

Subject

نستو

موضوع الدرس

Date :

الموافق

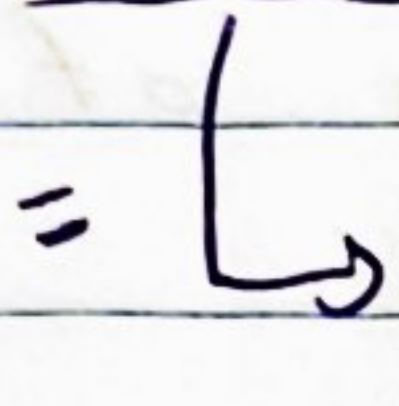
التاريخ

CNS is highly complex and highly organized system

- neuron is the basic cell of CNS.

- Containing about 10 billion neuron

- Each neuron processing up to 1000 connections

=  Synapse : connections between

2 neurons

or

neuron and effector organ

as skeletal muscles or secretory glands.

- Is an integrating communication system . Starting with receiving part "reception of impulses"

- CNS composed of basic electronic circuits.

- interneurons for analysis of the received and ~~and~~ formation of appropriate response against continuously changing environment.

"effector neuron or efferent neuron"

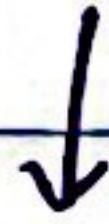
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elementary circuits. composed of receiving part and interneuron

- May form higher order system of organization

After analysis and coordination of impulses through complex system



Fine Coordination for a definite result (response)

- Synapses composed of Main 3 parts



1. presynaptic membrane
2. intermembranous/synaptic space
3. postsynaptic space.

- Sometimes there's an unconsciously responses. (reflexes)

هناك بعض ما يتعلق على المراكز التي في فوه

- functionally : Nervous system can be subdivided into 2 parts
Somatic & autonomic

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Somatic : with Consciousness & voluntary

Autonomous : involuntary & unconscious

(controlling and adjusting the functions of

internal
organs.

voluntary muscle movement →

(respiratory
cus
digestive
system)

has its
own brain

Nervous system work in Cooperation
with the endocrine system.



as : Smooth muscle contraction
heart beating
gland secretion

• Autonomous Nervous System Can be
Subdivided into Sympathetic and
Parasympathetic nervous system in addition
to enteric nervous system

Composition of Nerve tissue:

1. Neurons
2. supporting cells (neuroglial
cells)
3. enteric neuroglial cell
in Gut

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Supporting cells are:

Central
neuroglial

Peripheral

1. oligodendrocytes

2. Astrocytes

3. Microglia

4. ependymal cells.

1. Schwann cells

2. Satellite cells
(in the ganglia)

↓
are "in CNS"

enteric neuroglial cells in the
nervous system
of the digestive
system

There's
an "aggregation of cell body neurons
with special supporting cells"

↓
Morphologically and
functionally similar
to Astrocytes

Called: enteric neuroglial cells

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fragile
cells

للأغذية

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functions of neuroglial cells:-

1. physical support (Mechanically)

2. Isolation $\Rightarrow$ Lead to rapid transmission of Parts and tracts.

3. Repair of neuron

4. chemical adjustment and regulation of the microenvironment

5. clearance of neurotransmitters

(Postsynaptic $\downarrow$ Presynaptic) (تنظيم)

(Maintain the impulse to the following level)

6. Metabolic exchange



7. form a barrier between Vascular compartment and Neurons.

neuroglial cells forming an unique functional and Mechanical structures called: Blood Brain Barrier (BBB)

Neurons is one of the most heterogenous cells in shape & size

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كل ما زاد تعقيد الكائن يزيد
تعقيد interneurons

neuron types:-

Sensory & Motor & interneurons.

Conduct the
impulse from
receptors & outer
body surface to
CNS

على خلاية
العضو
إلى الدماغ

Between Motor
and sensory
for
integrating

data
analysis

Through Afferent
fibers may be

بالألياف الحسية
(efferent)

of
the
Stimuli

Somatic
"voluntary"
control

Visceral
"involuntary"

موتور
muscle
contraction
formation
of
the
appropriate
response

في المناطق
Position of
Joints & body
3D

also

99.9%
of
neurons

Somatic

Visceral

(skeletal
muscle)

(heart)
muscles of
gut.

