HUMAN FUNCTIONAL ANATOMY 213
CRANIAL NERVES – Pattern and organisation

READINGS
eg. Grant's Method:- Great vessels and nerves of the head
Last's:- The cranial nerves
Moore:- The cranial nerves
Stern:- The Pharynx
Or any other regional textbook, similar sections

IN THIS LECTURE
Composition of cranial nerves
   Innervated structures in the head
   Ganglia in the head
   Components in cranial nerves
Parasympathetic nerves of the head
   Oculomotor
   Facial
   Glossopharyngeal
   Vagus
Sympathetic nerves of the head
   Nerve supply of the ear

SENSORY GANGLIA
All sensory nerves have a cell body in the peripheral nervous system

In the rest of the body these are dorsal root ganglia (GSA and GVA)
They are pseudounipolar neurones (no synapses in the ganglion):
1. GSA
   Skin and mucus membranes
   Trigeminal nerve and ganglion
   Facial, glossopharyngeal and vagus nerves (ear)
2. GVA
   Sensory from visceral structures in the mouth & pharynx
   Facial, glossopharyngeal and vagus
All these nerves (V, VII, IX, X) have ganglia along their path:
V  Trigeminal ganglion
VII Geniculate ganglion
IX Glossopharyngeal ganglion
X  Vagal ganglion
3. Special senses:
   I - Olfactory nerve. Bipolar cells are also the receptor cells for smell. They pass through the cribriform plate to connect the nasal mucosa to the olfactory bulb (which is actually part of the brain)
   II - Optic nerve. Bipolar cells in the retina connect the photo receptors to other nerve cells of the retina (which are actually part of the brain)
   VIII – Vestibulocochlea nerve. Bipolar cells bodies lie in the vestibulocochlea nerve and connect the receptors to the brain.
   VII, IX, X all contain taste fibres. The cell bodies lie in the sensory ganglia of each of those nerves.

COMPOSITION OF CRANIAL NERVES

Components found in nerves to other parts of the body
GSA General somatic afferent: Cutaneous, joint, & muscle sense
GVA General visceral afferent: Sense from internal organs
GSE General somatic efferent: Motor to voluntary muscle (Somites)
GVE General visceral efferent: Smooth muscle and glands (Lateral plate: autonomic)

All these components are also found in cranial nerves.

Special components only found in cranial nerves
SSA (Special somatic afferent) and SVA (Special visceral afferent)
   Special senses: Smell, Taste, Vision, Hearing & balance
SVE (Special visceral efferent)
   Voluntary motor to pharyngeal arch muscle.

MOTOR GANGLIA
Autonomic nerves have a cell body in the peripheral nervous system

1. Parasympathetic ganglia:
   Ciliary Ganglion
      Preganglionic input: Oculomotor nerve
      Output: Short ciliary nerves
      To intraocular smooth muscle
   Ptengopateline Ganglion
      Preganglionic input: Facial nerve (greater petrosal nerve)
      Output: With branches of the maxillary nerve
      To lacrimal, nasal and palatine glands
   Submandibular Ganglion
      Preganglionic input: Facial nerve (chorda tympani)
      Output: With lingual nerve
      To Submandibular and sublingual glands
   Otic Ganglion
      Preganglionic input: Glossopharyngeal nerve (lesser petrosal nerve)
      Output: With auriculotemporal nerve
      To Parotid gland

2. Sympathetic ganglia: Superior cervical ganglion
   Input from T1, 2 & 3 via sympathetic trunk
   Output is distributed with arteries of the head
**COMPOSITION OF CRANIAL NERVES**

<table>
<thead>
<tr>
<th>GSA</th>
<th>GVA</th>
<th>SSA/SVA</th>
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* Also GSA - muscle sensory

**FACIAL NERVE**

Comprises: The facial nerve proper (SVE)
The nervous intermedius (GVE, GVA, SVA, GSA)

