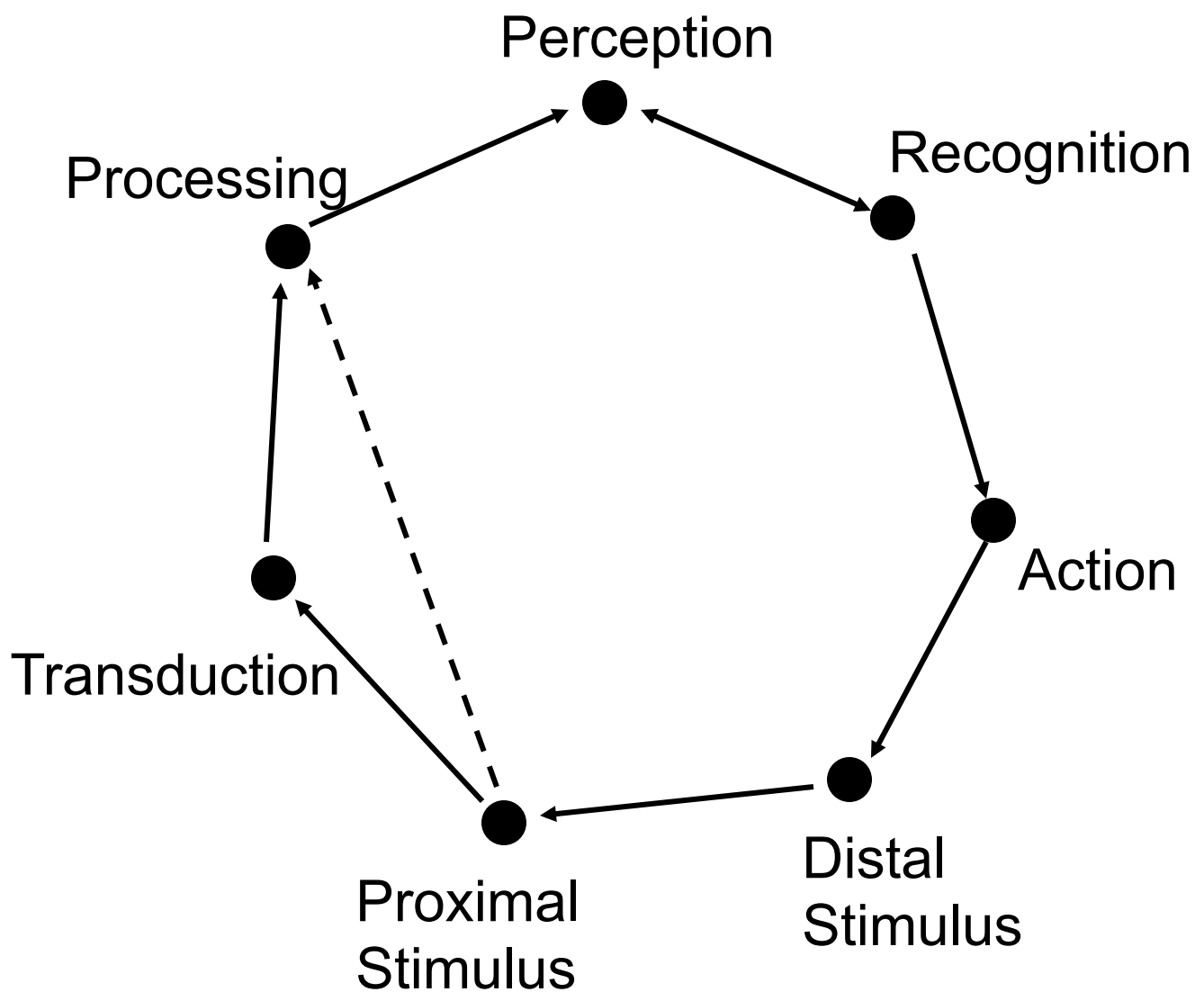


Neurophysiology Basics for Perception

- Perception is a complex process that starts with the **Distal Stimulus**
- Perception proceeds from the sensory receptors and involves attention and memory
- The outcome from perception is used as part of the process of recognition and leads to other mental processes or action
- All of these mental processes are based on the operation of brain mechanisms
- Understanding brain mechanisms increases our understanding of how perception and mental experience occur

The components of perception



Components of Perception - 2

As the diagram of the components makes clear, the process of perception leads to other mental processes. In turn, this can lead to action which changes the distal world and the proximal stimulus, which leads to changes in perception.

