Sleep disorders

Norbert Kozak

About the sleep…

Each of us will spend about 1/3 of our lifetime sleeping…..

…..And 1/3 part of the population has sleep complain

„Sleep is an essential biological function, but its exact function remains unclear.”

(Oxford Textbook of Sleep disorders, 2017)

Somatic theories of sleep function

Neural metabolic theories: detoxification and regeneration

Cognitive theories of sleep function: learning and brain development, memory

Regulation of sleep

Homeostatic drive: time without sleep ↑ - sleepiness ↑

Cirkadian timing: lasts about 24 hours

- Hypothalamus
    - Suprachiasmatic nucleus
- Pituitary gland: melatonin

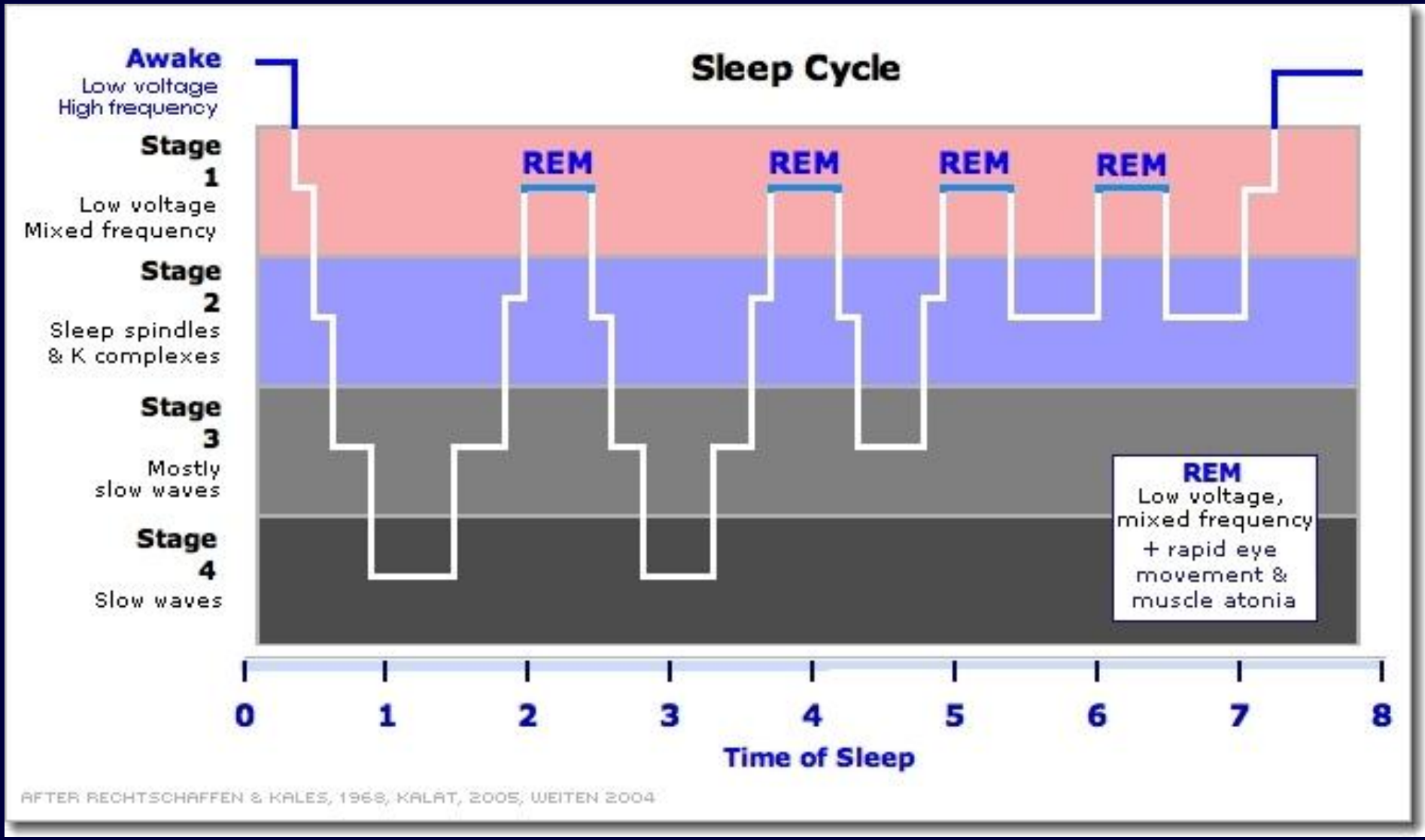
Ultradian timing: lasts less than 24 hours

- Prepontin nuclei
- Raphe nuclei
- L. coeruleus

Normal human sleep

Sleep cycle – occurs about every 90 minutes, approximately 4-6 cycles occur per major sleep episode

- NREM (70-80%)
  - slow wave sleep
  - heart rate, BP, breathing ↓
  - body temperature, muscle tone ↓
- REM (20-25%)
  - rapid eye movement, paradox, fast wave sleep
  - heart rate, BP, breathing ↑, metabolic rate ↑
  - dreaming, erection
  - muscleatonia, BUT: myoclonus!


