

Sleep
Sleep disorders
Lifestyle

SCIENCE FAIR JUNE 11, 2010

Dirk Pevernagie and Ronald M. Aarts

1

SLEEP

2

Polysomnography (PSG)

- **Method** : Simultaneous recording of neurophysiological signals (EEG, EOG, EMG) together with cardio-respiratory signals (as described under polygraphy [PG])
Special: synchronized videorecording
- **Aim** : Standardised procedure to diagnose functional disorders during sleep
- **Applications** (1) :
 - Sleep-related breathing disorders
 - Neurological disorders
 - [Insomnia, circadian rhythm disorders]

(1) ASDA. Practice Parameters for the Indications for PSG. Sleep 1997, 20:406-422

Polygraphy (PG)

- **Method** : Simultaneous recording of physiological signals:
 - Cardiac: ECG, arterial pulse at the tip of the finger
 - Respiratory: airflow, respiratory movement, -sound, SaO2, CO2,
 - Other: body posture, limb movements
- **Aim** :
 - Standardised procedure to diagnose breathing disorders during sleep
 - Assessment of sleep stages not possible
- **Applications** :
 - Sleep-related breathing disorders
 - Portable recording

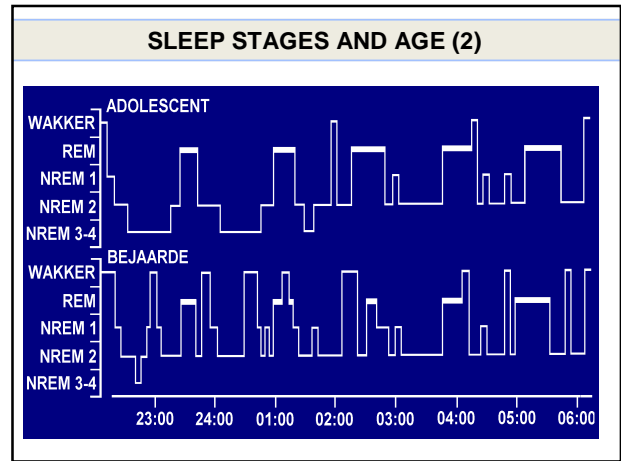
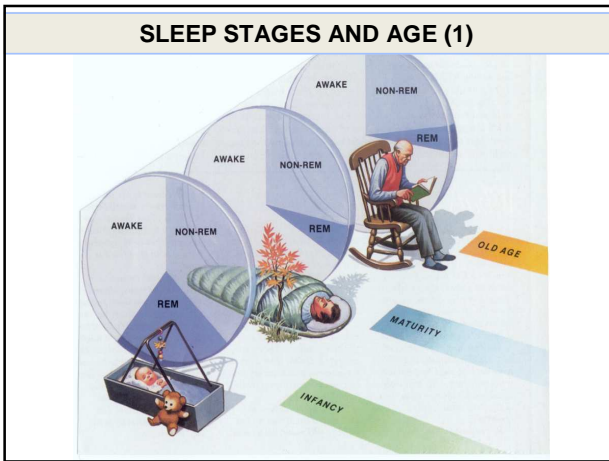
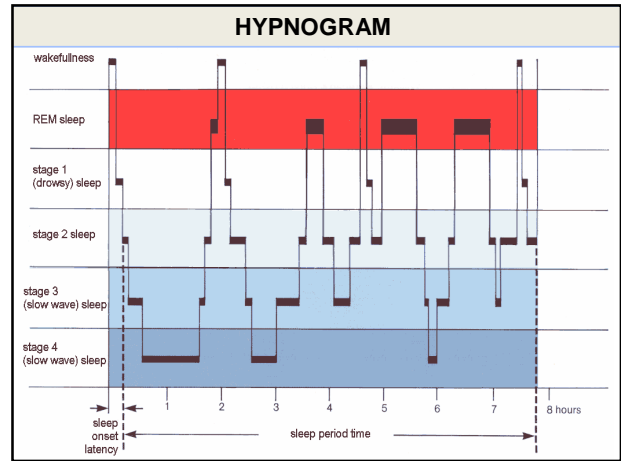
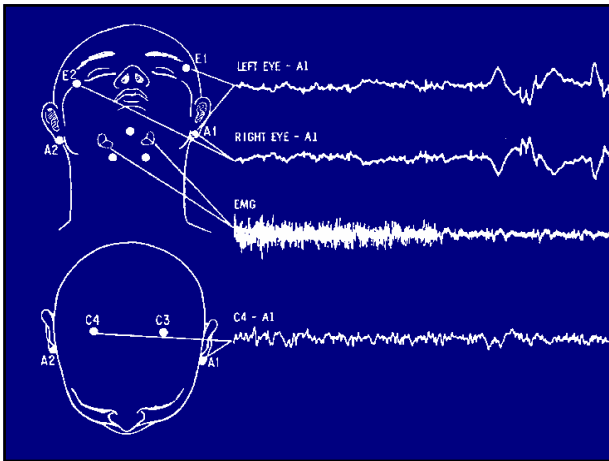


