ZOOACOR08T
UNIT – 07,Topic 2

Cranial Nerves In Mammals

•Cranial nerves have roots enclosed in the braincase. Most are named and numbered by Roman numerals from anterior to posterior. The conventional system for numbering these nerves is sometimes inconsistent. For instance, most anamniotes are said to have ten numbered cranial nerves plus six pairs of unnumbered, lateral line cranial nerves.

•A few anamniotes and all amniotes are said to have 12. In fact, there is an additional terminal nerve at the beginning of this series. If counted at all, it is numbered 0 to avoid renumbering the conventionally numbered sequence.

•Further, the second cranial nerve (II) is not a nerve at all but an extension of the brain. Nevertheless, by convention it is called the optic “nerve.” The eleventh cranial nerve (XI) represents the merger of a branch of the tenth cranial nerve (X) with elements of the first two spinal nerves (C-1 and C-2). Despite its composite structure, it is called the spinal accessory nerve and designated by Roman numeral XI.

•In addition to these numbered cranial nerves, up to six pairs of unnumbered, lateral line cranial nerves are present in jawed fishes and many amphibians.

•Dorsal and ventral nerves fuse in the trunk but not in the head, and they produce two series: dorsal cranial nerves (V, VII, IX, and X) and ventral cranial nerves (III, IV, VI, and XII). Like spinal nerves, the cranial nerves supply somatic and visceral tissues and carry general sensory and motor information. Some cranial nerves consist of only sensory or only motor fibers.

•Other nerves are **mixed, containing** both types. Cranial nerves concerned with localized senses (e.g., sight, hearing, lateral line, olfaction, taste) are called **special cranial nerves to distinguish them** from those concerned with the sensory or motor innervation of the more widely distributed viscera, **general cranial nerves.**

•Primitively, all cranial nerves serving the branchial pouches formed three branches per pouch: **pretrematic, posttrematic, and pharyngeal.** In amniotes, these tend to be lost or their homologies become uncertain. Most anamniotes possess 17 cranial nerves. The first few spinal nerves behind the braincase become housed in the skull of later derived groups. But in anamniotes, these anterior spinal nerves are still partially outside the skull.

•In cyclostomes, these anterior spinal nerves outside the skull are called **occipitospinal nerves. In other fishes and amphibians,** the anterior spinal nerves become partially incorporated into the braincase. They exit via foramina in the occipital region of the skull and are called **occipital nerves.** Occipital nerves unite with the next few cervical spinal nerves to form the composite **hypobranchial nerve that supplies** hypobranchial muscles in the throat.

