

CRANIAL NERVES

1. Olfactory mucosa of the upper portion of the nasal cavity
2. Ganglion cells of the retina
3. Midbrain at sup. colliculus (Oculomotor N.), Ant.periaqueductal gray (Edinger-Westphal N.)
4. Midbrain at inferior colliculus in the anterior periaqueductal gray (Trochlear N.)
5. Midpons (N. of spinal tract, Chief Sensory N., Mesencephalic N., Motor N.)
6. Lower Pons at facial colliculus
7. Lower Pons (Facial N.), Medulla (Nucleus of Solitary Tract, Superior Salivatory Nucleus)
8. Lateral aspect 4th ventricle (Vestibular Nuclei), Acoustic tubercle (Cochlear Nuclei)
9. Medulla (N. of Solitary Tract, N. ambiguus), Pons (Inf. Salivatory Nucleus)
10. Medulla (Dorsal motor n., Ambiguus, N. Solitary Tract, N. of the spinal tract of trigeminal)
11. Medulla and cervical segments (N. Ambiguus and disperse cell bodies)
12. Medulla (Hypoglossal nucleus)
13. Floor, forth
14. Cerebellopontine angle
15. Balance & Equilibrium connected to the position and movement of the head, and auditory
16. Vertigo and nystagmus
17. Deafness and Tinnitus
18. Uncontrollable rhythmical oscillations of the eye
19. Persistent buzzing/ringing sound
20. Both motor and sensory
21. Facial nucleus(pons), muscles of facial expression
22. tractus solitarius (medulla), taste of anterior tongue
23. salivatory (pons), salivary glands
24. IX and VII
25. Supranuclear, lower opposite side of the face
26. Infranuclear, same half of the face
27. Bell's palsy
28. Innability to close eye, drooping lower eyelid, tearing, drooling, drooping of mouth, etc.
29. Smile while closing eyes tightly
30. Motor & sensory
31. Muscles of mastication
32. Nucleus of the spinal tract
33. Mesencephalic nucleus (muscles of face)
34. principle sensory nucleus, (skin of face, sinouses, nose, tongue, teeth, and gums
35. deviation of jaw, inability to bite down, tic douloureux, facial anesthesia, shingles, headache



36. Herpes zoster, unilateral pain, sensory distribution of the nerve
37. Tic douloureux (Trigeminal neuralgia)
38. Same side because of unopposed action of the contralateral side pterygoid muscle
39. VI, motor
40. Nucleus is in the pons, exits between the basilar pons and pyramid of medulla
41. Innervate lateral rectus muscle of the eyeball, ipsilateral
42. Medial strabismus
43. ANS, somatic and visceral sensation, muscles : (coma)
44. Contra lateral hemipareses of trunk and extremities
45. Contra lateral weakness of the lower face
46. Loss of vibration sensation, discriminatory tactile sensation and contra loss of proprioception
47. Sensory info enters spinal cord via dorsal roots, Motor information leaves via ventral roots
48. Knowledge of limbs in space
49. Oculomotor III, and Trochlear IV
50. Levator palpebrae superioris
51. SO4, Trochlear Nerve IV
52. LR6, Abducens Nerve VI
53. Oculomotor Nerve III
54. Superior Colliculus, Periaqueductal grey
55. Edinger-Westpall nucleus (parasympathetic)
56. Pupillary light reflex
57. Trochlear
58. Accommodation reflex
59. Double vision
60. Loss of conjugate movement
61. Dilated pupil
62. Paralysis of sphincter pupillae and unopposed dilation action by sympathetic
63. Paralysis of the ciliaris, loss of accommodation reflex
64. Periaqueductal grey at the level of the inferior colliculus
65. Ptosis, lateral strabismus, diplopia, mydriasis, cycloplegia, and loss of light reflex
66. Weakness of downward gaze and diplopia when looking downward and inward
67. Superior medullary velum
68. Pons, facial colliculus
69. VI, medial strabismus and diplopia
- 70.



