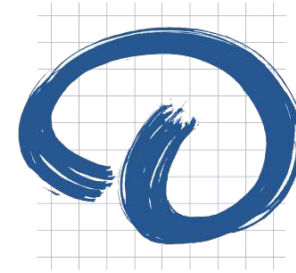


Basics of Neurobiology: Quo vadis-Neurobiology?



Pázmány Péter Catholic University
Faculty of Information Technology and
Bionics

Hungarian Academy of Sciences
Institute of Experimental Medicine

Department of Neuroscience

Prof. Zsolt Liposits

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ARS POETICA

The complexity of components has reached a level, where **their utilization overpasses the architectural capabilities of artificial systems** developed so far and requires solutions **applied also by nature**.

The development of **neurosciences and genetics** have reached a level where the exactness of models allows us creating **neuromorphic or nature inspired systems** and the application of the knowledge about our cognitive properties as a communicator and consumer of information becomes possible.

As a consequence of the “**sensory revolution**” **cheap artificial sensing arrays and activating devices** provide for acquiring an incredibly rich information base of the **spatial-temporal reality** that surround us, and at the same time require the **immediate processing of millions of analogue signals**.

The biomedical industry needs and uses the latest achievements of information technologies, including **noninvasive imaging devices and systems**, it also calls for the reliable interaction between electronics and living cells.

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ARS POETICA

The limits of classical microelectronic components have been reached; the **nanotechnologies** have appeared in information processing both for **artificial as well as for living systems**.

The emergence of cheap, broadly used and global mobile telecommunication services enables the application of **tele-presence** in broad scale.

The expansion of the European Union and the globalization of division of labor increased the **importance of human language technologies** in the variety of languages.

In order to face the above challenges our students need:

- a new structure of multidisciplinary studies
- a good theoretical formation via the effective application of information technologies
- specializations that are based on well-founded theoretical knowledge
- a skill based training, included from the start of the program

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SYNTHESIS OF LIFE SCIENCE DISCIPLINES

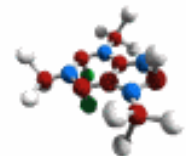
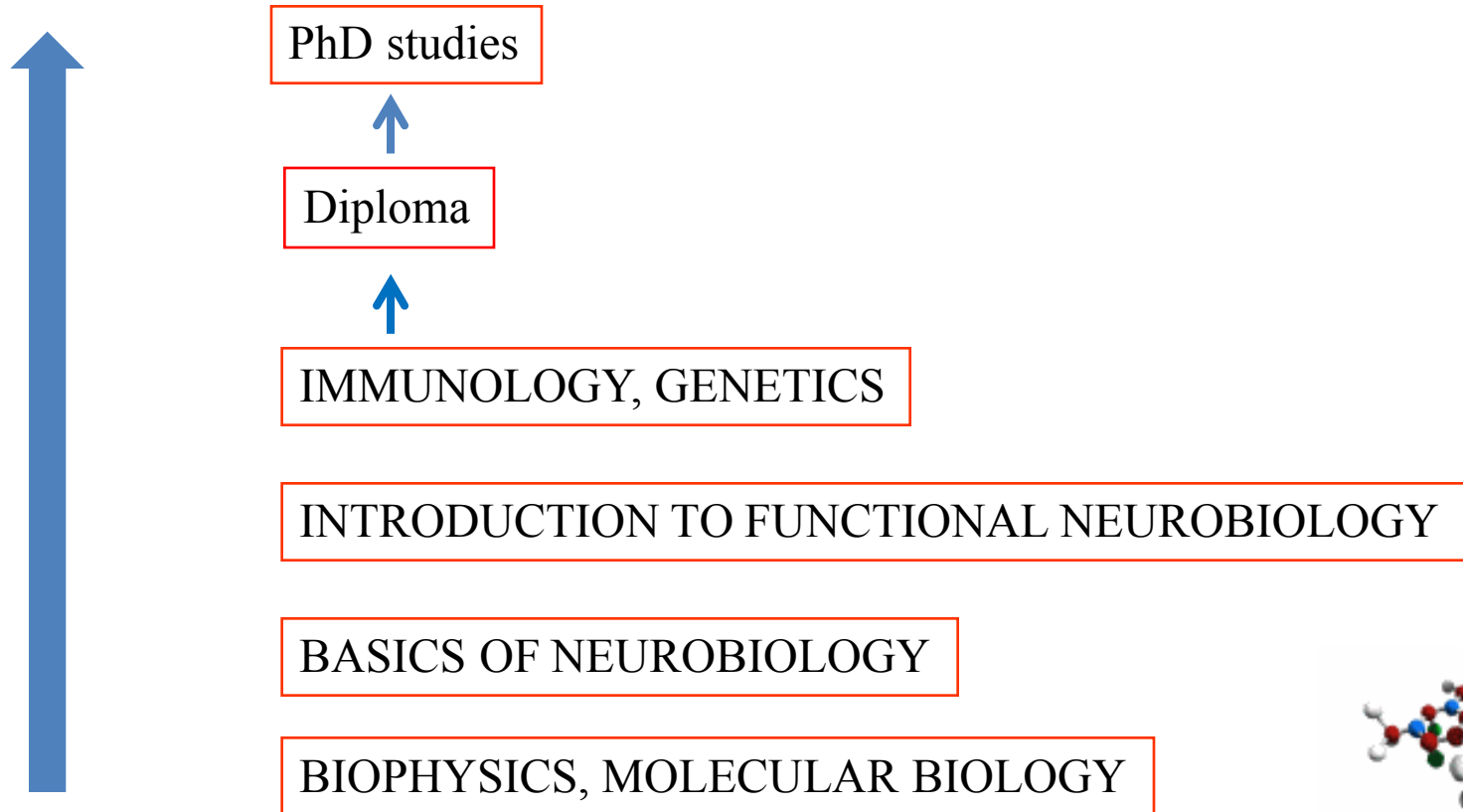


