

Neural pathways

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SPINAL REFLEX – proprioceptive

Proprioceptive receptor – muscle spindle

Register protraction and shortening of the muscles

Fibrous cover – in the muscle (extrafusal muscular fibres)

Inside modified muscular fibers – **intrafusal**

I: sensory, motor – **γ motoneurons**

Sensory fibers – protraction of the muscle – information carried to α motoneurons in ncl. motorii

α motoneurons – contraction of the muscle (extrafusal fibres)

Gama loop (regulation of muscular tonus):

γ motoneurons – activation via RF

Contraction of the muscle spindle – subsequent reaction of sensory fibers



SPINAL REFLEX – exteroceptive

1st neurons

ganglion spinale, pseudounipolar neurons
receptor – nerve endings in skin

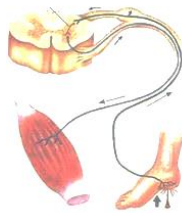
2nd neurons

interneurons in spinal cord (reflex centre)

3rd neurons

α motoneuron

effector – striated muscle



RADIX LATERALIS (80-90% fibers)

OPTIC PATHWAY

1st neuron

rods, cones

2nd neuron

bipolar cells

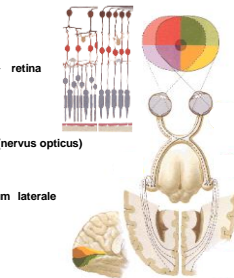
3rd neuron

multipolar cells (nervus opticus)

4th neuron

corpus geniculatum laterale

Area 17, 18, 19



Horizontal cells in retina

connect and inhibit rods and cones

Amacrine cells in retina

inhibit ganglionic cells

Retinotopic organization

Fibers from appropriate parts of retina

Terminate in specific regions of

corpus geniculatum lat. + cortex

RADIX MEDIALIS (10-20% fibers)

Colliculus sup. – optico-motor reflexes

efferent pathways tr. tectospinalis

Area praetectalis – pupilar reflexes

Hypothalamus – tr. retino-hypothalam. (ncl. suprachiasmatis)

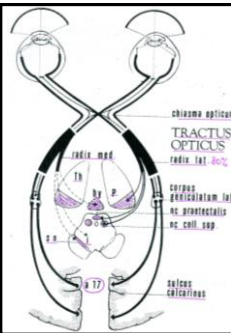
cirkadian rhythms

Pulvinar thalami – feedback circuits to the cortex

Ncl. interstitialis (Cajal) – FLM

eye coordination

Substantia nigra



PUPILAR REFLEX

miosis

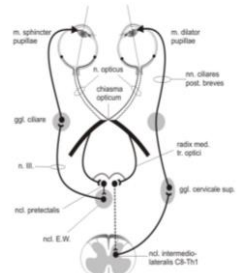


m. sphincter pupillae – parasympathicus

mydriasis



m. dilatator pupillae – sympathicus



Auditory pathway

1st neuron
ganglion spirale cochlae (pars cochlearis n. VIII)

2nd neuron
ncl. cochlearis dorsalis
(ncl. cochlearis ventralis – corpus trapezoideum)

3rd neuron
ncl. colliculi inf.

4th neuron
corpus geniculatum mediale
(radiatio acustica capsulae internae)

Gyri temporales transversi (area 41, 42)

VESTIBULAR PATHWAY

1st neurons – ggl. vestibulares n. VIII. (meatus acusticus int.)
tr. vestibulo-cerebellaris directus
balance, posture, head and eye movements

2nd neurons – ncll. vestibulares (sup., inf., med., lat.)

Effer. pathways:
tr. vestibulo-cerebellaris indirectus
FLM – vestibulo-oculo-motor reflex
tr. vestibulo-spinalis (ncl. motorii)

3rd neurons – thalamus (tr. vestibulo-thalamicus)

Cortex cerebri
Sensory, motor regions, lobus insulae (to realize the movements, vertigo....)

OLFACTORY PATHWAY

1st neuron
regio olfactoria
(axons - nn.olfactorii)

2nd neurons
bulbus olfactorius (mitral cells)
tr. olfactorius - stria olfactoria med. + lat. + intermedia

Cortex cerebri
interm.-piriform region (around area cribrosa ant.)
lat.-entorhinal region (uncus g. parahippocamp.)
med. - amygdalar complex

3rd neurons thalamus – orbitofrontal cortex

GUSTATORY PATHWAY

1st neuron – pseudounipolar neurons
ggl. geniculi n. VII (chorda tympani) 2/3 tongue
(n. petrosus major)
ggl. n. IX – posterior 1/3 tongue
ggl. n. X – around epiglottis

2nd neuron
ncl. gustatorius

3rd neuron
thalamus (ncl. VPM)