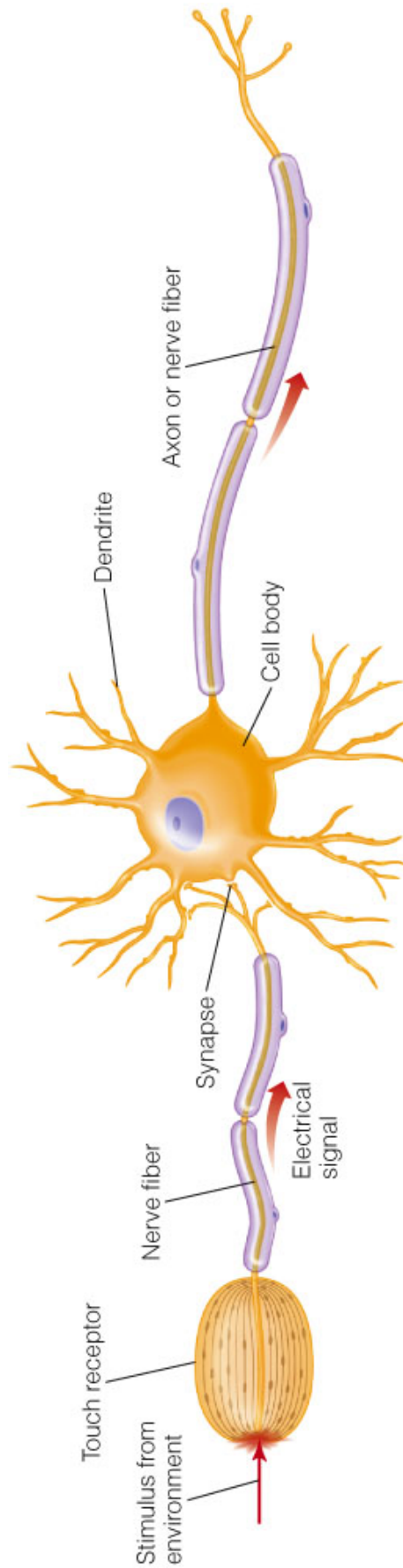
Even though we talk about perception as starting with the distal world, it is really a cycle.

In this section, we will focus on the part of the cycle that runs from proximal stimulus through processing.

Neurons

- Neurons are the building blocks of the brain
- Neurons operate by summing the input to them
- If the summed input exceeds their threshold, the neuron fires
- Each firing of a neuron generates an electrical pulse
- The electrical pulse travels down the axon and initiates activity in the synapse, connecting the neuron to other neurons
- Neural information processing is based on which other neurons a particular neuron is connected to and the rate of firing