MATHEMATICS
PHYSICS
MICROELECTRONICS
INFORMATION TECHNOLOGY
COMPUTING
PROGRAMING

BIOCHEMISTRY
MOLECULAR BIOLOGY
NEUROBIOLOGY
NEURONAL NETWORKS
SYSTEM BIOLOGY
MODELLING

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RECOMMENDED COURSES AND STUDIES



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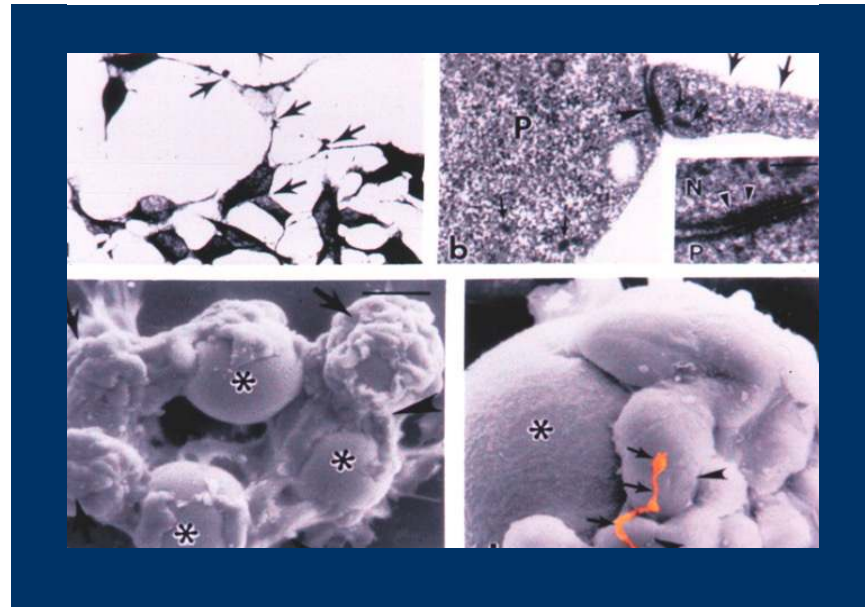
LECTURES OF THE COURSE

1. Quo vadis-Neurobiology?
2. Organ systems
3. Organization of the nervous systems
4. The cell
5. Cell organelles I.
6. Cell organelles II.
7. Nervous tissue
8. The neuron
9. Nerve fibers
10. The neuroglia
11. Nerve endings
12. Synaptic communication
13. Neurotransmitters I.
14. Neurotransmitters II.



