การประชุมสัมมนาวิชาการด้านวิทยาศาสตร์การแพทย์
เรื่อง “การพัฒนายุทธศาสตร์งานวิจัยเกี่ยวกับสมอง จิตใจ และพฤติกรรม” (Development of Research Strategies for Brain Mind and Behaviour)

จัดโดย สาขาวิทยาศาสตร์การแพทย์ สำนักงานคณะกรรมการวิจัยแห่งชาติ (วช.) ร่วมกับ สถาบันวิจัยระบบสาธารณสุข (สวรส.)วันที่ 21 – 23 กรกฎาคม 2557
ณ ห้องประชุมจูปิเตอร์ (Jupiter) ชั้น 3 โรงแรมมิราเคิลแกรนด์ คอนเวนชั่น กรุงเทพฯ

Introduction to sleep and importance of sleep on health and brain functions

รศ. ดร. นัยพินิจ คชภักดี
กรรมการสภาวิจัย สาขาวิทยาศาสตร์การแพทย์
อาจารย์พิเศษศูนย์วิจัยประสาทวิทยาศาสตร์
สถาบันชีววิทยาศาสตร์โมเลกุล มหาวิทยาลัยมหิดล
Vice President, Asian Sleep Research Societies
Founding President, Thai sleep Research and Sleep Medicine Societies
Email: naiphinich@gmail.com

Sleep Sciences:
- -Behavior & Life styles
- -Circadian biology
- -Psychology
- -Physiology
- -Pharmacology
- -Neuroscience
- -Genetics & Genomics

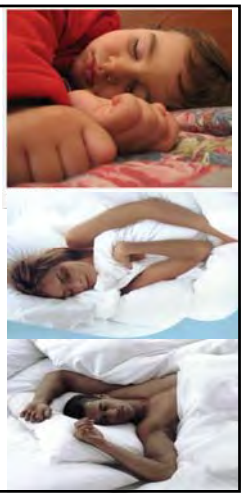
Sleep Medicine:
- -Epidemiology of sleep disorders
- -Classification of sleep disorders
- -Medical treatments
- -Promotion sleep health

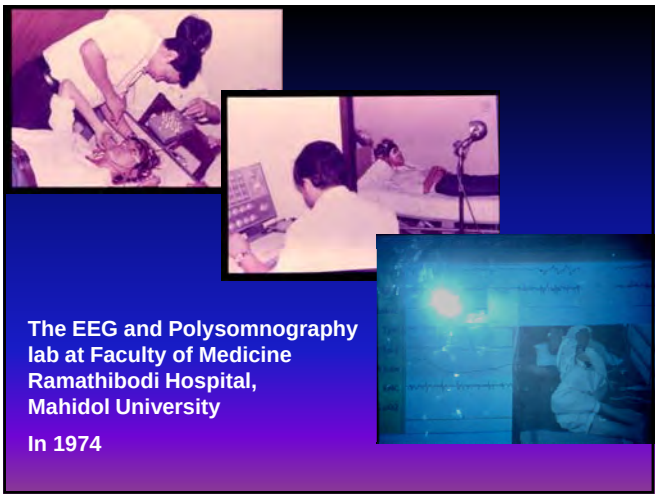
Sleep

From Wikipedia, the free encyclopedia

Sleep is a naturally recurring state characterized by reduced or absent consciousness, relatively suspended sensory activity, and inactivity of nearly all voluntary muscles. It is distinguished from quiet wakefulness by a decreased ability to react to stimuli, and is more easily reversible than being in hibernation or a coma. **Sleep is also a heightened anabolic state, accentuating the growth and rejuvenation of the immune, nervous, skeletal and muscular systems.** It is observed in all mammals, all birds, and many reptiles, amphibians, and fish.

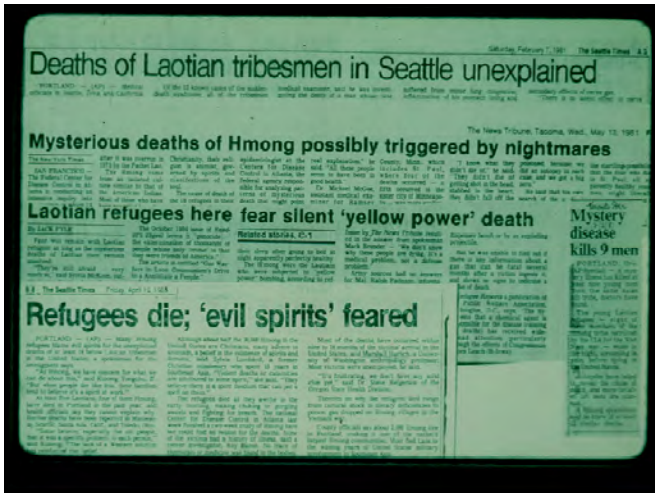
The purposes and mechanisms of sleep are only partially clear and are the subject of intense research. Sleep is often thought to help conserve energy, but actually decreases metabolism only about 5–10%. **Hibernating animals need to sleep** despite the hypometabolism seen in hibernation, and in fact they must return from hypothermia to euthermia in order to sleep, making sleeping "energetically expensive."





The EEG and Polysomnography lab at Faculty of Medicine Ramathibodi Hospital, Mahidol University

In 1974



Deaths of Laotian tribesmen in Seattle unexplained

Mysterious deaths of Hmong possibly triggered by nightmares

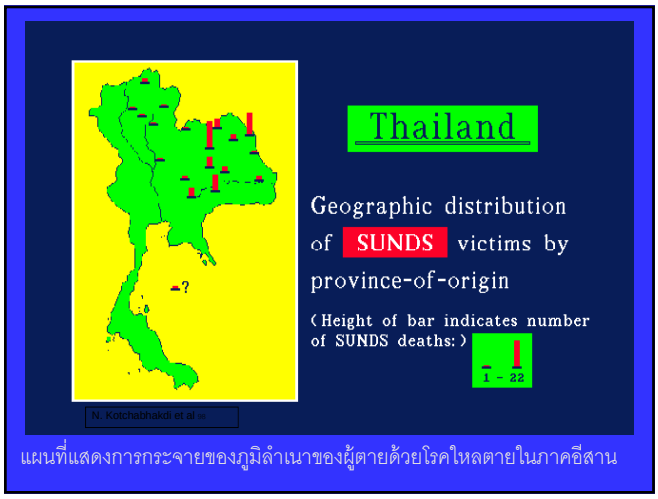
Laotian refugees here fear silent 'yellow power' death

Refugees die; 'evil spirits' feared

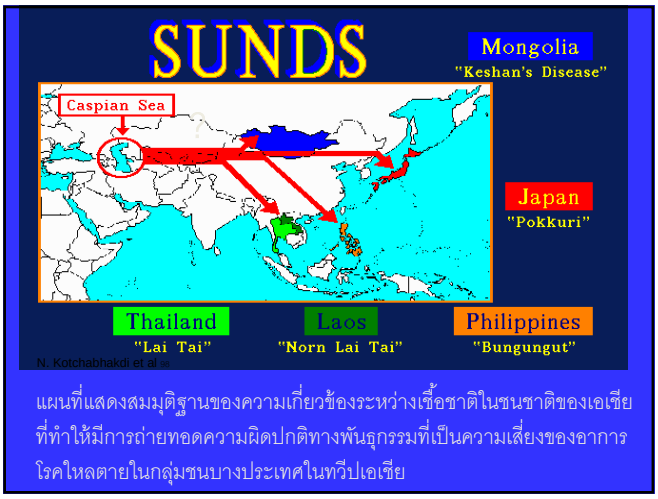
Mystery disease kills 9 men

โรคไหลตาย (Lai Tai)

(Sudden Unexplained Nocturnal Death Syndrome: SUNDS) คืออาการ**ตายอย่างเฉียบพลัน**ซึ่งเกิดขึ้น **ในผู้ชายที่มีอายุระหว่าง** 18-45 **ปี ที่เคยมีสุขภาพดีเป็นปกติ** ใน**ระหว่างการนอนหลับหรือขณะที่กำลังพักผ่อน** และภายหลังการตาย การชันสูตรผ่าศพ และตรวจทางพยาธิวิทยาตามปกติ**ไม่สามารถที่จะอธิบาย ถึงสาเหตุการตายได้อย่างแน่ชัด**



แผนที่แสดงการกระจายของภูมิลำเนาของผู้ตายด้วยโรคไหลตายในภาคอีสาน



แผนที่แสดงสมมุติฐานของความเกี่ยวข้องระหว่างเชื้อชาติในชนชาติของเอเชีย ที่ทำให้มีการถ่ายทอดความผิดปกติทางพันธุกรรมที่เป็นความเสี่ยงของอาการโรคไหลตายในกลุ่มชนบางประเทศในทวีปเอเชีย

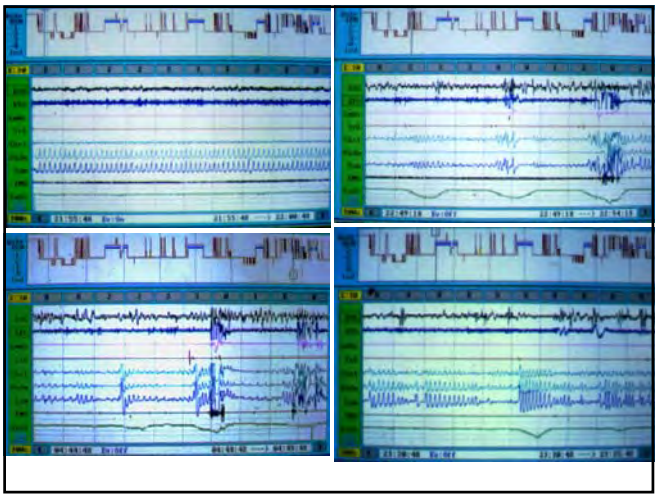
SUMMARY OF CONSISTENT PATHOLOGICAL FINDINGS ON SUDS AT AUTOPSY:

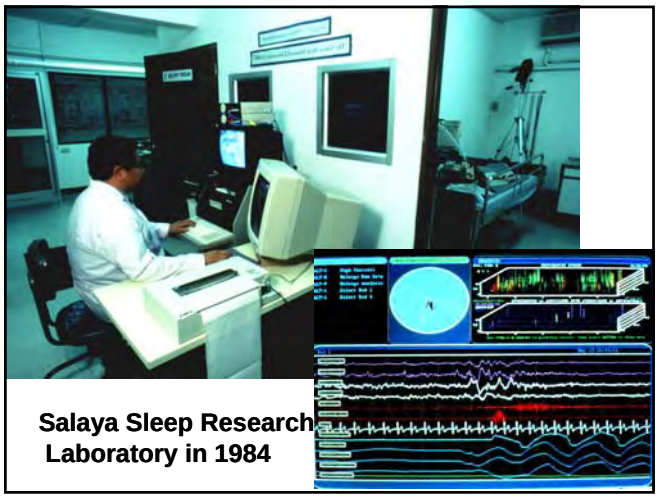
FINDINGS	POSSIBLE CAUSE(S)
Generalized congestion of blood	Sudden Cardio-Pulmonary Arrest (Right-sided Heart failure)
Pulmonary intra-alveolar Hæmorrhage (80% of cases)	Pulmonary Hypertension
Mild myocardial Hypertrophy	Increased cardiac work load
Mild myocarditis with mononuclear cell infiltration	(?) Viral infection
Anatomical anomalies & sclerosis of cardiac conducting system	(?) Genetic Anomalies
Mild edema of brain	(?) Hypoxia

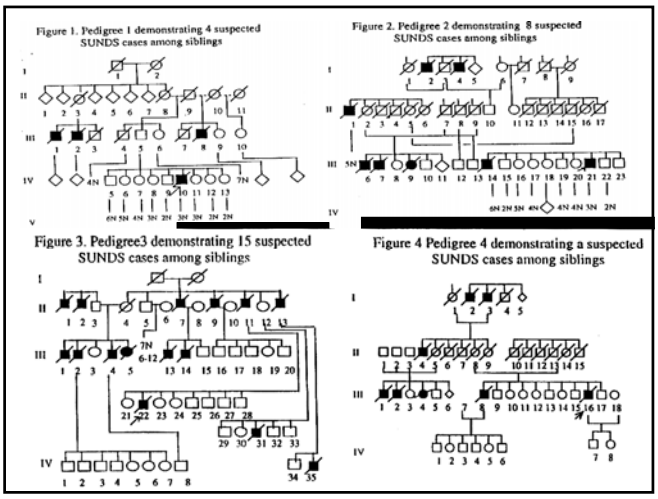
สรุปผลการตรวจชันสูตรผ่าศพ และสาเหตุที่น่าจะเกี่ยวข้องกับความผิดปกติต่างๆ

ในเบื้องต้นมีการตั้งสมมุติฐานว่าการตายในโรคไหลตายอาจจะเกี่ยวข้องกับสาเหตุที่เป็นไปได้หลายประการอาทิเช่น :

1. **ความผิดปกติทางพันธุกรรม**
2. ความผิดปกติในระบบเนื้อเยื่อนำไฟฟ้าภายในหัวใจ
3. การขาดสารอาหาร เช่น การขาดสารไธอามีน (ไวตามินบี 1)
4. การมีปริมาณโปแตสเซี่ยมในเลือดต่ำ
5. ความผิดปกติในระบบสารเคมีสื่อนำการสื่อสารในระบบประสาท (Neurotransmitters)
6. ความผิดปกติในระบบประสาทอัตโนมัติ (Autonomic Nervous System)
7. ภาวะความเครียดทางร่างกายและจิตใจ
7. การนอนฝันร้าย (Night terror and Nightmares)
8. ความเชื่อเรื่องทางไสยศาสตร์
9. **ความผิดปกติในการควบคุมการหายใจระหว่างการนอนหลับ** (Sleep related breathing disorders e.g. Sleep apnea Syndromes)
10. การได้รับเชื้อโรค อาทิ เช่น เชื้อไวรัส (Influenza virus Type A)
11. **โรคเมลลอยด์โดซีส** (Melloidosis) **จากการติดเชื้อ** Pseudomonas mellei
12. การได้รับสารพิษ เช่น แอลกอฮอล ยากระตุ้นประสาทและสารโพลีไนิลคลอไรด์



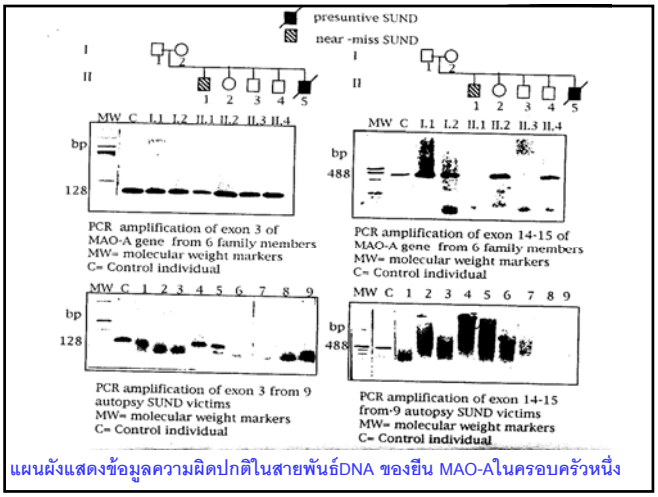




is SUNDS an X-linked recessive inheritance?

What are the possible biomarkers on the X chromosome ?