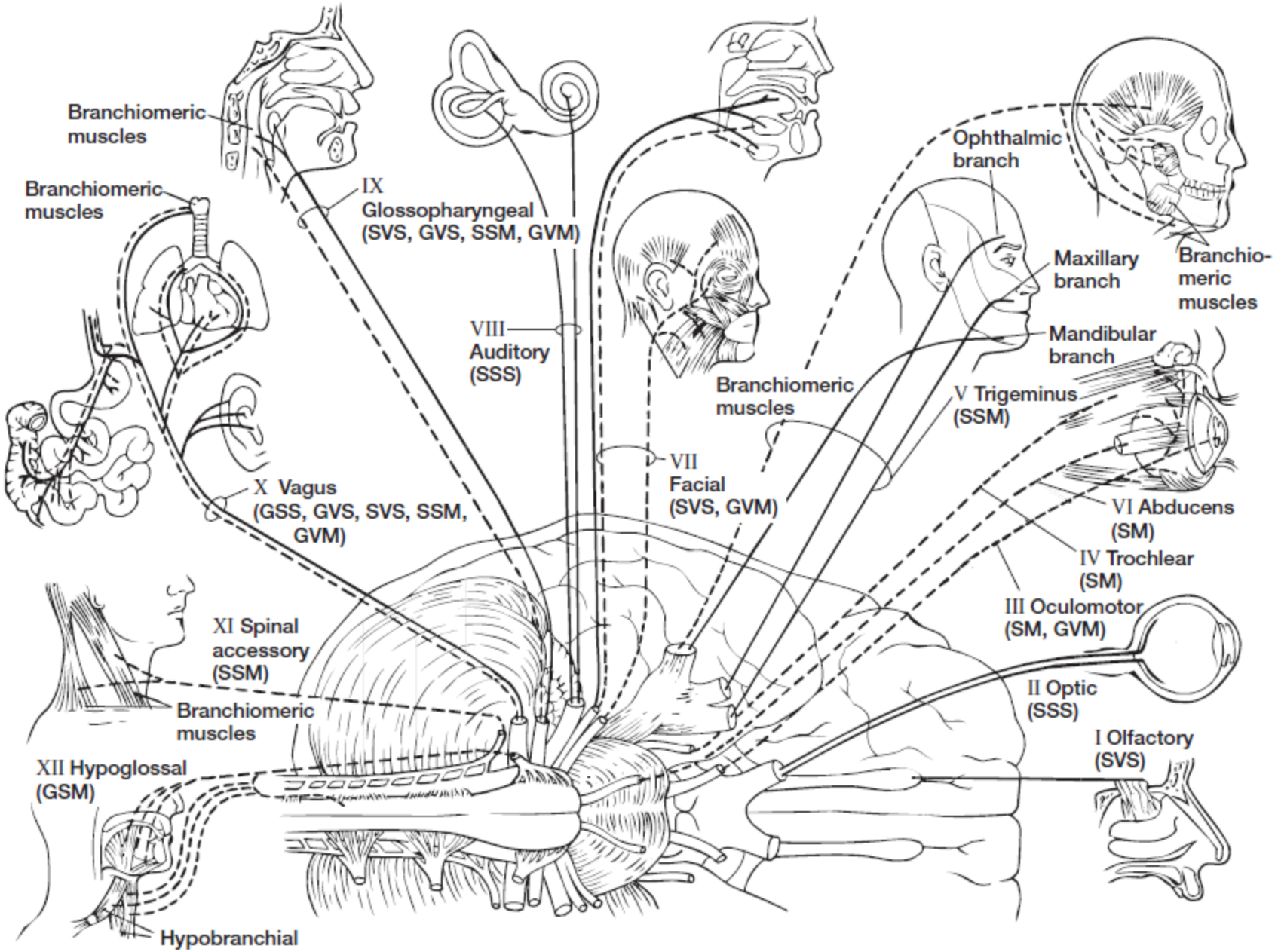
Branchiomeric muscles
Branchiomeric muscles
IX Glossopharyngeal (SVS, GVS, SSM, GVM)
VIII Auditory (SSS)
X Vagus (GSS, GVS, SVS, SSM, GVM)
VII Facial (SVS, GVM)
Branchiomeric muscles
Ophthalmic branch
Maxillary branch
Mandibular branch
V Trigeminus (SSM)
Branchio-meric muscles
VI Abducens (SM)
IV Trochlear (SM)
III Oculomotor (SM, GVM)
II Optic (SSS)
I Olfactory (SVS)
XI Spinal accessory (SSM)
Branchiomeric muscles
XII Hypoglossal (GSM)
Hypobranchial

Fig.1: Distribution of cranial nerves in a mammal, *Homo sapiens.*
Sensory (solid lines) and motor (dashed lines) nerve fibers are indicated. Enlarged views of innervated structures of cranial nerves are shown around the human brain in ventral view.
Abbreviations: general somatic sensory (GSS), general visceral sensory (GVS), general somatic motor (GSM), general visceral motor (GVM), special somatic sensory (SSS), special somatic motor (SSM), special visceral sensory (SVS).
Source: Kardong, 2011

Nervus Terminalis (0): The terminal nerve may be testimony to an ancient anterior head segment that has been lost. The terminal nerve is a nerve, or perhaps a complex of nerves, that arises from olfactory placodes. It is present in all classes of gnathostomes except birds. It runs to blood vessels of the olfactory epithelium in the olfactory sac and carries visceral sensory and some motor fibers. A role in reproduction is suspected.

