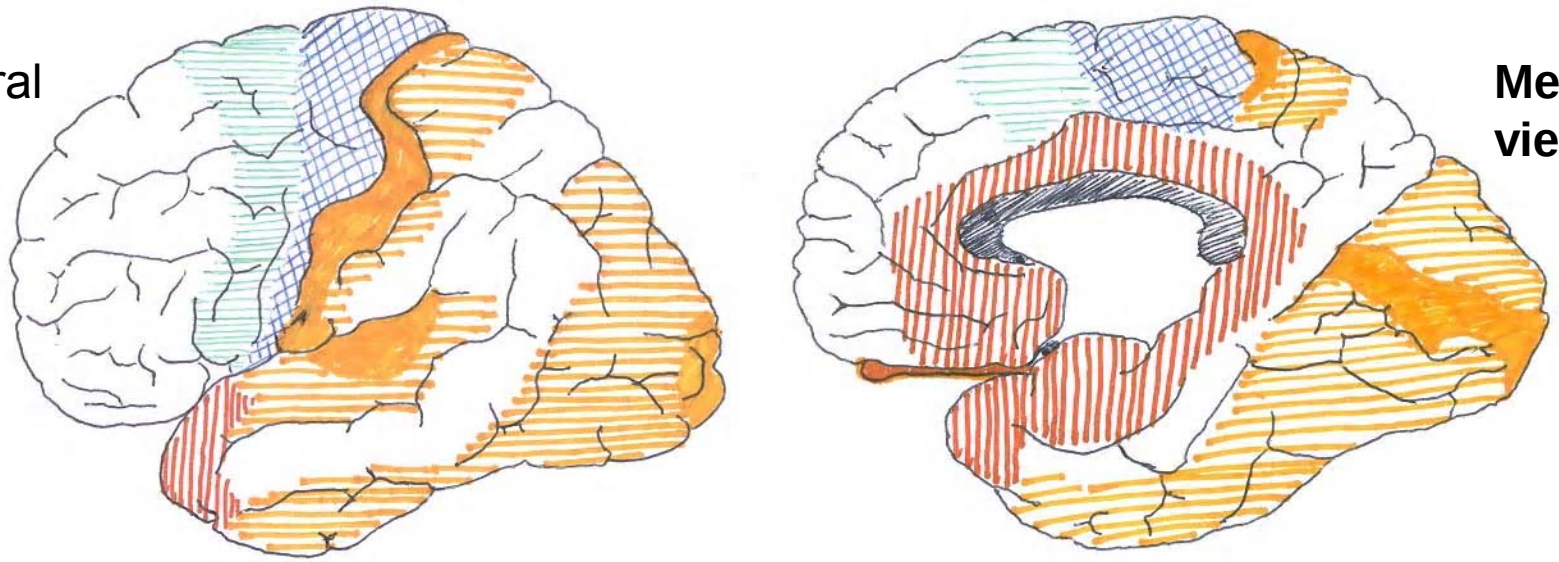
9.14
Class 32 Review

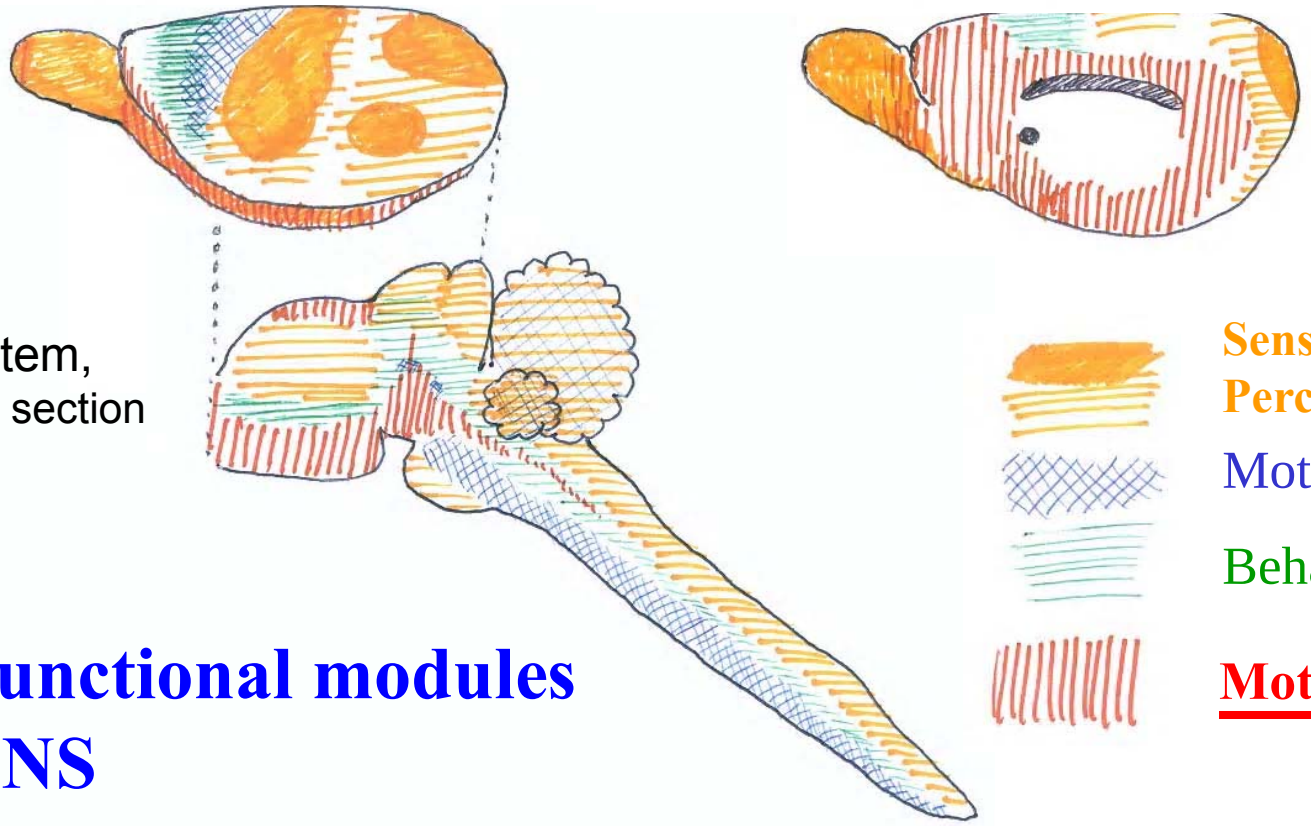
Limbic system

From a previous year, still useful although some illustrations are early versions