- pyruvate dehydrogenase
- ornithine carbamyl transferase
- glyceraldehyde-3 phosphate dehydrogenase
- α-phosphorylase kinase
- monoamine oxidase A and B
- glycine receptor
- GABA receptor



แผนผังแสดงข้อมูลความผิดปกติในสายพันธ์DNA ของยีน MAO-Aในครอบครัวหนึ่ง

The PCR results of SUNDS's parents and siblings

Case/sex Status

Genes:	MOA-A exon 3	4	5-6	14-15	K-*ras* 2
NP1.5 P/M(I-1)	+	+	+	+	+
NP1.30 M/F(I-2)	+	+	L	L	+
NP1.11 S/M(II-1)	+	+	-	-	+
NP1.12 S/F(II-2)	+	+	+	+	+
NP1.13 S/M(II-3)	+	+	-	-	+
NP1.14 S/M(II-4)	+	+	+	+	+
control /M	+	+	+	+	+

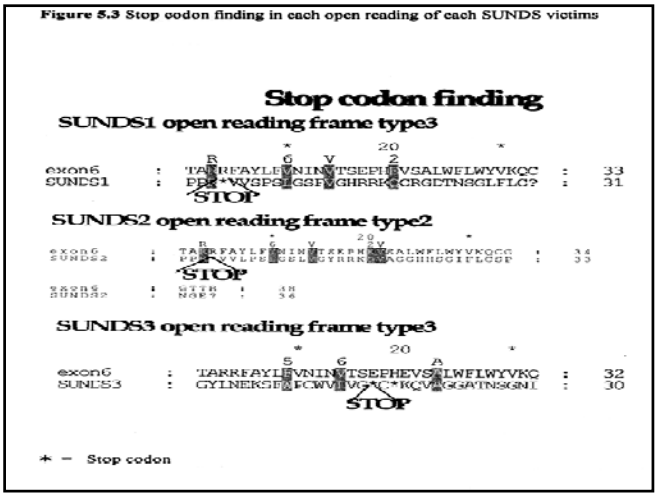
Case/sex Status

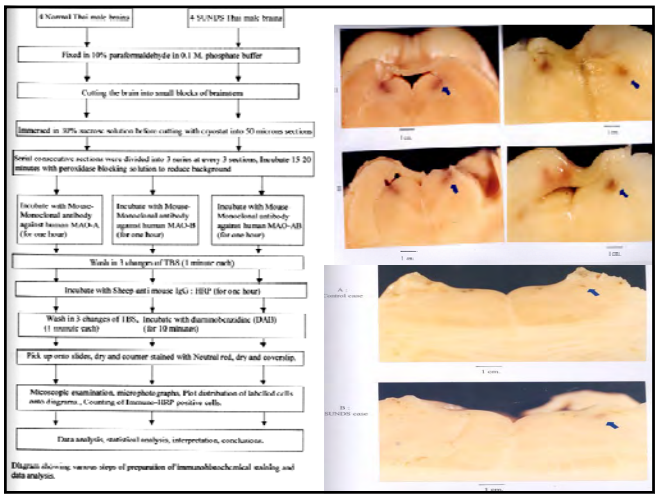
Genes :	MOA-A exon 3	4	5-6	14-15	K-*ras* 2
SUNDS 1/M	+	-	-	-	+
SUNDS 2/M	-	-	-	-	+
SUNDS 3/M	-	-	-	-	+
SUNDS 4/M	+	+	-	-	+
SUNDS 5/M	-	-	-	-	+
SUNDS 6/M	-	-	-	-	+
SUNDS 7/M	+	-	-	-	+
SUNDS 8/M	-	-	-	-	+
SUNDS 9M	-	-	-	-	+
control /M	+	+	+	+	+

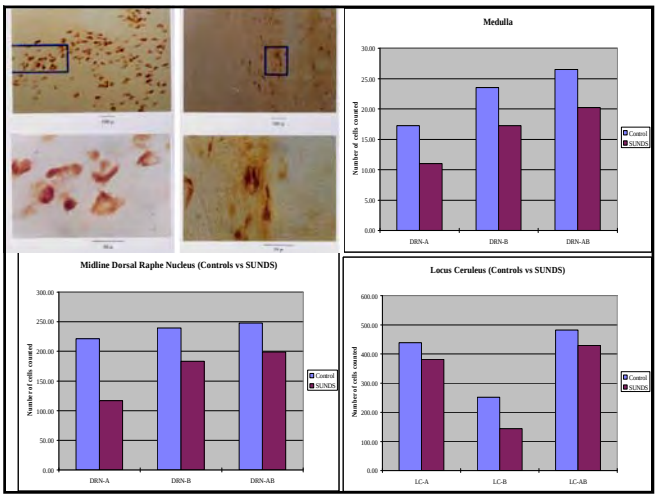
Remark : + = Normal positive amplification L = Light band
- = Negative amplification S = SUNDS sibship
Control = Normal individual
P = Paternal M = Maternal /F = Female /M = Male

ตารางแสดงความผิดปกติในหลายบริเวณของสายพันธ์DNAของยีน MAO-A

Figure 5.3 Stop codon finding in each open reading of each SUNDS victims





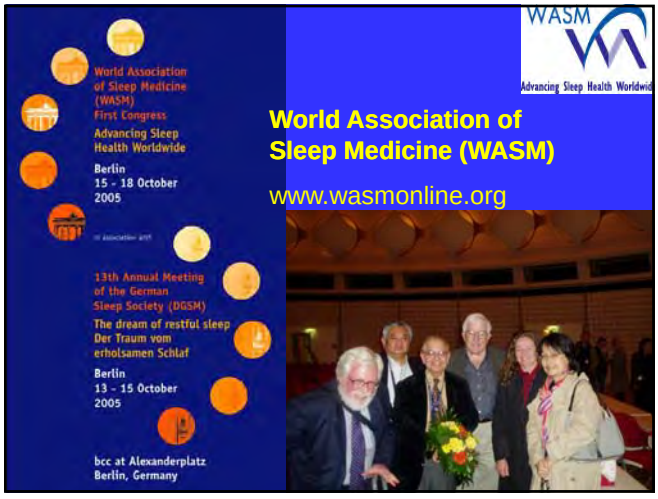


Asian Sleep Research Society

1992	**Foundation of Asian Sleep Research Society (ASRS)**
1994	1st ASRS Congress in Tokyo, Japan
1997	2nd ASRS Congress in Jerusalem, Israel
2000	3rd ASRS Congress in Bangkok, Thailand
2004	4th ASRS Congress in Zuhai, China
2005	5th ASRS Congress in Seoul, Korea
2008	6th ASRS Congress in Kyoto, Japan
2011	**WorldSleep 2011 and 7th ASRS, Kyoto**
2012	8th ASRS Congress in Taipei, Taiwan

3rd ASRS Congress Pre-Congress Training Workshop
December 1-2, 2000, Salaya, Thailand

3rd ASRS Congress,
December 3- 7, 2000 Bangkok, Thailand



World Association of Sleep Medicine (WASM)

www.wasmonline.org

Sleep is NOT just the absence of wakefulness

- Active
- Complex
- Highly Regulated
- Involves different areas in the brain
- The whole purpose is not fully understood
- Essential to life
  - We all do it

How much sleep do you need?*

Infants
- Birth–2 months need 12–18 hours
- 3–11 months need 14–15 hours

Toddlers/Children
- 1–3 years need 12–14 hours
- 3–5 years old need 11–13 hours
- 5–10 years old need 10–11 hours

Adolescents
- 10-17 years need 8.5–9.5 hours

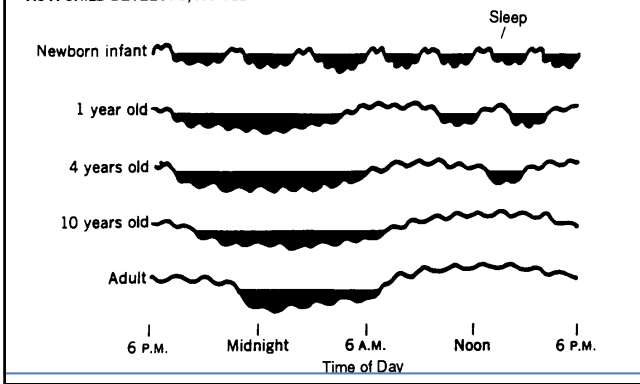
Adults
- need 7–9 hours

"... Sufficient sleep is not a luxury—it is a necessity—and should be thought of as a vital sign of good health."

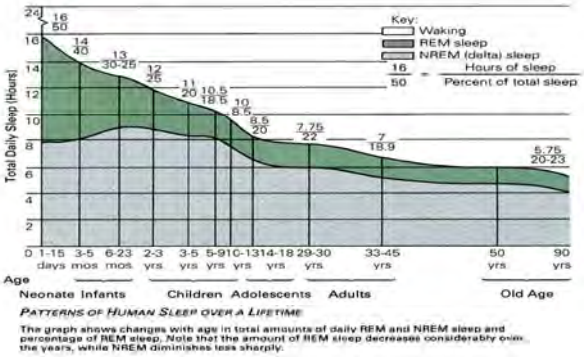
Wayne H. Giles, MD, MS, Director, Division of Adult and Community Health, National Center for Chronic Disease Prevention and Health Promotion.

CDC Centers for Disease Control and Prevention

Wake / Sleep Pattern Development



One-third of the life span is spent in sleep, a state that is crucial for physical, mental and emotional well-being



The graph shows changes with age in total amounts of daily REM and NREM sleep and percentage of REM sleep. Note that the amount of REM sleep decreases considerably over the years, while NREM diminishes less sharply.

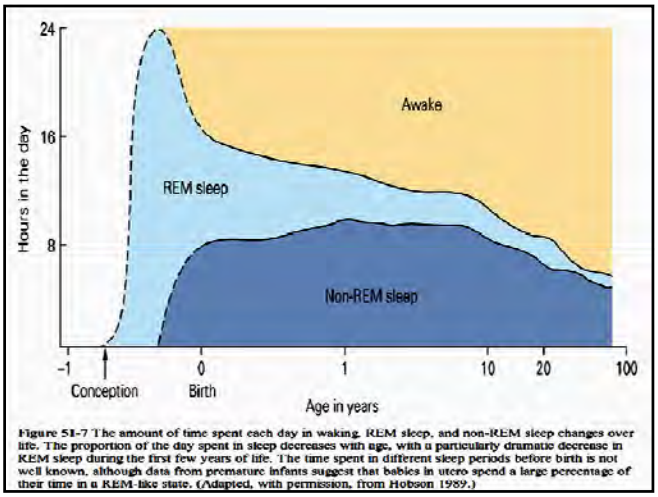
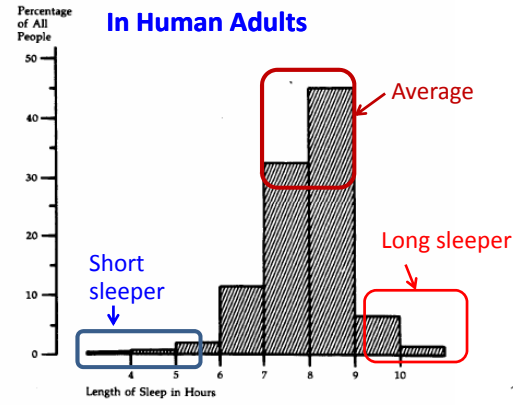
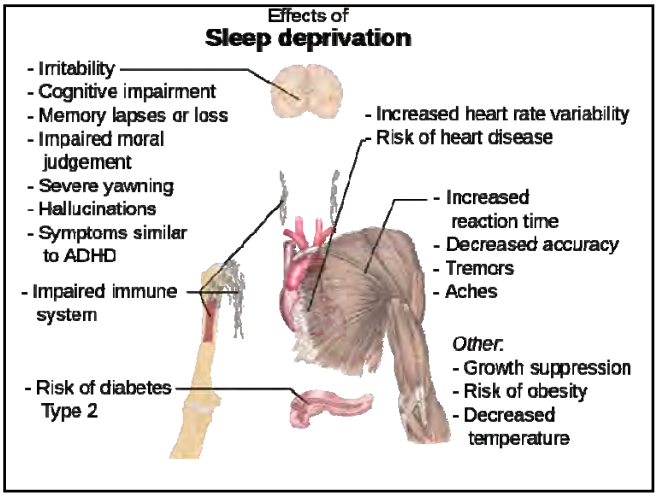


Figure 51-7 The amount of time spent each day in waking, REM sleep, and non-REM sleep changes over life. The proportion of the day spent in sleep decreases with age, with a particularly dramatic decrease in REM sleep during the first few years of life. The time spent in different sleep periods before birth is not well known, although data from premature infants suggest that babies in utero spend a large percentage of their time in a REM-like state. (Adapted, with permission, from Hobson 1989.)

Total Sleep Requirement





Psychiatric and Mental Health Aspects of Sleep

Changing Social Life Styles, Economics, Politics & Environment

↓

Sleep Deprivation or Insufficient Sleep + Stresses

↓

Sleep disturbances or Sleep Disorders

↓

Sleepiness + Poor Physical and Mental Health

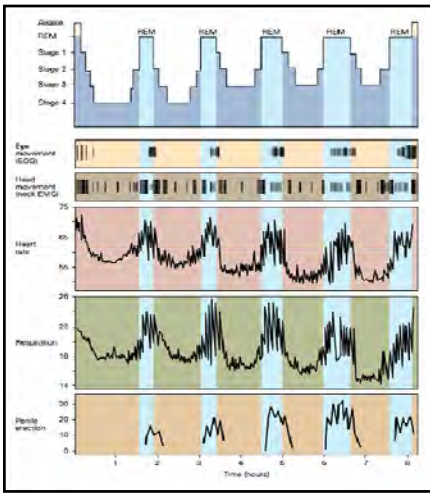
↓

Mental Health and Psychiatric Disorders

Sleep is regulated by the brain, its genetic clocks, neurochemical transmitters, hormones, and mediators.

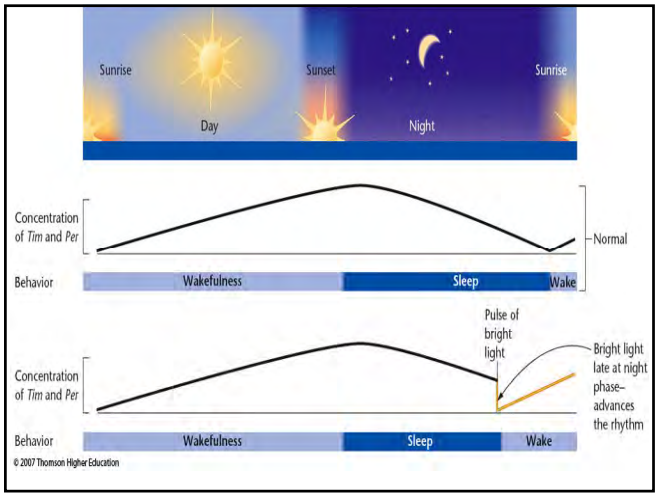
Sleep is determined by genetic factors and developmental learned experience.

Sleep is sensitive to environmental factors e.g. temperature, noises, pollution, psychological anxiety and stress, foods and drugs etc.



Physiological changes during sleep. Sleep consists of several cycles between stages 1 and 4 and rapid eye movement (REM) sleep.
As sleep deepens, eye movements become less prominent; movements of the head, heart rate, and respiration all decrease. As the level of sleep lightens, these trends reverse. During REM sleep heart rate and respiration increase, as does penile erection. Neck movements can occur just before and after an episode of REM sleep, whereas during REM sleep muscle tone is very low. (EOG, electro-oculogram; EMG, electromyogram.)

How do aquatic mammals sleep?
With one half-brain at a time !!!



