

January 3rd, 2005

Two Issues at the Extreme of Neural Science:

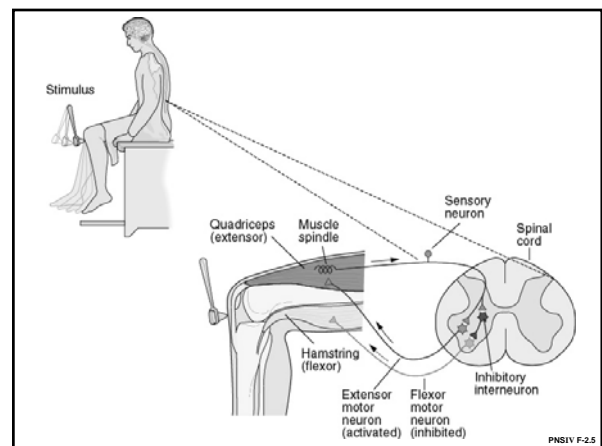
- The signaling properties of the individual neuron.
- How we move from understanding individual nerve cells to an appreciation of the highest human cognitive function: comprehension and expression of language.

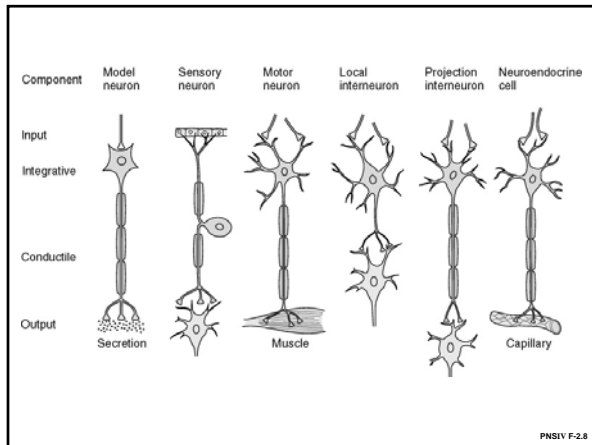
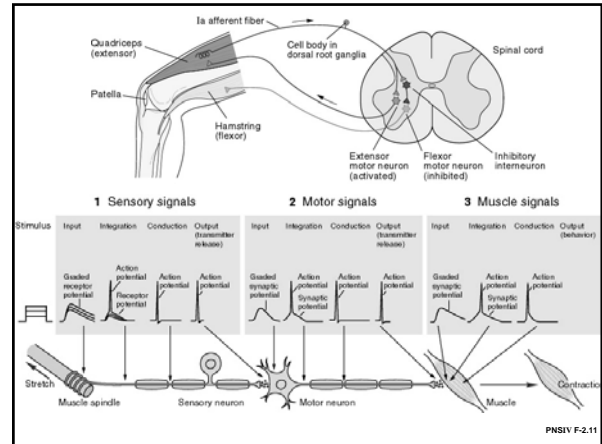
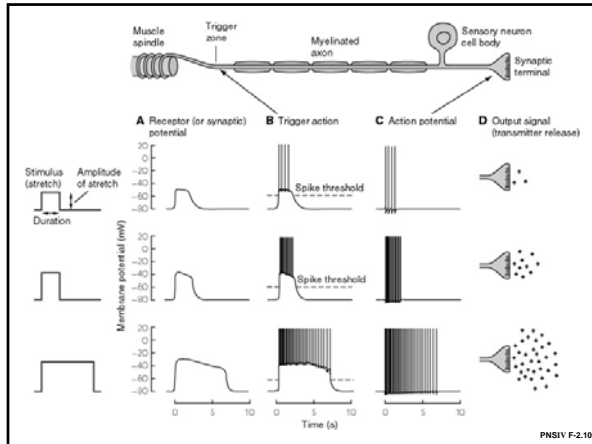
The Brain is Made Up of Two Types of Cells:

- 1) Neuroglial cells: the structural elements
- 2) Nerve cells: the signalling elements

Three Questions Related to Neural Signaling:

1. What types of electrical signals do neurons generate?
2. What is the function of each of the electrical signals?
3. Where within the neurons is each of these signals generated?





What makes the brain such a powerful integrating device is not that its constituent neurons are all that different but that rather that similar cells take on different functions because they are connected to each other and to the periphery in different ways.

Four Principles Underlying the Organization of the Brain

- The mechanisms whereby neurons produce their stereotyped actions.
- The ways neurons are connected together.
- The rules whereby different patterns of interconnections give rise to behavior.
- How the pattern of connections underlying a behavior is modified by experience.

From Nerve Cells to Cognitive Function

1. Human brain contains 10^{12} neurons.
2. A given behavior involves a large number of cells.
3. The Key Idea: Different aspects of function are represented in different brain regions and combinations of regions.
4. There are regions that represent the various peripheral sensory structures and regions that represent motor structures. Each of these is organized topographically. Thus, there are maps for perception and for action. As a result of these maps, we have internal representations of the outside world in the neural space of our brain. Therefore, we have a representation of knowledge. Basically similar neurons assume different functions because they are assigned to different regions and become interconnected in different ways.
5. This key idea that the brain is precisely organized was appreciated only recently: Holistic vs. localizationistic views of the brain.