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- 15. Release of neurotransmitters
- 16. Ionotropic receptors
- 17. Metabotropic receptors
- 18. Neurodegeneration
- 19. Development of the nervous system
- 20. Spinal cord
- 21. Internal structure of the spinal cord
- 22. Tracts of the spinal cord
- 23. Stretch reflex
- 24. The flexor and autonomic reflexes
- 25. Brain stem
- 26. Structure of cerebellum
- 27. Networking of cerebellum
- 28. Organization of the brain stem
- 29. Networking of brain stem



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30. Cranial nerves

31. Diencephalon

32. Divisions of the telencephalon

33. Cytoarchitecture of cerebral cortex

34. Sensory systems

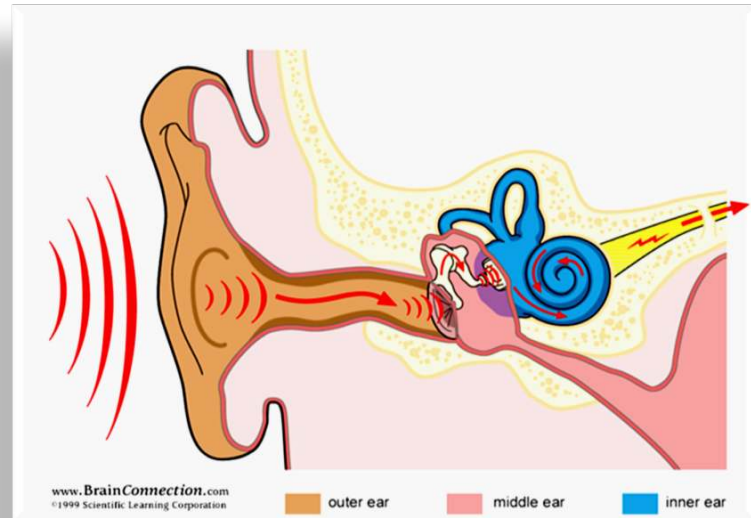
35. Motor systems

36. Hippocampal formation

37. Olfactory system

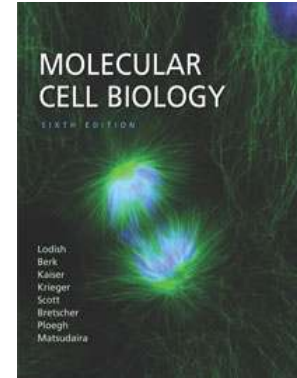
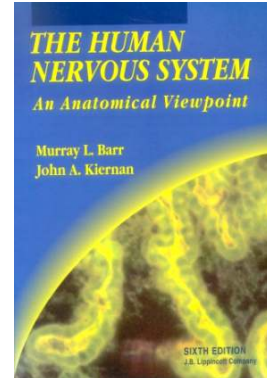
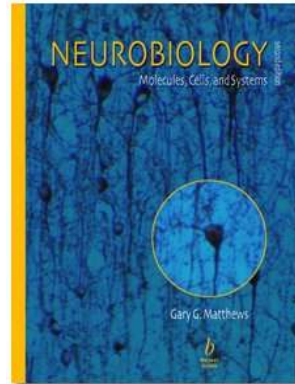
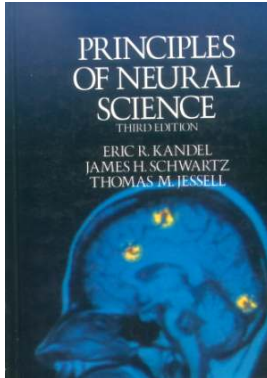
38. Visual system

