Development of Complex Curricula for Molecular Bionics and Infobionics Programs within a consortial* framework**

Consortium leader

PETER PAZMANY CATHOLIC UNIVERSITY

Consortium members

SEMMELWEIS UNIVERSITY, DIALOG CAMPUS PUBLISHER

The Project has been realised with the support of the European Union and has been co-financed by the European Social Fund ***

**Molekuláris bionika és Infobionika Szakok tananyagának komplex fejlesztése konzorciumi keretben

***A projekt az Európai Unió támogatásával, az Európai Szociális Alap társfinanszírozásával valósul meg.

BASICS OF NEUROBIOLOGY

Neurobiológia alapjai

ORGANIZATION OF THE NERVOUS SYSTEM

Az idegrendszer szerveződése

ZSOLT LIPOSITS

DEVELOPMENT OF THE NERVOUS SYSTEM

FIRST WEEK OF LIFE: FERTILIZATION, SEGMENTATION, MORULA, BLASTOCYST DIFFERENTIATION, IMPLANTATION

SECOND WEEK OF LIFE: AMNION AND YOLK SACS, FORMATION OF EPIBLAST AND HYPOBLAST CELLS, BILAMINAR GERM DISC

THIRD WEEK OF LIFE: GASTRULATION, MESODERM, TRILAMINAR GERM DISC, NOTOCHORDAL PROCESS, NEURAL PLATE FORMATION

FOURTH WEEK OF LIFE: FORMATION OF NEURAL TUBE, NEUROPORES DEVELOPMENT OF NEURAL CREST PLACODES

DERIVATIVES OF NEURAL TUBE, NEURAL CREST AND PLACODE

NEURAL TUBE: FOREBRAIN, MIDBRAIN AND HIINDBRAIN
SPINAL CORD
CAVITIES OF THE BRAIN AND SPINAL CORD

NEURAL CREST: GIVES RISE TO SENSORY AND AUTONOMIC GANGLIA

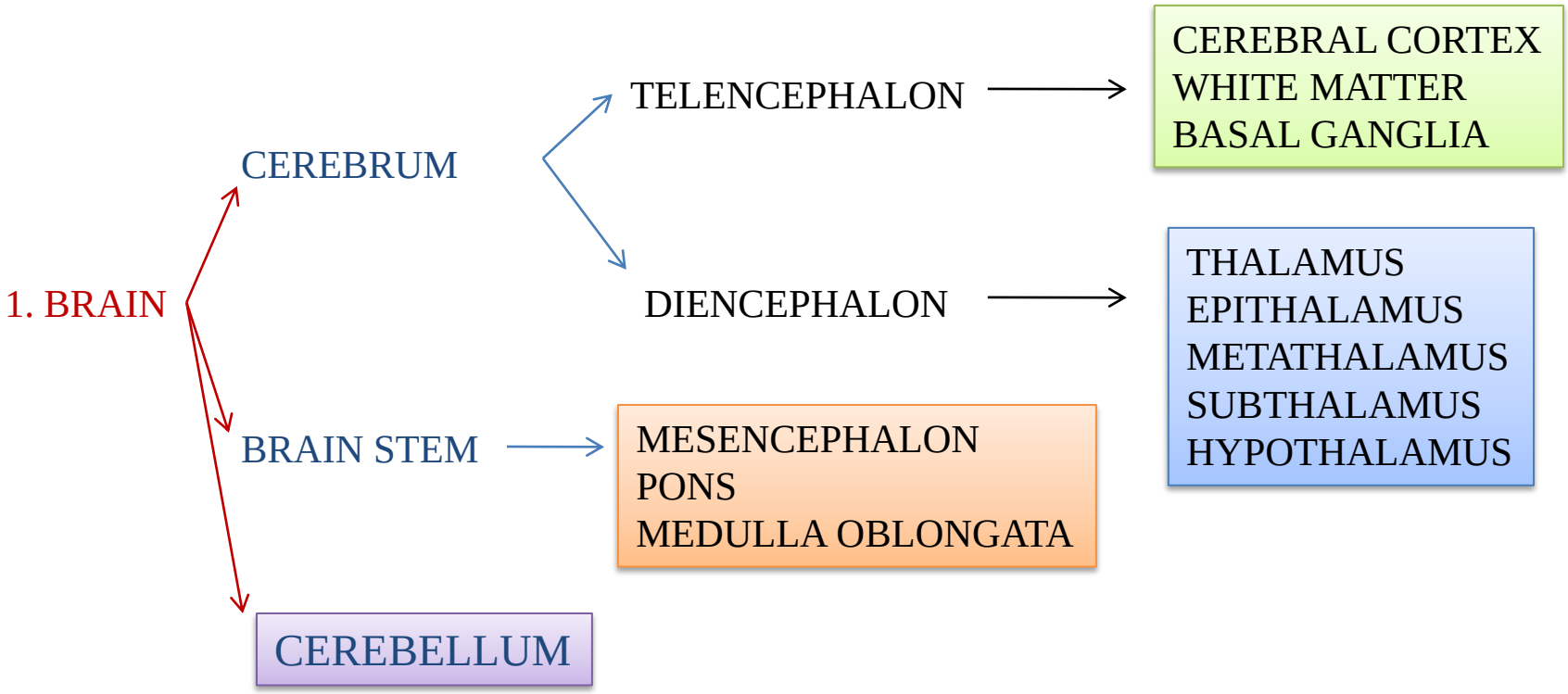
PLACODES: THICKENINGS OF THE ECTODERM IN THE HEAD REGION RESULTING IN NASAL, LENS AND OTIC PLACODES