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karyon = nucleus
التاريخ
النوية بال

Neurons consist of 3 parts :

① The cell body (perikaryon)

② Axon : plasma membran process + ^{no} large organelles
mostly only one + long
transmit signals from perikaryon
to other neuron or effector organ

③ Dendrites : ! Arborizing cell processes

Greater diameter than Axons
↓
1. is a cytoplasmic membran extensions
2. usually many and tapered
3. Short. + unmyelinated
4. have thousand of connections

Similar to receive impulse from other neurons.
cytoplasmic composition as perikaryon (except Golgi)

The Axon is surrounded by myelin sheath for isolation

Produced by Schwann Cells

Nodes of Ranvier

Are gaps in myelin sheath

طبياً ما هي الفجوات في الغشاء الميلاي
depolarizing wave jumping
أسرع (لنمو توصيل الإشارات)

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Axon near the effector organ may branch and ends in more than 1 point.

لبناني

Perikaryon →

The nucleus in the cell body are characteristic by dispersed chromatin "euchromatin"

↓
Can undergo transcription continuously

له و هاد طبي لازم لانه خلية زي ال neuron

new transmitter have to produce elements and proteins

لانها خلية نشطة

to replace the consume ones

protein synthesising cells

↓

1. Active chromatin nucleus

2. Prominent nucleolus

ribosomes

3. inside the cytoplasm it need to be reach with RER and golgi apparatus.

بري و كروماتين
بكميات كبيرة

Neuron doesn't proliferate (No mitotic activity)

limited stem cells

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RER + Poly ribosomes → May form aggregates
in the cytoplasm
seen by Light Microscope
as "body or granules"
called Nissl bodies

• ~~neuron~~ ^{neuron} ~~surrounds~~ ^{surrounds} by Many Synapses
coming from various neurons

• In CNS: the neuroglia forming myelin
Oligodendrocyte

In PNS: Schwann cells.

• **Axon hillock**: Specialized part of the
cell body of a neuron
(where the summation of signal occur)

initial segment: first part unmyelinated
of the Axon

• The site where impulse
formed (depolarization
waves starts)

according to various
received signals

Axonal transporter: Material transport to the
terminal bulb

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Motor end plates: terminal end of the axon

Swollen area of Axon where it meets the synapse or neuron

Neurons types:-

1 Multipolar: Motor neurons or interneurons

• More than 2 cell processes

• Mostly of types

2 Bipolar: rare

• associated with receptor of special sense (in retina + internal ear)

• one single axon and one single dendrite (2 cell processes)

3 Pseudounipolar: [1] one single cell process

[2] The majority are sensory neurons

2 branches (L)

to receive signals

"Afferent"

branch for

dendrite and the other for

axon

[3] Seen in spinal ganglia of PNS.

directly under spinal cord

[5] cell body

in the dorsal root and cranial nerve ganglia

[4] Located close to CNS

موضوع الدرس Subject محور الخلية العصبية - Axon

قبل كم صفحة ببي الدكتور عفاها الله ومن
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Periaxoplasmic plaques : • aggregation of proteins in axon and dendrites.

- though to have a connection with Memory and learning
- especially the ones in the dendrites called dendrite dendritic spikes.

- The proteins change their configuration when they receive signals

Synapses

(The number of them from a few tens to Thousands Per neuron.)

Classified Morphologically:

- Axodendritic (Axon → Dendrites)
- Axosomatic (Axon → perikaryon)
- Axoaxonic (Axon → Axon)

- Boutons en passant. (button in passing) where one neuron joins another at a place besides the axonal terminal

Buton terminal (end bulb)

Small knobs at the end of an axon

Cardiac muscle cell
 one single unit
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Synapses also classified as chemical or electrical:

in invertebrates
 Through gap Junctions
 Neuron connections through secretion of neurotransmitters inside synaps

Mammalian equivalent (Smooth and Cardiac muscle)

The neuroglia: Supporting cells

Central

Peripheral

astrocytes
 microglial
 ependymal
 oligodendrocyte

axon for myelin

Schwan cell
 Satellite cells

ganglion (aggregates of perikaryons)

The unmyelinated axons also surrounded by schwan cell

others neuroglia

Terminal neuroglia (teloglia)

in the Motor endplate

Enteric neuroglia
 Müller's cells

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Schwan cells :-

- arise from neural crest
- The production of it is induced by transcription factor called Sox-10

- produce myelin sheath

- present in both myelinated and unmyelinated axons.

are also covered & enveloped by Schwan cells

- Rapped concentrically around the axon

- Node of ranvier is the area between 2 Schwan cells

ملاحظة) Myelin is the clear area around the axon
ملاحظة) myelin مادة دهنية شفافة
ملاحظة) مادة دهنية شفافة

Satellite cells :- Complete layer around the perikaryon

Processes Penetrate between them

function) electrical isolation and controlled Microenvironment.

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Enteric neuroglial cells:

digestive system has its own neuroglial cells that called enteric neuroglial cells

Morphologically and functionally identical to astrocytes.

Pyelocalnon
in
Grit

found in → submucosa + intermuscular Part.