Sleep Cycle
Awake
Low voltage
High frequency
Stage 1
Low voltage
Mixed frequency
Stage 2
Sleep spindles
& K complexes
Stage 3
Mostly
slow waves
Stage 4
Slow waves
REM
REM
REM
REM
REM
Low voltage,
mixed frequency
+ rapid eye
movement &
muscle atonia
0
1
2
3
4
5
6
7
8
Time of Sleep
AFTER RECHTSCHAFFEN & KALES, 1968; KALAT, 2005; WEITEN 2004

NREM

- 1st stage (3-8%) ~ drowsiness, sleepiness EEG: α-activity < 50%, muscle tone ↓ , eye movement ↓
- 2nd stage (45-55%) ~ EEG: K-complexes, sleep spindles, no eye movement
- 3rd stage (5-10%) EEG: delta waves 20-50%
- 4th stage (15-20%) delta > 50%

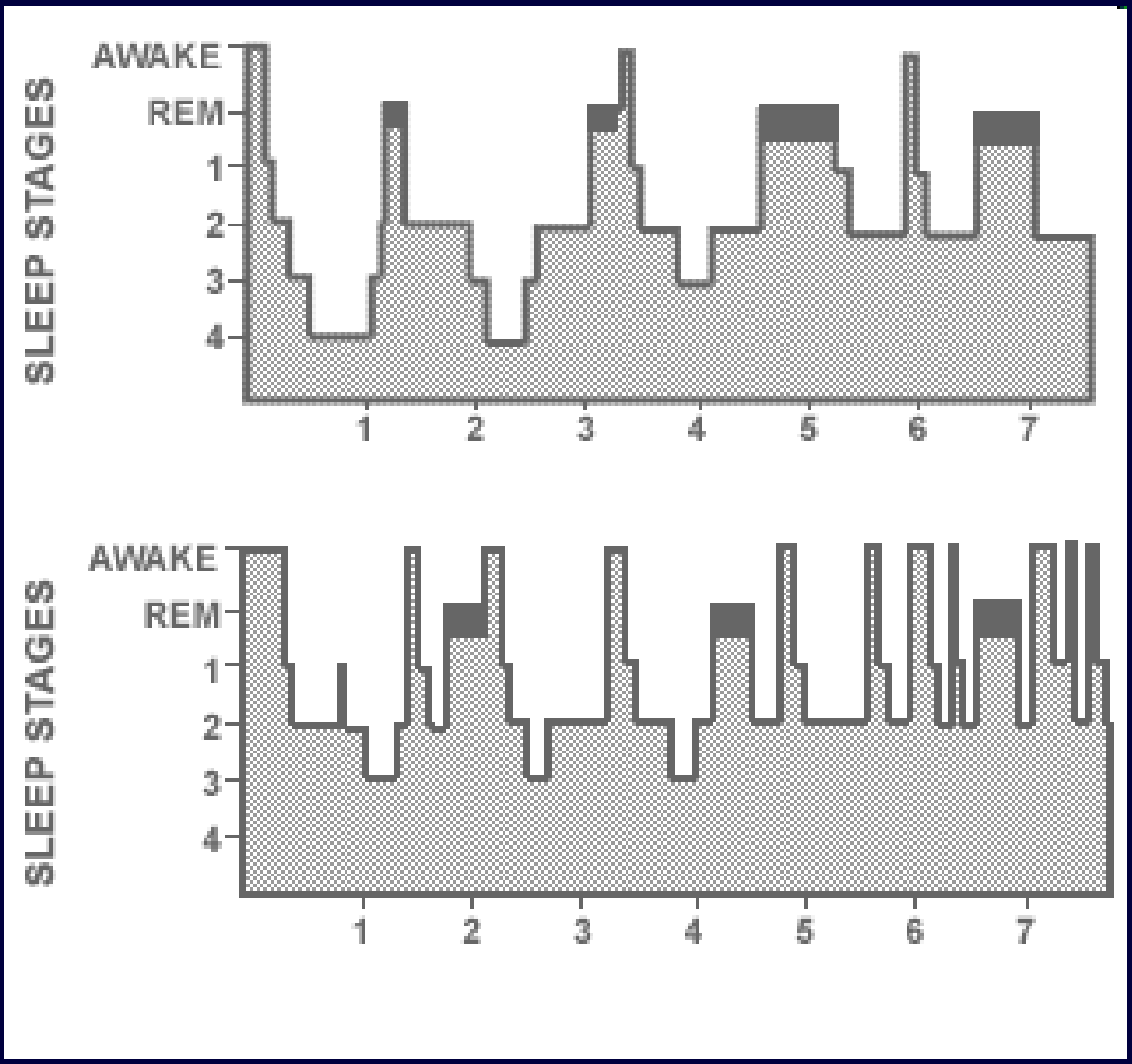
} SWS

REM

- Tonic stage (desyncronized EEG ~ low voltage, frequency ↑, muscle atonia)
- Phasic stage (rapid eye movements ~ fast, saccadic eye movements ~, irregular breathing, heart rate ↑, myoclonus, apnea, hyperpnea, dreaming!!!)

Age-related changes

- Healthy young adult needs 6-8h sleep
- 1 year old baby 12h, 10 years old 10h, adolescent 8h, above 60 5-6h
- Percent of deep slow wave sleep is higher in childhood, less in elder ages
- afternoon sleep in children and elderly people