NEUROEMBROLOGY

71. Fertilization of egg by sperm, cleavage (series of mitotic cell division), Implantation
72. Reorganization of the blastocyst into a bilaminar embryonic germ disk
73. Gastrulation, notochord & prechordal plate formation, neurulation
74. Primitive groove, epiblast
75. Primitive streak, primitive hypoblast
76. Endoderm, ectoderm, and hypoblast
77. Ectoderm
78. Mesoderm, Notochordal process and prechordal plate
79. Overlaying ectoderm into neural tissue
80. Ectoderm
81. Mesoderm
82. Neural plate
83. Formation of the neural plate, neural tube, and neural crest cells
84. CNS
85. Parts of the PNS and other structures
86. No primitive streak, sacrococcygeal teratoma
87. Neural tube
88. Caudal to the 4th pair, thick wall & small tube
89. Neural tube cranial to the 4th pair of somites
90. Neural canal cranial to the 4th pair of somites
91. Edge/Hinge Point, under surface ectoderm
92. DRG, Symp chain gang, Parasympth chain gang, Schwann cells, melanocytes, adrenal medulla
93. Neuroepithelial
94. Ventricular (Glial & Neuroblasts), Mantle (Gray CNS from neuroblasts), Marginal (Axons)
95. Alar plate, Basale plate, sulcus limitans
96. Neural Crest Cells, the spinal nerve
97. Synapse with intermediolateral column and ventral horn cells, ascend forming funiculi
98. Craniorachischisis totalis
99. Prosencephalon, Mesencephalon, Rhombencephalon
100. Telecephalon (cerebrum), diencephalon (thalami)
101. Mesencephalon (midbrain)
102. Metencephalon (pons and cerebellum), Myelencephalon (medulla and spinal cord)
103. Caudal neuropore
104. Cranial neuropore, anencephaly
105. Choroid plexus of the ventricles, pia mata



106. CSF
107. Ependymal layer of neural tube and Pia mater from Neural Crest Cells, Tela choroidea
108. Blockage of CSF resulting in intracranial pressure and abnormal growth
109. Narrow spaces with enlarged ventricles upstream of the blockage
110. Tumor of midbrain or debris after haemorrhage compresses cerebral aqueduct
111. Lamina Terminalis

BASAL GANGLIA MOTOR SYSTEM CONTROL

112. Muscle spindle, muscle
113. Golgi tendon organ, Tendon
114. Encapsulated Ib proprioceptors in between the muscle and tendon
115. Ib from golgi, cutaneous receptors, joint receptors
116. Inhibits the alpha motor neuron pool of agonist
117. A δ nociceptors cause the flexion(withdraw) of injured limb while extending contralateral limb
118. Internal arcuate fibers, medial lemniscus, Ventral posterior lateral thalamic nucleus
119. Through the internal capsule to the somatosensory cortex (area 1,2,3)
120. Romberg's test, dermatomes tuning forks, upper extremity position sense
121. Lower extremity (spinocerebellar tract), Upper (Cuneatus)
122. Spinothalamic, Spinoreticular, spinomesencephalic : Anterolateral system
123. Tract \rightarrow V. white commissure \rightarrow Ventral pos. lateral thalamic nucleus \rightarrow int. capsule \rightarrow 3,1,2
124. Pinwheel over dermatomes
125. Lentiform nucleus, Caudate n., Subthalamic n., Substantia Nigra
126. Putamen, Globus Pallidus II & I
127. Lateral wall of anterior horn of lateral ventricle
128. Roof of inferior horn of lateral ventricle ending inferiorly in the amygdala
129. Pars compacta (dopamine), Pars reticulata (GABA)
130. Caudate nucleus and lentiform nucleus
131. Neostriatum
132. Glutamate, Area 4
133. Area 6
134. VA & VL thalamic nuclei
135. Excitation of motor nucleus and initiation of movement
136. Akinesia (inability to initiate movements), Bradykinesia (slowness & shuffling of movement)
137. Chorea, Ballismus, Athetosis, dystonia
138. Depletion of dopaminergic cells in the Substantia nigra
139. L-Dopa, embryonic dopamine cells, pallidotomy (VA & VL Nuclei Cauterization)