MAIN CELLULAR CONSTITUENTS OF THE NERVOUS SYSTEM

I. NEURONS

II. GLIAL CELLS: FIBROUS ASTROCYTE
PROTOPLASMIC ASTROCYTE
OLIGODENDROCYTE
MICROGLIA
EPENDYMA

CENTRAL NERVOUS SYSTEM (CNS)



NUCLEUS: CLUSTERING NEURONS IN THE CNS

PERIPHERAL NERVOUS SYSTEM (PNS)

STRUCTURAL UNITS	FUNCTIONAL TYPES OF NERVES
CRANIAL NERVES: I-XII	SOMATO-MOTOR
SPINAL NERVES: 31 PAIRS	SOMATO-SENSORY
SENSORY GANGLIA	VISCERO-MOTOR
AUTONOMIC (VEGETATIVE) GANGLIA	VISCERO-SENSORY

GANGLION: CLUSTERING NEURONS IN THE PNS

COMMON FEATURES OF BRAIN AND SPINAL CORD

PROTECTED BY BONES: SKULL AND VERTEBRAL COLUMN

INVESTING MEMBRANES: DURA MATER, ARACHNOID, PIA MATER
SUBARACHNOID SPACE

SURROUNDED BY A LIQUID COMPARTMENT: CEREBROSPINAL FLUID (CSF)

SPECIAL SHAPE AND SURFACE ANATOMY

COMPOSED BY GRAY AND WHITE MATTERS

CONTAIN CAVITIES INSIDE: BRAIN VENTRICLES, CEREBRAL AQUEDUCT, CENTRAL CANAL

ESTABLISH MULTIPLE CONNECTIONS WITH EACH OTHER

COMMUNICATE WITH THE INTERNAL AND EXTERNAL ENVIRONMENTS

CHARACTERISTICS OF THE BRAIN

CEREBRAL CORTEX

NEOCORTEX AND ALLOCORTEX
LOBES: FRONTAL, PARIETAL, OCCIPITAL, TEMPORAL, INSULAR
CONVOLUTED GYRI
FUNCTIONAL AND TOPOGRAPHICAL MAPS
HEMISPHERIC DOMINANCE

BASAL GANGLIA

PARTS: CAUDATE AND LENTIFORM NUCLEI, CLAUSTRUM, AMYGDALA
CONTRIBUTES TO THE CONTROL OF THE MOTOR SYSTEM
DYSFUNCTION: DYSKINESIA