SLEEP STAGES
AWAKE
REM
1
2
3
4
1
2
3
4
5
6
7
SLEEP STAGES
AWAKE
REM
1
2
3
4
1
2
3
4
5
6
7

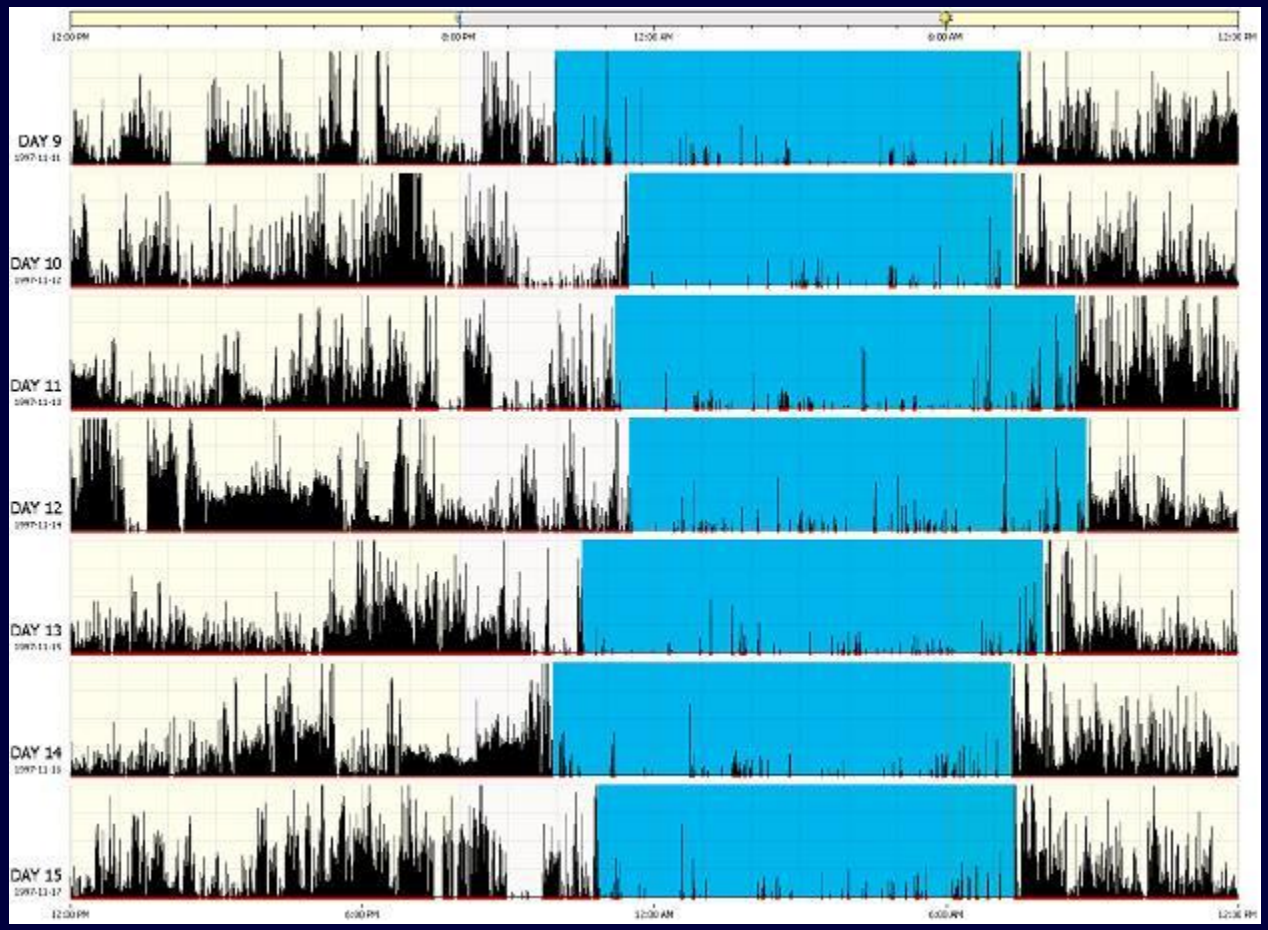
Polysomnography

- multiparametric monitoring during 1 night
- EEG
- Electrooculogram
- EMG (surface, chin)
- ECG
- Respiratory flow and effort
- SpO_2
- Body position
- Snoring (microphone)
- Limb electrode (EMG, optional)

Diagnostic methods

- Sleep diary
- Questionaires: eg. Epworth sleepiness scale
- Actigraphy
- Pulzoxymetry
- Polygraphy
- Polysomnography
- Special: eg. MSLT, MWT

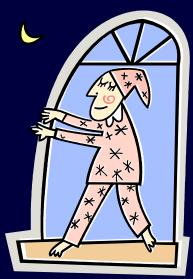
Actigraphy



More than 80 sleep disorders are known

(International Classification of Sleep Disorders, 3rd Edition
American Academy of Sleep Medicine, 2014)

- Insomnias (33%)
- Sleep related breathing disorders (1,4-40%)
- Central disorders of hypersomnolance (0,3-16,3%)
- Cirkadian rhythm sleep-wake disorders
- Parasomnias
- Sleep related movement disorders
- Other sleep disorders



Excessive daytime sleepiness

- Primary
- Secunder eg. fragmented sleep in OSAS
- Accidents!
- Epworth Sleepiness
- Scale
- MSLT, MWT

I. Insomnias

- Difficulty in initiating sleep or in staying asleep or waking up earlier
- Nonrefreshing, nonrestorative sleep
- Fatigue, concentration or memory impairment
- Mood disturbances, motivation, initiative reduction
- Daytime sleepiness
- Tension headache

I. Insomnias

- Prevalence: 33%
- Accompanied with daytime consequences
- Last less than 1 month: 4% (transient insomnia)
- Last more than 1 year: 85% (persistent insomnia)