The optimal amount of sleep is not a meaningful concept unless the timing of that sleep is seen in relation to an individual's circadian rhythms.

A person's major sleep episode is relatively inefficient and inadequate when it occurs at the "wrong" time of day; one should be asleep at least six hours before the lowest body temperature.

The timing is correct when the following two circadian markers occur after the middle of the sleep episode and before awakening:

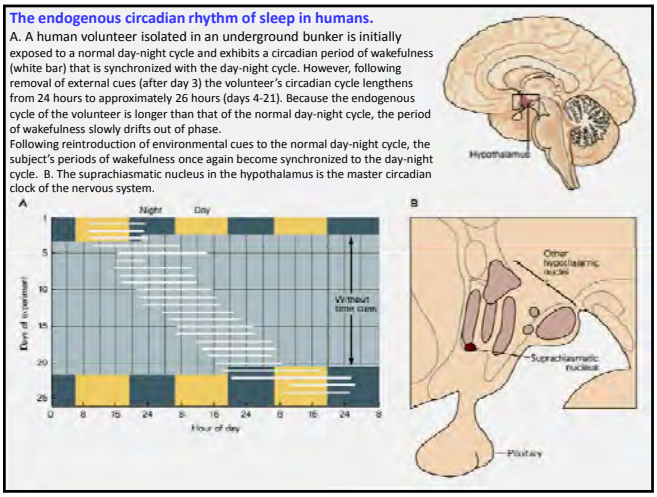
(1) maximum concentration of the hormone melatonin, and
(2) minimum core body temperature.

Human sleep needs can vary by age and among individuals, and sleep is considered to be adequate when there is no daytime sleepiness or dysfunction.

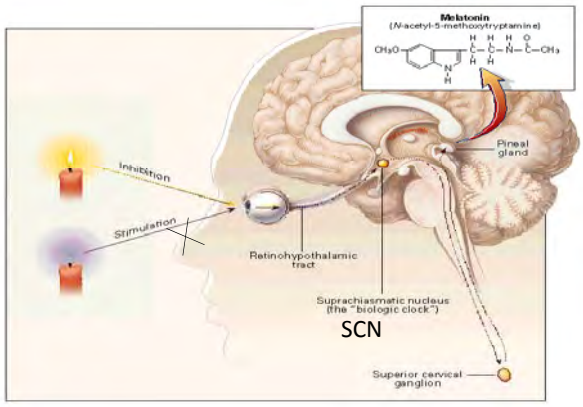
Moreover, self-reported sleep duration is only moderately correlated with actual sleep time as measured by actigraphy, and those affected with sleep state misperception may typically report having slept only four hours despite having slept a full eight hours

The endogenous circadian rhythm of sleep in humans.

A. A human volunteer isolated in an underground bunker is initially exposed to a normal day-night cycle and exhibits a circadian period of wakefulness (white bar) that is synchronized with the day-night cycle. However, following removal of external cues (after day 3) the volunteer's circadian cycle lengthens from 24 hours to approximately 26 hours (days 4-21). Because the endogenous cycle of the volunteer is longer than that of the normal day-night cycle, the period of wakefulness slowly drifts out of phase.
Following reintroduction of environmental cues to the normal day-night cycle, the subject's periods of wakefulness once again become synchronized to the day-night cycle. B. The suprachiasmatic nucleus in the hypothalamus is the master circadian clock of the nervous system.



CIRCADIAN BODY RHYTHMS

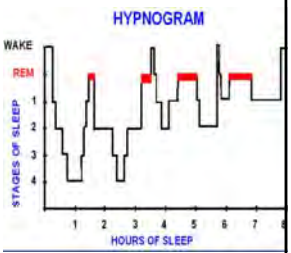


MELATONIN

How do we normally sleep?

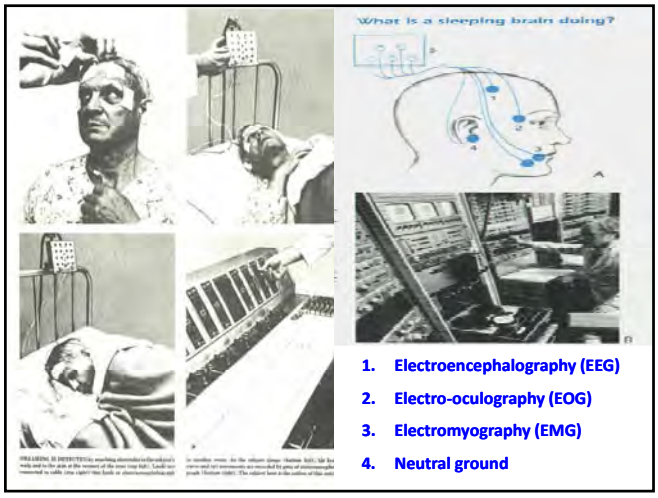
In human, all other mammals and birds, sleep is divided into two broad types: rapid eye movement (**REM**) and non-rapid eye movement (**NREM or non-REM**) sleep.

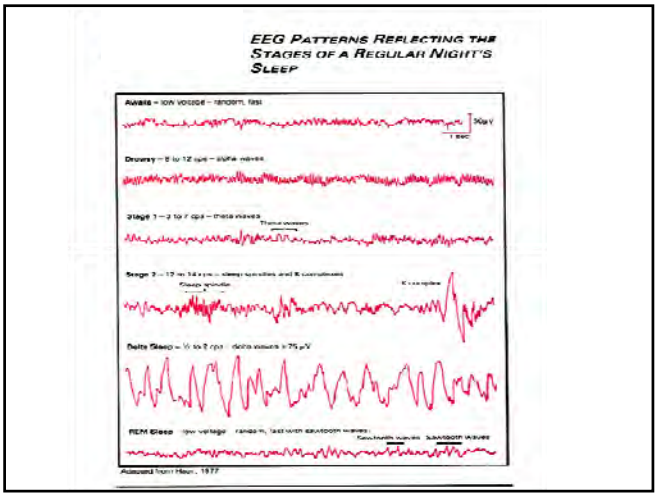
Each type has a distinct set of associated physiological, neurological, and psychological features. The American Academy of Sleep Medicine (AASM) further divides NREM into three stages: N1, N2, and N3, (previously there is also the last of which is also called N4) or delta sleep or slow-wave sleep (SWS).



Hypnogram showing sleep cycles from midnight to 8.00 am, with deep sleep early on. There is more REM (marked red) before waking.

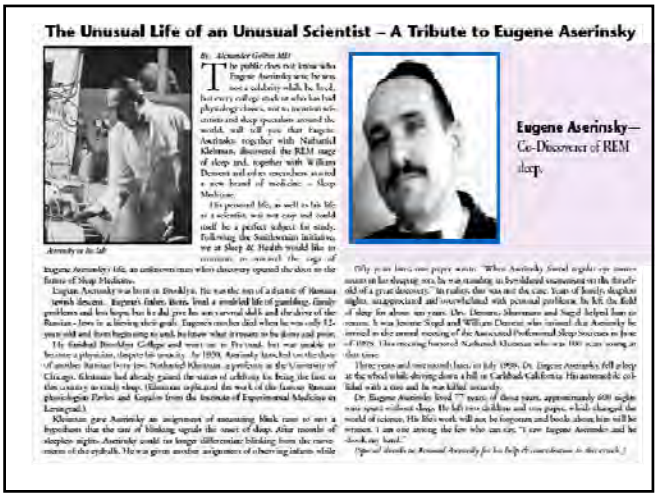
Sleep proceeds in cycles of NREM and REM, the order normally being N1 → N2 → N3 → N4→ N3 → N2 → N1 → REM. There is a greater amount of deep sleep (stage N3 and N4) earlier in the sleep cycle, while the proportion of REM sleep increases later in the sleep cycle and just before natural awakening.

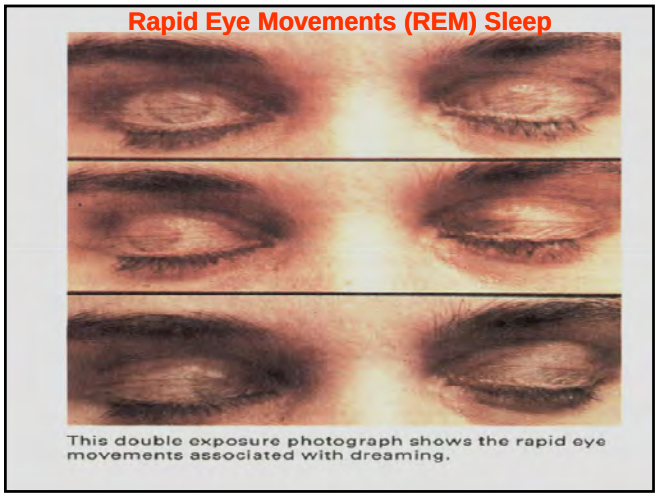


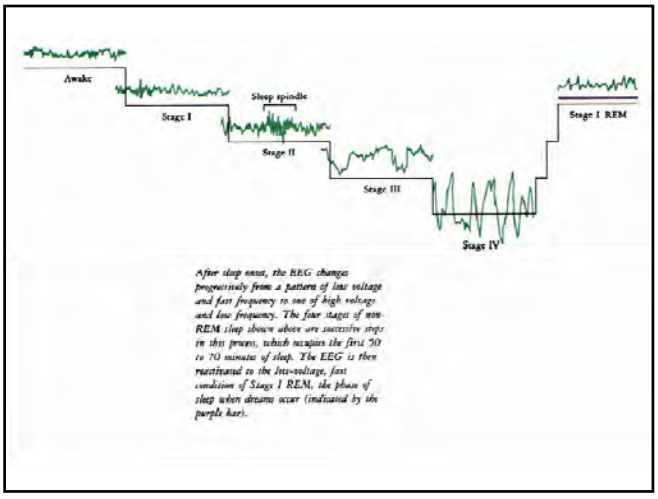


Two distinctive phases of sleep:

1. **Non-REM Sleep**
2. **Rapid Eye Movement (REM)**
   Sleep was discovered by Eugene Aserinsky and Nathaniel Kleitman in 1954, and was later found to be associated with dreaming

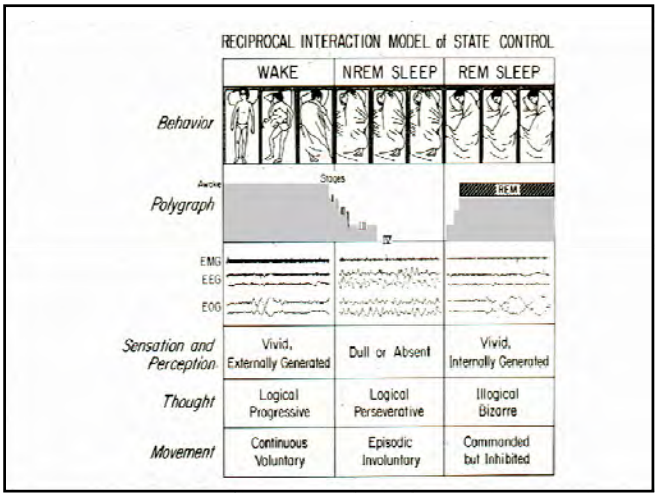


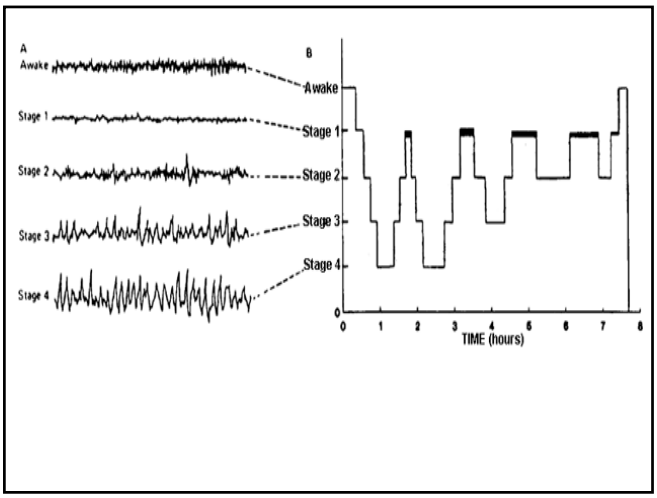


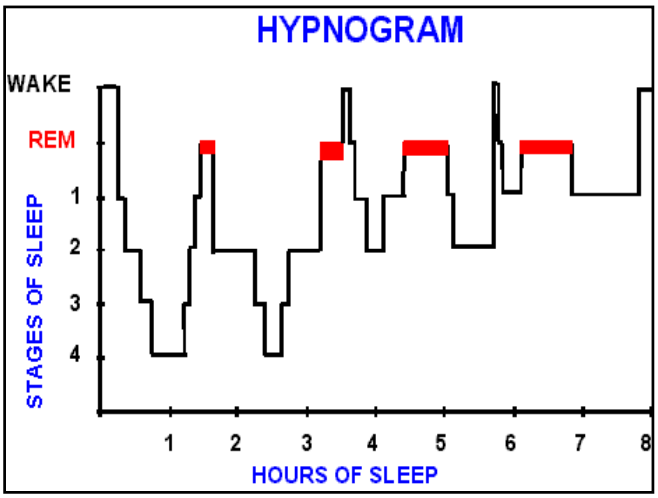


REM Sleep

- **"Rapid Eye Movement"**
- **REM called paradoxical sleep**
  - Brain waves similar to waking state, but person is deeply asleep and unable to move
- **Most dreaming takes place during REM**



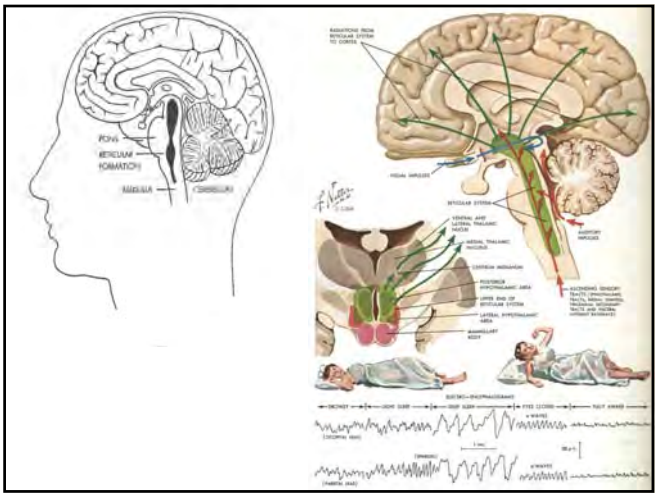


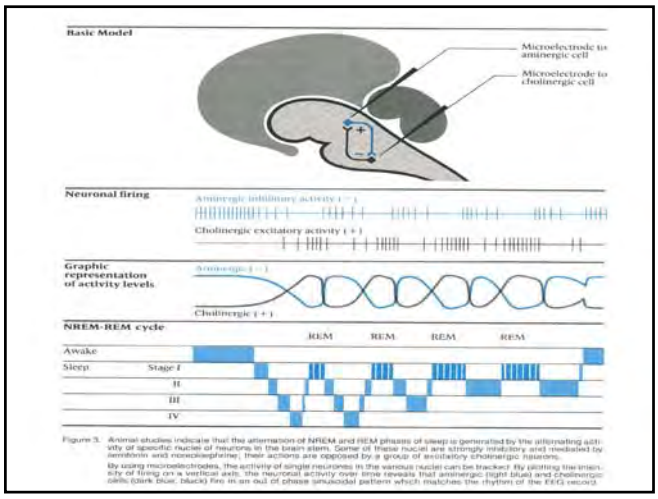


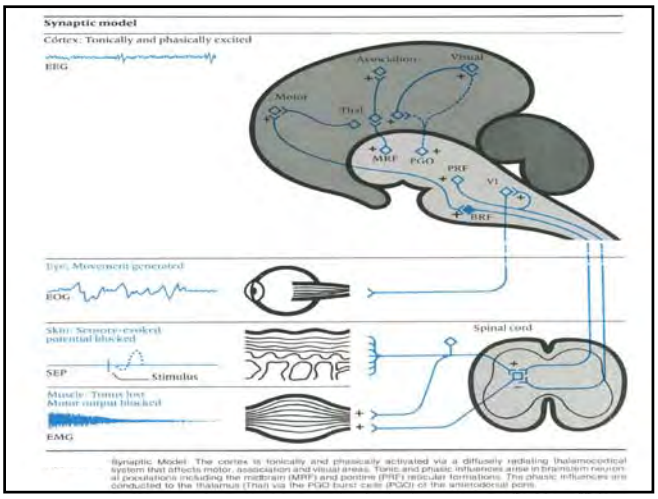
What Happens When We Sleep?

