

# SLEEPING

one of the most important things in your life

SPRING 2012 BE LAB  
MAY 2 2012

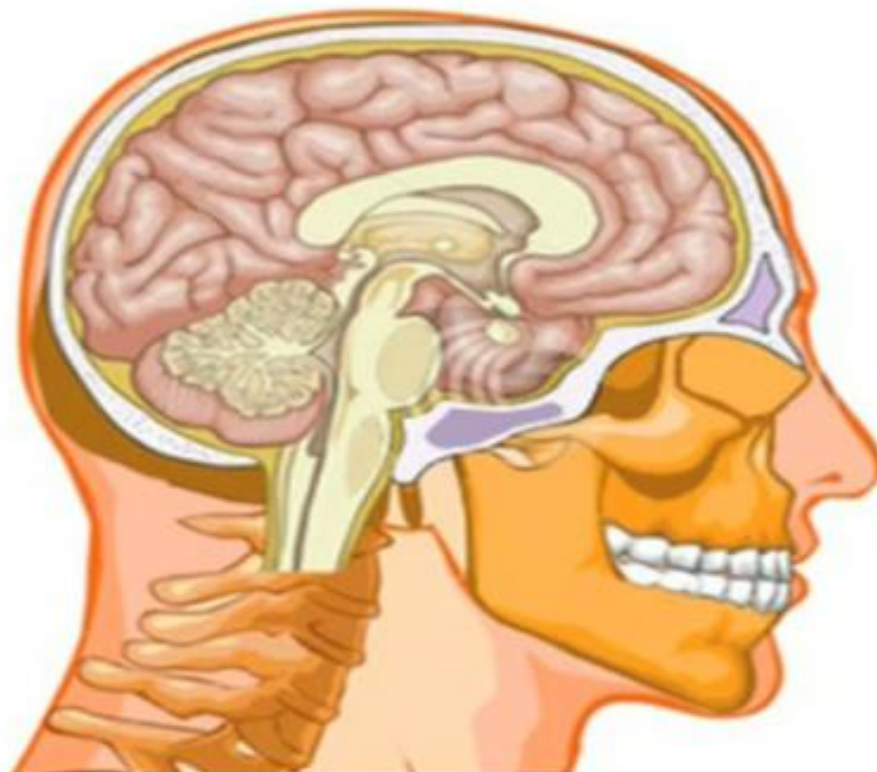
電機三 b98901002 張恆律  
電機三 b98901058 李啟瑞  
電機三 b98901147 呂懷哲

# OUTLINE

- Basic physiology of sleeping
- Factors affecting the sleeping quality
- How can technology helps us sleep better?

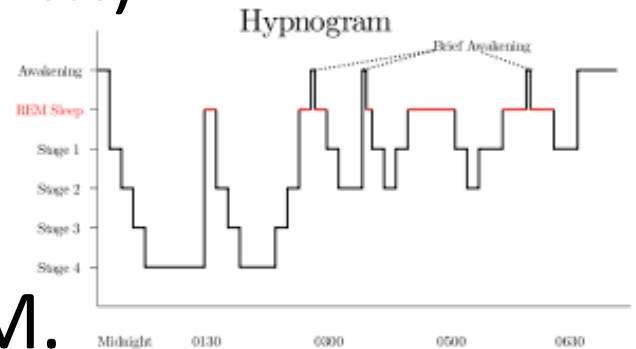
SLEEPING CYCLES

# **BASIC SLEEPING PHYSIOLOGY**



# Sleeping cycles

- Separate by electroencephalography(EEG) features.
- Rapid eye movement(REM)
- Non-rapid eye movement(NREM)
- Average 90 mins/cycle
- 5 cycles/night  
less deep sleep and more REM.
- Compensate effect



# 4 stages of NREM



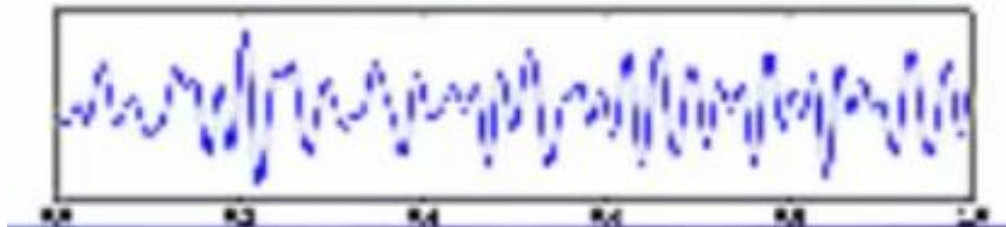
- Stage 1: Alpha waves.
- Stage 2: Theta waves.
- Stage 3&4: Delta waves.