Neuron



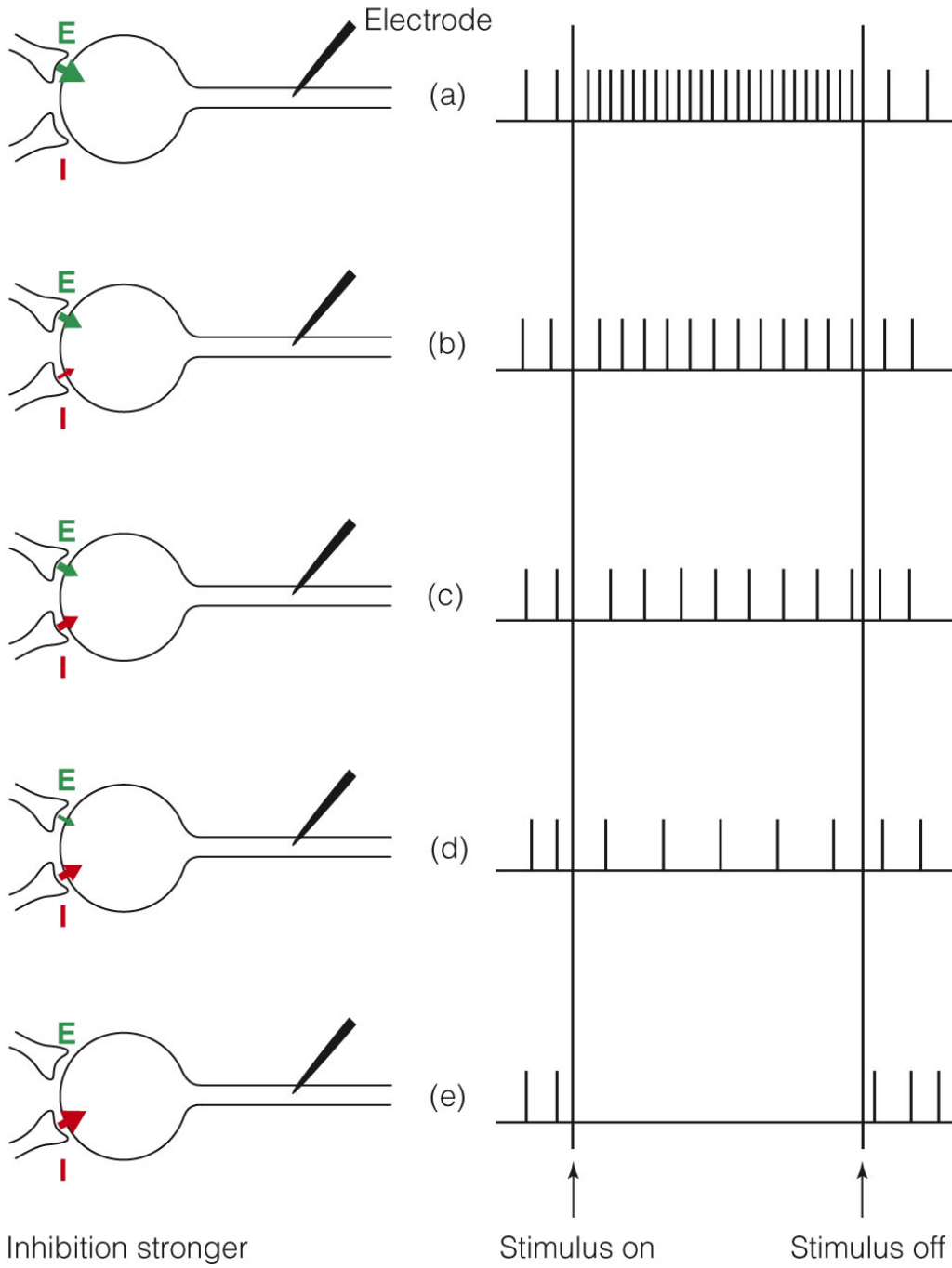
Nerve Cell Activity

Some basic aspects of nerve cells

1. Each cell has a “threshold” of input that must be met before it fires.
2. Most cells have a spontaneous firing rate.
3. When a cell fires, the magnitude of the electrical pulse is always the same.
4. The synaptic connection between cells can be positive (excitatory) or negative (inhibitory).

Thus, cells can convey information either by an increase or a decrease in their firing rate. The cell output is the “net” result of the excitation and inhibition that it receives.

Excitation stronger



Nerve Cell Activity (cont)

5. Once a neuron fires, it takes about 1 msec for the chemical balance in the cell to be restored. This is the refractory period and limits the firing rate of a neuron to 500 - 800 times per second.

Exception

Some sensory receptors work a little differently than nerve cells:

1. Their electrical activity is graded. Increase the magnitude of the stimulus to them and their electrical level goes up. They do not “fire” in the all or none way that neurons do.
2. Their input is not the neurotransmitter from another neuron but a form of energy or chemical interaction from the environment.

We'll deal with this in detail when we cover the receptors as a part of the individual sensory systems.