Lateral view

Medial view





Brainstem, sagittal section

Sensory-Perceptual

Motor

Behavior

Motivation

Limbic + paralimbic

Major functional modules of the CNS

Somatic regions: arousal type 1

Limbic regions: arousal type 2

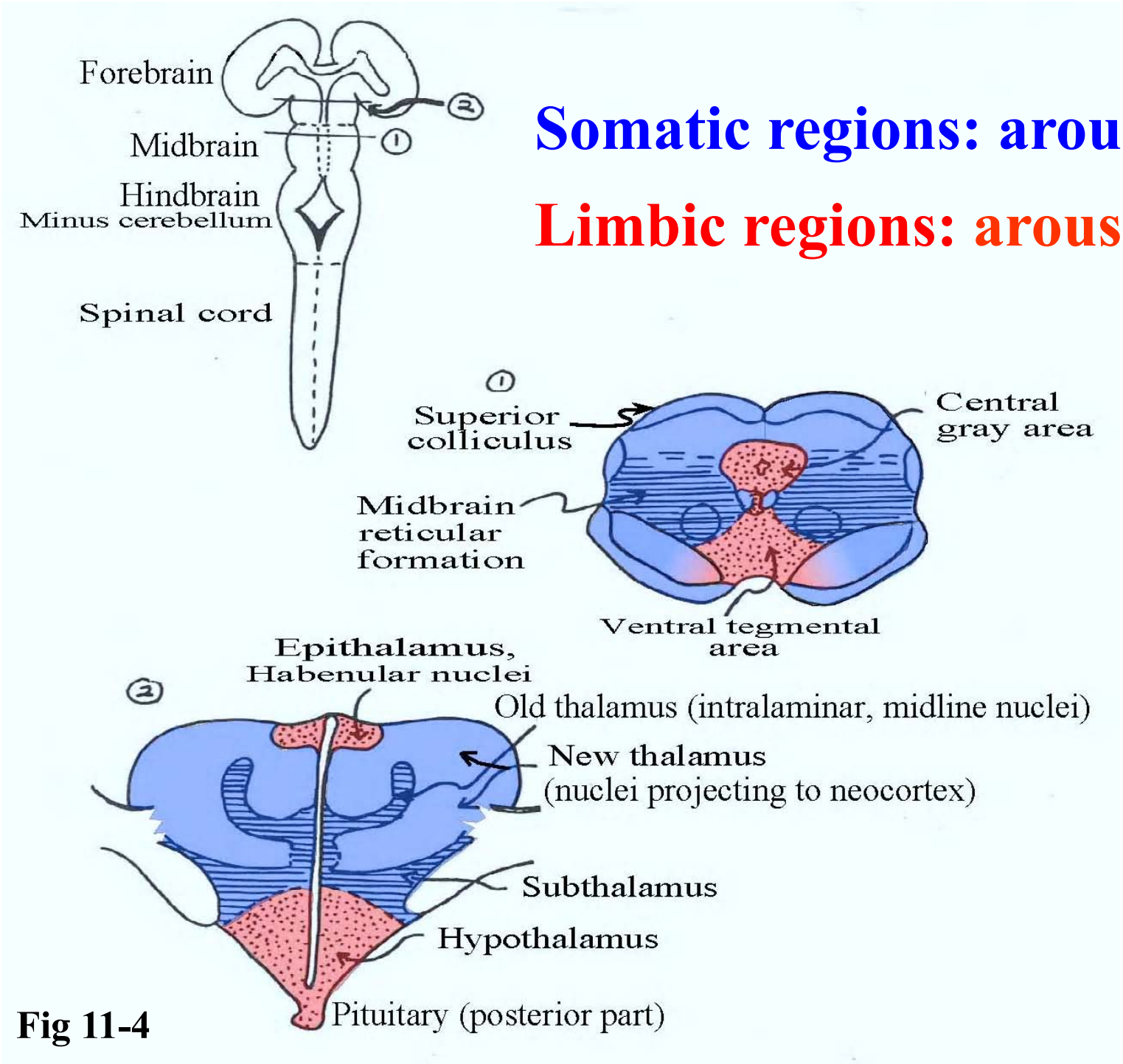


Fig 11-4

To understand the system better, go back to the ideas about early evolution:

- Limbic system is about "valences", values, +/-
  - Remembered objects & individuals
  - Remembered places
- Consider now the Papez circuit in these terms
  - Descending projections signal sense of direction and +/- values for places:
    - "I know where I am & where I am heading, and it is good/bad"
    - "I know where I could move and what is good or bad about those places, so I can judge whether these moves are good/bad"
  - Thus, valences are added to place & to next moves

Papez' Circuit: look at descending connections

OB, olfactory bulb

PF, prefrontal cortex

Cing, Cingulate cortex

RS, retrosplenial cortex (caudal cingulate)

