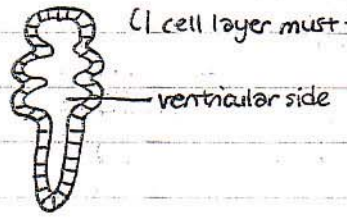
4/5/04

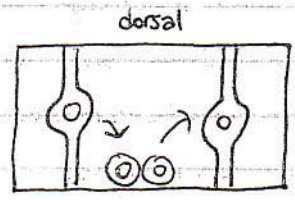
1. cell migration: neural tube → vesicles (single layer of epithelial columnar cells); have to migrate
   - in cortex (1 cell layer must form cortex)
   - in PNS (neural crest cells → entire PNS)



2. proneural genes & neurogenic genes
   (notch / delta pathway)

3. cell death (50% neurons die from apoptosis)

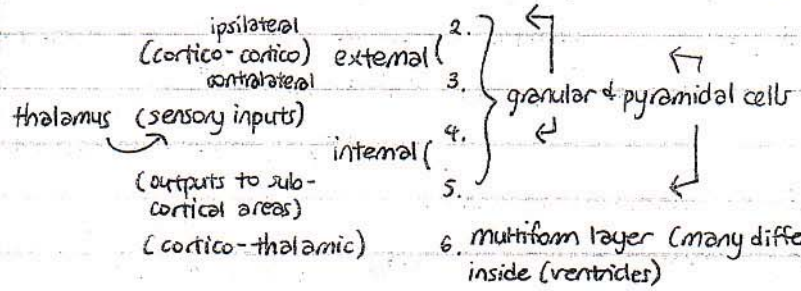
cortex cell migration:



cells attached to dorsal & ventral surfaces (8.5 day in mice)
- cells detach from surfaces down to ventral, divide, migrate back up, form D/V connections again

outside (pial layers)

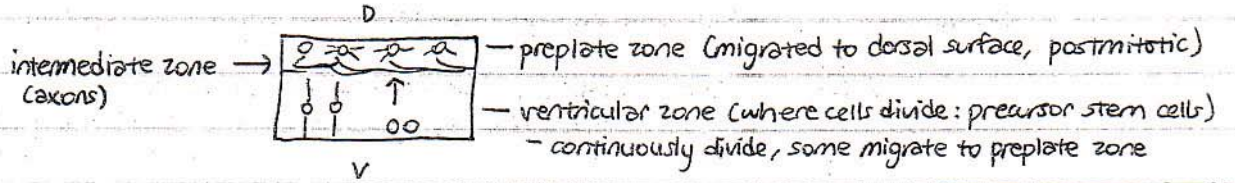
- must make 6 different layers: 1. molecular layer: many tracts



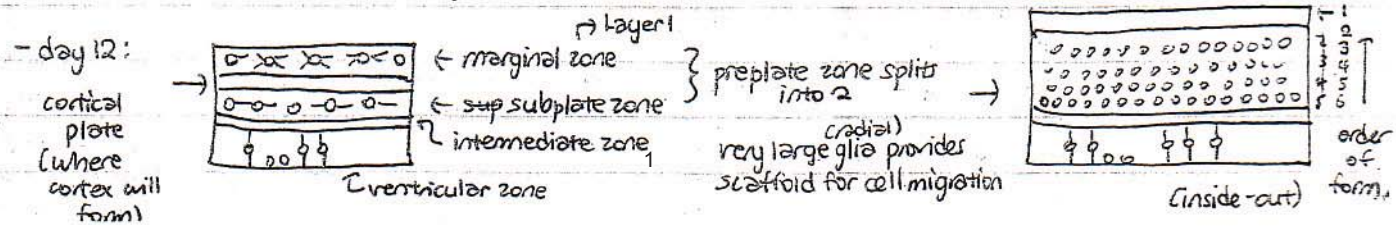
each layer acts as own functional unit

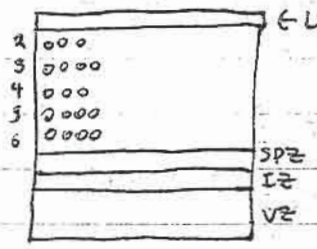
- in layer 4, visual & parietal areas have thick layer 4
- layer 5 in motor cortex very prominent (but little layer 4)

- day 10 in mice: formation of preplate zone (up to this point, dividing, pluripotent)



- day 12:

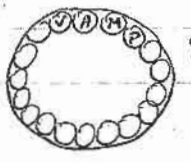




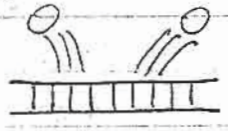
- if label layer cells w/ GFP, put back in VZ:
  - layer 6 cell from young animal w/ only 6, → migrates up to layer 2
  - w/ older animal, layer 2 ~~animal~~ put in young animal, cell migrates up to layer 2 (no longer able to form younger layer 6 neuron) : lost competence
  - take 6,5,4 animal, put in very old animal, can go up to layer 2 (layer 4 cell) ?
    (~~cell can't~~ young cell ~~can't~~ in old animal can redifferentiate
    old cell in young animal can't redifferentiate)

younger cells can assume older cell fates, but not vice-versa

- happens w/ cell migration throughout entire brain
  1. radial migration - cells born, migrate straight out ↕
     - cortex, hippocampus, cerebellum
       ↳ 6 layers 2 layers (but same principles: divide & migrate outward)
  2. mixed migration (radial & tangential) - retina, spinal cord ↔
     ↳ eg w/ SHH in ventral spinal cord?
  3. non-layered - in ganglia, eg, non-layered structure
     - diencephalon, brainstem