39. Cochlear and vestibular systems



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RECOMMENDED TEXTBOOKS



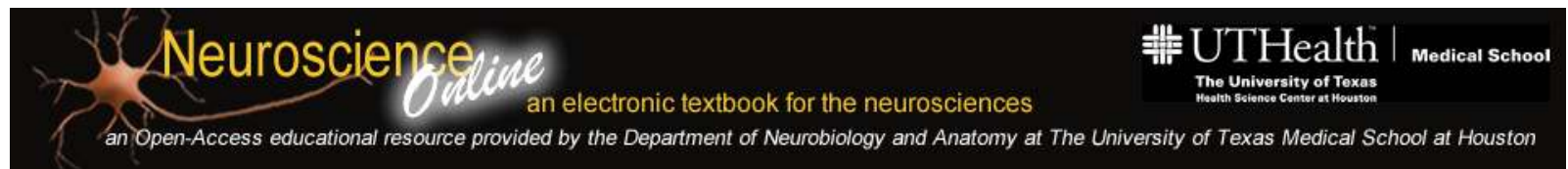
PRESENCE AT LECTURES AND PRACTICES is COMPULSORY!

FINAL EXAM

- | | |
|---|----------------|
| 1. Written exam at the end of the semester: | max. 70 points |
| 2. Written mid-term exam: | max. 15 points |
| 3. Activity at the practicals: | max. 15 points |

Receiving signature of the semester: mid-term exam + practicals = 15 points

ONLINE NEUROSCIENCE



<http://neuroscience.uth.tmc.edu/toc.htm>

LINKS FOR HANDOUTS AND LITERATURE

1. Source of handouts, recommended scientific literature

<http://neurobiologia.itk.ppke.hu>

2. Source of scanned textbook chapters

<http://neurobiologia.itk.ppke.hu>

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„Scientia et conscientia”

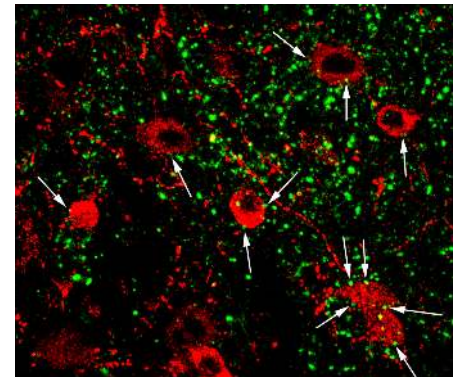
WAYS OF LEARNING

1. GENUINE INTEREST, HIGH MOTIVATION
2. ACTIVE PRESENCE AND PARTICIPATION
3. WORKING = LEARNING
4. CONTINUOUS LEARNING
5. ANALYSIS OF CAUSE AND ITS IMPACT
6. ABSTRACTION
7. REALIZE YOUR SCIENTIFIC DREAMS
8. RAISE QUESTIONS, WORK IN AN INTERACTIVE MANNER
9. BIOLOGICAL EVENTS ARE PLASTIC/DYNAMIC IN NATURE
10. STRUCTURE-FUNCTION-MODELLING-TRANSLATION-INNOVATION
11. 3D APPROACH AND PERSPECTIVE OF BIOLOGICAL STRUCTURES
12. LEARN FROM TEXTBOOKS AND USE PUBMED <http://ncbi.nlm.nih.gov/pubmed>