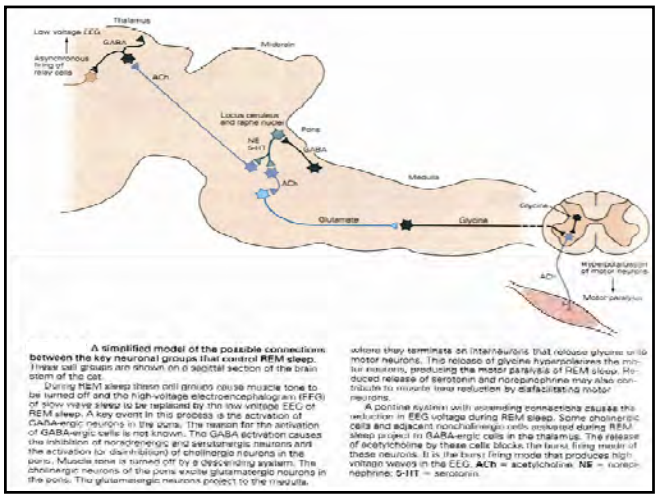
- ***Stage 1***
  - A twilight zone between full wakefulness and sleep.
  - The brain produces small, irregular, rapid electrical waves.
- ***Stage 2***
  - Brain waves with characteristics of Sleep Spindles and K-Complex before slipping into unawareness of the surrounding.
  - Eyes unresponsive and bodily functions slow.
- ***Stage 3 and 4***
  - The most profound state of unconsciousness and quiet resting sleep
  - The brain produces slower, larger waves, "Delta" or slow-wave sleep.
- ***REM sleep***
  - **Vivid dreaming during rapid eye movements, and body with no muscle tone to prevent body movements.**
  - **Brain waves resemble those of waking more than quiet sleep.**

These stages are repeated four or five times a night.





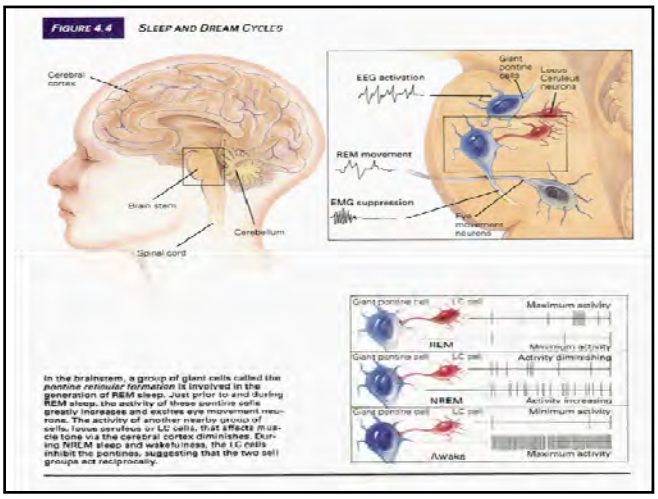




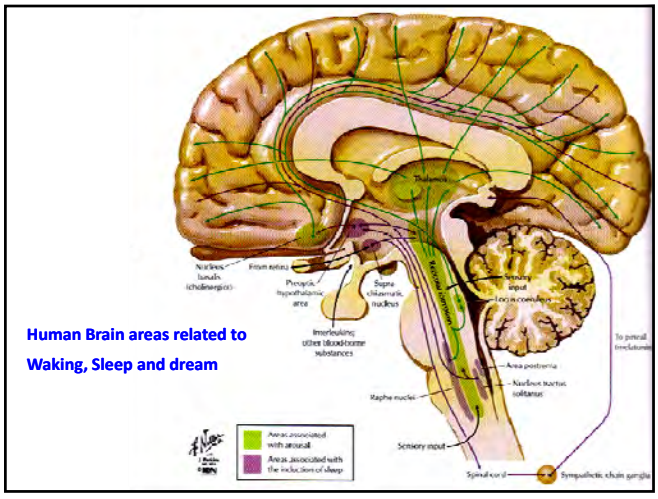
A simplified model of the possible connections between the key neuronal groups that control REM sleep. These cell groups are shown on a sagittal section of the brain stem of the cat.

During NREM sleep brain aminergic neurons reduce muscle tone to be turned off and the high-voltage electroencephalogram (EEG) of slow wave sleep is to be replaced by thin low voltage EEG of REM sleep. A key event in this process is the activation of GABA-ergic neurons in the pons. The reason for the activation of GABA-ergic cells is not known. The GABA activation causes the inhibition of noradrenergic and serotonergic neurons and the activation (or disinhibition) of cholinergic neurons in the pons. Muscle tone is turned off by a descending system. The cholinergic neurons of the pons excite glutamatergic neurons in the pons. The glutamatergic neurons project to the medulla, where they terminate on interneurons that release glycine onto motor neurons. The release of glycine hyperpolarizes the motor neurons, producing the motor paralysis of REM sleep. Reduced release of serotonin and norepinephrine may also contribute to muscle tone reduction by disfacilitating motor neurons.

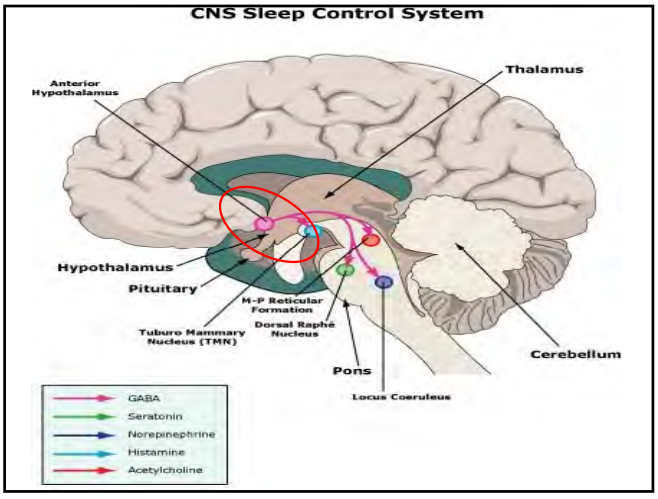
A pontine system with ascending connections causes the reduction in EEG voltage during REM sleep. Some cholinergic cells and adjacent noncholinergic cells produced during REM sleep project to GABA-ergic cells in the thalamus. The release of acetylcholine by these cells blocks the burst firing mode of these neurons. It is the burst firing mode that produces high-voltage waves in the EEG. **ACh** = acetylcholine. **NE** = norepinephrine; **5-HT** = serotonin.

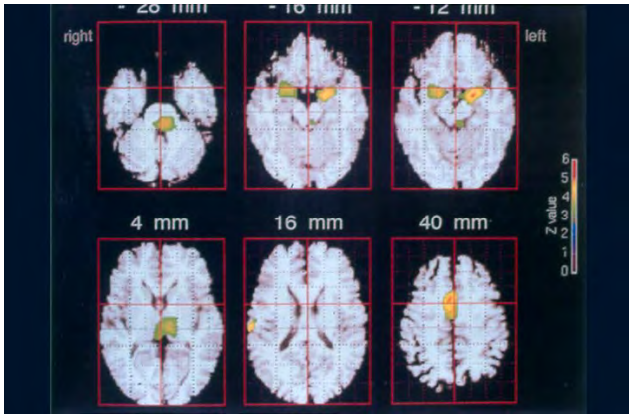


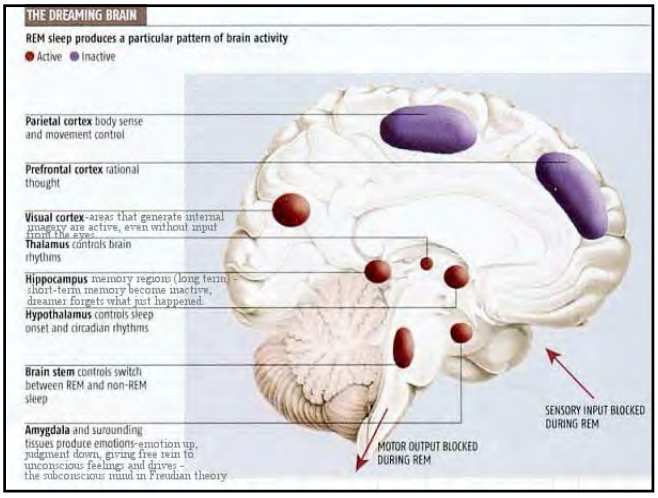
In the brainstem, a group of giant cells called the *pontine reticular formation* is involved in the generation of REM sleep. Just prior to and during REM sleep, the activity of these pontine cells greatly increases and excites eye movement neurons. The activity of another nearby group of cells, locus ceruleus or LC cells, that affects muscle tone via the cerebral cortex diminishes. During NREM sleep and wakefulness, the LC cells inhibit the pontines, suggesting that the two cell groups are reciprocally.

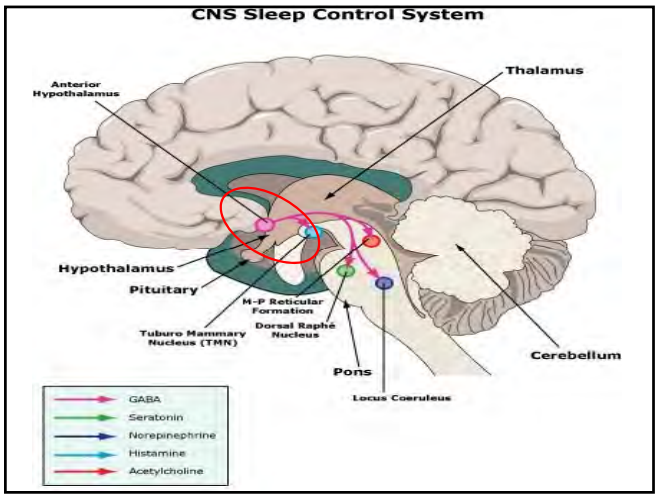


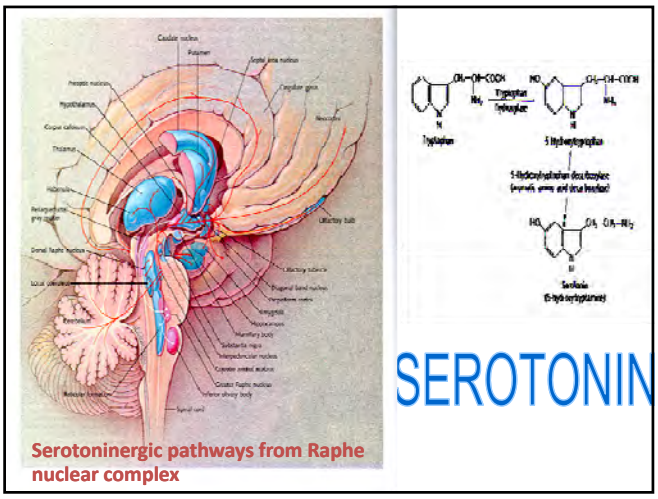
Human Brain areas related to Waking, Sleep and dream

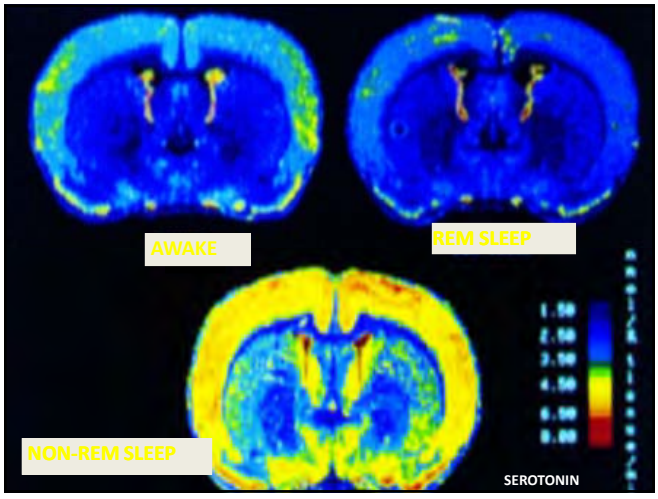


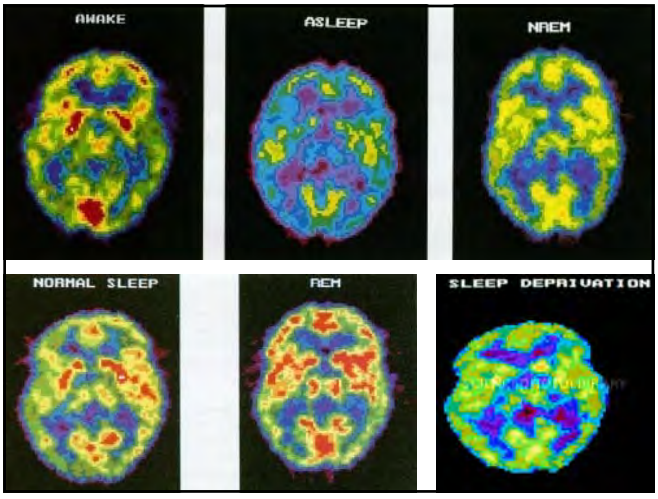

right
left
4 mm
16 mm
40 mm
Z value


THE DREAMING BRAIN
REM sleep produces a particular pattern of brain activity
Active
Inactive
Parietal cortex body sense and movement control
Prefrontal cortex rational thought
Visual cortex-areas that generate internal imagery are active, even without input from the eyes.
Thalamus controls brain rhythms
Hippocampus memory regions (long term, short-term memory become inactive, dreamer forgets what just happened.
Hypothalamus controls sleep onset and circadian rhythms
Brain stem controls switch between REM and non-REM sleep
Amygdala and surrounding tissues produce emotions-emotion up, judgment down, giving free rein to unconscious feelings and drives - the subconscious mind in Freudian theory
SENSORY INPUT BLOCKED DURING REM
MOTOR OUTPUT BLOCKED DURING REM


CNS Sleep Control System
Anterior Hypothalamus
Thalamus
Hypothalamus
Pituitary
M-P Reticular Formation
Tuburo Mammary Nucleus (TMN)
Dorsal Raphé Nucleus
Pons
Locus Coeruleus
Cerebellum
GABA
Seratonin
Norepinephrine
Histamine
Acetylcholine


SEROTONIN
Serotoninergic pathways from Raphe nuclear complex


AWAKE
REM SLEEP
NON-REM SLEEP
SEROTONIN

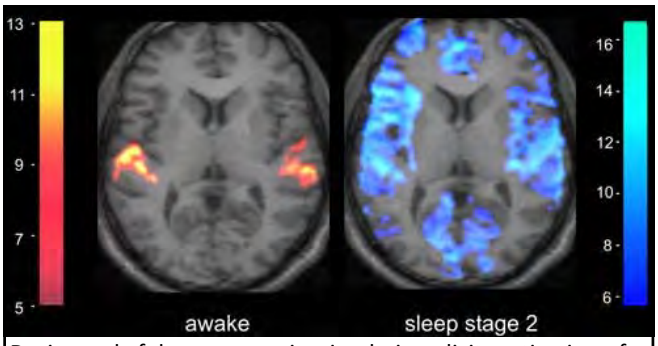

AWAKE
ASLEEP
NREM
NORMAL SLEEP
REM
SLEEP DEPRIVATION

Simultaneous sleep and functional magnetic resonance imaging (fMRI) studies

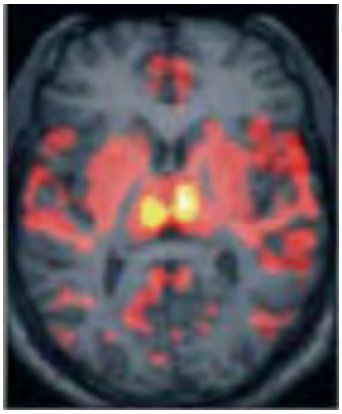
Fig. 1. Subject placed in the MR scanner.