Course and distribution:
1. Enters the internal acoustic meatus
2. Geniculate ganglion in petrous temporal bone
3. Greater (superficial) petrosal branch:
   - GVE=parasympathetic,
   - SVA=taste, GVA=visceral sensory
   - Emerges in floor of middle cranial fossa
   - Descends through foramen lacerum
   - Joins with sympathetic nerves from ICA (deep petrosal)
   - Nerve of the pterygoid canal => Pterygopalatine ganglion
4. Nerve to stapedius is given off in the tympanic cavity
5. Chorda tympani crosses the tympanic membrane:
   - GVE=parasympathetic, SVA=taste, GVA=visceral sensory
   - Emerges from the skull through the petrotympanic fissure
   - Joins lingual nerve => Submandibular ganglion
   - Parasympathetic to submandibular and sublingual glands
   - Taste to anterior 2/3 of tongue
6. Motor division (SVE, 2nd arch) through the stylomastoid foramen
7. Twigs to tympanic plexus and external ear arise in the petrous temporal

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**GLOSSOPHARYNGEAL NERVE**

Comprises: SVE, GVE, GVA, SVA, GSA

Course and distribution:
1. Exits cranial cavity through jugular foramen
2. Two small (sensory) ganglia in jugular foramen
3. Tympanic branch enters petrous temporal bone
   - Sensory to tympanic cavity and external ear (GSA)
   - Lesser petrosal nerve emerges in middle cranial fossa
   - Descends through foramen ovale => Otic ganglion (GVE)
4. Runs on Stylopharyngeus muscle (supplies it – SVE 3rd arch)
5. Pharyngeal branch joins pharyngeal plexus (GVA from pharynx)
6. Lingual branch to posterior 1/3 of tongue (SVA taste, GVA visceral sense)
7. Sinus nerve to carotid sinus and body (GVA – arterial blood pressure)

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**VAGUS NERVE**

Comprises: Vagus nerve proper (SVE, GVE, GVA, SVA, GSA)
Cranial accessory nerve (SVE => Larynx)

1. Exits cranial cavity through jugular foramen
2. Two small (sensory) ganglia in jugular foramen
3. Auricular branch enters petrous temporal bone & joins tympanic plexus
   - Sensory (GSA) fibres supply the external acoustic meatus and part of the external ear
4. Meningeal branch to posterior cranial fossa
5. Vagus nerve runs in carotid sheath
6. Pharyngeal branches to pharyngeal plexus (SVE Palate & pharynx)
7. Superior laryngeal branch
   - Internal laryngeal nerve (GVA Supraglottic mucosa)
   - External laryngeal nerve (SVE cricothyroid muscle)
9. Recurrent laryngeal nerve
   - SVE laryngeal muscles
   - GVA Infraglottic mucosa
10. Distribution to thoracic and abdominal viscera (GVA & GVA)
NERVE SUPPLY OF THE EAR

The external ear has a very rich and varied nerve supply:

Outer parts of the auricle (Helix and lobule) are supplied by “somatic nerves”:
1. Cervical plexus (C2,3) greater auricular nerve
2. Trigeminal nerve, auriculotemporal nerve

Inner parts of the auricle (concha and external acoustic meatus) are supplied by “visceral nerves”:
1. Vagus (auricular branch) to external acoustic meatus and cranial surface of concha (Alderman’s nerve).
2. Glossopharyngeal nerve (tympanic branch) to middle ear, external acoustic meatus and concha.
3. Facial nerve (tympanic twigs) to external acoustic meatus and concha.

Ear acupuncture chart in the medical library, shows points for somatic structures such as limbs, back and head are all on the lobule and helix. Points for visceral structures are in the concha and scaphoid fossa.

<table>
<thead>
<tr>
<th>Nerve</th>
<th>Classification</th>
<th>Function</th>
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<tbody>
<tr>
<td>I</td>
<td>GSA</td>
<td>Smell</td>
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<td>II</td>
<td>GVA</td>
<td>Vision</td>
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<tr>
<td>III</td>
<td>SSA/SVA</td>
<td>Extraocular muscles</td>
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<tr>
<td>IV</td>
<td>GSE</td>
<td>Superior oblique</td>
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<tr>
<td>V</td>
<td>GVE</td>
<td>Muscles of mastication</td>
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<tr>
<td>VI</td>
<td>SVE</td>
<td>Lateral rectus</td>
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<tr>
<td>VII</td>
<td>GSA</td>
<td>Taste</td>
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<tr>
<td>VIII</td>
<td>GVA</td>
<td>Hearing Balance</td>
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<td>IX</td>
<td>SSA/SVA</td>
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