Assessment of sleep stages



Neurophysiological parameters in PSG

- EEG in ≥ 4 leads
- EOG in 2 leads
- EMG of the chin
- EMG of the lower limbs



Kempenhaeghe TU/e Technische Universiteit Eindhoven University of Technology

SLEEP DISORDERS

11

Kempenhaeghe TU/e Technische Universiteit Eindhoven University of Technology

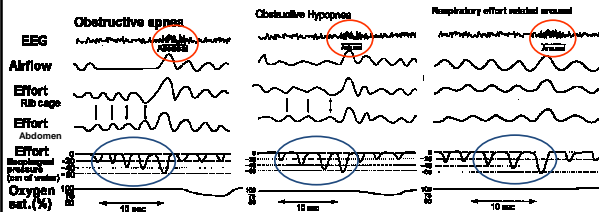
Common nosological entities

- **Insomnia** : primary type (idiopathic, psychophysiological and paradoxal insomnia)
- **Sleep-disordered breathing** : snoring, sleep apnea, sleep hypoventilation
- **Movement disorders** :
 - restless legs and periodic limb movements
 - parasomnias
- **Other neurological disorders** :
 - narcolepsy
 - degenerative diseases (RSBD)
- **Miscellaneous**
 - Delayed sleep phase syndrome
 - Nonrestorative sleep in chronic fatigue and pain syndromes

Sleep-disordered breathing

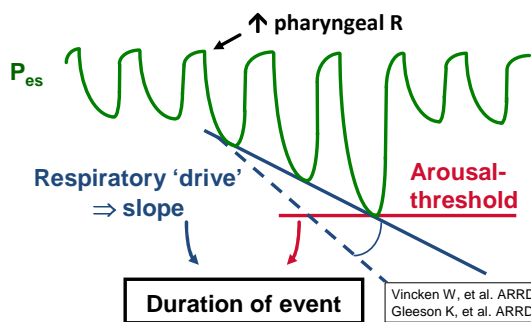
- Key features of obstructive SDB:
 - Complete or partial obstruction of the UA
 - Increased UA resistance
 - Increasing inspiratory effort
 - Arousal response
 - Restoration of unobstructed breathing
- Common to all types of obstructive SDB

Sleep-disordered breathing



Strollo PJ, Rogers RM. Current concepts: Obstructive sleep apnea. New England Journal of Medicine 1996; 334:99-104.

Respiratory effort related arousals



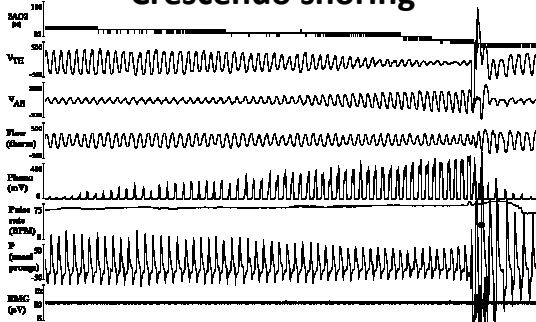
Snoring is paramount

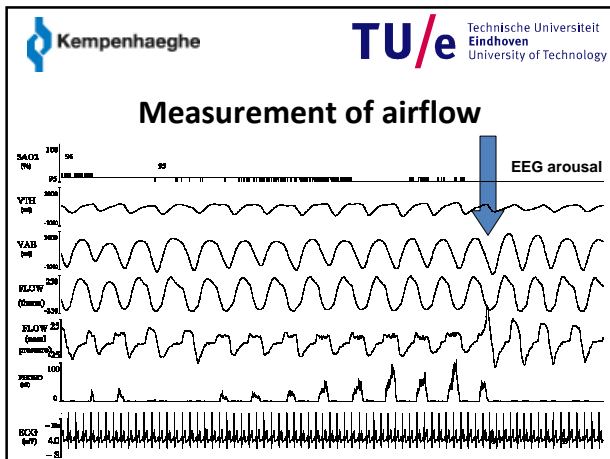
- Snoring types
 - Continuous snoring, steady loudness
 - Crescendo snoring with silent intermezzo's
 - Heavy interapneic snoring
- Other sounds (that may be confused with snoring)
 - Stridor
 - Sleep groaning

Interapneic snoring



Crescendo snoring





Kempenhaeghe TU/e Technische Universiteit Eindhoven University of Technology

Snoring is paramount

“Tell me how you snore...
... and I will tell you who you are!”