S, septal area

fx, fornix

st, stria terminalis

DB(B), diagonal band of Broca

Am, amygdala

EC, entorhinal cortex

O Tub, olfactory tubercle

SI, substantia innominata

Acc, nuc. Accumbens

BNST, bed nucleus of the stria terminalis

A, anterior nuclei of thalamus

Cb, cerebellum

MD, mediodorsal nucleus of thalamus

mm, mammillary body

mt, mammillothalamic tract

m teg, mammillotegmental tract

SC, superior colliculus

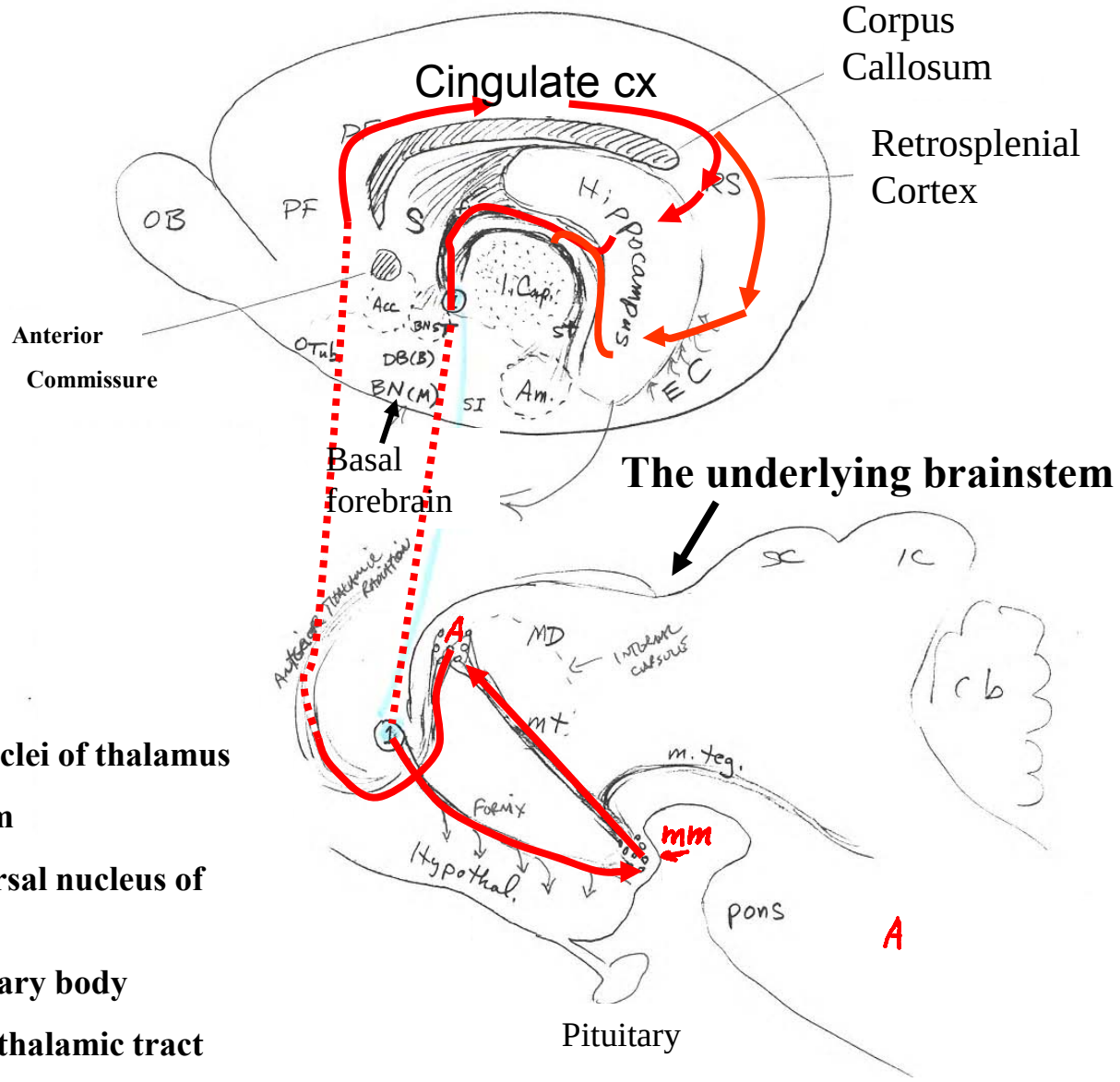
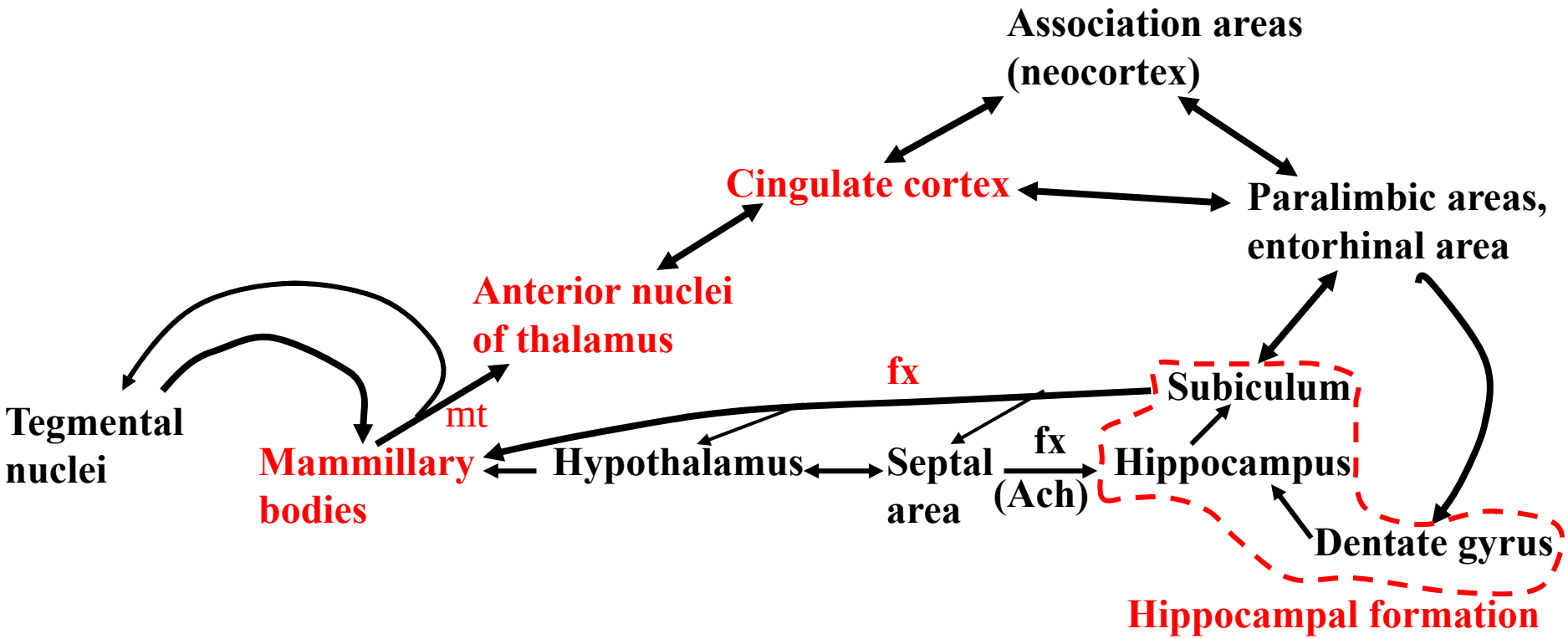


