therefore, it is our obligation to justify the responsibility and confidence we desire to establish by making ourselves thoroughly conversant with the requirements necessary by a more adequate knowledge of subjects such as the Phylogenetic Development of the Eye, Embryology of the Human Eye and Adult Structure, Embryology of the Nervous System, Structural Anatomy and Physiology of the Nervous System.

B. In order to establish a fundament, a brief treatise of phylogenetic development must challenge our attention. Primitive eye structure begins with primitive development of the head and eye. From one called animals of land and water, the Amoeba and parimoecium, continued through the various multiple called teleosts, fishes, mammals, carnivore, monkeys, apes, and man the central nervous system is approximately the same, but develops to a greater or lesser degree as is required for the normal functioning of the particular species.

Various types of eyes are found in the animal kingdom; Simple eyespots which are found in the Euglena Viridis, a one celled border-eyed animal with only a vague idea of light or darkness; the Ooilli with simple eyes which are believed to be used only on near vision; also Crustaceans which orient location towards light; the compound eyes of insects and crustaceans with a mosaic picture for distant vision; the vertebrate eye with binocular perception in higher forms stereopsis and bi-conjugate movement.

All types of development of the human eye are not a gradual development from simpler to more complicated firms. The fundament of the human eye is supposed to originate just prior to the early vertebrates, but not definite.

There are certain lower forms, for instance the lizard, that present an actual form of pineal eye. This eye is not connected with the optic nerve but with the sensory surface which conveys impulses.

The eyes of the shark are fundamentally the same as man.

It is interesting to note that no one central nervous system develops all senses to a maximum degree, but only to the degree for adequate requirements. As an example we will consider the optic nerve. In the lower vertebrates there is a total decussation of the optic nerve at the chiasms, where each nerve passes entirely to the opposite side of the brain with its independent pupillary and ocular movement and monocular temporal vision. In rabbits a few fibers from each do not cross at the point of decussation but continue to the same side of the brain. In the carnivore more than one sixth of the fibers pass to the same side of the brain which is rapidly assuming a partial decussation, and the orbits are generally so placed in the anatomical constructions that the visual fields are partially overlapping. In man one half of all the fibers of the optic nerves pass to the same side, while the other half decussate at the chiasms and pass to the same side of the brain. The eyes have moved forward so that the visual fields overlap and by the decussation process both sides of the brain function together giving the possibility of binocular vision. Consequently, we have "The visual impressions received from the left halves of the two retinal are superimposed on the left occipital cortex". –Treacher Collins-

With this binocular vision, mutual reaction of the pupils, conjugate movements of the eyes, hemi-decussation of the optic nerves, and superimposed cortical representations have the basis for binocular application (-stereoscopic vision-)

C. The bulbus oculi, being the organ of particular interest to the optometric syntonist, is imbedded in a fatty substance in the orbit, which provides for the protection from injury and allows an easy movement by the ocular muscles.

The eye develops from the lateral parts of the fore-brain before the neural tube has closed; after the closure are known as optic vesicles, projecting toward the frontal and peripheral part of the head forming a hollow bulb on the end. The tract of the projection remains small and becomes the optic stalk. The ectoderm which covers the bulb is finally detached in the process of folding, and out of this comes the rudiments of the crystalline lens. A thickening of the outer wall of the bulb enfolds and becomes the optic cup. The two margins eventually reach as far forward as the pupil. This growth also includes the posterior-inferior surface growth in the optic stalk, forming a groove called the choroid fissure. Through this groove the mesoderm enters the cup, and when closed becomes the central (unreadable) retina.

The retina develops from the optic cup. The outside (unreadable) develops and forms the pigmented part of the retina which first appears near the edge of the cup.

The inner part forms a thick layer of nerves ad fibers of the retina; which also divides and forms a part of the vitreous. The inner portion of the cup which overlaps the lens is not divided into nevus elements but forms a layer of cells and is connected to the pigmented layer forming the pars ciliaris and pars iridica retina.

The stalk is converted into the optic nerve by the nerve fibers growing into the cavity. The majority of the fibers proceed posteriorly from the nerve cells of the retina to the brain by the optic stalk, but a few fibers arising from cella in the brain do travel back to the retina.

Likewise, it can be established how the various tunics of the eye are developed from one or more of the original layers of the blastula. It is sufficient at this time, being particularly interested in adult structure, to establish the importance of the retinal relationship to the central nervous system as the means used as a major receptor.