**Pseudo snoring
(stridor)**

Patient no. 3

- Kempenhaeghe TU/e Technische Universiteit Eindhoven University of Technology
- ### Aims of research - snoring
- Analysis and handling snoring sounds (e.g. through focused sound rendering); development of a sound recording module that can be plugged in or wirelessly transmitted to existing PSG recorders
 - Outcome parameter of treatment (e.g. MRA)
 - Snoring assessment as an index of respiratory effort (possibly in combination with other signals) against the gold standard, i.e. the (invasive) esophageal pressure measurement.
 - Potential outcome is a stand-alone sensor to quantify apneas and hypopneas
 - Sound attenuation
- 22

Research Centrum voor Slaapgeneeskunde

Medisch hoofd: prof.dr. Dirk Pevernagie
Coordinator wetenschap: dr. Sebastiaan Overeem

- ### Themes
- Sleep-disordered breathing
 - Sleep disorders in Parkinson’s disease
 - Insomnia
 - Primary hypersomnia, i.e. narcolepsy

Sleep-disordered breathing

Non-invasive measurement of respiratory effort

- *Promovenda*: Nele Vandenbussche
- *Promotor*: Dirk Pevernagie
- *Copromotor*: Sebastiaan Overeem

M. Parkinson

Nocturnal sleep disorders in Parkinson's disease

- *Promovenda*: Maartje Louter
- *Promotores*: Bas Bloem, Dirk Pevernagie
- *Copromotores*: Sebastiaan Overeem, Johan Arends

Insomnia

Personality in insomnia: causality & treatment response

- *Promovendus*: Merijn van de Laar
- *Promotores*: Dirk Pevernagie
- *Copromotor*: Sebastiaan Overeem

Contractresearch

- Smart Bed sensor (Philips): detecting nocturnal body movements
- A new algorithm for respiratory event detection in Auto-CPAP devices (Philips-Respironics)

Projects S. Overeem

Psychiatric comorbidity in narcolepsy

Promotie H. Droogleever-Fortuyn, Nijmegen, 2010

Endocrinology of narcolepsy & effect of sodium oxybate

Promotie C. Donjacour, Leiden, 2012

Kempenhaeghe

-Clinical features of cataplexy

-Biobank for narcolepsy (with Hans Soons / Petra van Mierlo)

Nijmegen

-Sleep disorders in neuromuscular disease

-The effect of sleep on amyloid-beta dynamics in AD

Projects D. Pevernagie


Sleep in chronic fatigue syndrome

Promotie A. Mariman, Gent

Acoustics of snoring

Promotie M. de Meyer, Gent


Copromotor: R.M. Aarts (TU/e)

 **Kempenhaeghe** **TU/e** Technische Universiteit
Eindhoven
University of Technology

Common research opportunities in the clinical setting

- Polysomnography (PSG):
 - adding biophysical signals to the standard montage of polysomnography to obtain additional information on specific phenomena
- Continuous positive airway pressure (CPAP):
 - additional sensor-driven monitoring is desirable to assess compliance to treatment and unwanted side effects (e.g. leakage)


31

 **Kempenhaeghe** **TU/e** Technische Universiteit
Eindhoven
University of Technology

Common research opportunities in the clinical setting

- Duration of polysomnography (PSG):
 - PSG is usually performed once in an overnight setting; long-term EEG recording might provide better insight in unstable sleep-wake patterns
- Assessment of OSA complications
 - OSA syndrome may be complicated by other disorders, such as hypertension, arousals, and cardiac dysrhythmias; complementary sensor-driven monitoring may be helpful in the assessment of these complications

32

 **Kempenhaeghe** **TU/e** Technische Universiteit
Eindhoven
University of Technology

Common research opportunities in the clinical setting

- Web-based applications may be helpful in the monitoring of effects of cognitive behavioural therapy (CBT-i)
- Facilitate progressive awakening

33

 **Kempenhaeghe** **TU/e** Technische Universiteit
Eindhoven
University of Technology

SLEEP IN LIFESTYLE

...

34