



VA Mid-Atlantic Health Care Network

**MIRECC**

*Mental Illness  
Research,  
Education and  
Clinical Center*



**Post Deployment Mental Health  
VISN 6**

# **Windows to the Brain: Axial Anatomy 2**

## **Prefrontal-Subcortical Circuits Cortical Association Tracts**

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Research Health Scientist

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MIRECC Associate Director - Education

ACOS/Research and Education Service Line

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Professor, Psychiatry and Radiology

Wake Forest University School of Medicine

**Source:** <http://www.mirecc.va.gov/visn6/Tools-Tips.asp>

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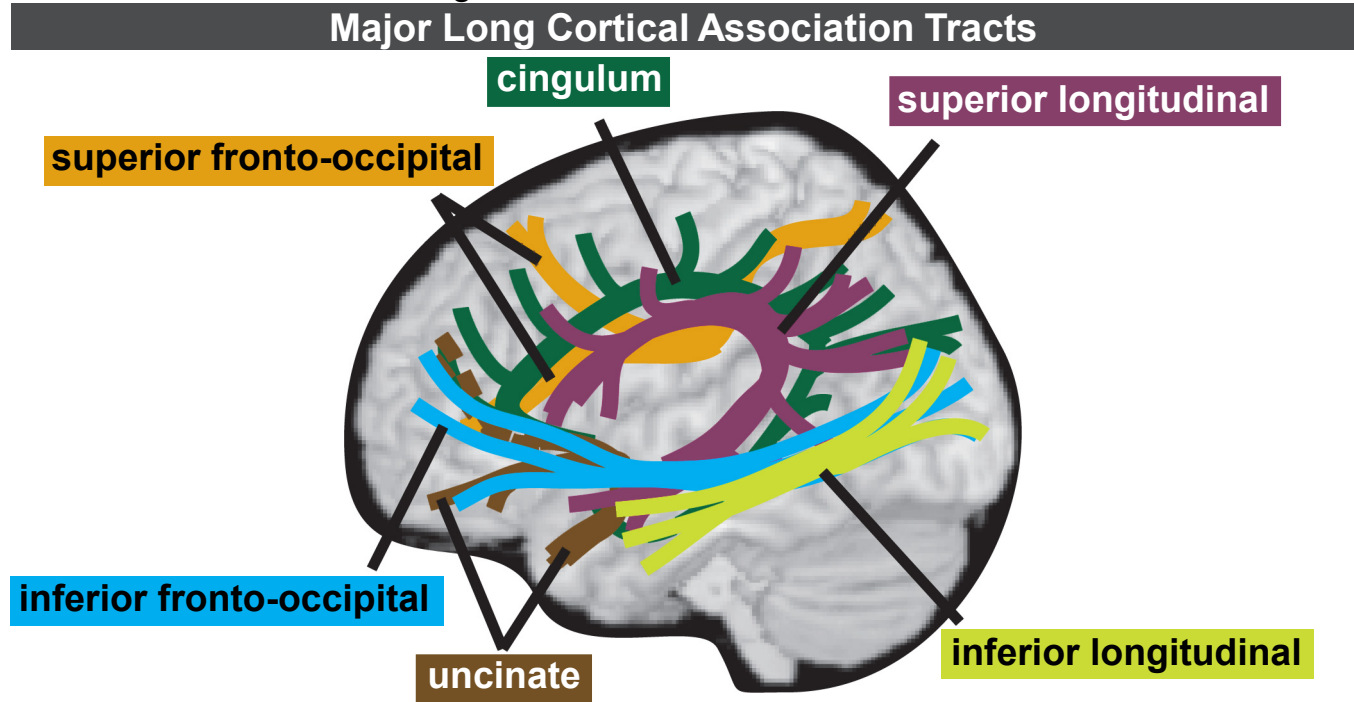
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**Right side of each section:** Major cortical association tracts are labeled and color-coded to match the figure below. \*



**Brief guide to neuropsychiatric symptoms associated with injury to tract.**

**superior fronto-occipital (subcallosal) fasciculus**  
orbital & medial prefrontal cortex <-> parietal cortex

akinetic mutism; disordered initiation & preparation of speech movements; transcortical motor aphasia; anomia & reduction of spontaneous speech with normal articulation