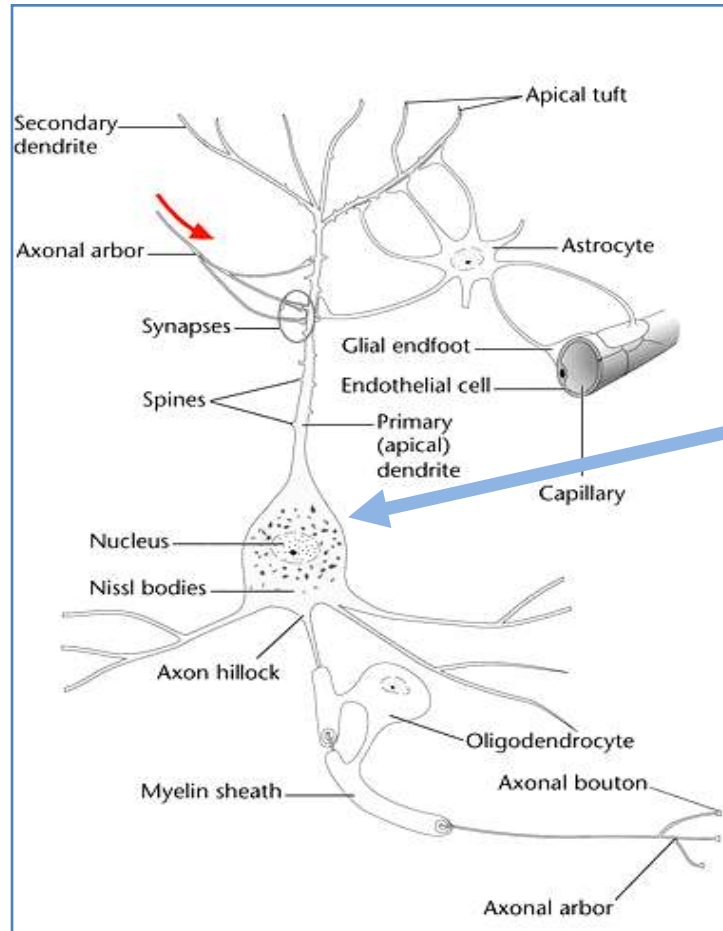
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CONTEMPORARY RESEARCH METHODS OF NEUROBIOLOGY

1. CLONING
2. GENETIC ENGINEERING
3. GENE EXPRESSION PROFILING
4. QUANTITATIVE REAL-TIME POLYMERASE CHAIN REACTION (PCR)
5. PROMOTER ASSAYS
6. DNA, RNA AND PROTEIN MEASUREMENTS
7. IMMUNOCYTOCHEMISTRY
8. CONFOCAL LASER MICROSCOPY
9. 2-PHOTON LASER MICROSCOPY
10. RADIOIMMUNOASSAY
11. PATCH CLAMP ELECTROPHYSIOLOGY
12. *IN VIVO* ELECTROPHYSIOLOGY
13. IMAGING AND RECONSTRUCTION TECHNIQUES
14. MONITORING OF BEHAVIOR