# Stage 1 of NREM sleep



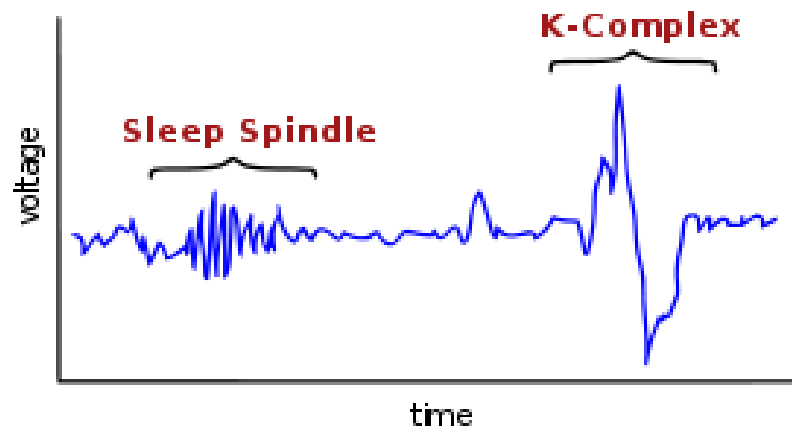
- Alpha waves (8~13Hz) are predominant.
- Transition stage when falling asleep.
- Experience hypnagogic hallucinations.  
e.g. Hypnic jerk  
feeling of falling



# Stage 2 of NREM sleep



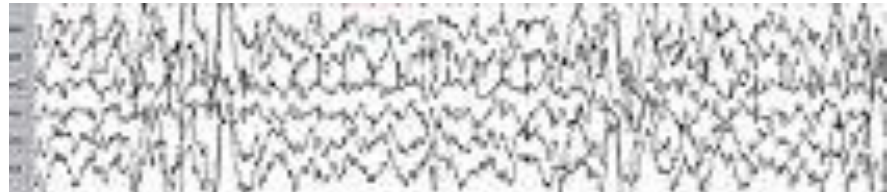
- Start of true sleep
- Theta waves(4~7Hz) are predominant.
- Conscious awareness of the external environment disappears.
- Sleep spindles and K-complexes.





# Stage 3 & 4 of NREM sleep

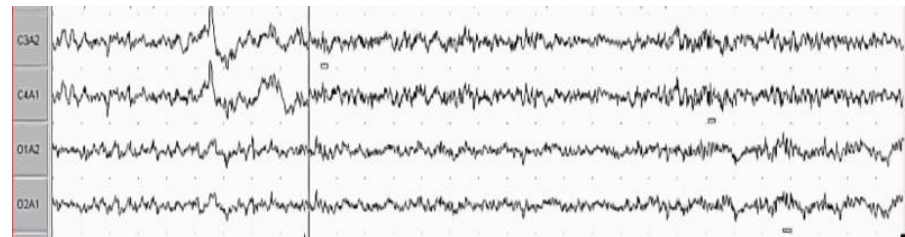
- Slow wave sleep.
- Delta waves (0.5~2Hz) are predominate.
- Movement is still possible.
- Sleep walking.



# REM sleep



- Also called active sleep.
- Eyes turns back and forth.
- Rapid low-voltage EEG.
- Muscle activity suppressed.
- Dreaming.



# Why do we need to sleep?

- Restoration theory: sleep promotes physiological processes that rejuvenate the body.
- Evolutionary theory: sleep emerge in revolution to preserve energy and preventing a particular species to interact with the environment.

CAN WE SLEEP BETTER?

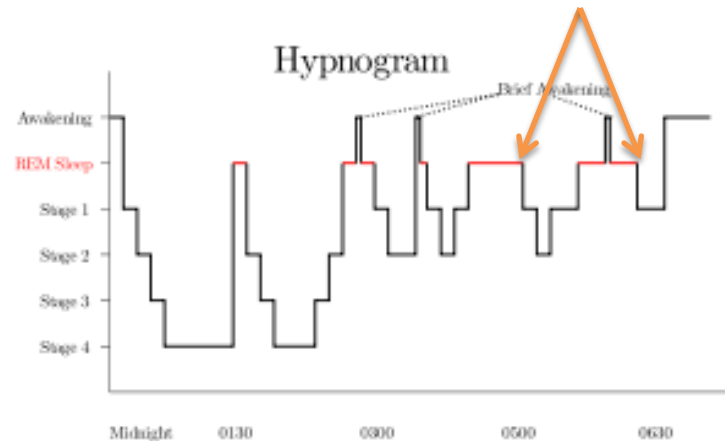
# **SLEEPING QUALITY**

# How come we sleep badly?

- Environment factors
  - Noise
  - Moisture
  - Temperature
- Metabolism factors
  - Caffeine, alcohol, nicotine....(diet)
  - Lack of regular exercise

# Just in time with sleep

- The **RIGHT** time to
  - sleep
    - Conforms to the physiological cycle
  - wake up
    - Conforms to the sleeping cycle
    - The end of REM is best