Fig 26-5

From previous class, #28 :

Papez' circuit brought up to date:



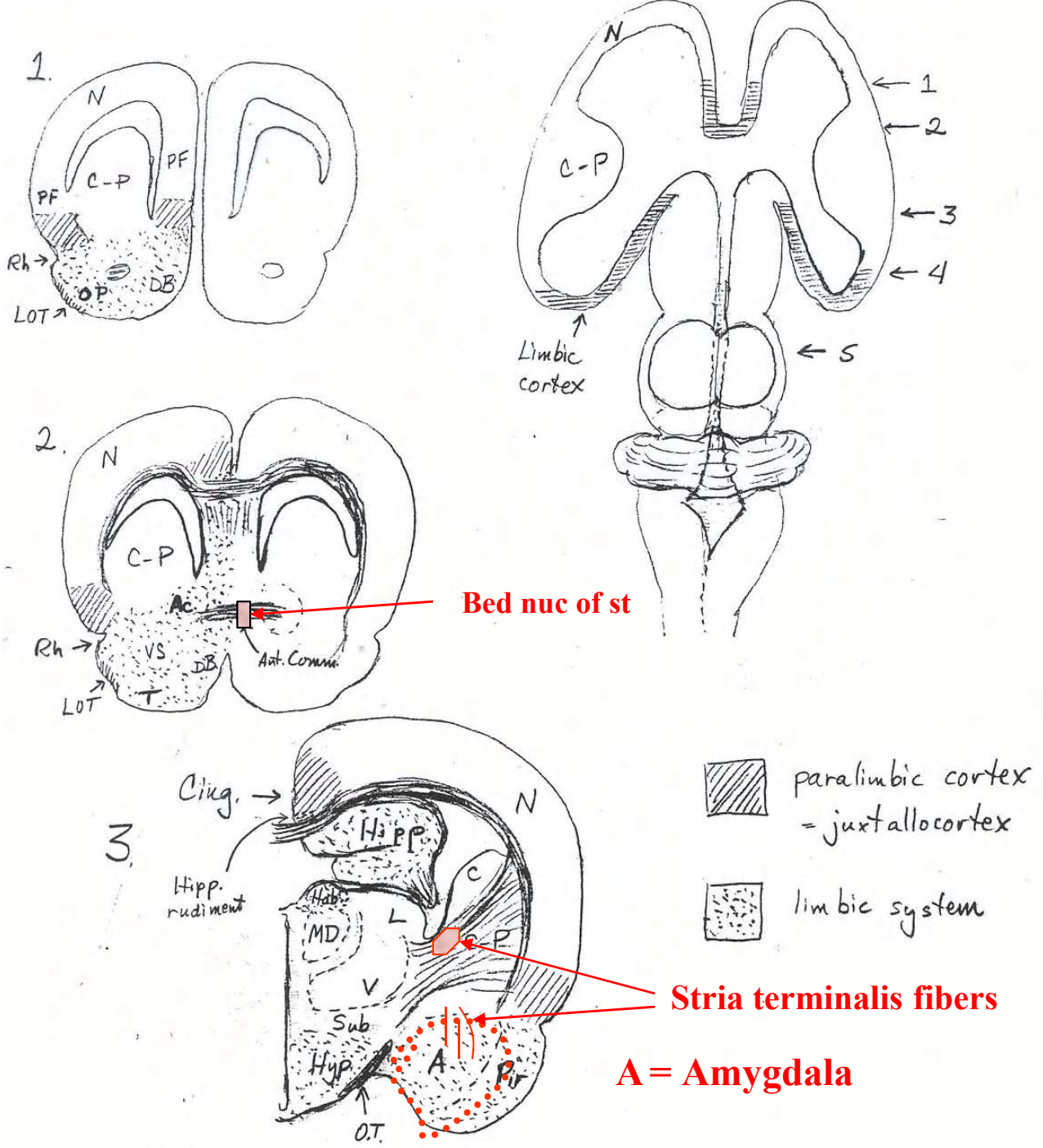
mt = mammillothalamic tract

fx = fornix bundle (output of hippocampus)