D. The first stage of embryologic formation is the combining of the sperm and ova. The second is the rapid division and doubling of the cells, into a mass known as the morula or third stage. The cells of the morula soon leave their close association and form into a peripheral layer and an inside cell mass. This formation is called a blastula, and consists of three layers; namely ectoderm, mesoderm, and entoderm.

The ectoderm forms the complete nervous system, also glandular cell linings, anterior lobe of the pituitary, epithelium of the cornea, conjunctive, and many others.

The entoderm forms linings for the digestive tube, with a few exceptions, and the linings of all the glands that open into the digestive tube, which include the liver, pancreas, epithelium of the auditory tube, trachea, bronchi, urinary bladder, and others.

The mesoderm supplies the cells from which the other tissues of the body develop.

The folding process of the ectoderm creates two longitudinal ridges which extend backward from the disk, folds enclosing a shallow groove known as the neural groove. The groove deepens and the folds meet and become fixed, enclosing the neural tube or canal. The neural folds group together first in the region of the hind brain, then extend forward and backward. Before the frontal end of the groove is closed, a ridge of ectodermal cells appear along the margin known as the neural crest, and from it the spinal and cranial nerve ganglia as well as the ganglia of the sympathetic nerves are developed. The cephalic end expands to form the future forebrain, midbrain and hindbrain. The walls form the nervous tissue and other parts of the brain, the cavity develops into ventricles. The remainder forms the spinal cord.

E. THE MEDULLA SPINALIS is continuous with the brain above and ends below in the conus medullaris; from this the felium terminate descends to the coccyx. Up to the third month the cord fills the entire canal in the column; then the bone structure grows rapidly and nerve fibers descend to find exits.

Now that we have a brief establishment of parts, the syntonist will be interested in the wiring, parenthetically speaking, from the origin to the termination with possible function.

In order to refresh our memories, a few words on the anatomy of the nervous system may be helpful at this time.

A neuron is the largest single cell unit of structure of the nervous system. They are never continuous, always contiguous. Neurons may be motor, sensory, internuncial, sensory neurons being bipolar and motor nerves usually unipolar.

A synapse is a connection between the end brush of one neuron and the dendrite of another. A crude illustration may be the impulses from a loud speaker received by a microphone and transmitted to the next receptor, et cetera. Synaptic resistance may be too great or too small a break in the conductor and the impulse is subject to normalizing.

A myelin sheath is a modulation which covers the neuron, ending just before it reaches the cell body or end brush, and acts as an insulator. In the nervous system there are receptors, conductors, and effectors. Keep in mind the maze of sensory ending in all organs. A question from Exner says that “for the production of any movement the sensory innervations must be intact.”

The basic parts of the central nervous system are the brain and spinal cord. There are twelve pairs of cranial nerves, thirty-one pairs of spinal nerves, and many sympathetic nerves.

The spinal nerves are composed of eight pairs cervical, twelve pairs thoracic, five pairs lumber, five pairs sacral, and one pair coccygeal. Cauda equine is the group of lower nerves that form a bundle and emerge at the proper place in the vertebrate.

The pathways from the brain to the cord are intensely interesting and will challenge the attention of all who may be active in research work.

The time and space not allow the required details to be presented at this time. However, a brief reference will be presented in the following paragraphs in connection with the cranial nerves.

Twelve pairs of the cranial nerves originate in the cerebrum, midbrain, cerebral aqueduct, and the medulla. The cranial nerves are more diversified in their function than the spinal nerves, as some contain comatic fibers only, and others contain somatic motor, sympathetic efferent somatic and sympathetic sensory. Also, there are included the specialized senses as those of sight, smell, hearing, taste, and equilibration.

Somatic nerves are those who function is to build up the various tissues, and the sympathetic nerves innervate the smooth muscles of the heart.

The writer desires at this time to make it definitely known that this paper is not to establish a treatise for physical treatment, but rather that when the syntonist applys a frequency to stimulate or inhibit any ocular abnormalcy, having that diagnosis uppermost in mind, but if the effect may be supportive in other systemic relationship, may we have an idea of why the effect was so far reaching through this central nervous system as conductors.

THE HYPOGLOSSAL NERVE, (XII cranial) consists of somatic motor fibers only and supplies the muscles of the tongue. Its deep roots originate from cells in the hypoglossal nucleus and emerge from the anterolateral sulcus of the medulla. The nuclei of the two sides are connected by commissural fibers and dendrites, receiving directly or indirectly many impulses from opposite pyramidal tracts, which convey voluntary motor impulses from the cerebral cortex.