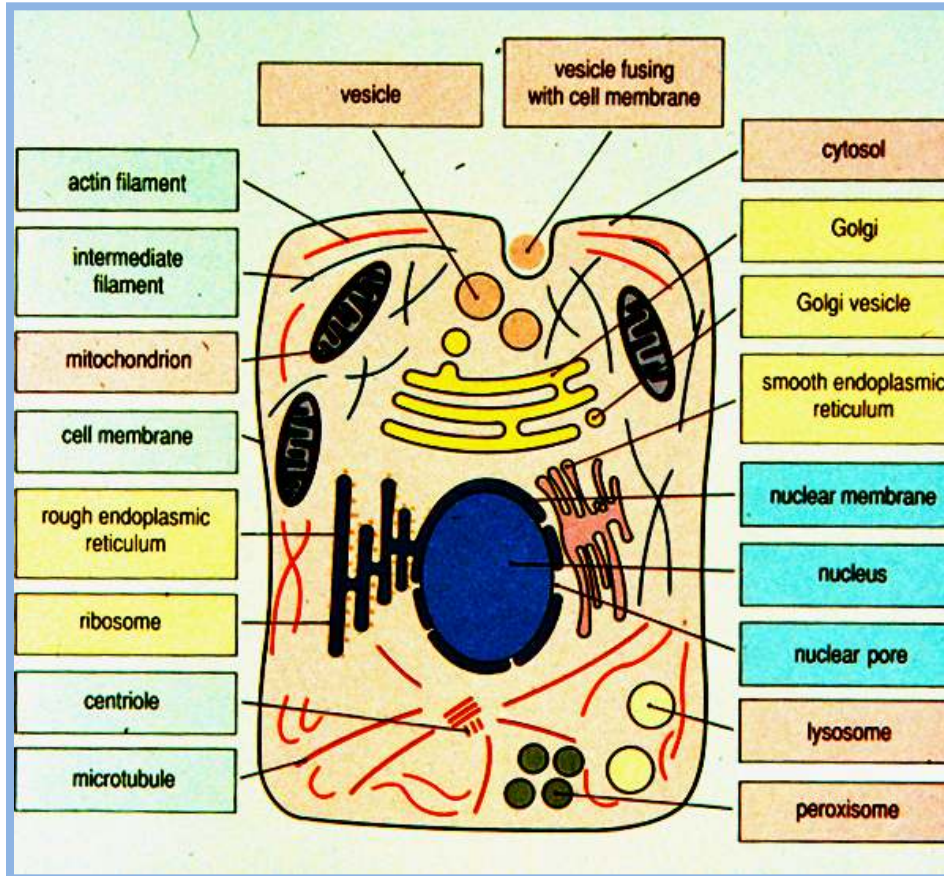


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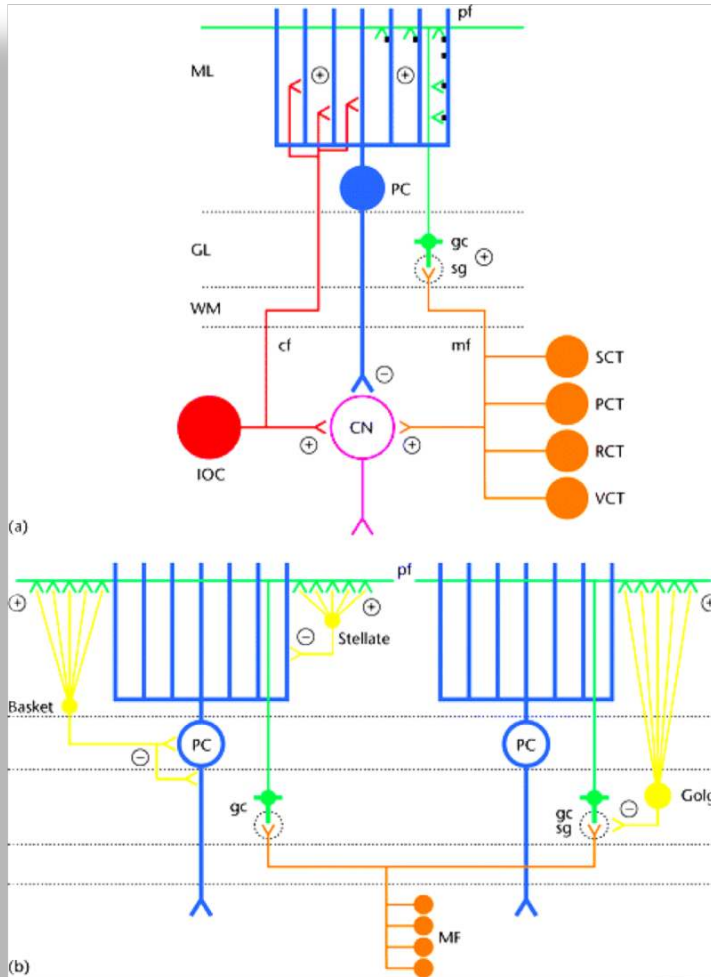
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