<p><b>cingulum - short fibers</b> cingulate cortex &lt;-&gt; frontal, parietal, occipital &amp; temporal cortex</p>	<p><b>cingulum - long fibers</b> frontal cortex &lt;-&gt; temporal cortex</p>
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**Anterior** - lack of emotional affective response to pain; anxiety; OCD; depression; panic; akinetic mutism    **Posterior** - impaired integration of visuospatial & memory processing

**superior longitudinal (arcuate) fasciculus**  
frontal cortex <-> parietal, occipital & temporal cortex

**R** - left hemispatial neglect; **L** - conduction aphasia (fluent aphasia with impaired repetition, mostly preserved language comprehension); ideational apraxia (can't carry out skilled movements and/or commands); depression; speech arrest; anomia; **Posterior** - transcortical sensory aphasia (impaired auditory comprehension, intact repetition & fluent speech)

**uncinate fasciculus**  
orbital & polar prefrontal cortex <-> anterior temporal cortex

deficits in retrieval of past information: **R** - episodic context-dependent memory, personal experiences, autobiographical; **L** - context-free memory, general knowledge of facts

**inferior fronto-occipital fasciculus**  
ventrolateral & dorsolateral prefrontal cortex <-> posterior temporal & occipital cortex

**R>L** - impaired orienting of attention; visual recognition abnormalities; **R+L** - impaired pursuit eye movements; inaccurate reaching under visual guidance; impaired motion perception; **R or R+L** - impaired seeing/selecting in crowds; impaired spatial relations; visual agnosia & poor visual memory; impaired recognition of places & directions to get there; getting lost

**inferior longitudinal fasciculus**  
temporal pole <-> occipital cortex

disorders in recognition (visual agnosia) impaired visual recent memory; **R or R+L** - impaired face recognition (prospagnosia), visual object agnosia, visual hypoemotionality if cue presented visually; **R+L or L>R** - contralateral deficit in color vision (hemiachromatopsia); **L-bilateral** misnaming of objects presented by touch (tactoverbal dysfunction)

\*Taber KH, Hurley RA. J Neuropsychiatry Clin Neurosci 2007;19(2):100-104.

**Left side of each section:** Tracts involved in major prefrontal cortical-subcortical circuits and major subcortical structures are labeled and color-coded to match the figures below.\*

### Major Prefrontal - Subcortical Circuits

In psychiatry, the prefrontal cortex is generally divided into three principal areas. Each area has reciprocal connections with subcortical structures that form cortico-subcortical circuits.

#### Dorsolateral circuit

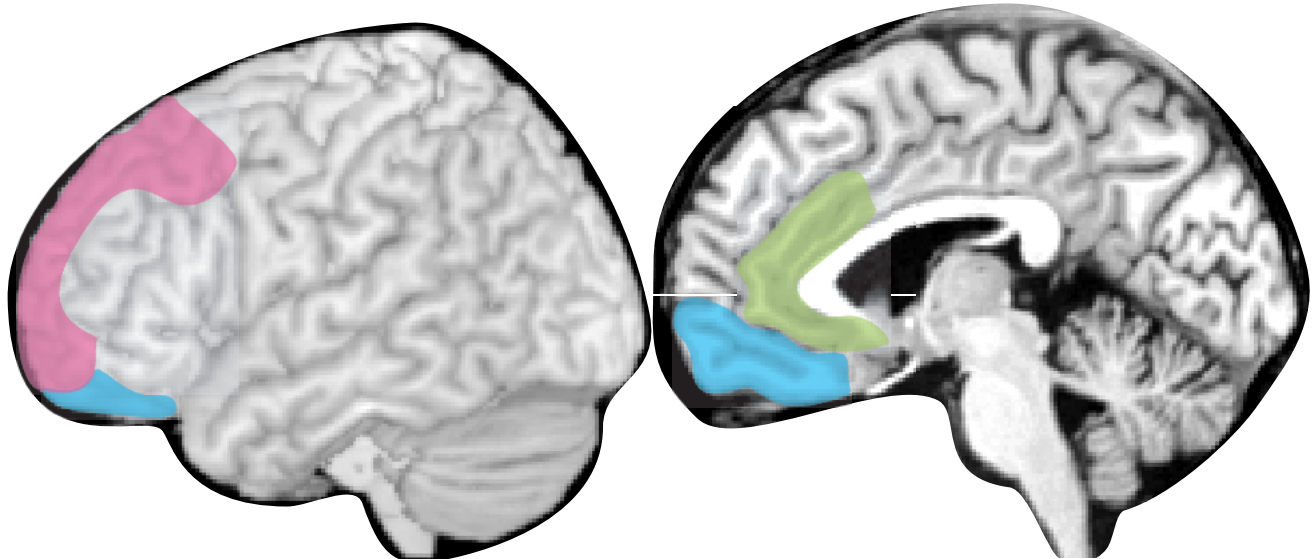
mediates executive functions such as organization, planning & attention