- Male:female = 1:1.4
- Increase with age: above 65 years: 50%

I. Insomnias

- Primary (idiopathic)
- Secunder
  - Inadequate sleep hygiene (10%)
  - Paradoxical insomnia (10%)
  - Insomnia due to mental disorder (30-40%)
  - Psychophysiological insomnia (15%)
  - Insomnia due to drug or substance
  - Insomnia due to medical conditions
  - Sunday night insomnia

Treatment

- Treating the medical or psychiatric conditions (sec. insomnias)
- Nonpharmacologic:
  - behavioral treatments: normalizing the circadian rhythm
  - sleep hygiene
  - cognitive behavior and other psychotherapies
- Pharmacologic treatment

Pharmacologic Treatment Approach

- Select appropriate medication
- Evaluate carefully for apnea, respiratory impairment, organic mental disorders, substance abuse history
- Use lowest effective dose
- Use at bedtime (or later, if indicated)
- Duration of therapy
  - Use as needed for 2 to 4 weeks
  - Reduce dose as tolerated
  - Intermittent use suggested
- Combine with behavioral strategies

Pharmacologic treatment

Selective $GABA_A$ agonists: nonbenzodiazepines

- no rebound insomnia
- *zolpidem, zopiclon, zaleplon*

Pharmacologic treatment

Benzodiazepines

- *midazolam, triazolam* ~ rebound insomnia
- *cinolazepam, quazepam*
- *brotizolam, temazepam*
- *nitrazepam* ~ drowsiness

Sleep hygiene

- Regular lifestyle
- Avoiding daytime napping
- Avoiding stimulating foods and bevereages (tea, cola, chocolate)
- Light dinner
- Smoking
- Alcohol (helps to fall asleep but fragments sleep)

