Nerves

I. Cranial nerves
   A. Olfactory (CN I)
      1. Olfactory bulb
      2. Olfactory tract
   B. Optic n. (CNII)
      function – carries visual sensory information from the neural retina to the diencephalon & midbrain
      1. Optic chiasm
         function – anatomical site where axons arising from the nasal (medial) half of the retina cross the midline to the contralateral optic tract
      2. Optic tract (same axons as the optic nerve)
   C. Oculomotor n. (CNIII)
      1. Superior ramus
         a. Muscular branches
            function – sensory [communication from the ophthalmic nerve in the superior orbital fissure], postganglionic sympathetic [communication from the internal carotid plexus in the cavernous sinus] & motor (lmn) innervation [oculomotor nucleus of the midbrain] of the superior rectus and levator palpebrae superioris muscles
      2. Inferior ramus
         a. Muscular branches
            function – sensory [communication from the ophthalmic nerve in the superior orbital fissure], postganglionic sympathetic [communication from the internal carotid plexus in the cavernous sinus] & motor (lmn) innervation [oculomotor nucleus of the midbrain] of the medial rectus, inferior rectus and inferior oblique muscles
         b. Parasympathetic communication to the ciliary ganglion
            function – preganglionic parasympathetic innervation [Edinger-Westphal nucleus of the midbrain] of the ciliary ganglion [the postganglionic parasympathetic axons travel with the short ciliary nerves [branches of the ophthalmic division of the trigeminal nerve] and innervate the ciliary body and constrictor muscle of the iris]
   D. Trochlear n. (CNIV) [L. pulley]
      function – sensory [communication from the ophthalmic nerve in the superior orbital fissure], postganglionic sympathetic [communication from the internal carotid plexus in the cavernous sinus] & motor (lmn) innervation [trochlear nucleus of the midbrain] of the superior oblique muscle
   E. Trigeminal n. (CNV)
      1. Sensory root
      2. Motor root
      3. Trigeminal ganglion
      4. Ophthalmic n.
         function – sensory, & postganglionic sympathetic [communication from the internal carotid plexus in the cavernous sinus] innervation of skin (forehead, upper lid & nose), cornea, mucosa (nasal cavity) & extraocular muscles
         a. Lacrimal n. [L. lacrima, tear]
            function – sensory & postganglionic sympathetic [communication from the internal carotid plexus in the cavernous sinus] innervation of the lacrimal gland and the skin overlying the lateral aspect of the upper lid, and forehead & postganglionic parasympathetic innervation of the lacrimal gland [communication from the pterygopalatine ganglion via the zygomatic nerve]
         b. Frontal n.
            i. Supraorbital n.
               function – sensory & postganglionic sympathetic [communication from the internal carotid plexus in the cavernous sinus] innervation of the skin overlying the forehead & mucosa of frontal sinus
            ii. Supratrochlear n.
               function – sensory & postganglionic sympathetic innervation [communication from the internal carotid plexus in the cavernous sinus] of the skin overlying the medial aspect of the forehead
         c. Nasociliary n.
            i. Anterior ethmoidal n.

function - sensory & postganglionic sympathetic [communication from the internal carotid plexus in the cavernous sinus] innervation of the mucosa of the frontal and ethmoidal sinuses, the mucosa of the superior aspect of the nasal cavity, the skin overlying the nose

ii. Posterior ethmoidal n.
function - sensory & postganglionic sympathetic [communication from the internal carotid plexus in the cavernous sinus] innervation of the mucosa of the sphenoidal and ethmoidal sinuses and superior nasal cavity

iii. Long ciliary n.
function - sensory & postganglionic sympathetic [communication from the internal carotid plexus in the cavernous sinus] innervation of the eye, and postganglionic sympathetic innervation of the dilator muscle of the iris

iv. Short ciliary n.
function - sensory & postganglionic sympathetic [communication from the internal carotid plexus in the cavernous sinus] innervation of the eye, and postganglionic sympathetic & postganglionic parasympathetic [axons arise from ciliary ganglion] innervation of the dilator [sympathetic] and constrictor [parasympathetic] muscles of the iris

v. Infratrochlear n.
function - sensory & postganglionic sympathetic [communication from the internal carotid plexus in the cavernous sinus] innervation of the skin overlying the bridge of the nose