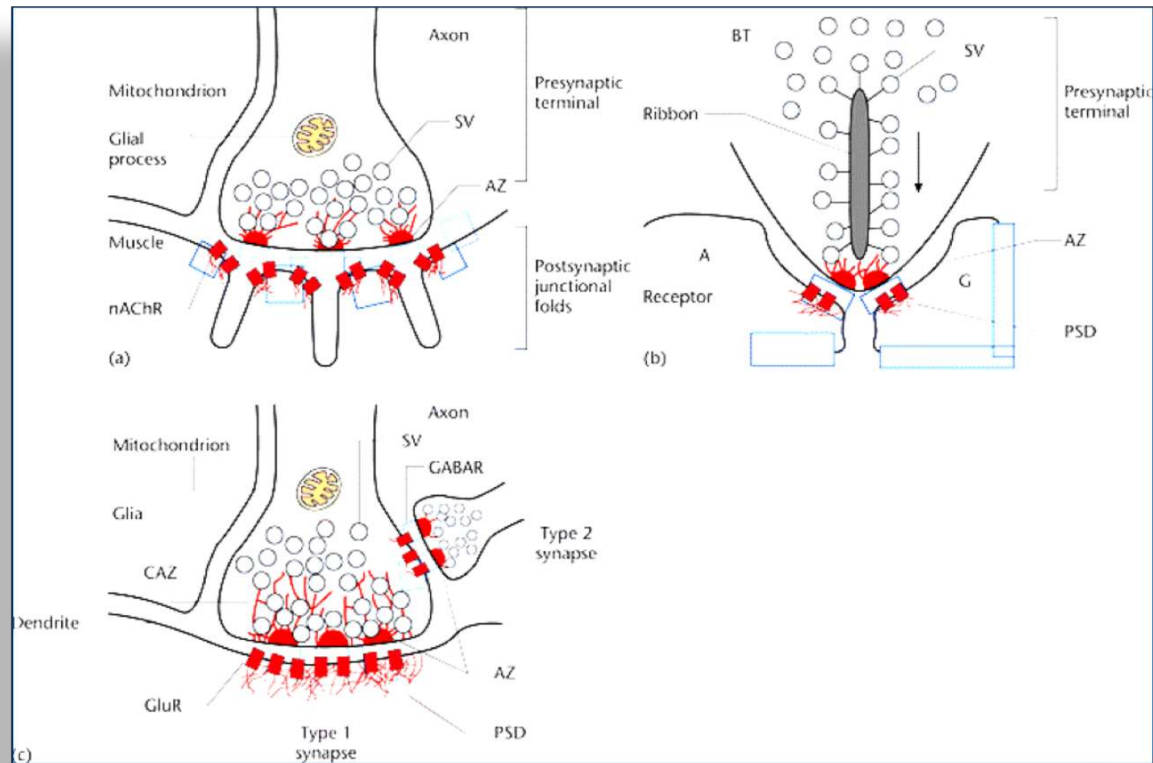
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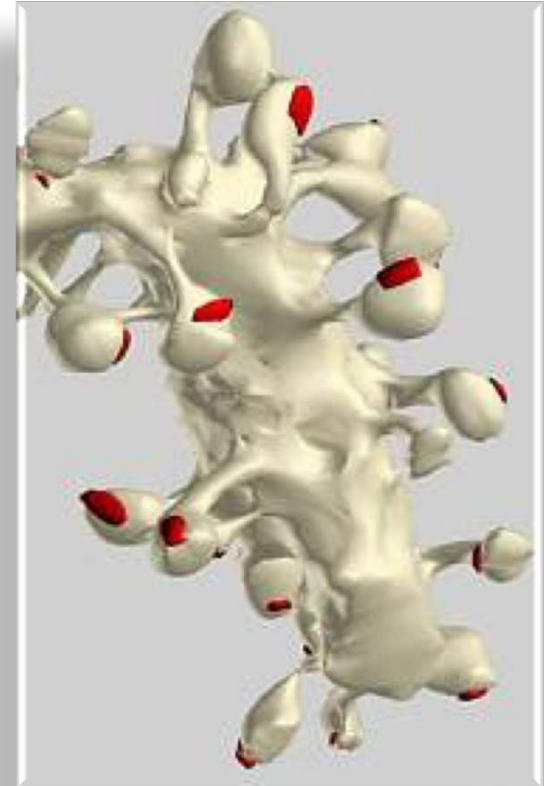
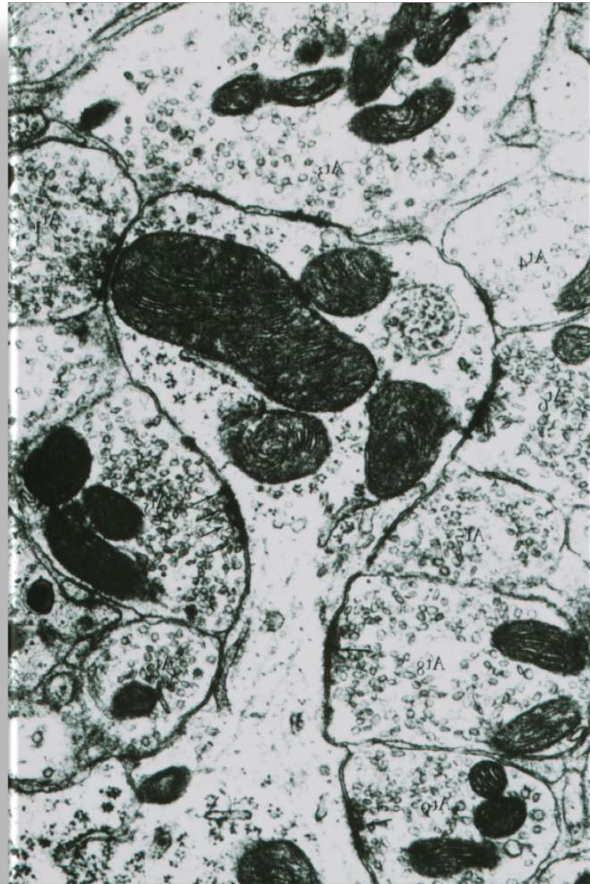
NETWORKING

