Lecture 14 -- 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 deep
  Each 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"