140. Akinesia, Bradykinesia, Resting tremor, cogwheel rigidity, flexed posture, masking, shuffling
141. Autosomal disease, onset at 40s-50s, slow degeneration of neurons in striatum
142. Chorea, Dementia, Behavioral or psychiatric disturbances
143. 15-20 years (also high suicide rate)
144. Involuntary twitching of the extremities and face that progressively worsens & expands
145. Transient childhood chorea associated with rheumatic fever and affects the striatum
146. Degeneration of globus pallidus, results in writhing movements of distal extremities
147. Lesion of subthalamic nucleus, contralateral invol. Movements of prox. Extremities & trunk
148. Can't Metabolism Cu, Cu accumulates in liver and becomes toxic to liver & basal ganglia
149. Liver cirrhosis, Kayser-Fleischer ring (Cu ring around iris)
150. Dystonia Musculorum Deformans
151. Focal dystonia: constant spasms of SCM & tracts
152. Blepharospasm
153. No caudate, little putamen
154. Ant. Frontal lobe, Pos. parietal lobe
155. Motor & sensory environmental respectance to self
156. Area 6 (premotor & supplementary motor cortex)
157. Area 4 in the precentral gyrus
158. Plan the sequence and timing of muscle contraction & relaxation of muscle for smooth motion
159. 3,1,2
160. Lateral pathway and Ventromedial pathway
161. Lateral Funiculus, Lateral Corticospinal Tract & Rubrospinal Tract
162. Distal muscles of limbs
163. Axial and proximal limb muscles
164. The corticobulbar tract for LMNs of brainstem is bilateral
165. Corona radiate → Pos. limb → Crus cerebri → basilar pons → pyramid → p. decussation
166. Distal flexor muscles
167. Paresis/paralysis, spasticity, hyper reflexes, clasp knife rigidity, babinski, no superficial reflex
168. Corticospinal
169. Reticular formation in pons, bilateral ventral horns
170. Antigravity muscles (example: Quadriceps femoris, scalenes)
171. Reticular formation of medulla → bilateral ventral horns
172. Inhibit antigravity muscles
173. Vestibular nuclei → Bilateral ventral horns
174. Head & back muscles on directional info from ear, also innervates U & L limb extensors
175. Superior colliculus → X in medulla → ventral horn



176. Coordinates head and eye movements
177. Corticospinal and rubrospinal
178. Tonic extension, vestibular nerves, dorsal roots
179. Tonic extension of legs with flexion of arms
180. Pontine & medullary reticulospinal
181. Red nucleus projections can counteract the vestibular extension function of the arms
182. Extensors, distal muscles
183. α -motor neuron
184. Muscle fibers within muscle spindles, γ -motor neurons
185. Visible muscle twitching from contraction of an entire motor unit (motor unit disease)
186. Spontaneous activity of a single muscle fiber (muscle denervation/myopathy)
187. Interfusal muscle, sensory afferents & motor axons
188. Keep muscle spindle open for maintenance of sensitivity
189. FC, FG
190. Ia & II
191. Sensitive to rate of change (fire during input), Ia
192. Slowly adapting stretch receptors (fire at start and end), Ia & II
193. Nuclear bag fibers
194. Monosynaptic conn. between Ia & α -motor causing muscle contraction in response to stretch
195. Antagonist muscle
196. Recurrent renshaw cell inhibition
197. Excites the antagonist & inhibits agonist