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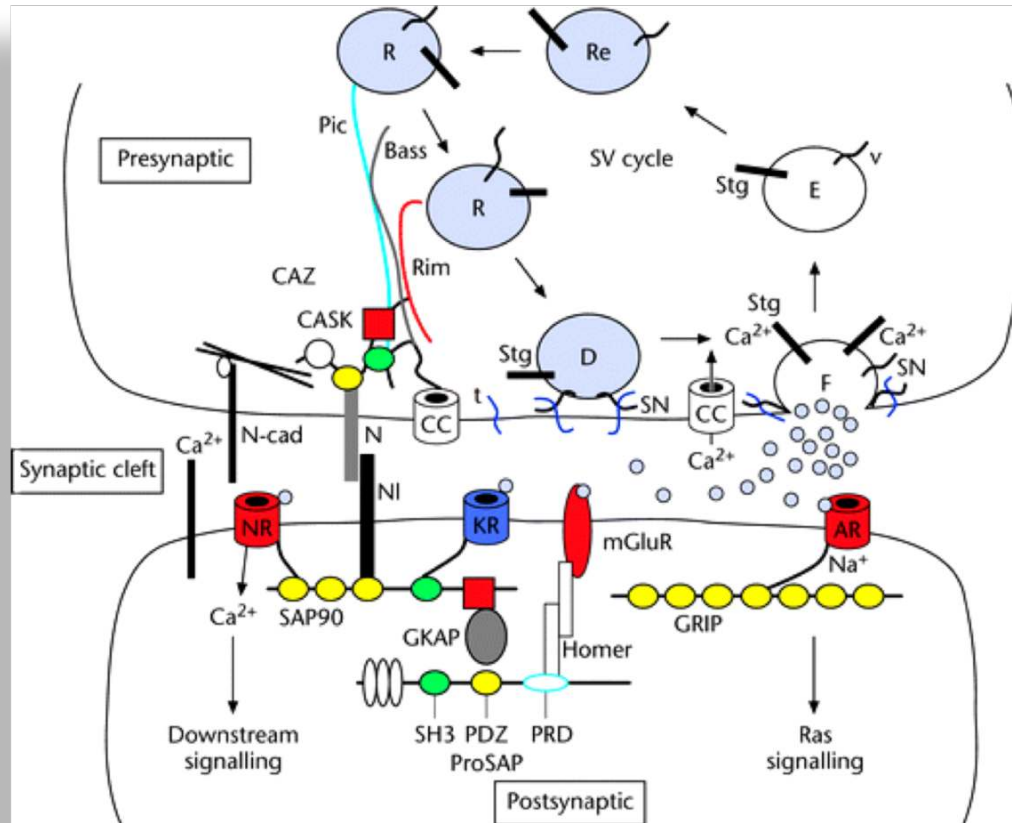
COMMUNICATION



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INFORMATION TRANSFER



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