← Astrocytes -

The largest +

rounded

كروية دائرية

Produce
myelin
in
PNS

for: Support & Control of Metabolism
and Modulation of activity

تتفرع
عبار ال neurons

وتنمو بطريقة صلبة

نرى بقول زي الاط

اني صنف ال neurons

Scaffolding during embryology

(to encourage the migration
differentiation & attachment
and development of regrowing cells)

BBB

Processer from vessels to
neurons

Note

CNS

gray matter

→ where the cell
bodies are located

white matter

→ where the cell processes
are located

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Astrocytes

2 types

protoplasmic

fibrous

1- More Common in Gray Matter

1- Common in the White Matter

2- with Numerous short branching processes

2- Relatively Straight with few processes.

38 } cell processes of astrocyte extends to the surrounds and Making contact on the Surface of Blood vessels (in one side)

توضيح } In the other side it surrounds the neuron and its part

Glial fibrillary acidic protein (GFAP)

- 1 a protein or an intermediate filament.
- 2 Marker for neuroglial origin (astrocytes)
- 3 Maintain the BBB
- 4 Covering for nodes of ranvier and synapses.
- 5 Neurotransmitter removal.
- 6 Glia limitans (impermeable layer)

brain surface
Pia Mater
✓
in the outer surface of brain there is a single layer of astrocytes for separation of outer surface

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Oligodendrocytes : neuroglial cells the
produce myelin inside
CNS

Few processes.

The unmyelinated axons are not
enveloped by oligodendrocytes.

من الخلايا
الدبقية
ما عدا

No Basal Lamina. with little CT

as

↓
fibroblasts and ECM

(ground substances)

Microglia : origin from monocytes
(hematopoietic system)

phagocytic function

5% of glial cells
higher in inflammation

(من الخلايا
الدبقية ما عدا)
elongated nucleus
less process

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ependymal cells :- line the ventricles
and central canal (spinalⁱⁿ Cord)

Has the same morphology of (The fluid
transporting cells) like in Salivary gland.



1. basal part has foldings rich in
mitochondria.

2. basal plasma membrane has
interdigitations

3. Apical surface contain microvilli
and extensions. + cilia (for more surface
area)

عشاء
الوصل 4. Tightly bound by Junctional Complex
at apical surface (Zonula occludens)

• Arranged like epithelium but lack
external Lamina directly attach on CNS tissue

• Production and secretion of CSF

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Types of ependymal cells

Tanycyte

Choroid plexus



1- in floor of 3rd ventricle

Modified

2- No cilia

ependymal cells

3- its surface is in close

and it is

contact with CSF

associated capillary

(CSF absorption في الدم)

for CSF production

4- Long processes

and secretion

into the brain parenchyma

• Peripheral nerves:-

Nerve fibers held together by C.T

is

[The axon on its own or the axon

with its association (Schwann cell, myelin)]

→ The C.T parts:-

! epineurium: The outer most C.T

surround the whole nerve

Dense irregular C.T

Has fat if the nerve is large

Has Blood vessels inside

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barrier

2. perineurium : Surrounds a group of axons
Metabolically active diffusion barrier
Contribute to formation of Blood nerve barrier
no lymphocyte or plasma cells.

3. endoneurium : Surrounds a single axon
Loose C.T
C.T is secreted by Schwann cells
Poor in fibers
rich in ground substance
has Macrophages + Mast cells
No lymphocyte or plasma cells
No blood vessels

عازل فيزيائي
diffusion barrier

Gray Matter Layers:-
(from outside to inside)
1. molecular layer
2. external granular layer
3. external pyramidal cell layer
4. internal granular layer
5. internal pyramidal cell layer
6. multiform cell layer
or (Polymorphic)

Cerebellar Layers:-
"gray matter"
1. Molecular Layer
2. purkinje cell layer
3. granular cell layer

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The spinal cord:-

- Gray Matter on the inside and white matter on the outside (brain ال عاى)
- spinal ganglia is pseudounipolar

بنيه
ال
butterfly
appearance } Columns (Ant post. Lat)

ventral part → Motor & large neurons
Control the voluntary movement of skeletal muscles.

Dorsal root ganglia → sensory neurons
Contact with
Post columns cells

Ant Column has the 2ry motor neurons

Meninges:- Layers of C.T surrounding CNS

أغشية
① Dura Matter

Dense C.T

Continuous with the skull periosteum

Separated from spinal canal by epidural space.

Have sinuses for venous drainage

② Arachnoid

trabeculae
of C.T
Loose

CSF
Subarachnoid space

closely attached

③ Pia Matter

Loose C.T / Continuous with the perivascular C.T