LIMBIC SYSTEM

198. Septal area, cingulate gyrus, parahippocampal gyrus, hippocampus, amygdala, uncus
199. Hypo-, epi-, thalamus, brainstem reticular formation, olfactory cortex, prefrontal cortex
200. Parahippocampal gyrus, hippocampus, dentate gyrus, subiculum
201. Map of spatial memory, learning, passage of short term to long term explicit memory
202. Hippocampus \rightarrow Fornix \rightarrow Mam. Bodies \rightarrow Ant. N. of Thalamus \rightarrow Cingulate Gyrus
203. Entorhinal area, thalamus, locus coeruleus, raphe nuclei, v. tegmental area, hippo. commissure
204. Contralateral hippocampus
205. Primary Olfactory Cortex
206. Defects in explicit memory and spatial orientation
207. Fornix
208. Episodic(Events)/Semantic(Facts) : Declarative Memory
209. Medial temporal lobe



210. Priming, procedural, emotional & musculoskeletal responses to associative learning
211. Amygdala
212. Neocortex, Striatum
213. Amygdala, Cerebellum
214. Stria terminalis, septal nuclei, hypothalamus, brainstem, cortex
215. Autonomic, sensory, auditory, and visual information
216. Affective perception of sensory stimuli
217. Intense feeling of fear, possibly olfactory hallucination
218. Kluver Bucy Syn., Korsakoff's Syn., Temporal lobe epilepsy, Schizophrenia, Alzheimer's
219. Bilateral complete lesion of amygdala and hippocampal formation
220. Visual agnosia, hyperorality, hypersexuality, docility, apathy, bulimia, memory deficit
221. Amyloid protein, temporal frontal and parietal cortices
222. Olfactory/visual/auditory hallucinations, lip smack, motor acts, temp. amnesia, aggressiveness
223. Emotion behavior, reward reaction, transient rage, water consumption

HEARING

224. Infrasound, Ultrasound
225. Tensor tympani & stapedius muscles : Facial Nerve VII
226. Bony modiolus
227. The tensor tympani connects to the _____ and functions for what purpose?
228. Tensor Tympani and Stapedius muscles attenuation reflex is at a 50-150msec delay
229. Large surface to small surface and ossicles act as levers
230. Oval window, fluid movement, round window
231. Body
232. At the apex
233. K^+
234. Perilymph, Na^+
235. SV, Reissner's Membrane, Scalas Media, Basilar Membrane, ST
236. Endolymph, K^+ , stria vascularis, absorbing Na^+
237. Organ of Corti
238. Base/narrow/rigid = high frequency : Apex,wide,floppy = low frequency
239. Apex
240. Rods of corti, Inner & outer hair cells, supporting cells
241. Basilar membrane, tectorial membrane
242. Bending of the 100 stereocilia of each hair cell
243. Outer hair cells



244. Bipolar spiral ganglion cells, cochlear nerve
245. Outer hair cells
246. K^+ channels open, De-pole, Ca^+ channels open, Neurotransmitter(glu) release on spiral ganglion
247. Hyperpolarization
248. Ototoxic antibiotics destroy them leading to hearing loss
249. 30,000
250. Cochlear nerve, cochlear nuclei
251. Tonotopic organization
252. Stellate (frequency encode), Bushy (fire at sound onset and aid in horizontal localization)
253. Fusiform (freq. encode, aid in vert sound localization), Tuberculoventral (delayed, inhibit echo)
254. Bi-lateral hearing loss with more pronounced contralaterally
255. Medial Olivary N. processes auditory time delay between ears
256. Low frequencies, high frequencies
257. Hyperolarization and resting phases
258. Lateral superior olivary nucleus
259. Superior Olivary Nuclei, bilaterally, lateral lemniscus
260. Nucleus of the Lateral lemniscus, inferior colliculus
261. 4-layer dorsal n. (auditory & somatosensory), + multi-central n. with a complete tonotopic map
262. Medial geniculate nucleus, somatotopic map
263. Transverse Temporal Gyri of Heschl (area 41,42, near sup. Temporal gyrus)
264. Insult to the middle ear
265. Loss of cochlear hair cells
266. Ossification of ossicle attachments
267. Scar tissue on tympani ossicles
268. Tonotopically, Localization of sound (columns responsive to freq. and interaural relationships)
269. Vertex or nasion
270. Lateralizes to conductive deaf ear, lateralizes away from sensorineural ear
271. Mastoid process, later by ear when fork is more quiet
272. Conductive
273. Sensorineural