THE ACCESSORY NERVE (XI cranial) contains somatic motor and sympathetic efferent fibers. The spinal part somatic motor fibers arise from the outside group in the anterior column near the dorso-lateral margin of the upper segments of the cord, passing through the lateral funiculus to the lateral surface of the cord. It supplies the trapezius (muscle of back part of neck and shoulder), and the sternocleidomastoideium (oblique muscle across the side of the neck).

The cranial part arises from the nucleus ambiguous, but higher up than the spinal part, and connects through motor fibers to the vagus larynx and pharynx. The cranial part receives directly or indirectly impulses from the opposite pyramidal tract of the sensory nuclei.

The sympathetic fibers are few and originate in the dorsal nucleus of the vagus and are efferent, joining and distributed by the vagus nerve.

THE VAGUS NERVE (X cranial) contains somatic sensory, somatic motor, sympathetic efferent, and perhaps taste fibers. The afferent fibers have their cells of origin in the jugular and nodosal ganglion, (of trunk). The same holds true with the sensory fibers of the posterior roots of the spinal nerves after they enter the cord.

The somatic fibers are few in number and probably join and terminate in the nucleus of the trigeminal nerve, which connects with the thalamus and somatic sensor area of the cortex. The sympathetic afferent fibers join the tractus solitaries and end in its nucleus. The taste fibers transmitting impulses are presumed to pass in the vagus, terminating in the nucleus of the tractus solitaries. The nucleus of the tractus solitarius centers with the motor centers of the pons, medulla, and cord; function being mastication and deglutition.

The somatic motor fibers arise in the nucleus ambiguous.

The sympathetic efferent fibers arise in the dorsal nucleus and terminate in the sympathetic ganglia, whose being motor reach the esophagus, stomach, small intestine, gall bladder, and lungs.

THE GOSSOPHARYNGEAL NERVE (IX cranial) is similar to the vagus nerve regarding its connections. It includes somatic sensory, sympathetic efferent, taste, somatic and sympathetic efferent fibers.

The somatic sensory fibers are few and terminate in the trigeminal nucleus.

The sympathetic afferent fibers from pharynx and middle ear terminate in the tractus solitaries, and with some fibers from the facial and vagus terminate in its nucleus.

The somatic motor fibers arise from the nucleus ambiguous and continue below with the anterior gray column of the medulla spinalis. From this nucleus they bend backward, then forward and lateral-ward to join the sensory root.

The synopsis of the glossopharyngeal distribution are: distribution are: tympanic, carotid, pharyngeal, muscular, Tonsillar, and lingual.

THE ACOUSTIC NERVE (VIII cranial) is composed of two main nerves, the cochlear nerve – the nerve of hearing, and the vestibular nerve – the nerve of equilibration.

The cochlear nerve arises from cells in the ganglion of the cochlea; the outside fibers end in the organ of corti. Then central fibers enter the cochlear nerve ends in the accessory nucleus ad in the tuberculum and acusticum in the inferior peduncle. Axons rise and pass over the lateral peduncle, cross the rhomboid fossa into the pons and pass into the lateral lemniscus and finally end in the medical geniculate bodies and partly in the inferior colliouli.

The vestibular root arises in the ganglia of scarpa, located in the internal auditory meatus.

The peripheral fibers are concerned with equilibration of the body, and the central fibers into the ascending and descending branches which contact the ventrolateral nuclei of the thalamus and a slow as the upper end of the nucleus gracillis.

THE FACIAL NERVE (VII cranial) consists of somatic sensory, sympathetic, efferent, taste, somatic motor, and sympathetic efferent fibers. The somatic sensory transmit impulses from the anterior two-thirds of the tongue. The somatic motor fibers are connected with the motor nuclei of the brain stem through the ventral and posterior longitudinal bundle by way of the superior and inferior colliculus.

THE ABDUCENS NERVE (VI cranial) composed of motor fibers supplies the lateral rectus muscle. They rise from the deep roots of the abducens nerve which is associated with the nuclei of the trochlear and oculomotor above, also the hypoglossal nerve and spinal cord below. These fibers are relative to neurons which control the action of all eye muscles. The abducens is said to receive impulses from the longitudinal bundle having their origin in the superior colliculus, the primary visual center, and others from the auditory center of the inferior colliculus.

THE TRIGEMINAL NERVE (V cranial) is the largest cranial nerve and the great sensory nerve of the head and face. The motor and sensory fibers arise in the trigeminal motor nucleus and supply the muscle of mastication, the sensory branches to the face and anterior two-thirds of the head.