The process of falling asleep could thus be shown to consist of a successive downregulation of specific brain networks as reflected in alterations in regional BOLD (blood oxygen level dependent) signals. During rapid eye movement (REM) sleep, a functional network fostering this sleep stage previously shown in animal models, could for the first time be demonstrated in humans. High activity in cortico-limbic areas is specifically enhanced during times of high phasic activity, characterized by a high number of rapid eye movements

Max Planck Institute of Psychiatry



During wakefulness, acoustic stimulation elicits activation of the auditory cortex (red). Similar stimulation during light NREM sleep stage 2 evokes transient down-regulation of widespread cortical areas (blue), supposedly a sleep protective mechanism.



During phasic REM sleep periods with high number of rapid eye movements, high cortico-thalamic activity (red) is generated in the brain.

Histamine

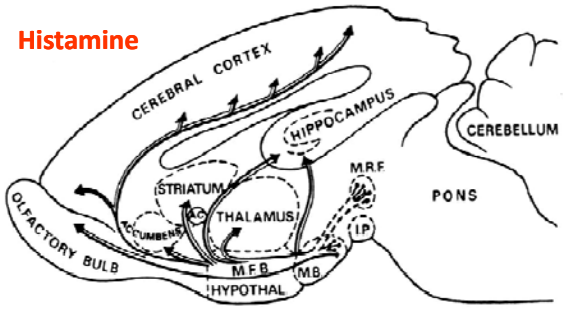
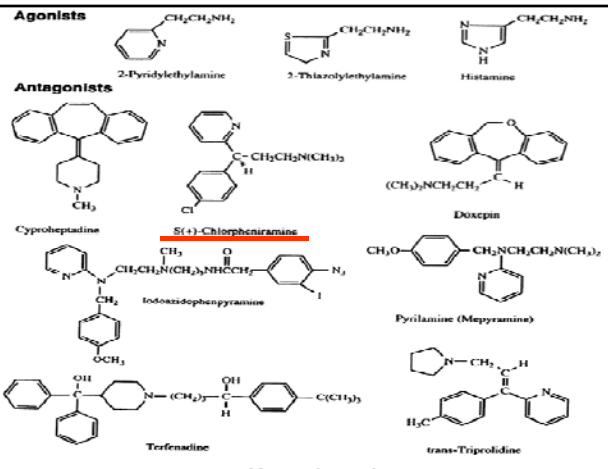
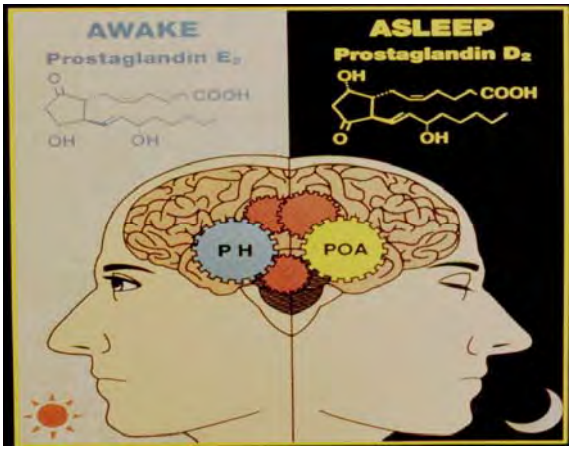


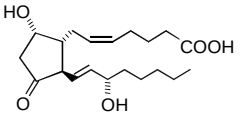
FIGURE 10-10. Schematic illustration of the distribution of histamine-containing neurons in brain. M.R.F., mesencephalic reticular formation; M.B., mammillary bodies; M.F.B., medial forebrain bundle. (Modified from Schwartz et al., 1986)



H_1 agonists and antagonists.

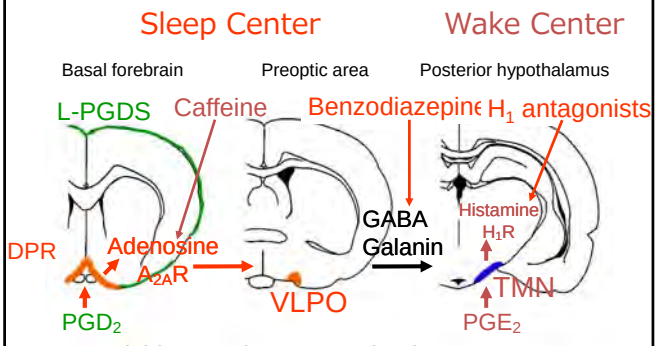


Prostaglandin D_2 and Sleep



1. PGD_2 is a major prostanoid produced in rat brain. (Narumiya *et al*., 1982)
2. PGD_2 induces sleep in rats and monkeys after intracerebroventricular administration. (Ueno *et al.*, 1983; Onoe *et al.*, 1988)
3. Deep sleep in patients with mastocytosis or African sleeping sickness is likely due to overproduction of PGD_2. (Roberts & Oates, 1985; Pentreath *et al*., 1990)

Mechanisms of Sleep-wake Regulation by PGD_2 and PGE_2



Hayaishi & Urade, Neuroscientist 2002

Sleep Disorders - Socioeconomic Consequences

- 40 million Americans suffer from chronic disorders of sleep and wakefulness.
- 95% of these remain unidentified and undiagnosed.
- The annual direct cost of sleep-related problems is $16 billion, with an additional $50-$100 billion in indirect costs (accidents, litigation, property destruction, hospitalization, and death).

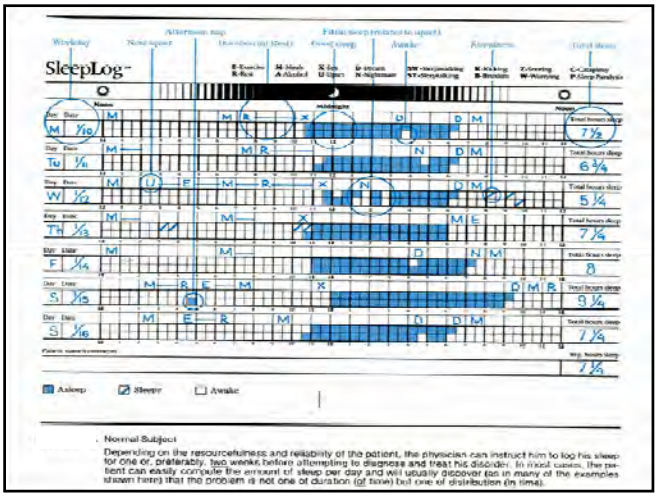
What else about sleep?

- Sleep disorders are ***common***
- Sleep disorders are ***serious***
- Sleep disorders are ***treatable***
- Sleep disorders are ***underdiagnosed***

ข้อมูลที่รวบรวมโดยองค์การอนามัยโลก **(WHO)** แสดงว่า ประมาณ ครึ่งหนึ่ง **(50 %)** ของประชากรของโลกมีความเสี่ยงต่อการเกิดปัญหา หรือ ความผิดปกติในการนอนหลับ เมื่อผู้ป่วยมีความผิดปกติในการนอนหลับก็จะมีผลกระทบกับการทำงานของร่างกาย และ ทำให้อาการโรคอื่นๆที่มีอยู่ก่อนแล้วมีอาการกำเริบหรือทรุดโทรมมากยิ่งขึ้น หรือทำให้ขาดสมาธิ มีอาการง่วงนอนอย่างมากในเวลากลางวัน **(Excessive Day-time sleepiness)** มีผลต่อการรับรู้ ความจำ การตัดสินใจ ความรู้สึกทางอารมณ์ และการควบคุมการตอบสนองทั้งด้านร่างกาย และจิตใจที่สำคัญต่อการดำรงชีวิต ความผิดปกติในการนอนหลับยังทำให้เกิดความเสี่ยงอย่างมากต่อการเกิดอุบัติเหตุ และ หลายๆครั้งได้ทำให้เกิดความเสียหายอย่างใหญ่หลวง ต่อชีวิต ทรัพย์สิน สิ่งแวดล้อมที่มีมูลค่าทางเศรษฐกิจจำนวนมหาศาล **(WHO 1998** และ **WHO 1999).** ในปัจจุบันองค์การอนามัยโลกได้ให้ความสำคัญกับปัญหาเรื่องของการนอนหลับและการป้องกัน รักษาบำบัดความผิดปกติในการนอนหลับแบบต่างๆอย่างมาก แบบ **Worldwide Project** และ การศึกษาวิจัยทำให้มีความก้าวหน้าอย่างมากในวิชาการด้าน **Sleep Medicine**

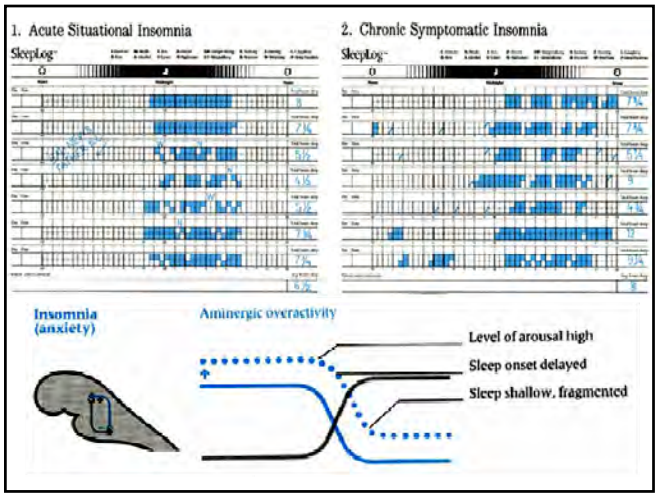
Major sleep disorders:

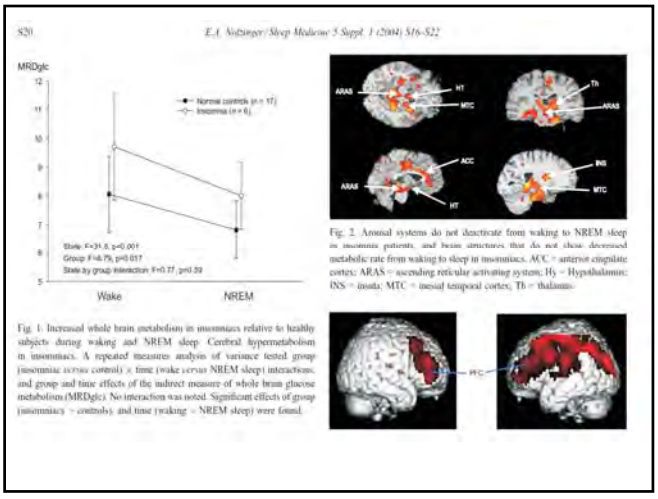
1. **Insomnia** (Depression, Situational etc.)
2. **Hypersomnia**
   - Excessive daytime sleepiness
   - Narcolepsy
3. **Parasomnia**
   - Night terrors, Nightmares
   - Snoring
   - sleep apnea syndrome
     - Central or Obstructive, or mixed
   - Sleep paralysis, Restless leg Syndrome
   - Sleep Walking, Sleep talking, Bruxism
   - Sudden Nocturnal Death Syndrome etc..

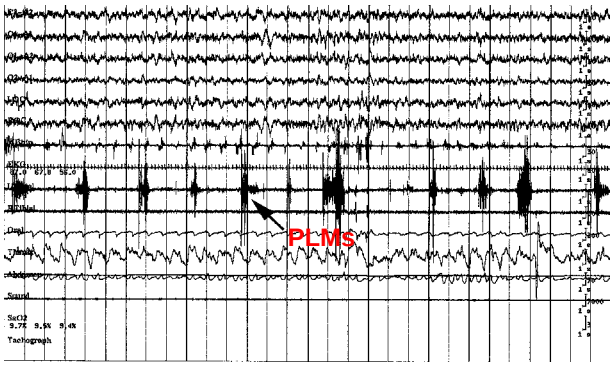


อาการนอนไม่หลับ (Insomnia)

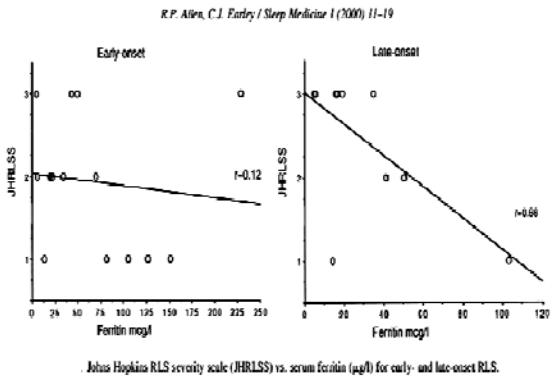
ในกลุ่มของปัญหาและความผิดปกติในการนอนหลับชนิดต่างๆ อาการที่เป็นปัญหาที่พบได้บ่อย มีผลกระทบกับประชากรอย่างมาก กว้างขวางและสำคัญที่สุดทั้งในประเทศไทย และทั่วโลก คือ อาการนอนไม่หลับ (Insomnia) ซึ่งหมายความว่า ผู้ป่วยมีอาการจากความรู้สึก (Subjective Complaint) ว่า นอนหลับได้ไม่เพียงพอ นอนหลับยาก (ใช้เวลา มากกว่า 30 นาทีจึงหลับ) หลับไม่ต่อเนื่อง เพราะตื่นกลางคืนบ่อย หรือตื่นเช้าเกินไปและไม่สามารถหลับต่อ และตื่นขึ้นมาแล้วยังรู้สึกง่วงอ่อนเพลีย ไม่สดชื่น ทำให้เกิดรู้สึกเครียด มีความทุกข์ทรมานจากความรู้สึกความคิดและความจำสับสน ขาดสมาธิ กังวล และ มีอาการง่วงนอนอย่างรุนแรงในตอนกลางวัน





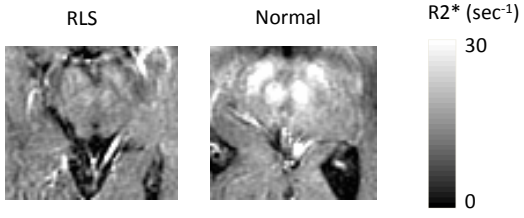


Typical polysomnographic recording of periodic leg movements (PLMs)



Johns Hopkins RLS severity scale (JHRLSS) vs. serum ferritin (μg/l) for early- and late-onset RLS.