VESTIBULAR SYSTEM

274. Cochlea, vestibule, and semicircular canals
275. Perilymph Na^+ , CSF
276. Endolymphatic sac
277. Endolymph



278. Posture, muscle tone, eye position in respect to the head
279. Macula utricule, macula succuli
280. Gelatinous otolithic membrane containing CaCO_3
281. Utricule & saccule, static orientation in respect to gravity
282. Orthogonally oriented
283. Angular decal/accel, semicircular cells
284. Crista ampullaris, Ampullae
285. Gelatinous cupula
286. Potassium
287. Microvillia, Kinocilium
288. Bend toward the kinocilium
289. When microvillia bend away from the kinocilium
290. Bipolar cells, vestibular ganglia, vestibular nerve
291. Cerebellopontine angle lateral to facial
292. Vestibulospinal tract, Flocculonodular lobe & fastigial n. of cerebellum, n. of CN III IV VI via MLF
293. Ventral Posterior Thalamic Nucleus, Parietal association area
294. CN VI can no longer synchronize with CN III
295. MS, Vascular diseases (NOT VETIBULAR DISEASE SPECIFIC)
296. Patient flexes forward while being spun, stopped abruptly
297. Nystagmus opposite that of direction of rotation
298. Warm or cold water is placed in the ex. Acoustic meatus. Nystagmus = $C_{\text{old}}O_{\text{pposite}}W_{\text{arm}}S_{\text{ame}}$
299. Vertigo, nystagmus, disequilibrium
300. Central (nystagmus in all directions w/o vertigo), Perpherial (nystagmus Horizontal w/ vertigo)
301. equilibrium loss, nystagmus, vertigo, progressive hearing loss & tinnitus, onset in 20s-30s
302. Common benign Schwann cell tumor, Interal acoustic meaus or cerebellopontine angle
303. Facial & Trigeminal nerves

CHEMICAL SENSES

304. Noxious
305. Top of nasal cavity around cribiform plate
306. Old receptors can be replaced regularly w/ new ones
307. Bipolar cells, unmyelinated axons, olfactory nerve
308. Mucous and odorant binding proteins
309. Mitral & tuft, olfactory bulb
310. Ca^{2+} in , Cl^- out
311. Olfactory tract, medial & lateral olfactory stria



312. Piriform & entorhinal cortex in the ant. Parahippocampal gyrus
313. Reach cortex w/out synapsing in the thalamus
314. Orbitofrontal olfactory cortex, dorsomedal thalamic nucleus
315. Orbitofrontal olfactory cortex
316. Chorda tympani
317. VII IX X, solitary nucleus
318. VII = Genicular ganglion , IX = Inferior ganglion , X = inferior-nodose ganglion
319. Ventral posteromedial thalamic nucleus, posterior limb, primary gustatory cortex
320. Postcentral gyrus, operculum, superior portion of insula
321. Pseudounipolar
322. Na in \rightarrow depolarization \rightarrow Ca in \rightarrow Vesicular release
323. H in \rightarrow K cannot leave \rightarrow depolarization \rightarrow Ca in \rightarrow Vesicular release
324. G-protein \rightarrow K cannot leave \rightarrow Depolarization \rightarrow Ca in \rightarrow Vesicular release
325. K cannot leave \rightarrow Depol \rightarrow VR or G-protein \rightarrow internal Ca release \rightarrow Vesicular release
326. Na in \rightarrow Depolarization \rightarrow Ca in \rightarrow Vesicular release