#### Orbitofrontal circuit

mediates socially appropriate behavior, impulse control & empathy

#### Anterior cingulate circuit

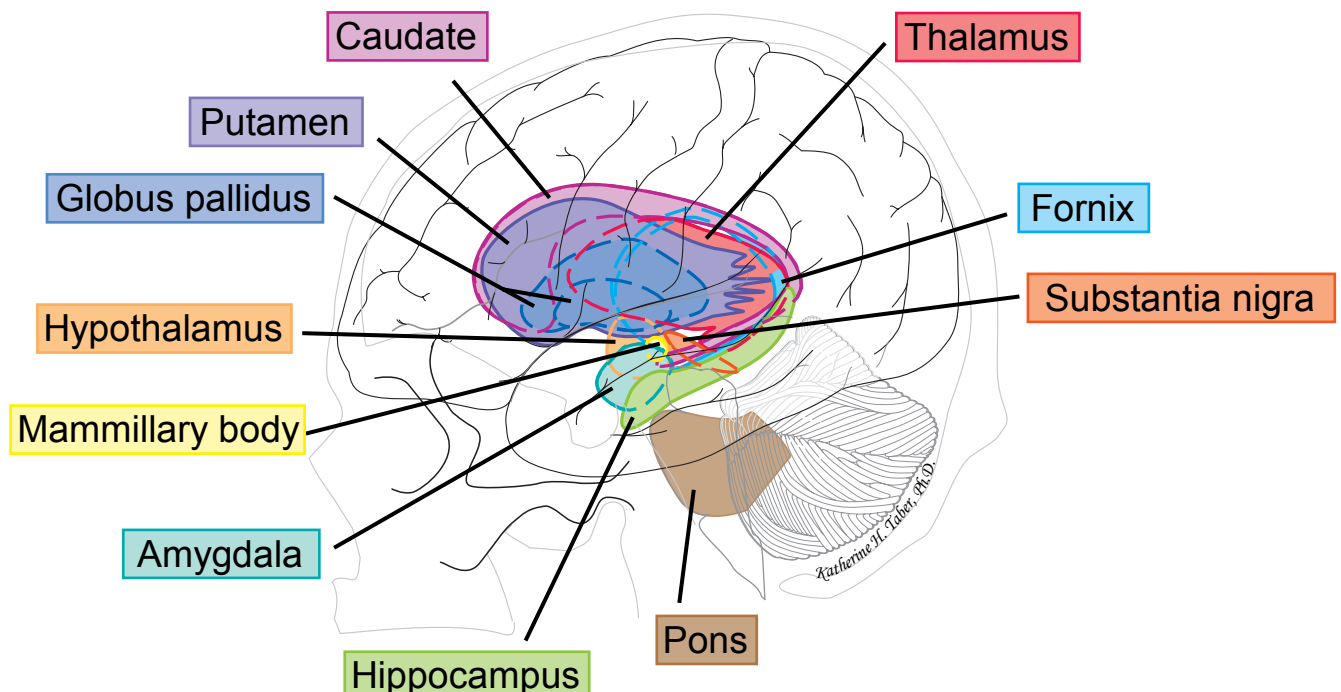
produces motivation by balancing the inhibitory input of the supplemental motor area with its own stimulus that supports wakefulness & arousal



\*Bonelli RM, Cummings JL. Dialogues Clin Neurosci. 2007;9(2):141-51.