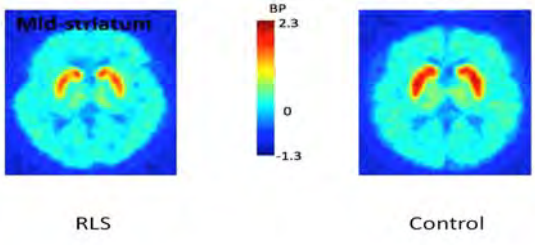
Brain: iron tissue concentrations low on MRI



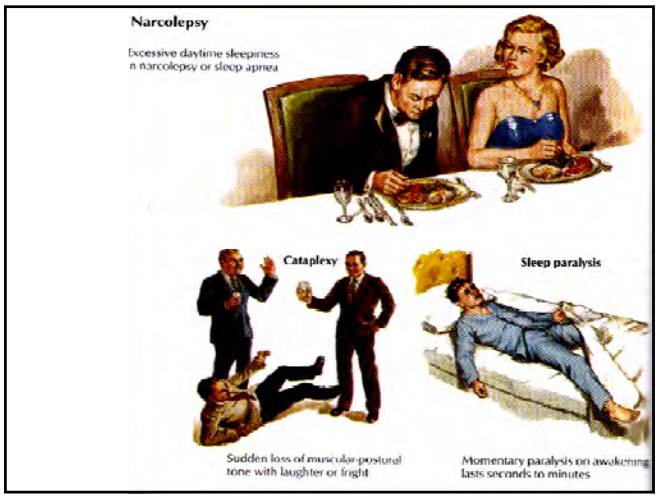
R2* images in a 70 year old RLS patient and a 71 year old control subject. Much lower R2* relaxation rates are apparent in the RLS case in both red nucleus and substantia nigra. (From Wayne Hening, 2004)

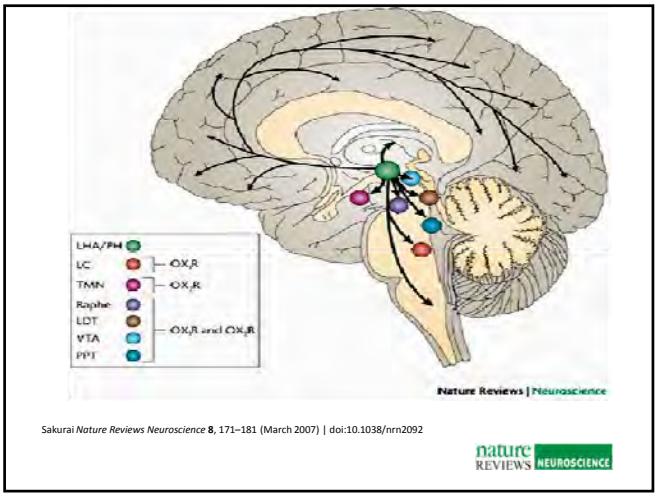
PLMD/RLS

Figure 2. Representative example of [¹¹C]methylphenidate binding potential in the striatum of a RLS and Control subject



Sleep. 2011 Mar 1;34(3):341-7.

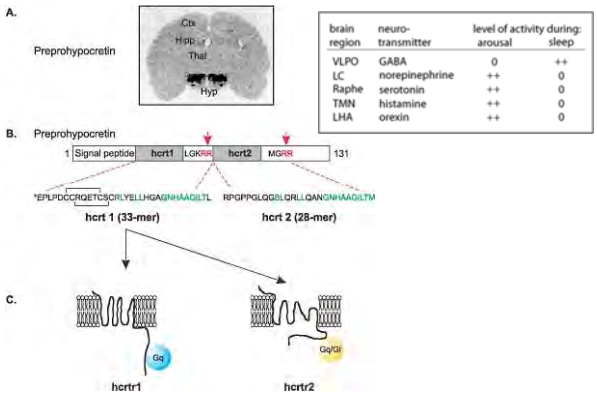




Sakurai *Nature Reviews Neuroscience* **8**, 171–181 (March 2007) | doi:10.1038/nrn2092

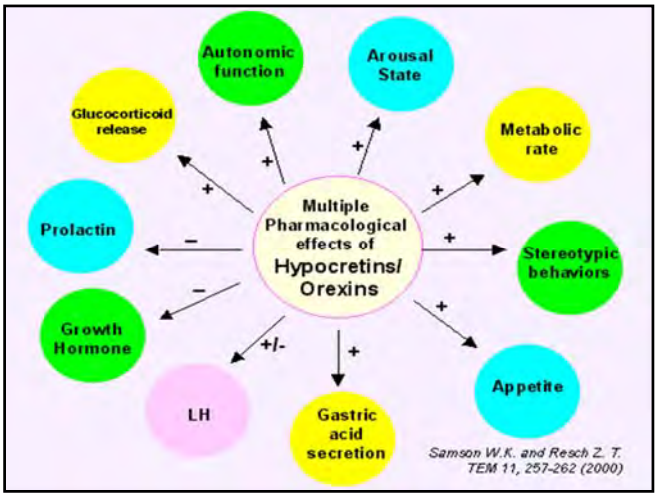
nature REVIEWS NEUROSCIENCE

Hypocretin/Orexin



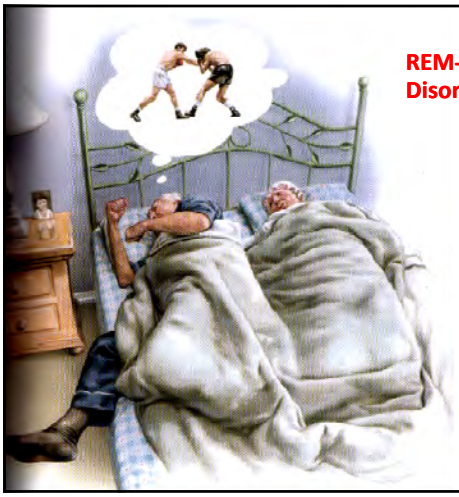
brain region	neuro-transmitter	level of activity during: arousal	sleep
VLPO	GABA	0	++
LC	norepinephrine	++	0
Raphe	serotonin	++	0
TMN	histamine	++	0
LHA	orexin	++	0

http://journals.prous.com/journals/dnp/20031608/html/dn160504/images/DeLeccea_f1.jpg

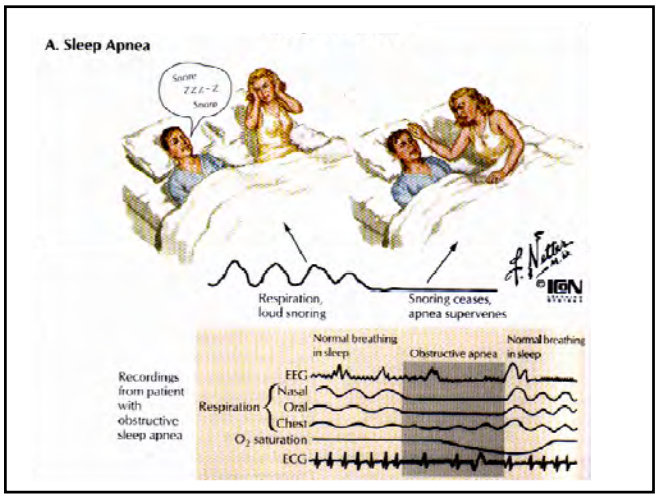


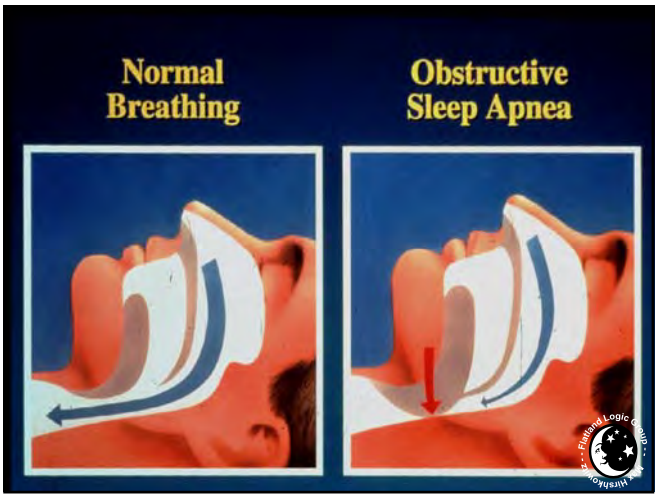
Abnormalities of Sleep

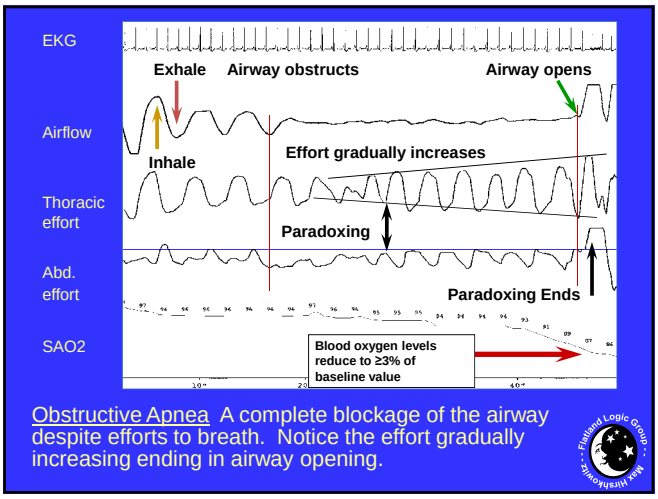
- **Night Terrors**
  - Abrupt, anxious awakening from a nREM sleep
  - More common in children than in adults
- **Sleep Talking**
  - Can occur in REM or nREM sleep
  - Harmless
- **Sleep Walking**
  - Usually in Stages 3 or 4 sleep
  - Early in the night
  - More common in children

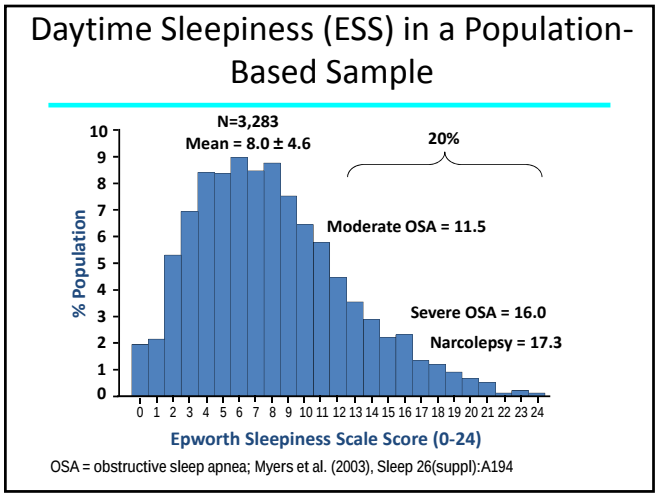


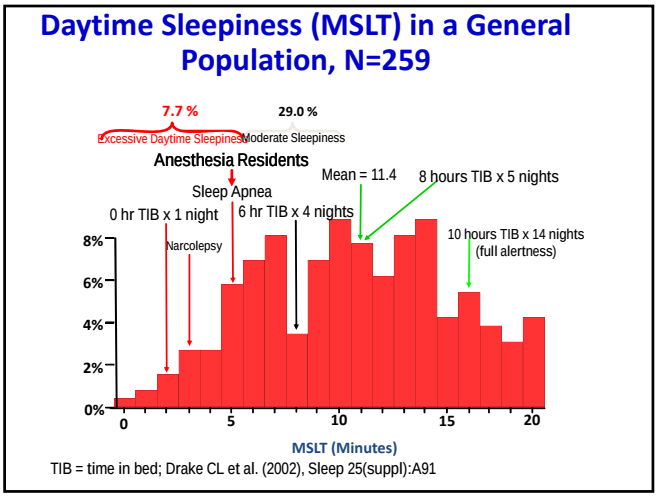
REM-Behaviour Disorders (RBD)


A. Sleep Apnea
Snore
ZZZ-Z
Snore
Respiration, loud snoring
Snoring ceases, apnea supervenes
Recordings from patient with obstructive sleep apnea
Normal breathing in sleep
Obstructive apnea
Normal breathing in sleep
EEG
Respiration
Nasal
Oral
Chest
O2 saturation
ECG

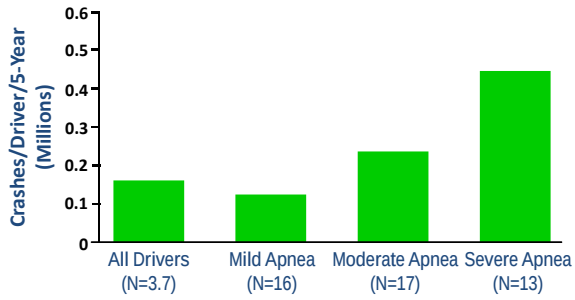

Normal Breathing
Obstructive Sleep Apnea


EKG
Exhale
Airway obstructs
Airway opens
Airflow
Inhale
Effort gradually increases
Thoracic effort
Paradoxing
Abd. effort
Paradoxing Ends
SAO2
Blood oxygen levels reduce to ≥3% of baseline value
Obstructive Apnea A complete blockage of the airway despite efforts to breath. Notice the effort gradually increasing ending in airway opening.


Daytime Sleepiness (ESS) in a Population-Based Sample
N=3,283
Mean = 8.0 ± 4.6
20%
Moderate OSA = 11.5
Severe OSA = 16.0
Narcolepsy = 17.3
% Population
Epworth Sleepiness Scale Score (0-24)
OSA = obstructive sleep apnea; Myers et al. (2003), Sleep 26(suppl):A194


Daytime Sleepiness (MSLT) in a General Population, N=259
7.7 %
Excessive Daytime Sleepiness
29.0 %
Moderate Sleepiness
Anesthesia Residents
Sleep Apnea
Mean = 11.4
8 hours TIB x 5 nights
0 hr TIB x 1 night
6 hr TIB x 4 nights
Narcolepsy
10 hours TIB x 14 nights (full alertness)
MSLT (Minutes)
TIB = time in bed; Drake CL et al. (2002), Sleep 25(suppl):A91

Car Crashes in Sleep Apnea Patients



Findley LJ et al. (1989), N Engl J Med 320(13):868-869

Contents lists available at ScienceDirect
Sleep Medicine
journal homepage: www.elsevier.com/locate/sleep

Original Article

Epidemiology of sleep-related complaints associated with sleep-disordered breathing in Bangkok, Thailand

Puntarica Suwanprathes [a,*], Christine Won [b], Chulaluk Komoltri [c], Arth Nana [d], Naiphinich Kotchabhakdi [e], Christian Guilleminault [f]

ARTICLE INFO

Article history:
Received 19 March 2009
Received in revised form 29 March 2010
Accepted 9 April 2010

Keywords:
Epidemiology
Thailand
Habitual snoring
Excessive daytime sleepiness
Sleep-disordered breathing
Prevalence

ABSTRACT

Background: This study assesses the prevalence of and risk factors for sleep-related complaints in Bangkok, Thailand.

Methods: A representative sample of the Bangkok population was selected based on results of the 2000 Census. A total of 4680 participants underwent face-to-face interview with a 49-question sleep inventory.

Results: Four percent of the total sampled (5.3% of men and 3.5% of women) complained of habitual snoring (>3 nights/week) and excessive daytime sleepiness (>3 days/week) for at least 3 months. These subjects were significantly ($p < 0.0001$) older (41.4 vs. 36.7 years), had greater BMI (26.0 vs. 22.8 kg/m^2), neck size (34.7 vs. 32.5 cms), and waist circumference (88.0 vs. 78.7 cms). They reported significantly shorter nocturnal sleep time, greater frequency of sleep disturbances and awakenings, unrefreshing sleep, choking during sleep, night sweats, nocturia, and bruxism. There was also a greater prevalence of cardiovascular and endocrine diseases. Multivariate analysis showed that male gender; BMI; waist size; and reports of witnessed apneas, unrefreshing sleep and night sweats were significant predictors of snoring and daytime sleepiness.

