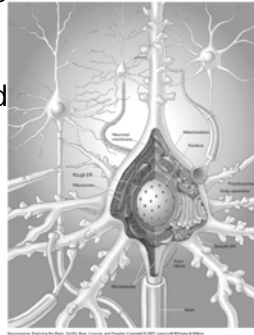
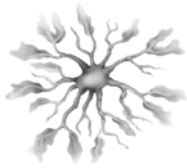


# Bear: Neuroscience: Exploring the Brain 3e

## Chapter 02: Neurons and Glia



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## Introduction

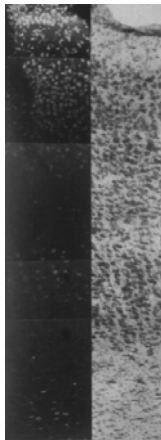
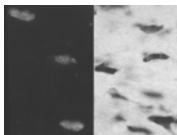
- ◆ “Neurophilosophy”
  - ◆ Brain is the origin of mental abilities
- ◆ Glia and Neurons
  - ◆ Glia: Insulates, supports, and nourishes neurons
  - ◆ Neurons
    - ◆ Process information
    - ◆ Sense environmental changes
    - ◆ Communicate changes to other neurons
    - ◆ Command body response

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## The Neuron Doctrine

- ◆ Histology
  - ◆ Study of tissue structure
  - ◆ The Nissl Stain
    - ◆ Facilitates the study of cytoarchitecture in the CNS

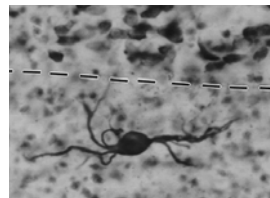
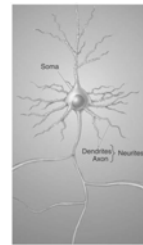


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## The Neuron Doctrine

- ◆ Golgi-stain shows two parts of neurons:
  - ◆ Soma and perikaryon
  - ◆ Neurites: Axons and dendrites



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## The Neuron Doctrine

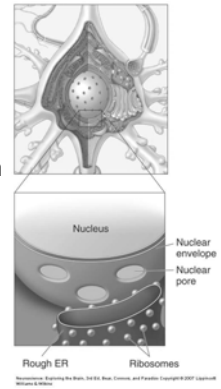
- ◆ Cajal's Contribution
  - ✦ Neural circuitry
  - ✦ Neurons communicate by contact, not continuity
- ◆ Neuron doctrine
  - ✦ Neurons adhere to cell theory

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## The Prototypical Neuron

- ◆ LOTS
  - ✦ Rough Endoplasmic Reticulum (ER)
    - ✦ Major site for protein synthesis
  - ✦ Free ribosomes
  - ✦ Polyribosomes

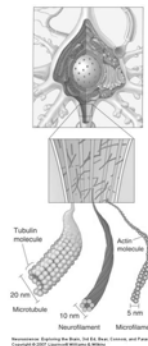


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## The Prototypical Neuron

- ◆ The Cytoskeleton
  - ✦ Not static
  - ✦ Internal scaffolding of neuronal membrane
  - ✦ Three "bones"
    - ✦ Microtubules
    - ✦ Microfilaments
    - ✦ Neurofilaments

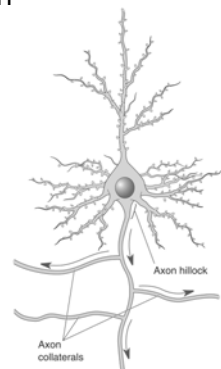


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## The Prototypical Neuron

- ◆ The Axon
  - ✦ Axon hillock (beginning)
  - ✦ Axon proper (middle)
  - ✦ Axon terminal (end)
- ◆ Differences between axon and soma
  - ✦ ER does not extend into axon
  - ✦ Protein composition: Unique