### Major Subcortical Structures

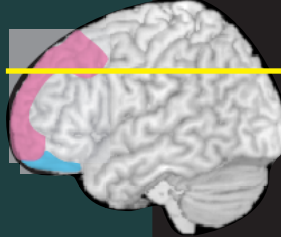
This cartoon of a lateral view of the brain and skull shows the approximate positions and configurations of the major subcortical structures. The colors assigned in this figure are used in the sectional atlas to facilitate structure identification.



\*Naumescu I, Hurley RA, Hayman LA, Taber KH. Int J Neuroradiol 1999; 5(1): 51-59.

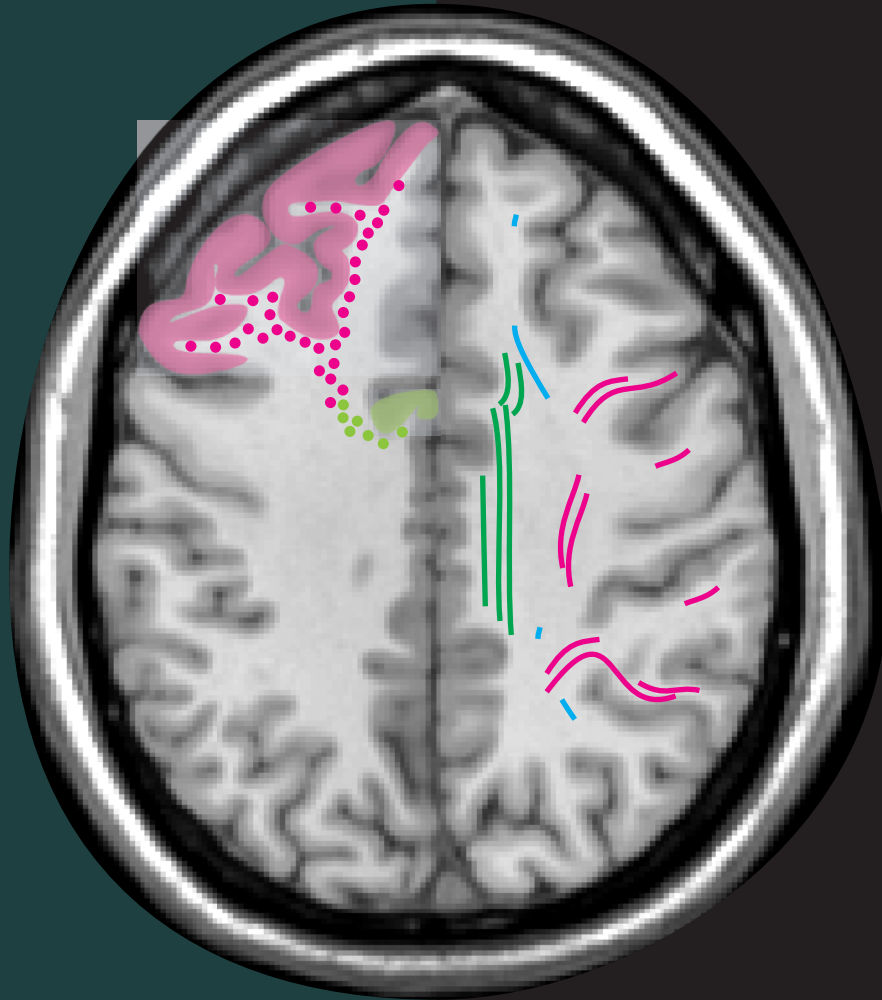
## Major Prefrontal-Subcortical Circuits

- Dorsolateral
- Anterior Cingulate
- Orbitofrontal



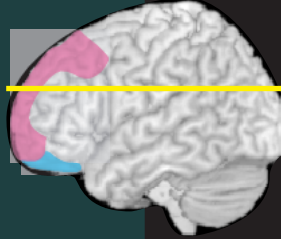
## Major Cortical Association Tracts

- cingulum
- superior fronto-occipital
- inferior fronto-occipital
- uncinate
- superior longitudinal
- inferior longitudinal



