

BRAINSTEM, RETICULAR SYSTEMS ATTENTION NETWORKS

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RETICULAR FORMATION

- One of the oldest portions of the brain
- Represents the core of the brainstem
- Complex collections of cells that form diffuse cellular aggregations and more defined nuclei
- Functions:
 - **Wakefulness, alertness, arousal (ARAS)**
 - **Regulation of muscle tone and reflexes** (descending RF)
 - **Coordination of autonomic functions**
 - » Control of breathing and cardiac function influenced by higher centers
 - **Modulation of pain sensations**

ARAS: Magoun & Moruzzi

- Brainstem Reticular Activating System
 - Desincronizes the EEG via a relay in the thalamus
 - Subsequent work: the most important component in this system consists of a cholinergic reticulothalamic pathway that facilitates the corticopetal relay neurons in the thalamus
 - The original concept of the ARAS needs to be expanded...
- Anatomically: central core region of the brainstem
 - Contains a number of nuclei
 - Recibes collateral fibers from the specific sensory systems
 - The main ascending pathway of the RF is the central tegmental tract

ARAS: modern view

- The cerebral cortex has three sources of afferent neural connections:
 - Cortical
 - Thalamic
 - Extrathalamic
 - » Ventral tegmental area (dopaminergic)
 - » Raphe nuclei (serotonergic)
 - » Nucleus locus ceruleus (noradrenergic)
 - » Hypothalamus (histaminergic)
 - » Basal forebrain (cholinergic and GABAergic)

Central tegmental tract

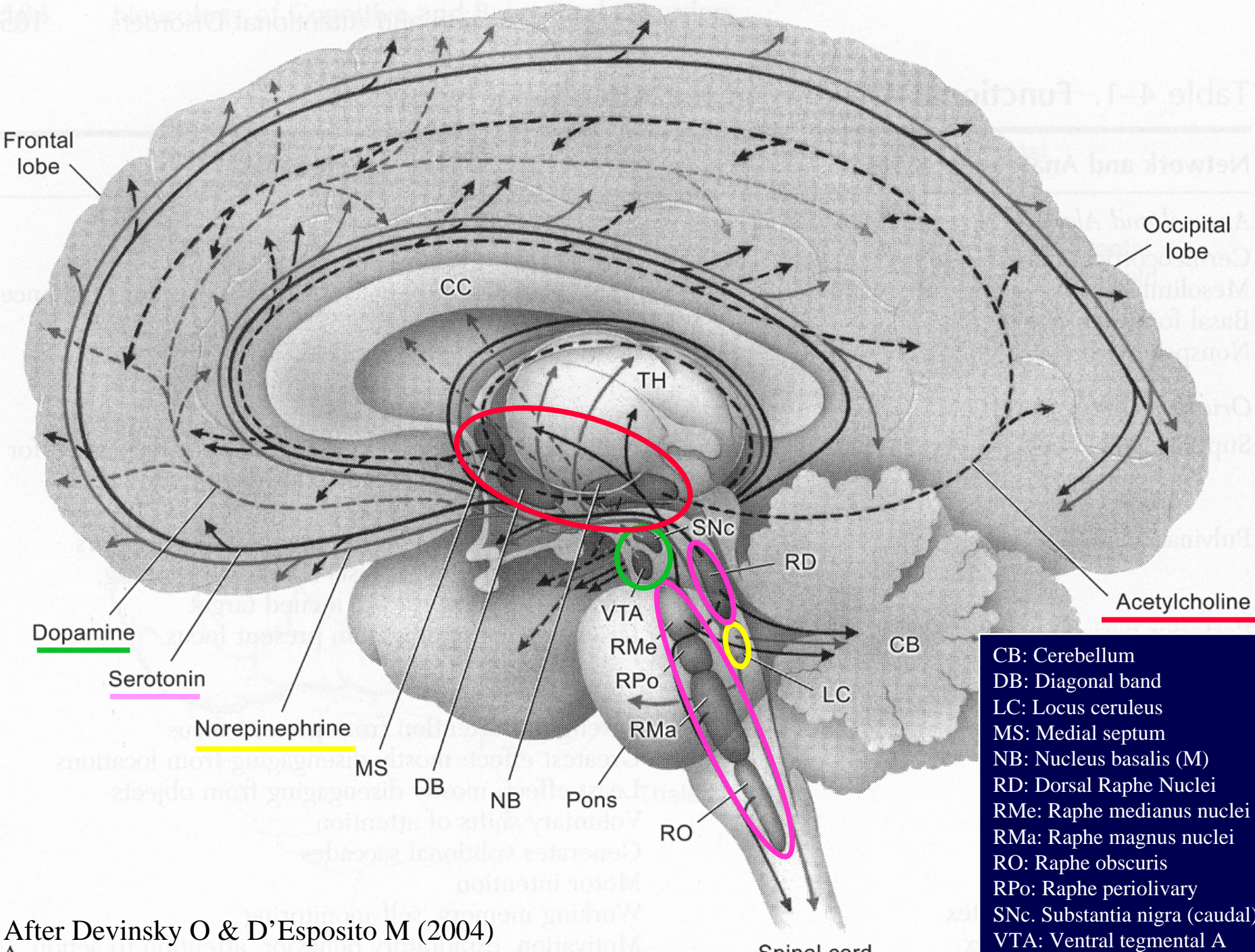
- The main ascending pathway of the ARAS
- Projects to the intralaminar nuclei of the thalamus
- The RF extends rostrally from the brainstem into the hypothalamus.

ACTIVATION OF THE ARAS

- Collateral fibers of the ascending systems
 - Sensory input: wakefulness, alertness, and arousal.
 - Lesions in the rostromedial midbrain tegmentum: abolish EEG arousal elicited by sensory stimulations
- Cerebral cortex: arousing effect
 - Prefrontal cortex, lateral surface of the frontal lobe, sensory motor cortex, superior temporal gyrus, cingulate gyrus

Pedunculopontine tegmental nucleus

- Cholinergic nucleus of the ARAS
- Involved in sleep mechanisms
 - Important in the induction and maintenance of REM sleep.
- Is a component of the “mesencephalic locomotor region”
- A decrease in Choline acetyltransferase has been reported in Schizophrenia



- CB: Cerebellum
- DB: Diagonal band
- LC: Locus ceruleus
- MS: Medial septum
- NB: Nucleus basalis (M)
- RD: Dorsal Raphe Nuclei
- RMe: Raphe medianus nuclei
- RMa: Raphe magnus nuclei
- RO: Raphe obscuris
- RPo: Raphe periolivary
- SNC: Substantia nigra (caudal)
- VTA: Ventral tegmental A

After Devinsky O & D'Esposito M (2004)