5. Maxillary n.
function - sensory, & postganglionic sympathetic [communication from the internal carotid plexus in the cavernous sinus & n. of pterygoid canal] innervation of skin (lower lid, nose, upper lip, cheek & cheekbone), mucosa (nasal cavity, oral cavity & pharynx) & dental pulp (upper teeth)
    a. Pterygopalatine nerves (emerge from ganglion)
        i. Pharyngeal n.
        function - sensory, postganglionic sympathetic [communication from nerve of the pterygoid canal] & postganglionic parasympathetic [axons arise from pterygopalatine ganglion] innervation of the mucosa of the nasal pharynx & auditory tube
        ii. Lateral posterior superior nasal n.
        function - sensory, postganglionic sympathetic [communication from nerve of the pterygoid canal] & postganglionic parasympathetic [axons arise from pterygopalatine ganglion] innervation of the mucosa of the lateral wall of the nasal cavity
        iii. Medial (septal) posterior superior nasal n. (including nasopalatine)
        function - sensory, postganglionic sympathetic [communication from nerve of the pterygoid canal] & postganglionic parasympathetic [axons arise from pterygopalatine ganglion] innervation of the mucosa of the nasal septum and anterior hard palate and gingiva (nasopalatine n)
        iv. Greater palatine n.
        function - sensory, taste [greater petrosal], postganglionic sympathetic [communication from nerve of the pterygoid canal] & postganglionic parasympathetic [axons arise from pterygopalatine ganglion] innervation of the mucosa of the hard palate and gingiva
        v. Lesser palatine n.
        function - sensory, taste [greater petrosal], postganglionic sympathetic [communication from nerve of the pterygoid canal] & postganglionic parasympathetic [axons arise from pterygopalatine ganglion] innervation of the mucosa of the soft palate
    b. Zygomatic n.
    function - sensory & postganglionic sympathetic [communication from the external carotid plexus] innervation of the skin overlying the zygomatic arch, and postganglionic parasympathetic [axons arise from pterygopalatine ganglion] innervation of the lacrimal gland [communicates with the lacrimal n.]
    c. Posterior superior alveolar n.
    function - sensory & postganglionic sympathetic [communication from the external carotid plexus] innervation of the upper molars, and sensory, postganglionic sympathetic [communication from the external carotid plexus] & postganglionic parasympathetic innervation of mucosa of maxillary sinus
    d. Infraorbital n.

function - sensory & postganglionic sympathetic [communication from the external carotid plexus] innervation of the skin of the upper lip, cheek, lateral nose and lower lid, and mucosa of upper lip and labial gingiva; and sensory, postganglionic sympathetic and postganglionic parasympathetic innervation of mucosa of the maxillary sinus

i. Middle superior alveolar n.
function - sensory & postganglionic sympathetic [communication from the external carotid plexus] innervation of the upper premolars and sensory, postganglionic sympathetic [communication from the external carotid plexus] & postganglionic parasympathetic innervation of maxillary sinus

ii. Anterior superior alveolar n.
function - sensory & postganglionic sympathetic [communication from the external carotid plexus] innervation of the upper canines and incisors and sensory, postganglionic sympathetic [communication from the external carotid plexus] & postganglionic parasympathetic maxillary sinus

6. Mandibular n.
function - sensory (skin [lower lip, chin, cheek, ear & temple], mucosa [oral cavity] & muscles of mastication), motor, & postganglionic sympathetic [communication from the external carotid plexus via maxillary a.]

a. Meningeal branch
function - sensory & postganglionic sympathetic [communication from the external carotid plexus] innervation of the cranial dura mater

b. Muscular branches

i. Nerve to the medial pterygoid
function - sensory, postganglionic sympathetic [communication from the external carotid plexus] & motor (lmn) [trigeminal motor nucleus of the pons] innervation of the medial pterygoid, tensor palatini and tensor tympani muscles

ii. Masseteric n.
function - sensory, postganglionic sympathetic [communication from the external carotid plexus]& motor (lmn) [trigeminal motor nucleus of the pons] innervation of the masseter muscle

iii. Deep temporal n.
function - sensory, postganglionic sympathetic [communication from the external carotid plexus]& motor (lmn) [trigeminal motor nucleus of the pons] innervation of the temporalis muscle