Nerve Cell Connections

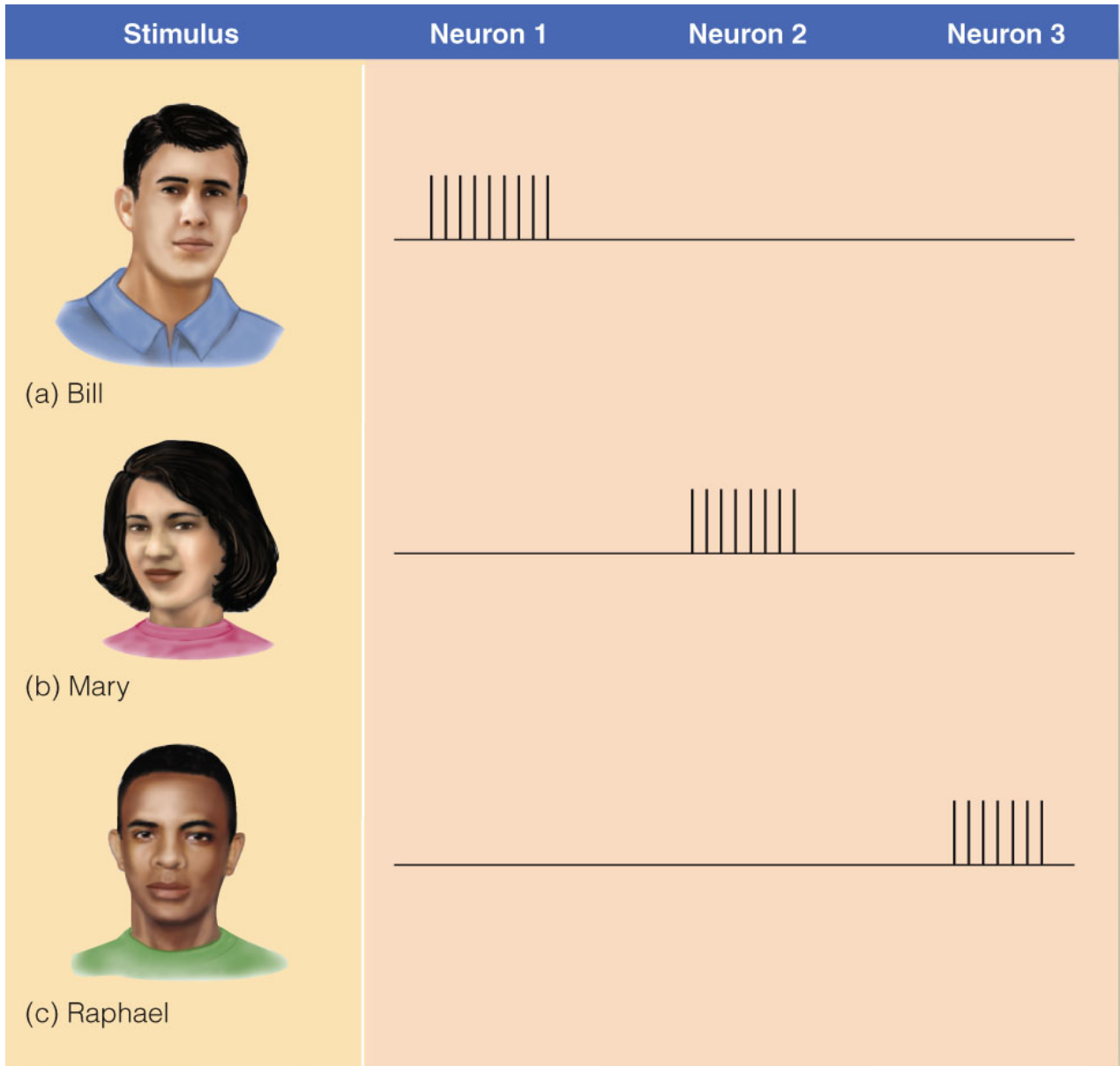
1. There are about 100 billion neurons
2. Neurons may receive input from a 1000 other neurons and transmit to (synapse on) a 1000 other neurons
3. Different regions of the brain are involved in different aspects of perception.
4. Neural information processing is based on:
 - a) The connections among neurons
 - b) Whether the connections are excitatory or inhibitory
 - c) The firing rate of each neuron

Implication

An object could be perceived or recognized because:

1. A different unique cell responds to each different input. This is *Specificity Coding*.
2. A different pattern of firing occurs across a large number of neurons for each different input: *Distributed Coding*.
3. A different pattern of firing occurs across a small number of neurons for each different input: *Sparse Coding*.

Specificity Coding Example



Distributed or Sparse Coding Example

