NEOCORTEX
 1) excitatory cells (spiny--long range axons)
    --pyramidal (many subclasses)
    --spiny stellate (only in layer 4)
 2) inhibitory cells (no spines--local axons)
    --basket (large)
    --chandelier (small, synapse on pyramidal axons' initial seg)
    --double bouquet (very small, vertical)
    --clutch (very small)
 3) layers of the cortex
    --layer 1 (feedback input layer)
    --layers 2/3 (feedforward cortical output layer)
    --layer 4 (feedforward input)
    --layer 5 (descending output => striatum, SC, pontine nuc., spinal crd)
    --layer 6 (feedback output layer)

CEREBELLAR CORTEX
 1) input axons (excitatory)
    --mossy fibers from many sources
    --climbing fibers from inferior olive
 2) inhibitory
    --Purkinje (output cells => three deep cereb. nuc.)
    --basket, Golgi, stellate
 3) excitatory
    --granule cells (give off parallel fibers)

BASIC PARTS OF THE BRAIN
 1) spinal cord
    --dorsal horn (sensory)
    --ventral horn (motor)
 2) medulla
    --lateral half (sensory)
    --medial half (motor)
 3) pons
    --ditto
----
       the pons-midbrain junction
  (relative to body: crossed above, uncrossed below)
----
 4) midbrain
    --tectum ('roof': superior & inferior colliculus)
    --tegmentum ('floor': red nucleus, substantia nigra, midbrain retic. fm.)
 5) thalamus
    --epithalamus (e.g., habenula)
    --dorsal thalamus (e.g., dLGN)
    --ventral thalamus (e.g., subthalamic nucleus)
    --hypothalamus
 6) forebrain
    --pallium (neocortex, hippocampus, amygdala)
    --septum
    --basal forebrain (caudate/putamen, globus pallidus)

SOMATOSENSORY SYSTEM
 1) receptors
    --specialized distal ends of dorsal root ganglion cells
    --pain, cold, heat (free endings)
    --slowly adapting touch (Merkel, Ruffini)
    --rapidly adapting touch (Meissner, Pacinian)
    --muscle length (muscle spindles)
    --force exerted by muscle (golgi tendon organs)
 2) dorsal root ganglion cells => spinal cord, dorsal column nuclei
 3) spinal cord (dorsal horn)
    --spinocervical: spinal cord => lateral cervical nucleus
    --spinothalamic: spinal cord => posterior nuclei, intralaminar nuclei
 4) spinal cord (ventral horn)
    --pattern generators
    --motor neurons (synapse on muscles)
 5) dorsal column nuclei
    --cuneate nucleus (hand and upper body) => ventrobasal thalamus
    --gracile nucleus (foot and lower body) => ventrobasal thalamus
 6) principal sensory nucleus of the trigeminal (face)
    --also => ventrobasal thalamus
 7) ventrobasal thalamus (= VPL + VPM)
    --entire body reprensetation
    --projects to cortical areas 3b, 1, and 2
 8) intralaminar nuclei (in dorsal thalamus)
 9) cortical areas list
    --3a, 3b, 1, 2, 5, 7b, S-II, Ig, VS

AUDITORY SYSTEM--MAMMALS
 1) hair cells
    --separate receptor cells synapse on distal end of ganglion cells
 2) cochlear ganglion cells
 3) cochlear nuclei
    --posterior ventral (PVCN; branched endings)
    --anterior ventral (AVCN; calyces of Held)
    --dorsal (DCN)
 4) lateral superior olive (LSO)
 5) medial superior olive (MSO)
 6) dorsal and ventral periolivary nuclei
 7) medial nucleus of the trapezoid body (MNTB)
 8) nuclei of lateral lemniscus
    --dorsal (nLLd)
    --intermediate (nLLi)
    --ventral (nLLv)
 9) inferior colliculus
    --central nucleus (ICc)
    --external nucleus (ICx)
    --dorsal nucleus (ICd)
    --medial nucleus (ICm)
 10) medial geniculate complex
    --dorsal anterior (MGDA)
    --dorsal posterior (MGDP)
    --principal (MGP)
    --magnocellular (MGM--only non-tonotopic nucleus)
 11) cortical areas list
    --A-I, RL, CM, paAlt, A-II, Tpt, T1, T2, T3

AUDITORY BRAINSTEM--OWLS
 1) cochlear nuclei
    --nucleus angularis (NA; amplitude path--like mammalian PVCN)
    --nucleus magnocellularis (NM; time path--like mammalian AVCN)
    --there is nothing like DCN in birds
 2) nucleus laminaris (NL; time path--like mammalian MSO)
    --first binaural nucleus
    --detects interaural time differences; phase ambiguity

3) nuclei of the lateral lemniscus (VLVA, VLVP)
4) inferior colliculus
--ICc core (time pathway--characteristic delay columns; input from NL)
--ICc medial shell (amplitude pathway; input from VLVP)
--ICx (space map--time, amplitude converge; input from both parts of ICc)

