

## **Lecture 15 -- Central Representation of Touch -- Martin**

### **Sensations mediated**

- \*Touch/tactile
- \*Vibration and pressure (clinically important tests)
- \*Limb position sense
- \*All add up to stereognosia (ability to sense 3-D shapes of grasped objects without vision)

### **Dorsal column-medial lemniscal system**

Review of organization

### **Somatotopic organization**

- \*Preserves peripheral neighborhood relationships
- \*Why do we explore tactile surfaces with our finger tips, not our elbows?
- \*Distorted body map in postcentral gyrus
- \*What determines representational area for the various parts of the body?
- \*Receptor innervation density
- \*Receptive field overlap
- \*Distal to proximal gradient
- \*Importance of body map for stimulus localization and resolution

### **Receptive field structure: key properties for tactile acuity**

- \*Convergence of peripheral inputs onto neurons in the CNS
- \*Spontaneous activity
- \*Gradient of excitation
- \*Gradient of inhibition

Examples:

Resolution of Braille letters w/ and w/o inhibition  
Contrast enhancement

### **Other functions of inhibition**

Construction of complex receptive field structure  
Feature extraction  
Regulate subcortical transmission

### **Cortical columns, submodality representation, and cortical mechanisms for higher somatic sensory functions**

- \*Lamination of the cortex
- \*6 (more or less) layers
- \*Columnar organization
- \*Vertical (with respect to pial surface) array of neurons all receive input from single peripheral site and single receptor type
- \*Columns shaped more like slabs
- \*Primary somatic sensory cortex
  - Area 3a            deep input from VP nucleus
  - Area 3b            cutaneous input from VP nucleus
  - Area 1             cutaneous input from area 3b
  - Area 2             convergent inputs from areas 3a, 3b, and 1; especially deepEach area has body map
- \*Hierarchical and parallel connections within primary somatic sensory cortex for generating complex receptive fields (e.g, shape)

### **Elaboration of somatic sensory processing in higher-order sensory and association areas**

Different cortical layers project to different cortical and subcortical sites  
[Layer 1 has few neurons]  
Layers 2,3 to other cortical areas  
[Layer 4 is input layer]  
Layer 5 to basal ganglia, brain stem, and spinal cord  
Layer 6 to thalamus

**Relevant reading: chapter 23 in "Principles"**