Now look at the ascending connections, and add a consideration of the amygdala

- Ascending info re changes in head direction (& locomotion)
  - To Cingulate cortex → Association neocortex, with a memory/ model of the surrounding environment
    - "This move takes me to that place"
    - Anticipation of consequences
- The amygdala (omitted by Papez) adds non-spatial information:
  - Valences applied to objects & individuals (values/ affective tags)
    - Projection to Prefrontal Cortex: value associated with Plans
    - Projection to Ventral Striatum: anticipation of reward or punishment
    - Projection to hypothalamus & midbrain: emotional expression, mood changes, autonomic & endocrine changes
  - Actions influenced: approach/ avoidance, orienting, learned actions

Structures of the Limbic System



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Schneider, G. E. *Brain Structure and its Origins: In the Development and in Evolution of Behavior and the Mind*. MIT Press, 2014. ISBN:9780262026734.

Amygdala, the **S**tria **T**erminalis, and the Bed Nucleus of the Stria Terminalis

Can you also identify the positions of the fornix fibers from the hippocampal formation? (See also next slide.)

Cerebral hemisphere, medial view, hamster

OB, olfactory bulb

PF, prefrontal cortex

RS, retrosplenial cortex (caudal cingulate)

S, septal area

fx, fornix

st, stria terminalis

DB(B), diagonal band of Broca

EC, entorhinal cortex

O Tub, olfactory tubercle

SI, substantia innominata

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BNST, bed nucleus of the stria terminalis

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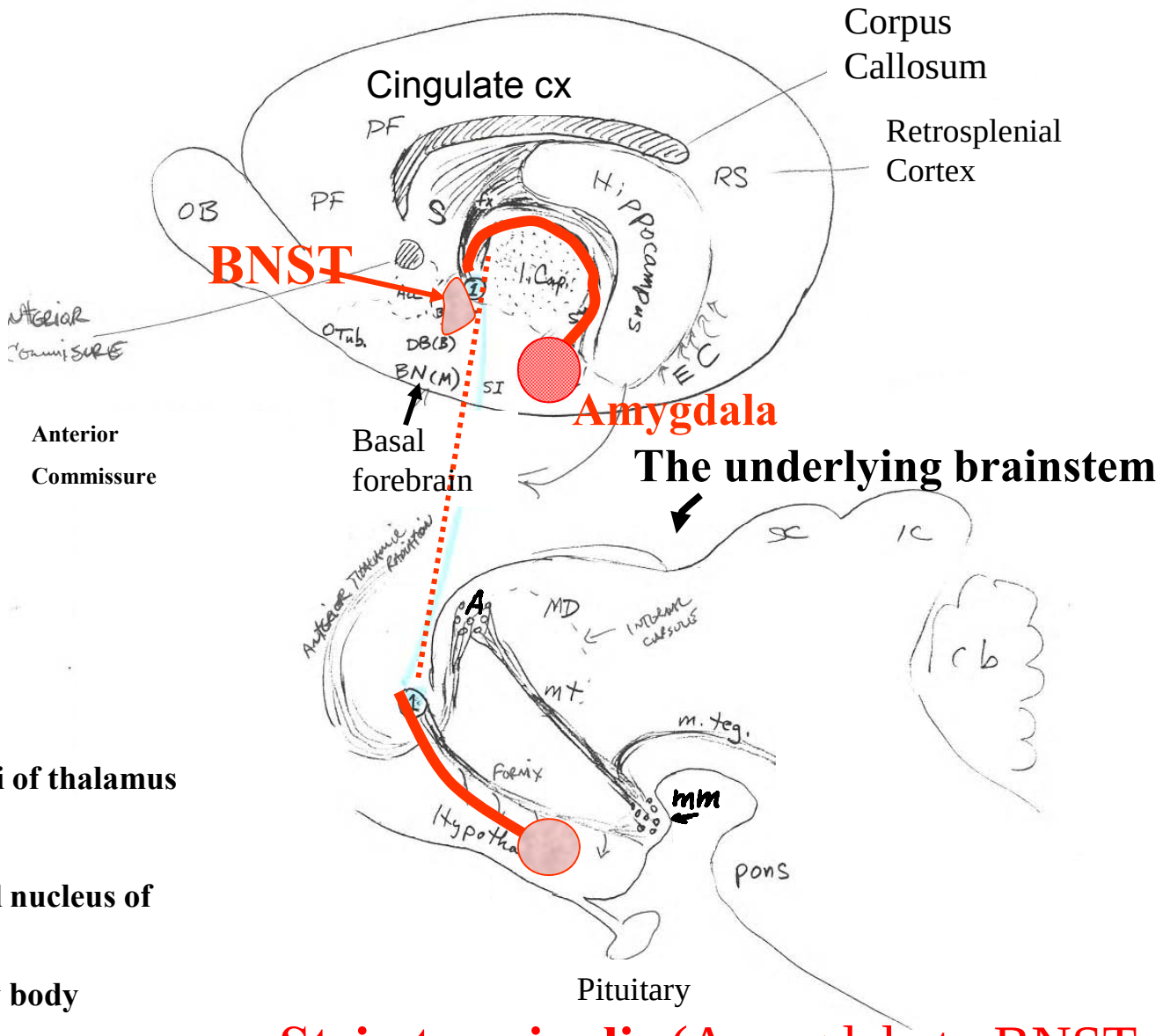