# Light does matter

- Light is a strong signal
- Blue light can stimulate neurotransmitters, tell your brain when to work



# Physiological aspects

- Brain disorder
- Anxiety , sadness ...
- Too tired, accumulation of lactic acid

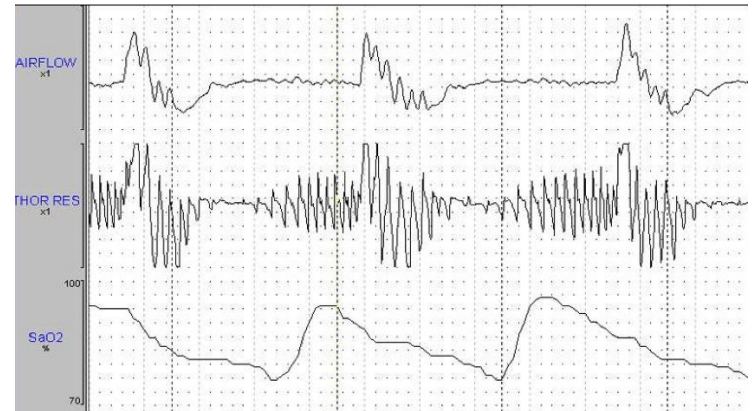


YEAH, IT'S BE LAB THOUGH

**HOW COULD MACHINES INVOLVED?**

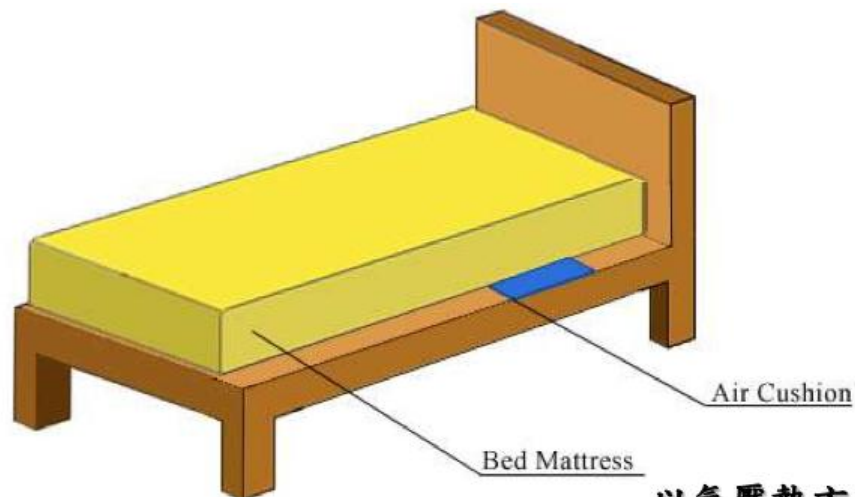
# Polysomnography (PSG)

- EEG / EOG / EMG / ECG
- Respiratory patterns
- Body positions
- Oxygenation
- Snoring
- LIFE-SAVING!  
Ex.OSAS



# Force sensors

- Static charge sensitive bed (SCSB)
- Air cushion

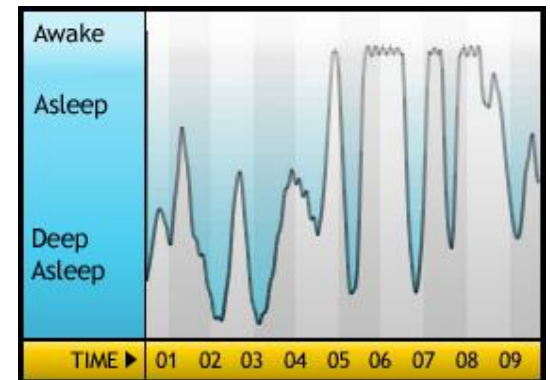
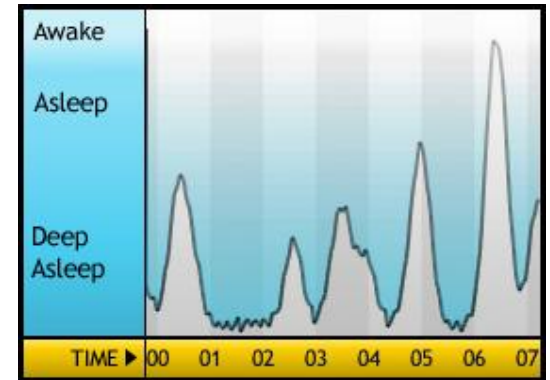


以氣壓墊方式量測身體活動

# Apps, why not?



Monitor your movement with the accelerometer.  
Wake you up at the right time.



# References

- [Wikipedia - Sleep](#)
- [Sleep Cycles](#)
- [全面啟動你的夢境](#)
- [適用於居家環境之睡眠監測技術](#)
- [Sleep Cycle Alarm](#)