iv. Nerve to the lateral pterygoid
function - sensory, postganglionic sympathetic [communicationfrom the external carotid plexus]& motor (lmn) [trigeminal motor nucleus of the pons] innervation of the lateral pterygoid muscle

c. Sensory branches (other than n. to mylohyoid)

i. Buccal branch (long buccal n.)
function - sensory & postganglionic sympathetic [communication from the external carotid plexus] innervation of the buccal skin and buccal mucosa and gingiva

ii. Auriculotemporal n.
function - sensory & postganglionic sympathetic [communication from the external carotid plexus] innervation of the TMJ, external auditory meatus and skin anterior to the ear, and sensory, postganglionic sympathetic & postganglionic parasympathetic [axons arise from the otic ganglion] innervation of the parotid gland

iii. Lingual n.
function - sensory & postganglionic sympathetic [communication from the external carotid plexus] innervation of the mucosa overlying the anterior 2/3rds of the tongue, the floor of the oral cavity and the adjacent gingiva, taste innervation to the anterior 2/3rds of the tongue [communication from the chorda tympani n,], and sensory, postganglionic sympathetic and preganglionic parasympathetic [communication from the chorda tympani n.] innervation of the lingual, sublingual and submandibular glands [by way of the submandibular ganglion, some of the postganglionic parasympathetic axons rejoin the lingual nerve branches prior to innervating sublingual gland and minor lingual glands]

iv. Inferior alveolar n.
function - sensory & postganglionic sympathetic [communication from external carotid plexus] innervation of the lower teeth and their adjacent buccal and labial gingiva

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  function – sensory & postganglionic sympathetic [communication from external carotid plexus] innervation of the skin overlying the chin and lower lip, and labial mucosa and gingiva
- to mylohyoid
  function – sensory, postganglionic sympathetic [communication from external carotid plexus]& motor (lmn) [trigeminal motor nucleus of the pons] innervation of the mylohyoid and anterior digastric muscles

F. Abducens n. (CNVI)
function – sensory [communication from the ophthalmic nerve in the superior orbital fissure], postganglionic sympathetic [communication from the internal carotid plexus in the cavernous sinus] & motor (lmn) [abducens nucleus of the pons] innervation of the lateral rectus muscle

G. Facial n. (CNVII)
1. Geniculate ganglion
2. Branches in the facial canal
   a. N. to the stapedius
      function – motor (lmn) innervation of the stapedius muscle
   b. Chorda tympani n.
      function – sensory [taste] innervation of the mucosa of the anterior 2/3rds of the tongue [taste axons join the lingual nerve to innervate the mucosa of the tongue], and preganglionic parasympathetic [superior salivatory nucleus of the pons] innervation of the submandibular ganglion [the postganglionic parasympathetic axons travel with the lingual nerve and innervate the sublingual and submandibular glands]
3. Greater petrosal n.
   function – preganglionic parasympathetic [superior salivatory nucleus of the pons] innervation of the pterygopalatine ganglion [postganglionic parasympathetic axons arising from the pterygopalatine ganglion join branches of the maxillary nerve to reach the lacrimal gland and the mucosa of the nasal cavity & paranasal sinuses, the nasal pharynx and roof of the oral cavity] and sensory [taste] innervation of mucosa of palate
   a. Nerve of the pterygoid canal
      function – postganglionic sympathetic and preganglionic parasympathetic innervation of the pterygopalatine ganglion [postganglionic parasympathetic axons arising from the pterygopalatine ganglion join branches of the maxillary nerve to reach the lacrimal gland and the mucosa of the nasal cavity & paranasal sinuses, the nasal pharynx and roof of the oral cavity] and taste (palate)
4. Branches at the stylomastoid foramen
   a. Nerve to the stylohyoid m.
      function – motor (lmn) [facial motor nucleus of the pons] & postganglionic sympathetic [communication from external carotid plexus] innervation of the stylohyoid muscle
   b. Nerve to the posterior digastric m.
      function – motor (lmn) [facial motor nucleus of the pons] & postganglionic sympathetic [communication from external carotid plexus] innervation of the posterior belly of the digastric muscle
   c. Posterior auricular n.
      function – motor (lmn) [facial motor nucleus of the pons] & postganglionic sympathetic [communication from external carotid plexus] innervation of the occipitalis m.
5. Branches on the face
   a. Temporal branch
      function – motor (lmn) [facial motor nucleus of the pons] & postganglionic sympathetic [communication from external carotid plexus] innervation of the corrugator supercilii, frontalis and orbicularis oculi muscles
   b. Zygomatic branch
      function – motor (lmn) [facial motor nucleus of the pons] & postganglionic sympathetic [communication from external carotid plexus] innervation of the levator anguli oris, levator labii superioris, orbicularis oculi and zygomaticus major muscles
   c. Buccal branch
      function – motor (lmn) [facial motor nucleus of the pons] & postganglionic sympathetic [communication from external carotid plexus] innervation of the buccinator, depressor anguli oris, levator anguli oris, levator labii superioris, levator labii superioris alequae nasi, nasalis, orbicularis oris, procerus, risorius, zygomaticus major & zygomaticus minormuscles
   d. Marginal mandibular branch