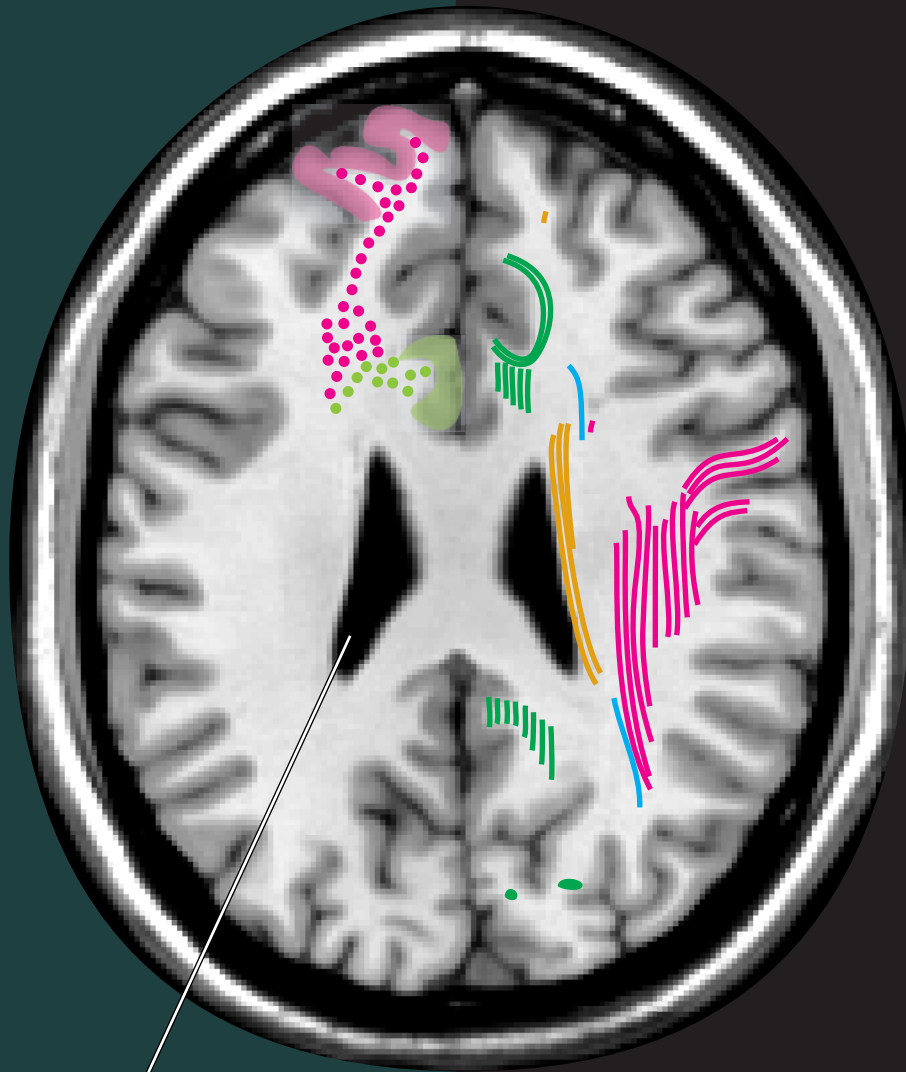
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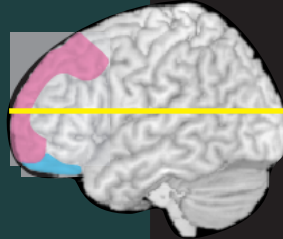
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- inferior fronto-occipital
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- inferior longitudinal