THALAMUS

SUBCORTICAL, NUCLEAR COMPLEX RELAYING MOTOR, SENSORY AND LIMBIC INFORMATION TO THE CORTEX

CHARACTERISTICS OF THE BRAIN

HYPOTHALAMUS

NEUROSECRETORY CAPACITY
CONTROLS THE PITUITARY-ENDOCRINE AXES AND AUTONOMIC FUNCTIONS

BRAIN STEM

REGULATES FUNCTIONS OF CRANIAL NERVES III-XII
EXERTS CONTROL OVER THE CRANIAL PART OF THE PARASYMPATHETIC SYSTEM
HOSTS MONOAMINERGIC AND PEPTIDERGIC CELL GROUPS OF THE AROUSAL SYSTEM
CONTAINS VITAL CIRCULATORY AND RESPIRATORY CENTERS
ENSURES OUTFLOW OF CSF TO THE SUBARACHNOID SPACE

CEREBELLUM

DERIVATIVE OF THE METENCEPHALON
2 HEMISPHERES
VESTIBULOCEREBELLUM, SPINOCEREBELLUM, PONTOCEREBELLUM
COORDINATES DURATION, EXTENT AND FORCE OF MUSCLE CONTRACTION

FEATURES OF THE SPINAL CORD

COLUMNAR SHAPE WITH 2 ENLARGEMENTS
SEGMENTED: 8 CERVICAL, 12 THORACIC, 5 LUMBAR, 5 SACRAL, 1-2 COCCYGEAL
GRAY MATTER ORGANIZED IN COLUMNS
WHITE MATTER DIVIDED INTO FUNICULI
STRUCTURE OF THE SPINAL SEGMENT AND SPINAL NERVES:

1. SPINAL CORD SEGMENT
2. VENTRAL ROOT FIBERS (MOTOR FUNCTIONS)
3. DORSAL ROOT FIBERS + DORSAL ROOT GANGLION (SENSORY FUNCTIONS)
4. SPINAL NERVE
5. DORSAL RAMUS
6. VENTRAL RAMUS

SPINAL REFLEXES
SPINAL INJURIES

PERIPHERAL NERVOUS SYSTEM: THE SOMATIC PART

CRANIAL AND SPINAL NERVES CARRY SOMATOMOTOR AND SOMATOSENSORY FIBERS

SOMATOMOTOR NERVES INNERVATE SKELETAL MUSCLES

THE LOWER MOTONEURONS AND THE INNERVATED STRIATED MUSCLE FIBERS FORM MOTOR UNITS THAT EXECUTE THE ACTIVE MOVEMENTS

THE COMPLEX UPPER MOTONEURON SYSTEM CONTROLS THE LOWER MOTONEURONS

SOMATOSENSORY FIBERS ARE ASSOCIATED WITH SENSORY GANGLIA

GANGLION CELLS HAVE PERIPHERAL AND CENTRAL PROCESSES

THE PERIPHERAL PROCESS COMMUNICATES WITH SPECIAL RECEPTORS THAT PICK UP STIMULI FROM THE INTERNAL AND EXTERNAL ENVIRONMENTS

THE CENTRAL PROCESS FORWARDS THE INFORMATION TOWARD SENSORY CENTERS OF THE CENTRAL NERVOUS SYSTEM

PERIPHERAL NERVOUS SYSTEM: THE VISCERAL PART

THE ORGAN SYSTEMS ARE CONTROLLED BY THE AUTONOMIC NERVOUS SYSTEM

IT HAS TWO WINGS: THE SYMPATHETIC AND PARASYMPATHETIC PARTS

ACTIONS OF THE PARASYMPATHETIC SYSTEM CONSERVE ENERGY FOR THE BODY

THE SYMPATHETIC SYSTEM UTILIZES THE STORED ENERGY FOR EMERGENCY AND COUNTERACTS ACUTE CHALLENGES AFFECTING THE BODY

PARASYMPATHETIC CENTERS ARE LOCATED IN THE BRAIN STEM AND THE CAUDAL, SACRAL PART OF THE SPINAL CORD

SYMPATHETIC CENTERS ARE DISTRIBUTED IN THE THORACO-LUMBAR SEGMENTS OF THE SPINAL CORD

THE AUTONOMIC OUTFLOWS DO NOT INNERVATE DIRECTLY THE TARGET ORGANS, VEGETATIVE GANGLIONS ARE INTERPOSED THAT RELAY THE CENTRAL INFORMATION