Olfactory Nerve (I): The olfactory nerve is a sensory nerve concerned with the sense of smell. Olfactory cells lie in the mucous membrane of the olfactory sac. A short axon leads from each cell to the olfactory bulb. Each axon constitutes an olfactory fiber. Collectively, the olfactory fibers form the short olfactory nerve, which is the only cranial nerve composed of the axons of the receptor cells themselves.

Optic Nerve (II): Strictly speaking, the optic nerve is not a nerve but a sensory tract. That is, it is not a collection of peripheral axons; it is a collection of fibers in the CNS. Embryologically, it develops as an outpocketing of the brain. However, once it is differentiated, it lies outside the brain. Its fibers synapse in the thalamus and midbrain.

Oculomotor Nerve (III): The oculomotor nerve primarily supplies extrinsic eye muscles (superior rectus, medial rectus, inferior rectus, and inferior oblique muscles) derived from preotic myotomes. It is a motor nerve that also carries a few visceral motor fibers to the iris and ciliary body of the eye. Fibers arise in the oculomotor nucleus in the floor of the midbrain.

Trochlear Nerve (IV): The trochlear nerve is a motor nerve that supplies the extrinsic, superior oblique eye muscle. Fibers arise in the trochlear nucleus of the midbrain.

Trigeminal Nerve or Trigeminus (V): The trigeminus is so named because it is formed of three branches: **ophthalmic (V1), maxillary (V2), and mandibular (V3) in amniotes.** The ophthalmic nerve, sometimes called the deep ophthalmic (profundus) nerve to distinguish it from a more superficial nerve, usually merges with the other two branches. However, in anamniotes, the ophthalmic nerve often emerges from the brain separately.

The mixed trigeminus includes sensory fibers from the skin of the head and areas of the mouth and motor fibers to derivatives of the first branchial arch. Sensory fibers of the trigeminus return to the brain from the skin, teeth, and other areas through each of the three branches. The mandibular branch also contains somatic motor fibers to muscles of the mandibular arch.

Abducens Nerve (VI): The abducens is the third of the three cranial nerves that innervate muscles controlling movements of the eyeball. It is a motor nerve that supplies the extrinsic, lateral rectus eye muscle. Fibers arise in abducens nucleus located in the medulla.

Facial Nerve (VII): The mixed facial nerve includes sensory fibers from taste buds as well as motor fibers that service derivatives of the second (hyoid) arch. This nerve also carries a substantial number of somatic sensory fibers to the skin. In fishes, the skin of the entire opercular complex is innervated by the facial nerve.

Octaval (Auditory) Nerve (VIII): The sensory octaval nerve (acoustic, vestibulocochlear, statoacoustic) carries sensory fibers from the inner ear, which is concerned with balance and hearing. The nerve synapses in several regions of the medulla.

Glossopharyngeal Nerve (IX): The mixed glossopharyngeal nerve supplies the third branchial arch. It contains sensory fibers from the taste buds, the first gill pouch, and the adjacent pharyngeal lining. Motor fibers innervate muscles of the third branchial arch.

Vagus Nerve (X): The term vagus is Latin for wandering and aptly applies to this mixed nerve. The vagus meanders widely, serving areas of the mouth, pharynx, and most of the viscera. It is formed by the union of several roots across several head segments. Occasionally, additional nerves of the lateral line merge with the vagus.

Spinal Accessory Nerve (XI): In anamniotes, the spinal accessory nerve is probably composed of a branch of the vagus nerve and several occipitospinal nerves. In amniotes, especially in birds and mammals, it is a small but distinct motor nerve that supplies derivatives of the cucullaris muscle (cleidomastoid, sternomastoid, trapezius). A few of its fibers accompany the vagus nerve to supply part of the pharynx and larynx and perhaps the heart. Fibers arise from several nuclei within the medulla.

Hypoglossal Nerve (XII): The hypoglossal nerve is a motor nerve of amniotes that innervates hyoid and tongue muscles. Fibers originate in the hypoglossal nucleus within the medulla. In fishes and amphibians, the confluence of one or several occipital nerves (ventral roots of original spinal nerves) and often modified spinal nerves form the hypobranchial nerve. In amniotes it is incorporated into the skull and therefore more appropriately recognized as a cranial nerve, the hypoglossal nerve.