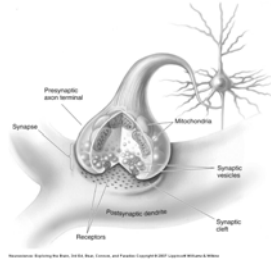


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## The Prototypical Neuron

- ◆ The Axon
  - ◆ The Axon Terminal
    - ◆ Differences between the cytoplasm of axon terminal and axon
      - ◆ No microtubules in terminal
      - ◆ Presence of synaptic vesicles
      - ◆ Abundance of membrane proteins
      - ◆ Large number of mitochondria

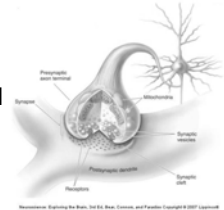


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## The Prototypical Neuron

- ◆ The Axon
  - ◆ Synapse
    - ◆ Synaptic transmission
    - ◆ Electrical-to-chemical-to-electrical transformation
    - ◆ Synaptic transmission dysfunction
      - ◆ Mental disorders

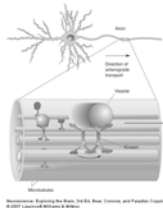


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## The Prototypical Neuron

- ◆ The Axon
  - ◆ Axoplasmic transport
    - ◆ Anterograde (soma to terminal) vs. Retrograde (terminal to soma) transport



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## The Prototypical Neuron

- ◆ Dendrites
  - ◆ “Antennae” of neurons
  - ◆ Dendritic tree
  - ◆ Synapse - receptors
  - ◆ Dendritic spines
    - ◆ Postsynaptic (receives signals from axon terminal)

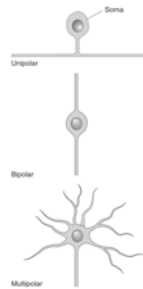


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## Classifying Neurons

- ◆ Classification Based on the Number of Neurites
  - ✦ Single neurite
    - Unipolar
  - ✦ Two or more neurites
    - Bipolar- two
    - Multipolar- more than two



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## Classifying Neurons

- ◆ Classification Based on Dendritic and Somatic Morphologies
  - ✦ Stellate cells (star-shaped) and pyramidal cells (pyramid-shaped)
  - ✦ Spiny or aspiny



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## Classifying Neurons

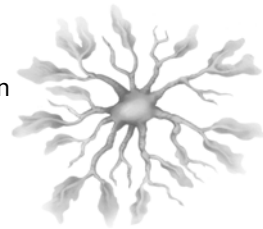
- ◆ Further Classification
  - ✦ By connections within the CNS
    - Primary sensory neurons, motor neurons, interneurons
  - ✦ Based on axonal length
    - Golgi Type I
    - Golgi Type II
  - ✦ Based on neurotransmitter type
    - e.g., - Cholinergic = Acetylcholine at synapses

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## Glia

- ◆ Function of Glia
  - ✦ Supports neuronal functions
- ◆ Astrocytes
  - ✦ Most numerous glia in the brain
  - ✦ Fill spaces between neurons
  - ✦ Influence neurite growth

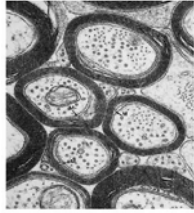


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## Glia

- ◆ Myelinating Glia
  - ✦ Oligodendroglia (in CNS) and Schwann cells (in PNS)
    - ✦ Insulate axons
  - ◆ Node of Ranvier
    - ✦ Region where the axonal membrane is exposed



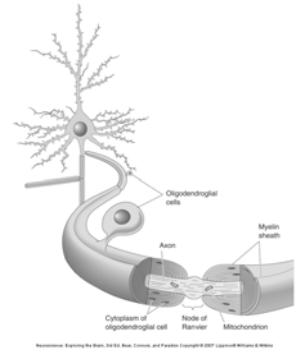
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## Glia

- ◆ Myelinating Glia (Cont'd)
  - ✦ Oligodendroglial cells
  - ✦ Node of Ranvier
- ◆ Other Non-Neuronal Cells
  - ✦ Microglia as phagocytes (immune)



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