function – motor (lmn) [facial motor nucleus of the pons] & postganglionic sympathetic [communication from external carotid plexus] innervation of the depressor anguli oris, depressor labii inferioris, mentalis & orbicularis oris muscles

e. Cervical branch
function – motor (lmn) [facial motor nucleus of the pons] & postganglionic sympathetic [communication from external carotid plexus] innervation of the platysma muscle

H. Vestibulocochlear n. (CNVIII)

I. Glossopharyngeal n. (CNIX)
1. Superior ganglion
2. Inferior ganglion
3. Tympanic n. (lesser petrosal nerve past middle ear)
function – sensory and postganglionic sympathetic [communication from superior cervical ganglion] innervation of the middle ear, and preganglionic parasympathetic [inferior salivatory nucleus of the medulla] innervation of the otic ganglion [postganglionic axons arising from the otic ganglion travel with the auriculotemporal nerve to innervate the parotid gland]
4. Carotid branch
function – sensory innervation of the carotid sinus and body
5. Pharyngeal branches
function – sensory and postganglionic sympathetic [communication from the superior cervical ganglion] innervation of the mucosa of the upper pharynx
6. Tonsilar branch
function – sensory and postganglionic sympathetic [communication from the superior cervical ganglion] innervation of the tonsilar mucosa
7. Lingual branch
function – sensory [including taste] and postganglionic sympathetic [communication from the superior cervical ganglion] innervation of the mucosa of the posterior 1/3rd of the tongue
8. N. to the stylopharyngeus m.
function – sensory, postganglionic sympathetic [communication from the superior cervical ganglion] & motor (lmn) [nucleus ambiguus of the medulla] innervation of the stylopharyngeus muscle

J. Vagus nerve (CNX) (do not forget the branches of the vagus in the trunk)
1. Superior (jugular) ganglion
2. Inferior (nodose) ganglion
3. Branches in the jugular fossa
a. Auricular
function – sensory and postganglionic sympathetic [communication from the superior cervical ganglion] innervation of the skin of the external auditory meatus and ear
4. Branches in the neck & mediastinum
a. Pharyngeal (plexus)
function – sensory, postganglionic sympathetic [communication from the superior cervical ganglion], motor (lmn) [nucleus ambiguus of the medulla] innervation of the all the muscles of the pharynx [except the stylopharyngeus] and the palate [except the tensor palatini]
b. Carotid n.
function – sensory and postganglionic sympathetic [communication from the superior cervical ganglion] innervation of the carotid sinus and body
c. Superior laryngeal
i. Internal laryngeal n.
function – sensory, taste [to epiglottis], postganglionic sympathetic [communication from the superior cervical ganglion] and preganglionic parasympathetic [dorsal motor nucleus of the medulla] innervation of the mucosa of the oral & laryngeal pharynx, epiglottis and larynx superior to the vocal folds
ii. External laryngeal n.
function – sensory, postganglionic sympathetic [communication from the superior cervical ganglion] & motor (lmn) [nucleus ambiguus of the medulla] innervation of the cricothyroid, and inferior constrictor muscles
d. Recurrent laryngeal n.
function – sensory, postganglionic sympathetic [communication from the superior cervical ganglion] & motor (lmn) [nucleus ambiguus of the medulla] innervation of all the muscles of the larynx with the exception of the cricothyroid muscle, and the inferior constrictor muscles; sensory, postganglionic sympathetic and preganglionic parasympathetic [dorsal motor nucleus of the medulla] innervation of the tracheal, laryngeopharyngeal, and

laryngeal mucosa (inferior to the vocal folds)