lateral ventricle

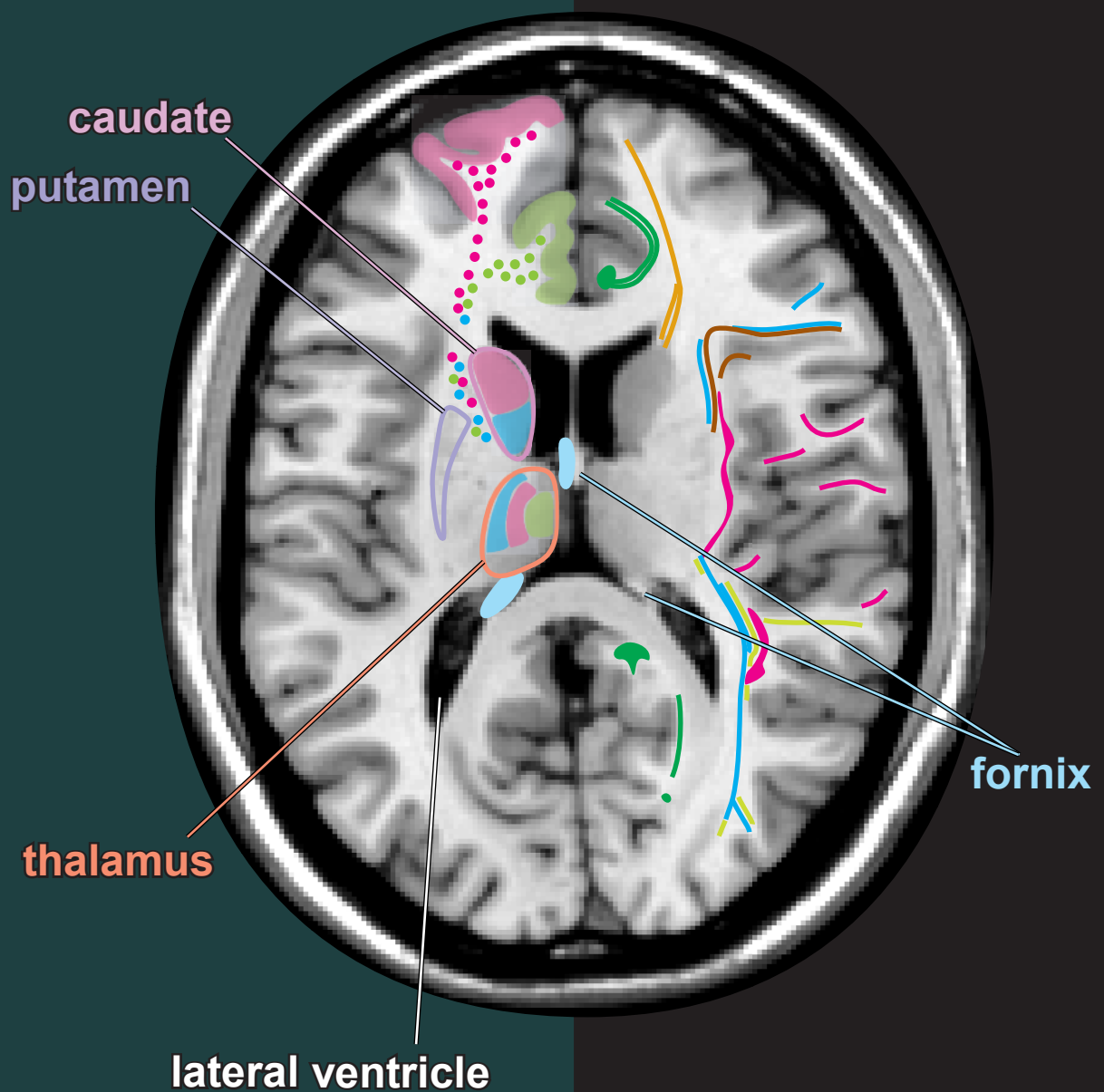
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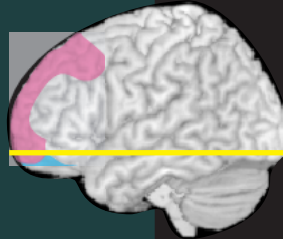
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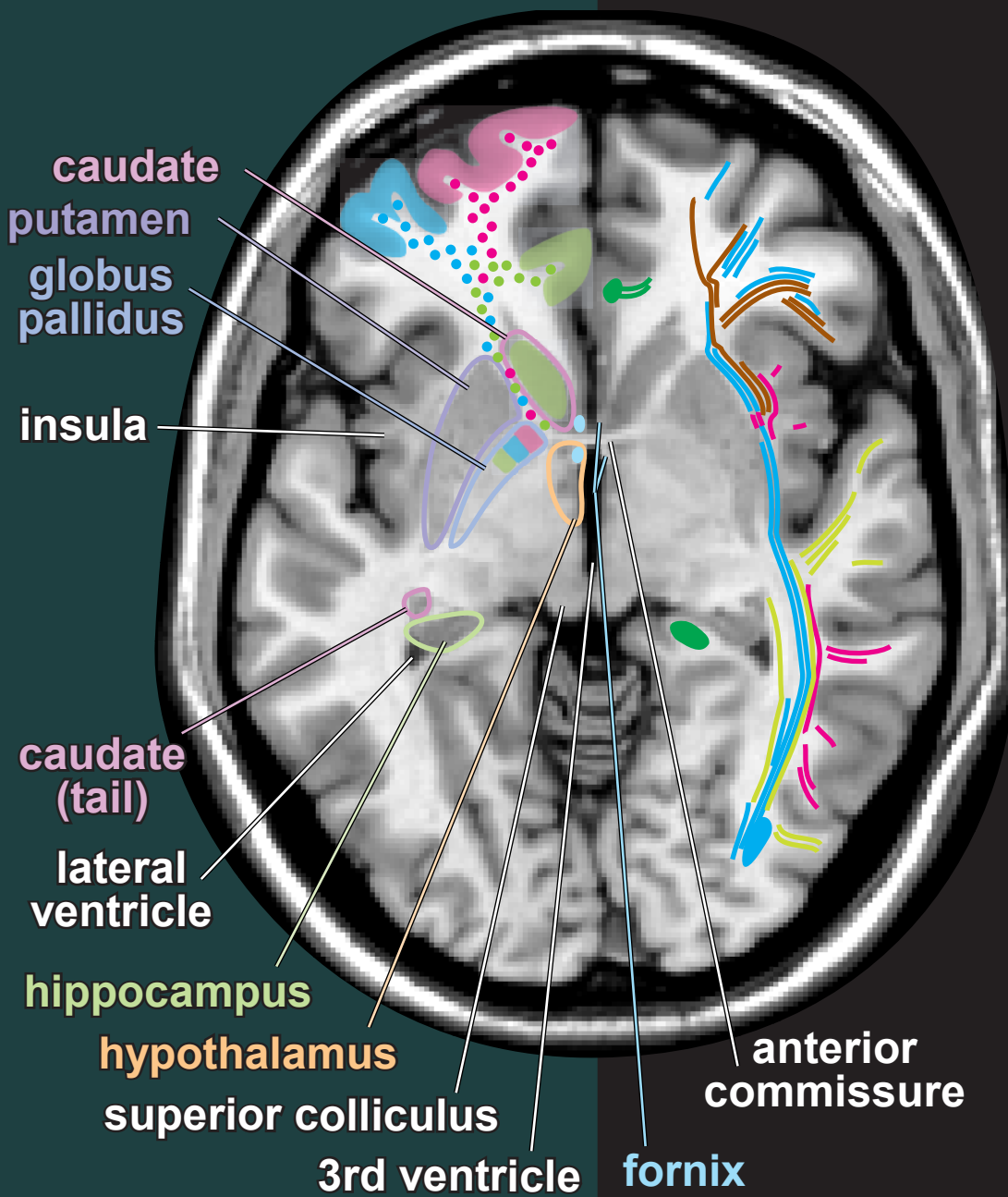
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