Stria terminalis (Amygdala to BNST & VMH)

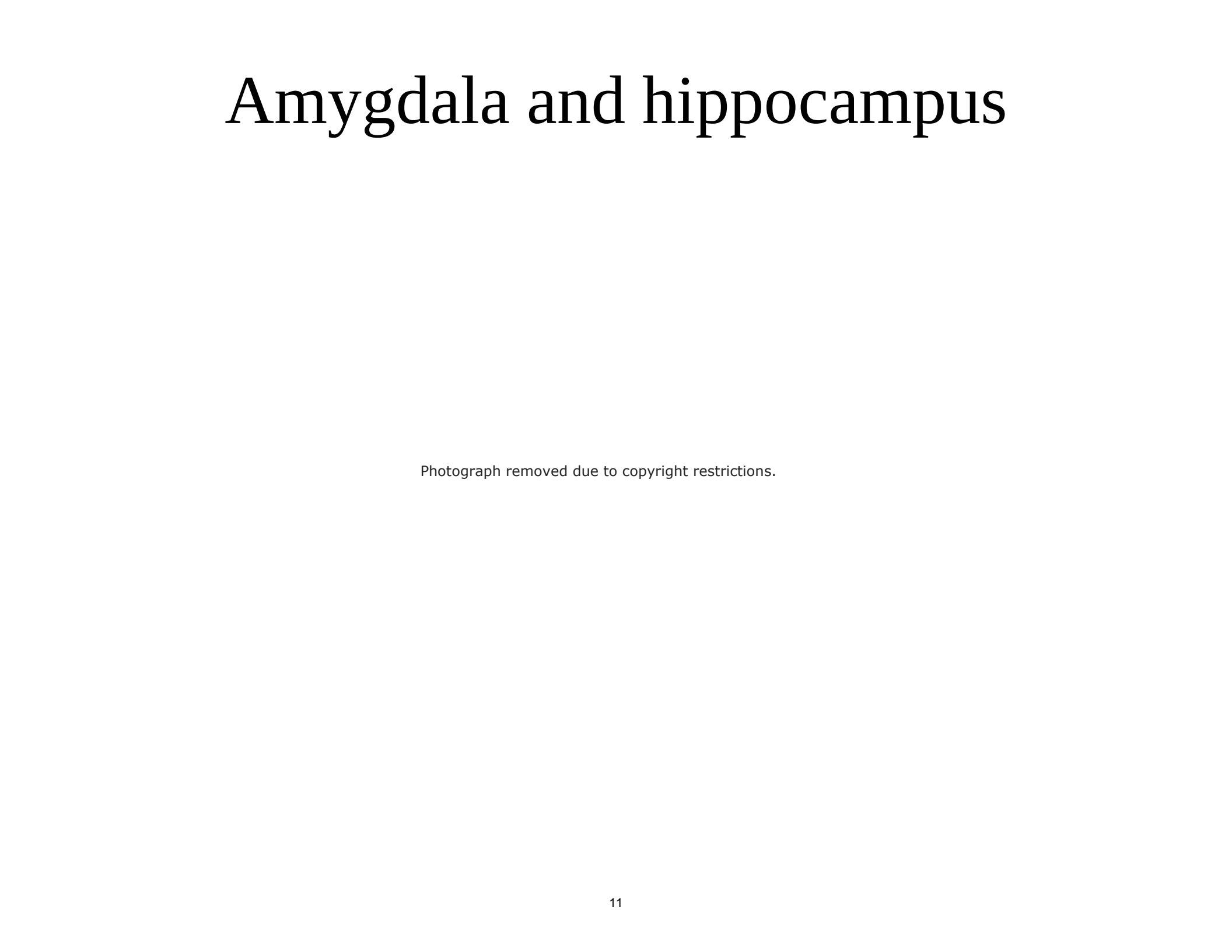
mm

Fig 29-5

Amygdala and Caudate Nucleus

Photograph removed due to copyright restrictions.

