ACh, acetylcholine

acetyl-CoA

Choline acetyltransferase

Acetylcholine

Acetic acid

Choline
Striatum (large aspiny neurons)

Nucleus of Meynert

Basal forebrain

Bregma

Parnabrical region

Parasympathetic ANS

NMT

Acellular line
Acetylcholine

ACh from parabrachial region modulates thalamic modes burst $\rightarrow$ tonic ACh

ACh from parabrachial region mediates atonia of REM sleep

REM-on cells in parabrachial region induce SWS $\rightarrow$ REM switch
Acetylcholine

ACh from parabrachial region and basal forebrain act directly on cortical arousal.

Anti-cholinesterase treatments treat AD work through basal forebrain homeostatic sleep pressure via adenosine signalling in basal forebrain, striatum, and brainstem

Sommogen
Glutamine cycle

$[K^+]$ buffering

SNARE-dependent exocytosis of gliotransmitters

E.g., ATP

Adenosine

Sommogen

A1 receptors

A2a receptors

Gliotransmission

Ectonucleotidase

Astrocytes

ATP
basal forebrain

adenosine → cholinergic neurons

adenosine receptor A1

adenosine analogs infused into basal forebrain

✓ promote sleep
✓ inhibit ACh release
Caffeine

Adenosine
NE, norepinephrine

locus ceruleus, etc.
neurons most active when startled
mainly silent during sleep
REM off firing
5HT, serotonin

raphe nuclei, etc.

REM off firing

↑ NE ⇒ specific shifts in attention

↑ 5HT ⇒ cortical level of arousal

Antidepressants work by ↑ NE, 5HT transmission
HA, histamine

TMN, tuberomammillary nucleus

electrical stimulation of

TMN neurons cause

waking

ablation of TMN

causes hypersomnia

of sleeping sickness

anti-histamines cause
drowsiness
Ox, orexins
aka hypocretins
lateral hypothalamus

prepro-orexin gene
⇒ orexin A, orexin B
receptors OxR1, OxR2

x orexins ⇒ hypophagia

sleep disorder {narcolepsy, cataplexy

energy homeostasis
narcolepsy

transit from wake to REM sleep without SWS intermediate

Hypnogogic brief loss of muscle tone when awake
cataplexy
brief loss of muscle tone when awake

REM sleep behavioural disorder
human REM w/o atonia
most common in older males

animal models REM w/o atonia
lesions just ventral to the locus ceruleus
animals "act out their dreams"