Cortex cerebri
area 43 (operculum frontale), insula

SOMATOSENSORY PATHWAY (protopathic, anterolateral system)

Information via spinal nerves – temperature, pain

1st neuron
pseudounipolar neurons in ganglion spinale

2nd neuron
ncl. proprius
(axons are crossed on appropriate spinal segment)
tractus spino-thalamicus ant. (skin sensitivity, sensory information about pain)
tractus spino-thalamicus lat. (temperature, affective aspects of pain)

3rd neuron
thalamus (ncl. VPL)
Gyrus postcentralis area 3,2,1,

SOMATOSENSORY PATHWAY (protopathic, trigeminal system)

Information via cranial nerves – temperature, pain

1st neuron
pseudounipol. neurons in cranial nerves ggl
(V, VII, IX, X)

2nd neuron
ncl. tr. spinalis n. trigemini
tractus trigemino-thalamicus

3rd neuron
thalamus (ncl. VPM)
Gyrus postcentralis area 3,2,1,

SOMATOSENSORY PATHWAY (epicritic, posterior column, lemniscal system)

Information via spinal nerves – soft touch – discriminative sensation

1st neuron: pseudounipolar neurons in ganglion spinale
 central branches – **tractus spino-bulbaris**
 (fasciculus gracilis + cuneatus)

2nd neuron: ncl. gracilis + ncl. cuneatus med.
tractus bulbo-thalamicus
 axons (fibræ arcuatae int. crossed – decussatio lemniscorum)
 lemniscus medialis

3rd neuron
 thalamus (ncl. VPL)
Gyrus postcentralis area 3,2,1,

SOMATOSENSORY PATHWAY (epicritic, trigeminal system)

Information via cranial nerves – soft touch – discriminative sensation

1st neuron: pseudounipolar neurons in ggl V, VII, IX, X
2nd neuron: ncl. sensorius principalis n. V
 axons are crossed – lemniscus trigeminalis

3rd neuron
 thalamus (ncl. VPM)
Gyrus postcentralis area 3,2,1,

SOMATOSENSORY PATHWAY (PROPRIOCEPTION)

Information via spinal nerves – from locomotor app. LE + trunk

1st neuron: pseudounip. neurons in ganglion spinale

2nd neuron: ncl. thoracicus (C8 – L3)
 tr. spino-cerebellaris ant. + post.

cerebellum – information processing
tractus cerebello-thalamicus
 thalamus
 ncl. ventrales laterales (VL)
Gyrus frontalis + praecentralis
 (praemotor and motor cortex)

SOMATOSENSORY PATHWAY (PROPRIOCEPTION)

Information via spinal nerves – locomotor app. UE

1st neuron: pseudounip. neurons in ganglion spinale
 cent. branches – **fasciculus cuneatus (lat)**

2nd neuron: ncl. cuneatus lat.
 tr. cuneo-cerebellaris

cerebellum - information processing
tractus cerebello-thalamicus
 thalamus
 ncl. ventrales laterales (VL)
Gyrus frontalis + praecentralis
 (praemotor and motor cortex)

SOMATOSENSORY PATHWAY - PROPRIOCEPTION

Information via cranial nerves – V, VII, IX, X (muscles derived from branchial arches)

1st neuron: pseudounipolar neurons in ncl. tractus mesencephalicus n. V
 central branches – **tractus trigemino-cerebellaris**

cerebellum – information processing
tractus cerebello-thalamicus
 thalamus
 ncl. ventrales laterales (VL)
Gyrus frontalis + praecentralis (praemotor and motor cortex)

MOTOR PATHWAY - PYRAMIDAL

fylogen. young, strongly myelinated, voluntary
 Descendent from cortex cerebri to motor ncl.

Tractus cortico- spinalis
 from cortex cerebri, decussatio pyramidum (medulla oblongata)
ncl. motori medullae spinalis

Tractus cortico- nuclearis
 ncll. motori cranial nerves
 (in somato and branchiomotor zone)

MOTOR PATHWAY - EXTRAPYRAMIDAL (involuntary)

reflex motion, automated movements,

Control circuits of voluntary motion (affect speed, preciseness)

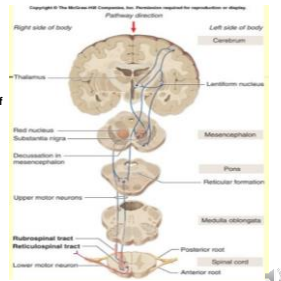
Connections of BG – processing motor circuits

Tr. reticulo-spinalis – facilitatory + inhibitory system of motion

Tr. rubro-spinalis – muscular tonus of UE flexors

Tr. tecto-spinalis – optic and acoustic-motor reflexes

Tr. vestibulo-spinalis – affect postural muscles



References

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