The deep roots of the moor nucleus are in the upper part of the pons. This nucleus receives reflex impulses by way of trigeminal, the posterior longitudinal bundle, and fibers in the formatic reticularis; as well as the voluntary movements from opposite pyramidal tract. There are many clearly associated branches divided and subdivided, which contact many important organs of the face, leading directly from the trigeminal nerve, which open t the syntonist a clear, concise picture, the probable cause for certain relative effects. It may be recommended that the functions of this nerve be given thorough and careful consideration.

THE TROCHLEAR NERVE (IV cranial) is the smallest of the cranial nerves and supplies the superior oblique muscles. The deep roots are located in the floor of the cerebral aqueduct. Interest awakens with the thought that in the superior orbital fissure this nerve gives off a contact to the lacrimal nerve.

THE OCULOMOTR NERVE (III cranial) supplies motor fibers to all ocular muscles except the superior oblique and lateral rectus; also connects through the ciliary ganglion with the sympathetic motor fibers to the sphincter and ciliary muscles, passing through the posterior longitudinal bundle, tegmentum, red nucleus, and emerge from the medical side of the cerebral peduncle. Since the ocular motor and abducens nuclei are so closely connected, the decussation of fibers probably make possible the movements of the eye where the medical and lateral muscles are involved.

In short ciliary nerves transmit parasympathetic control (contraction) to the iris and ciliary and the long ciliary nerves transmit the sympathetic control (relaxation).

The Edinger-Westphal nucleus is presumed to be the origination of the sympathetic efferent fibers. Consequently, we have the ocular motor through its nucleus connecting with the trochlear, abducens, and other cranial nuclei.

THE OPTIC NERVE (II cranial) consists of fibers which arise from the ganglionic layer of the retina and are supposed to transmit visual impressions only. A few fibers pass in the optic nerve from the retina to the primary centers and support reflexes of the pupil. A number of fibers pass from the brain to the retina, said to control efferent chemical changes in the retina. A few fibers from the medial geniculate body join the optic tract as it crosses to the opposite medial geniculate, which is in the posterior part of the chiasma, known as the commissure of Gudden, which is assumed to be connected with the auditory system. The termination of most of the optic fibers end in the lateral geniculate body, while some pass through the superior brachium to the superior colliculus, others pass over or through the lateral geniculate to the thalamus. The lateral geniculate connect with the visuo-sensory cortex of the occipital lobe, which connects the opposite side by the commissural fibers. The superior colliculi, being the central organs of eye muscle control, probably are connected with other sensory paths. Sensory fibers from the spinal cord are directly connected from the medial fillet, as is also a portion of the ventral spinocrebellar tract, with the superior colliculus and thalamus. In the superior colliculus fibers arise, decussate, and pass downward as the ventral longitudinal bundle, giving off filaments to the motor cranial nuclei. It passes to the ventral column of the spinal cord where it is known as the tectospinal tract. Its function is disputed. Some say it is for body reflex to visual stimuli, others say it is concerned with voluntary motor activity. It runs through the red nucleus, ending in the ventral funiculus. From the ventral bundle associations are definite with eye muscle, oculomotor, trochlear, and abducens.

THE OLFACTORY NERVES (I cranial) are the nerves of smell distributed in the mucus membrane of the nasal cavity. The olfactory center is generally accepted as being in the rhinencephalon, and supposed to be connected with the mammillo-thalamic-fasciculus.

"It is the property of nerve centers that they are not only able to excite movements, but also to prevent them." (Edinger)

F. Consequently, the brief synopsis gives us some idea of the maze of interconnections by the transition of impulses possible by way of the optic nerve to the cranial nerves, and probable relations with the complete central nervous system through its associations. In a like manner the spinal nerve tracts can be established through the cerebrospinal, rubrospinal, tectospinal, Vestibulospinal, and pontospinal tracts with the cranial nervous system.

"The activity of the spinal cord can be influenced, regulated, inhibited, or stimulated by the other parts of the central nervous system." (Edinger)

G. Key words relative to syntonic application have been included in various places, rather than the suggested application for effect, which may be misinterpreted by those who have not availed themselves of the privilege and are not conversant with the science and function of Syntonics, the application and promotion and presentation for which we are deeply appreciative to our National Research Director, and Fellow of Syntonics, Dr. H. Riley Spitler.

In conclusion may we trust that if this presentation has been helpful in the stimulation of interest and consecration to study and research activity of any one or more syntonists, to the privilege that is ours to better prepare our position of rendering a more manifest, dignified, and ethical service, then the purpose and effort of this thesis has well served its purpose.

Dr. C. H. Armesy
489 The Arcade
Cleveland, Ohio