Conclusion: This is the first epidemiologic study investigating sleep-related complaints and associated health morbidities in the Thai population.

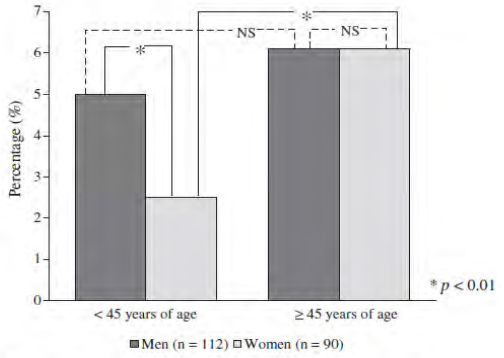
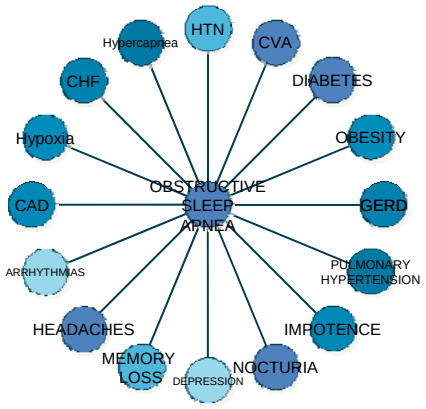


Fig. 1. Gender and age group differences in the prevalence of sleep-related complaints associated with sleep-disordered breathing.

The Consequences of Sleep Apnea



Sleep Medicine 11 (2010) 754–720
Contents lists available at ScienceDirect
Sleep Medicine
journal homepage: www.elsevier.com/locate/sleep

Review Article

Autonomic alterations and endothelial dysfunction in pediatric obstructive sleep apnea

Leila Kheirandish-Gozal [a,*], Rakesh Bhattacharjee [b], David Gozal [a]

ARTICLE INFO

Article history:
Received 17 October 2009
Received in revised form 6 December 2009
Accepted 12 December 2009

Keywords:
Autonomic nervous system function
Cardiovascular disease
Endothelium
Stem cells
Inflammation
Pediatric sleep apnea
Oxidative stress

ABSTRACT

The cardiovascular consequences of obstructive sleep apnea syndrome (OSAS) in children have started to emerge over the last decade. It is clear that the respiratory and sleep alterations that characterize this relatively prevalent condition induce substantial alterations in autonomic nervous system control, ultimately generating high sympathetic outflow and reactivity that reflect an imbalance between sympatho-excitatory and vagal inhibitory inputs. In addition to these important consequences, the constitutive elements of OSAS also elicit a rather extensive activation of systemic inflammatory pathways that in turn pose substantial risk to the integrity and functional homeostasis of the endothelial network. The complex interactions between the multiple injury-associated pathways recruited by OSAS are further compounded by the potential release of angiogenic factors and by the mobilization and homing of progenitor cells that have the potential to repair and restore the OSAS-disrupted vascular function. Improved characterization of the mechanisms involved in every one of these processes and identification of the determinants of susceptibility in pediatric populations along with the interactions with obesity will clearly modify our approaches to OSAS in the future.

Endothelial Function in Obstructive Sleep Apnea

Amy Atkeson, Susie Yim Yeh, Atul Malhotra and Sanja Jelic

Untreated obstructive sleep apnea (OSA) is an independent risk factor for hypertension, myocardial infarction, and stroke. The repetitive hypoxia/reoxygenation and sleep fragmentation associated with OSA impair endothelial function. Endothelial dysfunction, in turn, may mediate increased risk for cardiovascular diseases. Specifically, in OSA, endothelial nitric oxide availability and repair capacity are reduced, whereas oxidative stress and inflammation are enhanced. Treatment of OSA improves endothelial vasomotor tone and reduces inflammation. We review the evidence and possible mechanisms of endothelial dysfunction as well as the effect of treatment on endothelial function in OSA.

associated with OSA. For example, OSA patients who are otherwise free of cardiovascular comorbidities have increased endothelial oxidative stress, inflammation, and reduced endothelial repair capacity, strongly suggesting that OSA independently impairs endothelial function.[8-13] Endothelium-dependent vasodilation is impaired in otherwise healthy patients with OSA, suggesting reduced nitric oxide (NO) bioavailability.[14,15] Furthermore, treatment of OSA improves endothelial function and appears to reduce the risk of fatal and nonfatal cardiovascular events.[16,17] Reversal of endothelial dysfunction may play an important role in treatment-mediated reduction of cardiovascular risk in these patients.

Progress in Cardiovascular Diseases, Vol. 51, No. 5 (March/April), 2009: pp 351-362

J Appl Physiol 98: 2226–2234, 2005.
First published January 27, 2005; doi:10.1152/japplphysiol.01225.2004

Functional imaging of working memory in obstructive sleep-disordered breathing

Robert J. Thomas,[1,2] Bruce R. Rosen,[2] Chantal E. Stern,[2] J. Woodrow Weiss,[1] and Kenneth K. Kwong[2]
[1]Division of Pulmonary Critical Care and Sleep Medicine, Department of Medicine, Beth Israel Deaconess Medical Center, Boston; [2]Martinos Center for Biomedical Imaging, Department of Radiology, Massachusetts General Hospital, Charlestown; [3]Brain, Behavior and Cognition Program, Departments of Psychology, Boston University, Boston, Massachusetts

Submitted 1 November 2004; accepted in final form 20 January 2005

Thomas, Robert J., Bruce R. Rosen, Chantal E. Stern, J. Woodrow Weiss, and Kenneth K. Kwong. Functional imaging of working memory in obstructive sleep-disordered breathing. *J Appl Physiol* 98: 2226–2231, 2005. First published January 27, 2005; doi:10.1152/japplphysiol.01225.2004.—Functional magnetic resonance imaging was used to map cerebral activation in 16 patients with obstructive sleep-disordered breathing (OSDB) and 16 healthy subjects, during the performance of a 2-back verbal working memory task. Six patients with OSDB were reimaged after a minimum period of 8 wk of treatment with positive airway pressure. Working memory speed in OSDB was significantly slower than in healthy subjects, and a group nonrigid image alignment showed decreased prefrontal activation, regardless of nocturnal hypoxia. After treatment, resolution of subjective sleepiness contrasted with no significant change in behavioral performance, persistent lack of prefrontal activation, and partial recovery of posterior parietal activation. These findings suggest that working memory may be impaired in OSDB and that this impairment is associated with disproportionate impairment of function in the dorsolateral prefrontal cortex. Nocturnal hypoxia may not be a necessary determinant of cognitive dysfunction, and sleep fragmentation may be sufficient. There may be dissociations between respiratory vs. cortical recovery and objective vs. subjective recovery. Hypofrontality may provide a plausible biological mechanism for a clinical overlap with disorders of mood and attention.

apnea; executive functions; imaging

memory is an important abnormality in pathological sleepy states including obstructive sleep-disordered breathing (OSDB) or narcolepsy.

The focus of our neuroimaging investigation in patients with OSDB was the executive network that includes the dorsolateral prefrontal cortex, posterior parietal cortex, and midcingulate gyrus, because there is evidence of its vulnerability in states of inadequate or disrupted sleep (27, 29, 45). Sleep deprivation in young adults induces executive dysfunction (29). Patients with severe OSDB have longer P300 latencies than normal individuals (64). Postdeprivation recovery sleep is associated with a greater increase in frontal compared with nonfrontal delta power (9). Evaluation of regional cerebral blood flow after sleep deprivation shows prefrontal and posterior parietal hypometabolism (5). A positron emission tomographic study of sleep deprivation demonstrated reduced relative regional cerebral metabolic rate of glucose, predominantly in the thalamus and prefrontal and posterior parietal cortices (66). Thus tasks requiring activation in the executive network may reasonably be used as a probe of cognitive function in the sleepy state.

Normal dopamine neurotransmission is crucial for maintaining wakefulness. Support for this conclusion includes the fact that most clinically active stimulants are associated with an increase in dopaminergic neurotransmission (52), and excess-

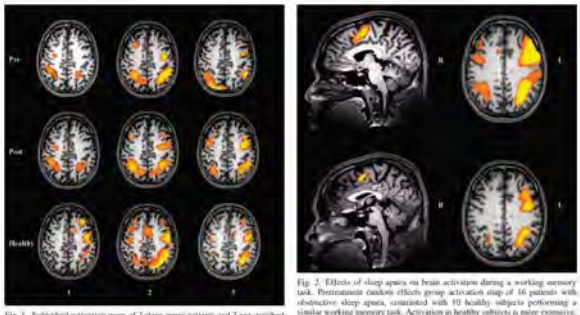


Fig. 1. Individual activation maps of 3 sleep apnea patients and 3 age-matched (within 5 yr) healthy subjects. The well-documented individual differences in activation maps during functional imaging experiments are seen, but common themes can also be identified. Pretreatment (Pre) activation is seen in the posterior components of the executive network. Posttreatment (Post) activation in the anterior components of the network remains minimal. In contrast, the healthy subjects show activation in the lateral prefrontal and posterior parietal cortices. All activations are Bonferroni corrected for multiple comparisons. $P < 0.05$. Talairach space z-coordinate is 37. Statistical color scale: red, $t = 0.4$; yellow, $t = 0.8$.

Fig. 2. Effects of sleep apnea on brain activation during a working memory task. Pretreatment random effects group activation map of 16 patients with obstructive sleep apnea, contrasted with 10 healthy subjects performing a similar working memory task. Activation in healthy subjects is more extensive, is bilateral, and involves areas well described in the literature: posterior parietal cortex, medial wall in the region of the anterior cingulate cortex, and dorsolateral prefrontal cortex. Sleep apnea patients do not show significant lateral prefrontal activation but do so in left posterior parietal and the medial wall. R, right; L, left. All activations are Bonferroni corrected for multiple comparisons, $P < 0.05$. Talairach space z-coordinate is 30. Statistical color scale: red, $t = 0.4$; yellow, $t = 0.8$.

some new activation in posterior cortical areas including the

J. Sleep Res. (2009) 18, 69–78 Sleep disordered breathing
doi: 10.1111/j.1365-2869.2008.00705.x

A combined neuropsychological and brain imaging study of obstructive sleep apnea

KHALID YAOUHI[1], FRANÇOISE BERTRAN[1,2], PATRICE CLOCHON[1], FLORENCE MEZENGE[1], PIERRE DENISE[2], JEAN FORET[1], FRANCIS EUSTACHE[1] and BEATRICE DESGRANGES[1]
[1]Inserm – EPHE – Université de Caen Basse-Normandie, Unité 923, GIP Cyceron, CHU Côte de Nacre and [2]CHU Côte de Nacre, Service des Explorations Fonctionnelles Neurologiques, Caen, France

Accepted in revised form 23 September 2008; received 14 February 2008

SUMMARY Patients with obstructive sleep apnea (OSA) show neuropsychological impairments ranging from vigilance decrements, attentional lapses and memory gaps to decreased motor coordination, but their cognitive profile, and the origin of the impairments, remain unclear. We sought to establish the neuropsychological profile of 16 newly diagnosed apneics and to highlight both their morphological and functional brain abnormalities. We used an extensive neuropsychological test battery to investigate attention and vigilance, executive functions, episodic memory and motor domains. For brain imaging, we used the optimized voxel-based morphometry procedure for the MRI data, resting-state ^{18}F-fluoro-2-deoxy-D-Glucose positron emission tomography (^{18}FDG-PET) with correction for partial volume effects (PVEs) and voxel-based analyses. In terms of neurobehavioral performance, our patients displayed objective daytime somnolence but little impairment in memory and motor domains. Cerebral data revealed gray matter loss in the frontal and temporo–parieto–occipital cortices, the thalamus, hippocampal region, some basal ganglia and cerebellar regions, mainly in the right hemisphere. The decrease in brain metabolism was also right lateralized, but more restricted than the gray matter density changes, and involved the precuneus, the middle and posterior cingulate gyrus, and the parieto–occipital cortex, as well as the prefrontal cortex. To conclude, despite the presence of only minor memory and motor impairments, our patients displayed significant cerebral changes in terms of both gray matter density and metabolic levels, and may have benefited from cognitive reserve and compensatory mechanisms. Thus, cerebral changes in OSA patients may precede the onset of notable neuropsychological consequences.

KEYWORDS cognitive reserve, magnetic resonance imaging, neuropsychology, positron emission tomography, resting state

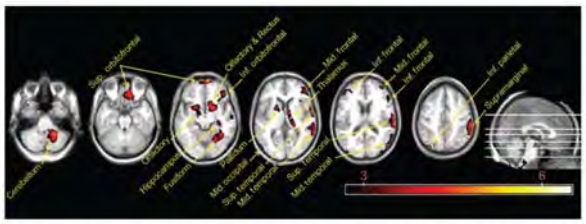


Figure 1. Significant gray matter loss ($P < 0.005$ uncorrected for multiple comparisons for voxels and P-corrected < 0.05 for clusters) in the apneic group compared with controls, as shown by superimposition onto axial slices of the customized template (right hemisphere corresponds to the right side of figure).

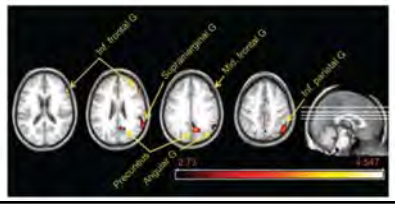


Figure 2. Significant hypometabolism ($P < 0.005$ uncorrected for multiple comparisons for voxels and P-corrected < 0.05 for clusters) in the apneic group compared with controls, as shown by superimposition onto axial slices of the customized template (right hemisphere corresponds to the right side of figure).

J. Sleep Res. (2002) 11, 1–16

REVIEW

Obstructive sleep apnea and the prefrontal cortex: towards a comprehensive model linking nocturnal upper airway obstruction to daytime cognitive and behavioral deficits

DEAN W. BEEBE[1] and DAVID GOZAL[2]
[1]Children's Hospital Medical Center, Cincinnati, OH, USA and [2]Division of Pediatric Sleep Medicine, Department of Pediatrics, University of Louisville, Louisville, KY, USA

Accepted in revised form 14 January 2002; received 17 July 2001

SUMMARY Obstructive sleep apnea (OSA) is accompanied by significant daytime cognitive and behavioral deficits that extend beyond the effects of sleepiness. This article outlines a causal model by which to understand these psychological effects among OSA patients. The model proposes that sleep disruption and blood gas abnormalities prevent sleep-related restorative processes, and further induce chemical and structural central nervous system cellular injury. This, in turn, leads to dysfunction of prefrontal regions of the brain cortex (PFC), manifested behaviorally in what neuropsychologists have termed 'executive dysfunction'. Executive dysfunction is proposed to markedly affect the functional application of cognitive abilities, resulting in maladaptive daytime behaviors. The proposed model (1) accounts for the specific psychological phenotype associated with OSA, (2) accommodates developmental components in this phenotype, (3) bridges between physical and psychological phenomena, (4) suggests mechanisms by which the nocturnal disorder might have effects on daytime functioning, (5) is empirically testable, (6) generates unique research hypotheses, and (7) has practical implications. The model is intended to act as a catalyst for future research and as a preliminary guide for clinicians.