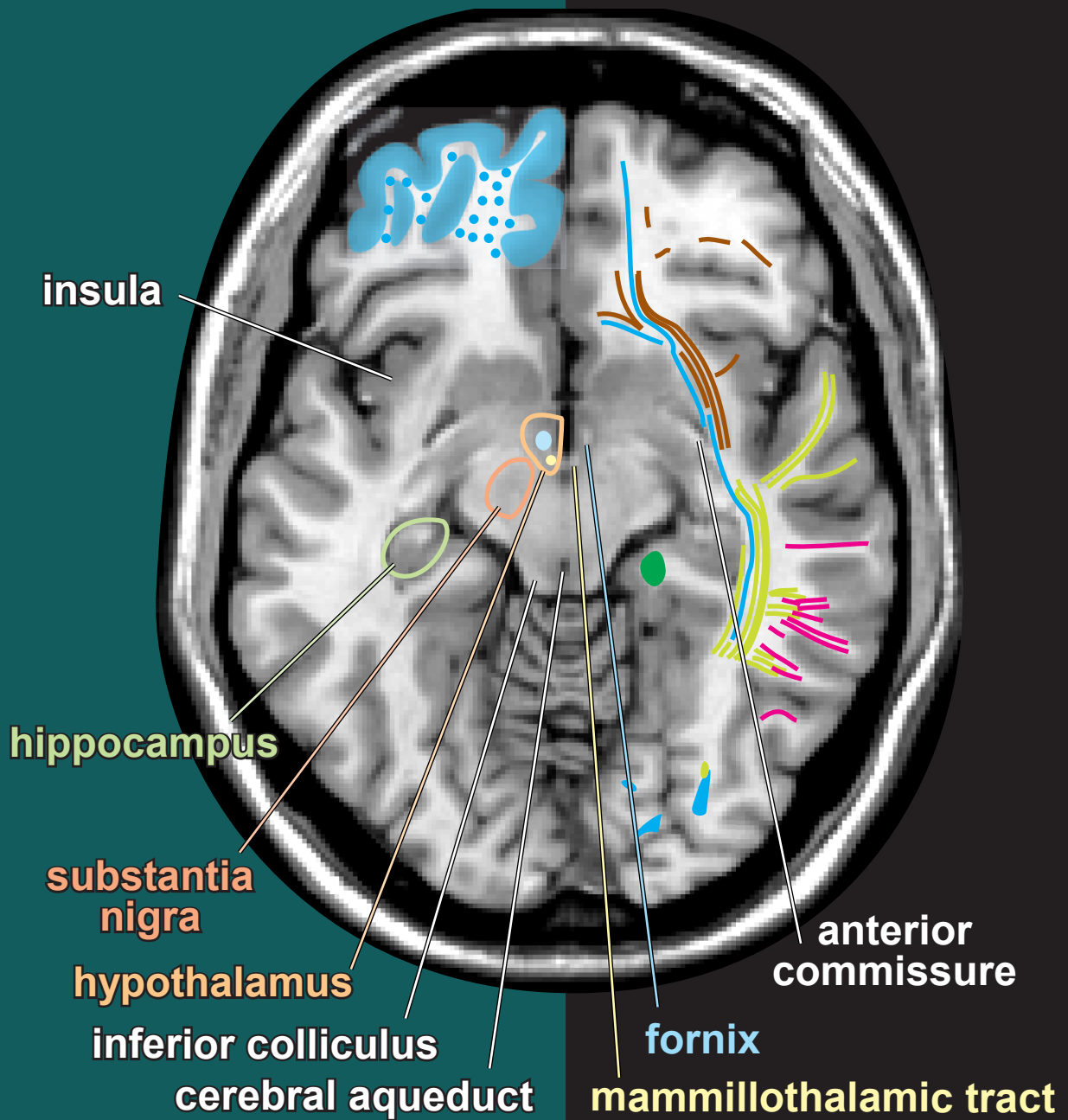
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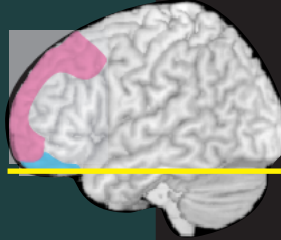
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## Major Prefrontal-Subcortical Circuits

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Anterior Cingulate  
Orbitofrontal



## Major Cortical Association Tracts

cingulum  
superior fronto-occipital  
inferior fronto-occipital  
uncinate  
superior longitudinal  
inferior longitudinal

amygdala

basal  
forebrain

hippocampus

substantia nigra

mammillary body

hypothalamus