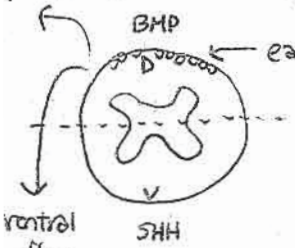
ganglion structure



start as layer, migrate into different nuclei

PNS cell migration:

- somatic & autonomic nervous systems
  ↳ spinal cord ↳ sympathetic, parasympathetic, enteric nervous systems



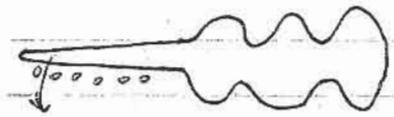
early formation of sensory neurons: neural crest cells (immediately migrate out: 2 paths, 1. ventral flow → PNS neurons, glia, 2. dorsal flow → melanocytes

adrenochromatin (EPI release,

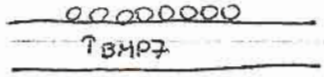
aorta secretes BMP7, turns into ? symp.

also neural crest cells here to form cranial neurons for sensory function

first: ventral stream
then: dorsal flow
(if take dorsal cell & put back in ventral stream



if take neuron from spinal cord, earlier, put in other part, will take on that fate (not later)
- can give BMPs to turn into neurons
- neuregulin → glia
- glucocorticoids → adrenal chromatin cells

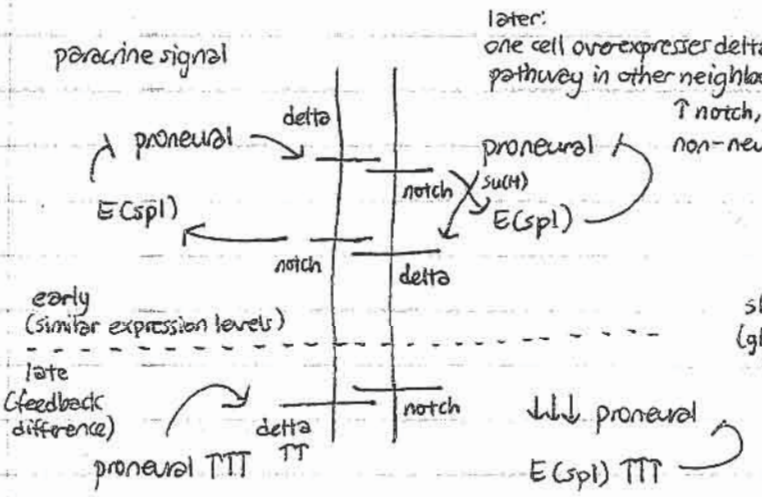


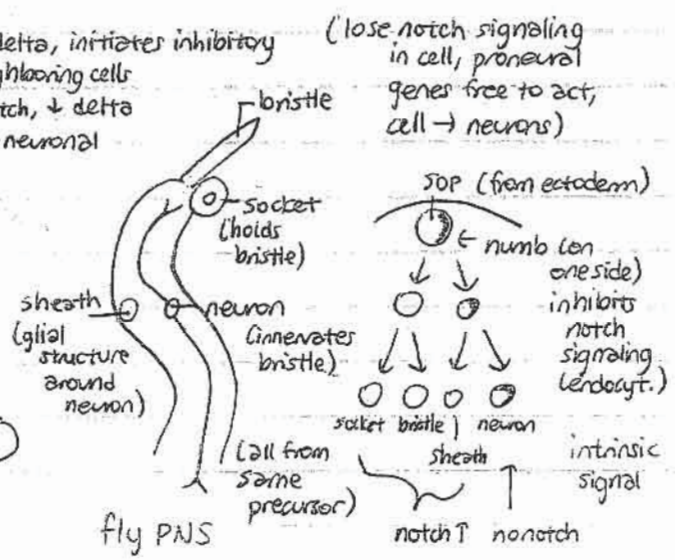
dorsal aorta releases BMP7, turns cells into sympathetic neurons

- dorsal root ganglia evenly spaced along spinal cord: cord divided, caudal nonpermissive for migration, cluster rostrally
- ephrins expressed by neural crest cells, ligand for ephrin receptors ~~on~~ expressed by rostral region? region?, repels to push out neural crest cells to certain regions (caudal): so move along specific tracts

cues:

1. extrinsic (regulative)
   - endocrine → growth factor (eg soluble molecules, TGFβ, SHH, etc)
   - paracrine → cell-attached (eg notch-delta) ← notch ON means no neuronal fate
2. intrinsic (fixed lineage)
   - cell division is important (inherit different fates based on cell division) (eg w/ numb)





in flies, get epithelial layer; in developing ectoderm signals along A/P + D/V axes turn on proneural genes (achaete-scute complex): BHLH TFs: turn on neural system's ability to form
- need these to get neurons (drive neural fate)

proneural genes - drive neural competence

neurogenic genes - eg notch + delta, E(spl) (inhibitory)
↳ turns off proneural genes

- if knock out, form way too many neurons
- refine expression of proneural genes to subset

7.29J / 9.09J Cellular Neurobiology

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