KEYWORDS sleep, apnea, adults, children, neuropsychology, prefrontal cortex, cognition

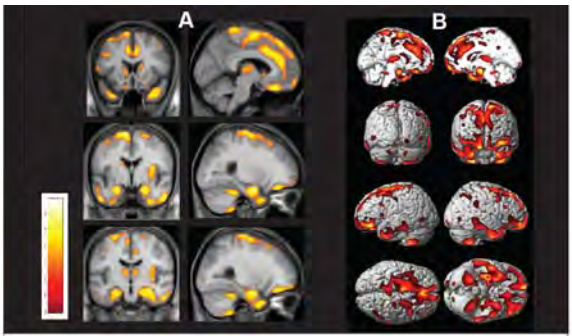
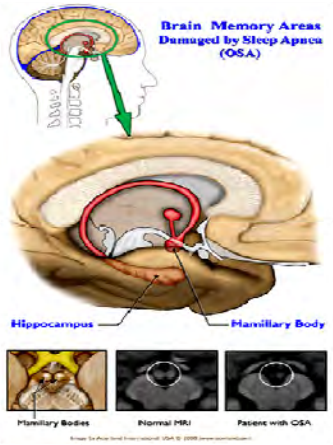
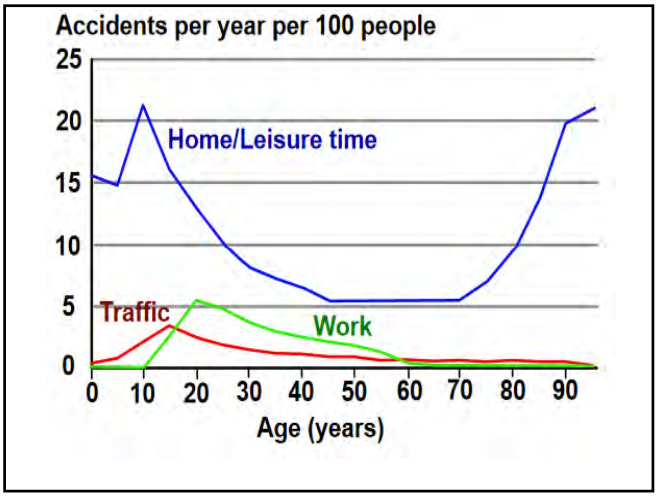


Figure 2—A statistical brain map showing a decrease in gray matter concentration (GMC) in patients with severe obstructive sleep apnea syndrome (OSA).
(A) Gray matter concentrations were reduced in patients with OSA compared with healthy volunteers (at the false discovery rate corrected $P < 0.05$, independent t-test) in the following brain structures: bilateral superior frontal gyri, left gyrus rectus, and bilateral frontomarginal gyri, bilateral anterior cingulate gyri, right anterior insular gyrus, bilateral caudate nuclei, bilateral thalami, bilateral amygdala and hippocampi, bilateral inferior temporal gyri, and bilateral cerebellar cortices. The results were superimposed on the 2-dimensional planes of averaged T1 template of all subjects. Scales in color bar are t scores. Left-hand sides of images represent the left hemisphere of the brain.
(B) The overall areas with reduced gray matter concentrations are shown in a three-dimensional brain rendering view.



A study using high-resolution magnetic resonance imaging (MRI) scans reports that mammillary bodies — brain structures involved in memory — were 20% smaller in patients with sleep apnea than in controls. These findings, by Rajesh Kumar, PhD, from the University of California, Los Angeles (UCLA), and colleagues, are published in the June 27 issue of

Neuroscience Letters.
2008;438:330-334



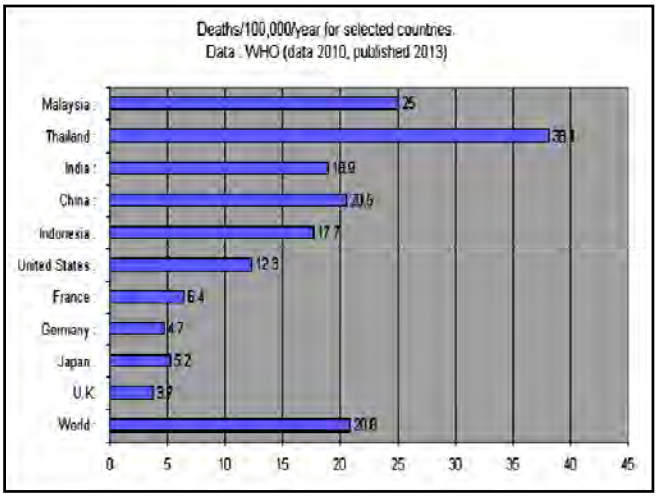
In Thailand, sleepy and drunk driving have been found to be the major causes of higher mortality and morbidity, and the loss of life and property during the last few years which require annual public health policies and campaigns against sleepy and drunk driving.

HEAVY TOLL Cost of road crashes

	Police reported		Estimated*		Annual economic losses	
Countries	**Deaths**	**Injuries**	**Deaths**	**Injuries**	**US$ m.**	**% of GDP**
Brunei	28	645	28	1,273	65	1.00
Burma	1,308	9,299	1,308	45,780	200	3.0
Cambodia	824	6,329	1,017	20,340	116	3.21
Indonesia	8,761	13,941	30,464	2,550,000	6,032	2.91
Laos	415	6,231	581	18,690	47	2.70
Malaysia	6,282	46,420	6,282	46,420	2,400	2.40
Philippines	995	6,790	9,000	493,970	1,900	2.60
Singapore	211	7,975	211	9,072	457	0.50
Thailand	**13,116**	**69,313**	**13,116**	**1,529,034**	**3,000**	**2.10**
Vietnam	11,319	20,400	13,186	30,999	885	2.45
Total	**43,259**	**187,343**	**75,193**	**4,745,578**	**15,102**	**2.23**

Note: *Based on local research, health statistics, sample surveys (where available) or international experience

Source: Asean Region Road Safety Strategy and Action Plan, final draft Sept 2004



Adequate sleep is not only important for good health and well-being but also for road safety of driving automobiles. Sleepiness, fatigue and/or drowsiness related traffic accidents are very common, particularly among long-distance private, public or truck drivers.

At present traffic accidents kill 1.2 million people each year. By 2020 traffic accidents will kill 2.3 million people annually and will be the third leading cause of death.

In Asia Pacific region traffic accidents account for about 60% of global road deaths despite having only 16% of the world vehicles.

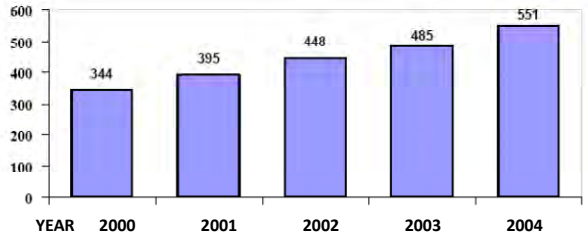
Road deaths jumped by nearly 40% in Asia between 1987 and 1995 while in developed nations they fell by about 10% because of better awareness and various safety measures.

Sleepiness can be considered as a possible cause of an accident if there are some combinations of the following:

- sleep deprivation from short and inadequate sleep preceding the accident,
- long wakefulness exceeding 8 to 12 hours of driving,
- driving at early morning hours, and
- history of alcohol drinking or taking some sedatives or medicines which induce sleepiness.

In this lecture, we explore the current evidence on impacts of sleepiness, fatigue and drowsiness with or without alcohol drinking on automobile accidents in different countries, and the campaign to stop sleepy driving.

Numbers of accident caused by sleepy driving / year



Source: National Police Bureau of Thailand

Crashes killed 4 Thais an hour

■ *The Nation*

ROAD ACCIDENTS killed about four people every hour and injured about four every minute over the New Year holiday period, pushing the toll about 30 per cent higher than it was last year, according to Public Health Ministry statistics.

At least 857 people were killed in road accidents and 42,179 injured from December 27 to January 3, the ministry said yesterday.

The number of Thais killed in road accidents during last year's New Year holiday period was 657.

Vice Minister for Public Health Jamlong Iamchaengphan said that the statistics were compiled from information provided by about 900 hospitals across the country.

New Year accidents

The road death toll from Dec 27 to Jan 3 topped that for the same period a year earlier despite the government's all-out effort to reduce the number of accidents.

	Dec 27 to Jan 3
INJURIES	42,179
DEATHS	857

Source: Public Health Ministry NATION GRAPHICS

"Motorcycle accidents accounted for about 78 per cent of the death and injury toll," Jamlong said.

"This reflects the need by relevant agencies to improve their preventative measures," he said, adding that the agencies had already been allocated more funds for the task.

Deputy Prime Minister Chaturon Chaisang, who heads a road safety centre, said most of the deaths resulted from the failure to wear crash helmets while riding motorcycles.

Meanwhile, Deputy Transport Minister Nikorn Jamnong said that buses operating under the Transport Company Limited had not caused any traffic deaths during the holidays.

"This means that our measures were successful," Nikorn said.

As the New Year holidays drew to a close yesterday, thousands of holiday-makers headed back to Bangkok causing traffic congestion on many roads leading to the capital.

The number of bus trips between Nakhon Ratchasima, the gateway to the Northeast, and Bangkok rose from the normal 148 to 300 yesterday.

HIGHWAY ACCIDENT

10 killed in head-on smash

Prachuap Khiri Khan

Ten rescue workers were killed when a van they were travelling in collided head-on with a tour bus on Phetkasem highway in Pran Buri district yesterday morning.

Police said the accident took place at about 2.30am between kilometre markers 250-251, when a van from the provincial disaster relief centre slammed into a Krabi-Bangkok tour bus which was running in the opposite lane.

All 10 rescue volunteers — two men including driver Kowit Phetnil and eight women — were killed.

Saman Mohkit, 46, the tour bus driver who was only slightly injured, said the van was coming at high speed when it violated its lane and rammed into the oncoming bus.

The workers were returning from a study tour in Chiang Mai.

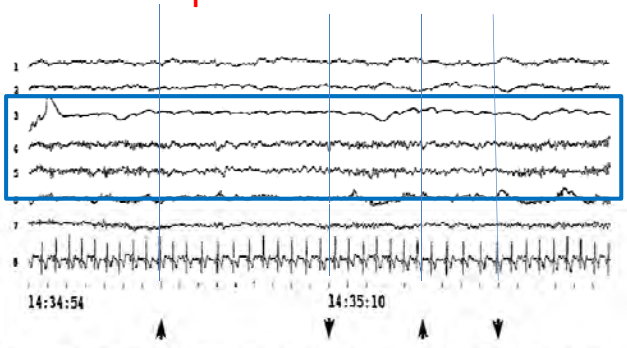
Police believe the van driver fell asleep at the wheel.

No bus passengers were seriously hurt.

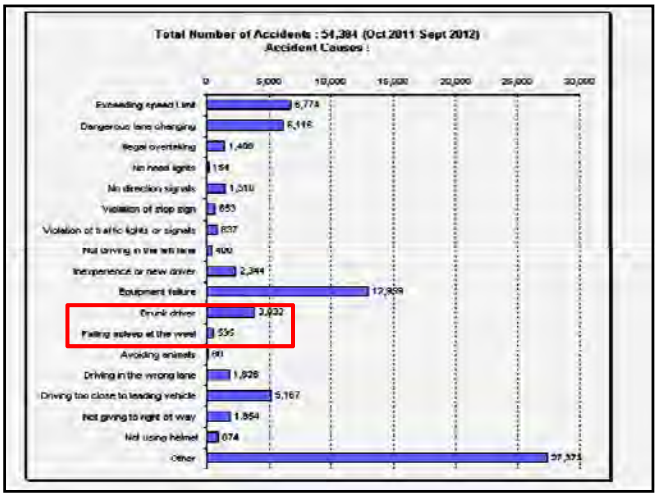
19 die as lorry driver falls asleep

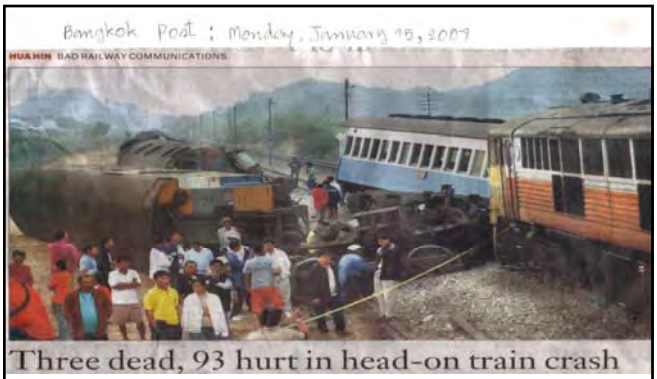
The accident took place on the Bangkok-bound side of the Mittraphap Highway in tambon Thap Kwang of Kaeng Khoi district about 4.30am. An 18-wheel lorry ran across the traffic island and slammed into the Bangkok-Roi Et double-decker bus of state-owned Transport Co. The bus did not overturn but burst into flames. The resulting blaze caused many of the fatalities. Both vehicles ran on natural gas. **Ten men, including the bus driver, and nine women were killed. Sa-ard Boonyoung, the 29-year-old driver of the lorry, said he fell asleep at the wheel.**

Microsleep



Example of microsleep periods. From top to bottom, channels 1 and 2: EOG; channel 3: chin EMG; channels 4, 5, 6, and 7: EEG (respectively, C3-A2, C4-A1, Fp2-C4, and C4-O2), and channel 8: ECG. The small vertical bars below the ECG are 1-s marks. The time is given in hh:mm:ss at the bottom left corner of each screen page. Upward arrows signal the start of two microsleep periods of 9 and 4 s, respectively. The downward arrows show the end of each microsleep period.



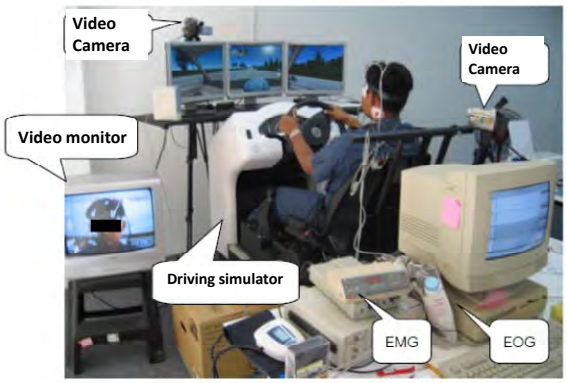


Recent train crash which was blamed on the sleepy train drivers (15 January 2007)

Sleep deprivation was a contributing factor in biggest disasters in history, e.g.,
1979 nuclear accident at Three Mile Island,
the massive Exxon Valdez oil spill,
1986 nuclear meltdown at Chernobyl,
1986 space shuttle Challenger accident, and many others.

Japan, 新幹線 Shinkansen
Driver fell asleep when driving

In March 2003, a shinkansen train stopped at about 100 meters before its regular stopping point after the driver of the train fell asleep for eight minutes while the train was traveling at speeds up of up to 270 kilometers per hour.
A disaster was averted because the train was equipped with an automatic control system that stopped the train when it pulled into the station.
It was later revealed that the driver had a sleep disorder.



Experimental set up on the driving simulator

Study in the public bus driving

Her Royal Highness Princess Galyani Vadhana Krom Luang Narathiwas Rajanagarinda

And Members of the Committee for the Anti-Drowsy Driving Fund Ramathibodi Hospital Foundation, Under the Royal Patronage of Her Royal Highness Princess Galyani Vadhana Krom Luang Narathiwas Rajanagarinda

"Drowsy or Sleepy, don't drive campaign"

Have a good night sleep sweet dream

Thank you