Amygdala and hippocampus



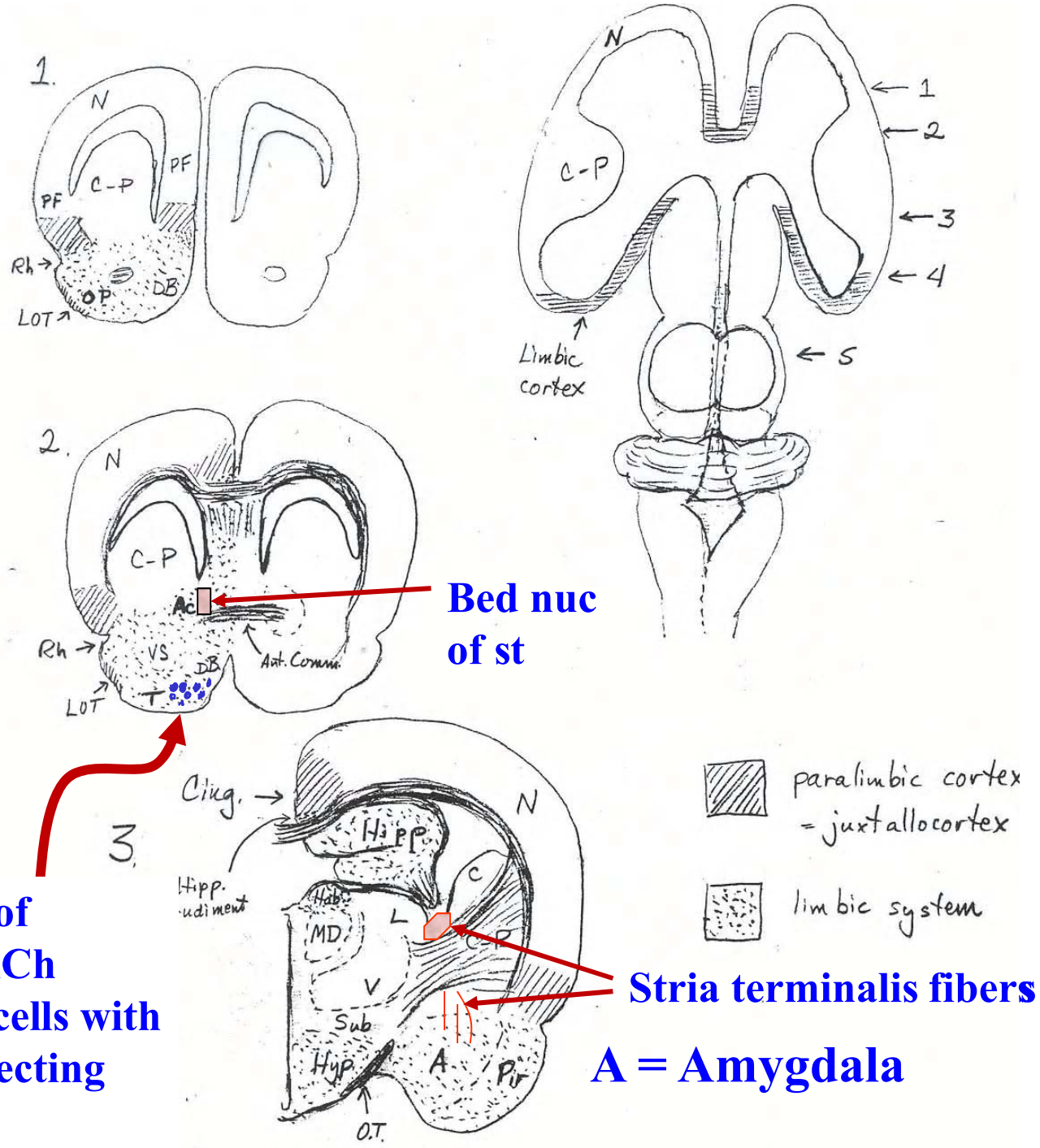
Structures of the Limbic System:

Amygdala, the stria terminalis, and the Bed Nucleus of the Stria Terminalis

Additional basal forebrain structures:

T=olfactory tubercle
DB=diagonal band of Broca (continuous with septal area)
VS=ventral striatum, includes n.accumbens and bed nuc of stria terminalis

Fig 29-10



Basal Nuc. of Meynert (ACh containing cells with widely projecting axons)

9.14 Brain Structure and Its Origins

Spring 2014