AUDITORY CORTEX--BATS
1) DSCF area (doppler shift constant frequency)--in area A-I
--expanded representation around 60 kHz
--amplitude vs. frequency map
--detect size, texture of object
2) CF/CF area (const. freq./const. freq.)
--map of CF1 of outgoing vs. CF2,3 of echo
--detect relative velocity of target
--possible relation to formant perception in human speech
3) FM-FM area (freq. modulated-freq. modulated)
--map of monaural delays between FM1 of outgoing & FM2,3,4 of echo
--detect distance of object

VISUAL SYSTEM
1) retina
--photoreceptors (red, green, blue cones, rods)
--bipolar cells (ON, OFF, rod)
--ganglion cells
      midget or X-cells (ON and OFF types) => LGN parvo
      parasol or Y-cells (ON and OFF types) => LGN magno
      W cells => LGN, superior colliculus
      direction selective => pretectum
      thorn cells => superior colliculus
--horizontal cells (synapses with photoreceptors and bipolars)
--amacrine cells (synapses with bipolars and ganglion cells)
2) dorsal lateral geniculate nucleus (dLGN)
--magnocellar layers (Y input)
--parvocellular layers (X input)
3) input layers in area V1
--layer 4C-alpha (magno/Y input layer)
--layer 4C-beta (parvo/X input layer)
4) secondary stage layers in V1
--layer 4B (magno pathway)
--layer 3 blobs (parvo blob pathway)
--layer 3 interblobs (parvo interblob pathway)
5) area V2
--thick stripes (magno)
--thin stripes (parvo blob)
--interstripes (parvo interblob)
6) higher areas in magno pathways
--thick stripes => MT => MST => 7a
--other areas in magno pathway: V3, VIP, PO
7) higher areas in parvo pathways
--thin and interstripes => V4 => PIT => AIT
--other areas in parvo pathway: VP, CIT, TF
8) visual areas list
--main input areas: V1, V2
--'parietal' areas: V4t, V3A, MT, MST, FST, DP, PO, PIP, LIP, VIP, MDP
--'temporal' areas: VP, VOT, PITv, PITd, CITv, CITd, AIT, TF, TH

MOTOR SYSTEM
1) four main descending pathways

--reticulospinal
--vestibulospinal
--rubrospinal (crossed)
--corticospinal (crossed)
2) sensory info affecting motor outputs via the cerebellum
--sensory cortex => pontine nuclei
--pontine nuclei => (crossed) cerebellar cortex
--cerebellar cortex => deep cerebellar nuclei
--deep cerebellar nuclei => (crossed) red nucleus
--red nucleus => (crossed) spinal cord
         also
--deep cerebellar nuclei => ventrolateral thalamus (VL; not VPL!)
--ventrolateral thalamus => motor cortex
--motor cortex => (crossed) spinal cord
3) sensory info affecting motor outputs via the basal forebrain
--sensory cortex => caudate and putamen
--caudate and putamen => globus pallidus
         also: caudate and putamen <=> substantia nigra
--globus pallidus => ventrolateral thalamus
         also: globus pallidus <=> subthalamic nucleus
--ventrolateral thalamus => motor cortex
--motor cortex => (crossed) spinal cord
4) vestibulo-ocular reflex
--vestibular canals => vestibular nuclei => oculomotor neurons
5) optokinetic nystagmus
--retina => pretectal nuc. => vestibular nuclei => oculomotor nuc.
6) pursuit eye movements
--retina => LGN => visual cortex
--visual cortex => pontine nuclei
--pontine nuclei => flocculus
--flocculus => vestibular nuclei
--vestibular nuclei => oculomotor neurons
7) orienting eye movements (subcortical pathway)
--retina => superficial superior colliculus
--superficial superior colliculus => deep superior colliculus
--deep sup. colliculus, frontal eye fields => saccade patt. generators
--saccade pattern generators => oculomotor neurons
   (horizontal movement pattern generator is PPRF)
         (vertical movement pattern generator is riMLF)
8) orienting eye movements (parallel cortical pathway)
--retina => LGN => visual cortex
--visual cortex => frontal eye fields
--frontal eye fields => saccade pattern generators

LIMBIC SYSTEM
1) medial forebrain bundle axis
--septum <=> hypothalamus <=> limbic midbrain
2) hippocampus
--dentate gyrus (input from entorhinal)
--CA3 and CA1 (place cells; input from dentate gyrus)
--subiculum (connections with entorhinal and hypothalamus)
--entorhinal cortex (connections with tertiary cortex)
--postsubiculum (head direction cells; vestibular & visual input)
3) amygdala
--central nucleus (taste input)
--corticomedial amygdala (limbic connections)
--basolateral amydala (tertiary sensory cortex connections)