K. Accessory n.
   1. Cranial root (joins pharyngeal plexus of vagus n.)
   2. Spinal root
      function – postganglionic sympathetic [communication from the superior cervical ganglion] & motor (lmn) [spinal accessory nucleus of C1-5] innervation of the trapezius and sternocleidomastoid muscles

L. Hypoglossal n.
   function – sensory [communication from the lingual nerve near the hyoglossus muscle], postganglionic sympathetic [communication from the superior cervical ganglion] & motor (lmn) innervation of the genioglossus, styloglossus, hyoglossus and intrinsic tongue muscles

II. Cervical Spinal Nerves
   A. Dorsal rami
      1. C1- suboccipital nerve
         a. Muscular branches
            function – sensory, postganglionic sympathetic [gray ramus] and motor (lmn) innervation of semispinalis capitis, inferior oblique, superior oblique, rectus capitis posterior major and rectus capitis posterior minor muscles
         b. Cutaneous branch (usually not present)
      2. C2 – Greater occipital n.
         a. Medial branch
            function – sensory and postganglionic sympathetic [gray ramus] innervation of the skin overlying the back of the head
         b. Lateral branch
            function – sensory, postganglionic sympathetic [gray ramus] and motor (lmn) innervation of the splenius capitis, longissimus capitis & semispinalis capitis muscles
      3. C3
         a. Medial branch (3rd occipital n.)
            function – sensory and postganglionic sympathetic [gray ramus] innervation of the skin overlying the suboccipital triangle
         b. Lateral branch
            function – sensory, postganglionic sympathetic [gray ramus] and motor (lmn) innervation of the overlying neck muscles
      4. C4-8
         a. Medial branches
            function – sensory and postganglionic sympathetic [gray rami communicans] innervation of the skin overlying the cervical vertebrae
         b. Lateral branches
            function – sensory, postganglionic sympathetic [gray ramus] and motor (lmn) innervation of the overlying neck muscles
   B. Ventral rami (Cervical Plexus)
      1. Cutaneous branches
         a. Lesser occipital n. (C2)
            function – sensory & postganglionic sympathetic [gray ramus] innervation of the skin overlying the posterior-lateral aspect of the head and upper neck
         b. Great auricular n. (C2,3)
            function – sensory & postganglionic sympathetic [gray rami communicans] innervation of the skin overlying the upper SCM, lower parotid region and ear
         c. Transverse cervical n. (C2,3)
            function – sensory & postganglionic sympathetic [gray rami communicans] innervation of the skin overlying the lower SCM and anterior neck
         d. Supraclavicular n. (C3,4)
            function – sensory & postganglionic sympathetic [gray rami communicans] innervation of the skin overlying the lower half of the posterior triangle of the neck
      2. Sensory (non-cutaneous) branches
         a. Proprioceptive branches to trapezius m.
            function – sensory & postganglionic sympathetic [gray rami communicans] innervation of the trapezius muscle
         b. Proprioceptive branches to the SCM m.
            function – sensory & postganglionic sympathetic [gray rami communicans] innervation of the SCM muscle

3. Muscular branches
    a. Nerve to the geniohyoid m. (C1)
    function - sensory, postganglionic sympathetic [gray ramus] and motor (lmn) innervation of the geniohyoid muscle
    b. Nerve to the thyrohyoid m. (C1)
    function - sensory, postganglionic sympathetic [gray ramus] and motor (lmn) innervation of the thyrohyoid muscle
    c. Superior root of the ansa cervicalis (C1) [L. loop, handle]
    function - sensory, postganglionic sympathetic [gray ramus] and motor (lmn) innervation of the superior belly of the omohyoid muscle
    d. Inferior root of the ansa cervicalis (C2,3)
    function - sensory, postganglionic sympathetic [gray rami communicans] and motor (lmn) innervation of the sternohyoid, sternothyroid and inferior belly of the omohyoid muscles
    e. Phrenic n. (C3-5)
    function - sensory, postganglionic sympathetic [gray rami communicans] and motor (lmn) innervation of the diaphragm (other functions are listed under UNIT TWO)
    f. Misc. muscular branches
    function - sensory, postganglionic sympathetic [gray rami communicans] & motor (lmn) innervation of the longus capitis, longus coli, & anterior, middle & posterior scalene muscles