Historical Observations on the Cranial Nerves

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Interest in the cranial nerves has existed since the earliest medical writings. Although no mention of nerves as such occurred in the Edwin Smith Papyrus, observations of the brain and some functional localization had already been made. Descriptions of individual cranial nerves had begun by the time of Herophilus, and in the first century A.D., Marinus listed seven pairs of cranial nerves. The prominent position of these nerves led to frequent commentaries on them by many anatomists. During the years, systems of numbering the nerves changed, but seldom were new anatomical observations made.

This paper compares the descriptions of the cranial nerves by prominent and some less well-known anatomists in an attempt to present the background of our current classification of 12 pairs of cranial nerves. The discussion deals with the intracranial course, points of exit, and eponymic designations of the nerves and not with their nuclear origins or peripheral distributions. Particular attention is given to European anatomical writings. No attempt has been made to examine the anatomical works of the Arabian writers, as they did not directly influence Western anatomists except through the preservation of Galen’s writings.

Olfactory Tracts

The olfactory tracts have always been mentioned in any description of the cranial nerves. Galen described them in Book XIV of On Anatomical Procedures but excluded them from his numbered pairs of cranial nerves. He argued that they were softer than the other nerves and often contained a cavity. He did not specify that this cavity existed only in lower mammals, but the distinction of the olfactory tracts from actual cranial nerves was certainly a valid one. This difference was commented upon by anatomists well into the 17th century. Vesalius, Colombo, Eustachius, Fallopius, and Bauhin illustrated or discussed the olfactory tracts and often referred to them as the mammillary processes. Although they were aware of their role in olfaction, they did not consider them to be true cranial nerves. Leonardo da Vinci and Eustachius showed the olfactory bulbs, but they left no text to accompany their illustrations. Willis in 1664 was the first to list the olfactory tracts as the first pair of cranial nerves; all classifications prior to this began with the optic nerves. Willis' designation has persisted even though he described tracts as nerves. Because of this it is now necessary to list the nervus terminalis without a number.

Optic Nerves

The optic nerves offer several interesting points in the history of anatomical description. It is understandable why many writers commented on these easily visible structures. Galen was well aware of the difference in texture of the optic nerves compared to the other cranial nerves; he also noted that the inner portion of the nerve was softer than the outer part. He discussed the joining of the nerves in the form of the Greek letter chi (X) but was quite explicit about the absence of any intermingling of the left- and right-sided fibers.

According to Cogan, the first illustration of the optic chiasm was made by Leonardo da Vinci in 1505. These drawings were not seen by other 16th century anatomists as they remained unpublished until the end of the 19th century. Garrison has shown an earlier illustration of the chiasm in an Arabian manuscript.

The first 50 years of the 16th century marked a period of great productivity in anatomical illustration. The chiasm was shown by many anatomists including Vesalius, Eustachius, and Estienne. Vesalius actually reported a case in which no chiasm was present and the optic nerves were separate. Winslow as late as 1738 also referred to a similar case. Vesalius did state
that he could find no cavity within the optic nerves; this represented a departure from Galen's writings. It was not until the 18th century that the true structural relationship of the fibers within the chiasm was established.

Ophthalmology in the 17th and 18th centuries was hardly a medical specialty as we understand it today. Throughout Western Europe and England, diseases of the eye, both real and imaginary, were treated by itinerant oculists who, for the most part, came close to being prototypes of the medical quack. From this group, however, ophthalmology eventually developed, and the specialty is indebted to these men for their early observations.

John Taylor, or Chevalier Taylor as he titled himself, was one of this group who treated some of the more illustrious personages of the day. Among his patients were George II of England and George Frederick Handel. In 1738 he published a book on the anatomy of the eye, with copper plates that clearly showed the decussation of the nasal fibers at the chiasm (Fig. 1). He quite correctly interpreted the role of the chiasm in the integration of binocular vision. These observations in themselves must certainly challenge the charge of charlatan and quack in his case. A more thorough discussion of the early writings on the optic nerves is given by Polyak.

Oculomotor, Trochlear, and Abducens Nerves

The nerves concerned with eye movements have been described under different headings and with varying degrees of accuracy. Galen's second pair was composed of "hard nerves, whose origin springs from the anterior parts of the brain." He felt that this nerve divided and reached each of the extraocular muscles. It was not until the 16th century that the innervation of the intraorbital muscles was clarified.

None of the pre-Vesalian anatomists presented anything resembling an accurate picture of the base of the brain or the origins of the cranial nerves. Vesalius' own plates of the inferior aspect of the brain omitted a structure as obvious as the pons and showed the cranial nerves with only minor variations of the Galenic system (Fig. 2). Vesalius did not distinguish the trochlear nerve; a nerve which could be the abducens is labelled "d" in his illustration and is described as a nerve which inserts in the inferior maxillary muscles. This nerve is not listed in the numbered pairs.

We now turn to the question of Bartolomeo Eustachi and his role in the description of the cranial nerves. In 1714 Lancisi published the anatomical plates of Eustachius. These plates were engraved in 1552 in Rome, but only the first eight were published during Eustachius' lifetime. Eustachius' position in 16th century anatomy was therefore delayed for over 150 years. Unfortunately, he did not write any text to accompany his illustrations; we must therefore infer his observations from the drawings themselves. The text published with the 18th century editions was by Lancisi and reflected the writings of 17th century anatomists, particularly Willis, in regard to the cranial nerves. Tabula XVIII of Eustachius shows the base of the brain; a distinct oculomotor, trochlear, and abducens nerve can be seen in the main illustration as well as in the four detailed inserts (Fig. 3).

In 1561 in Padua, Fallopius published Observationes Anatomicae which contains much significant information on the cranial nerves. Although this book is not illustrated, the text is explicit enough to allow us to follow closely Fallopius' classification. His second pair of nerves was clearly the oculomotor; he described the course of this nerve into the orbit and its division into a superior and inferior branch. The former went to the muscle which "opens the eye" (the levator palpebrae superioris) and to the muscle which "draws the eye directly upward" (the rectus superioris). Fallopius described the inferior branch as going to the muscles that draw the eye inward, downward, and outward. This last action was performed by the "sixth muscle" which is the inferior oblique. In summation he stated that this nerve went to four muscles of the eye as well as to the muscle that elevated the eyelid. Fallopius' fourth pair of cranial nerves entered the orbit and became entirely "embedded in the muscle which draws the eye straight towards the outer corner"—surely the rectus lateralis. In closing his discussion of the cranial nerves, Fallopius added one other pair and noted