- Regular physical activity (not before going to bed)
- Bed is for sleep (not work)
- Comfortable temperature and light
- Don't suffer in the bed (go to bed when you are sleepy) (get up if you can't fall asleep in 30 minutes)

II. Sleep related breathing disorders

(International Classification of Sleep Disorders, 3rd Edition
American Academy of Sleep Medicine, 2014)

1. Obstructive sleep apnea disorders, adult and pediatric
2. Central sleep apnea syndromes
3. Sleep related hypoventilation disorders
4. Sleep related hypoxaemia disorders

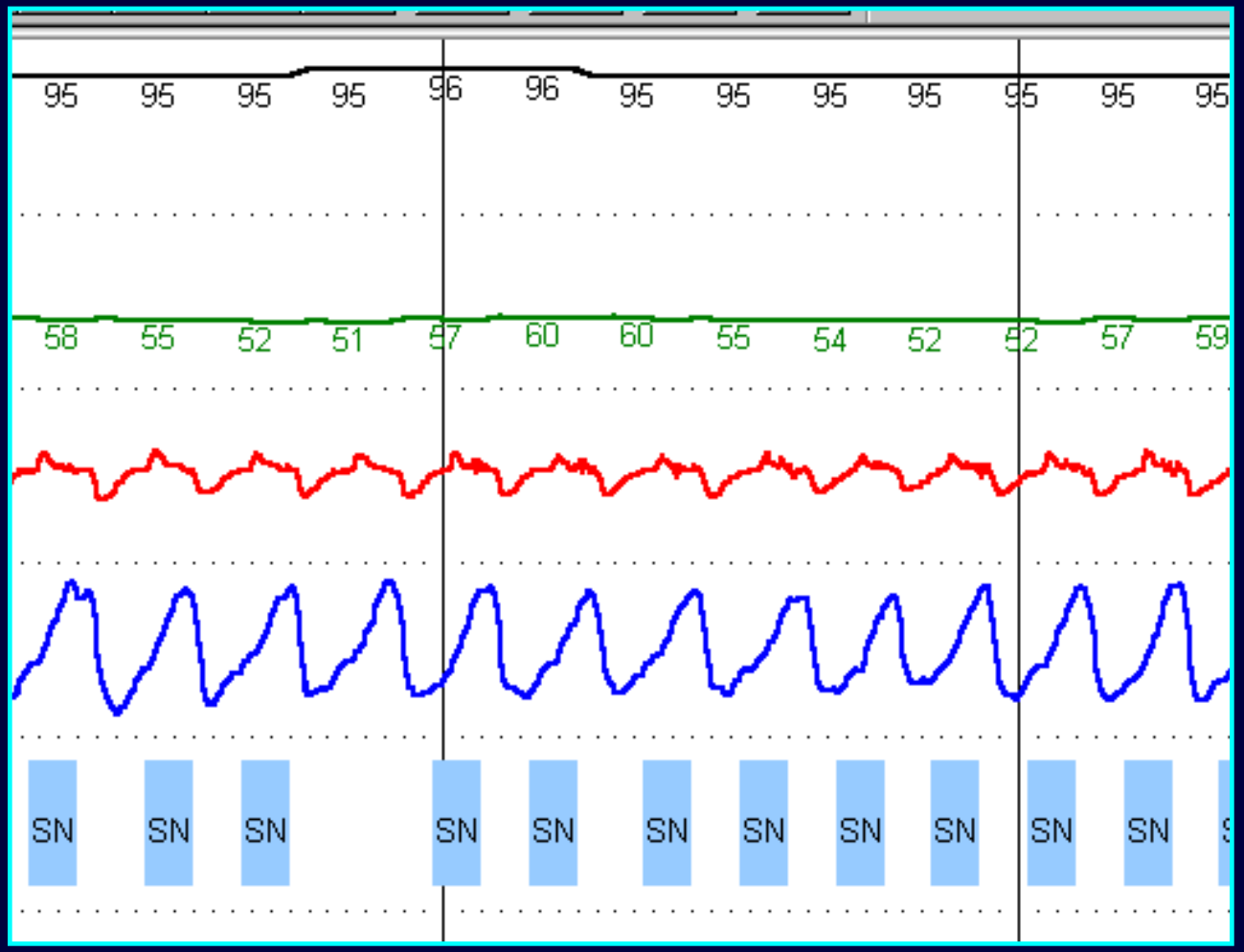
SpO2

HR

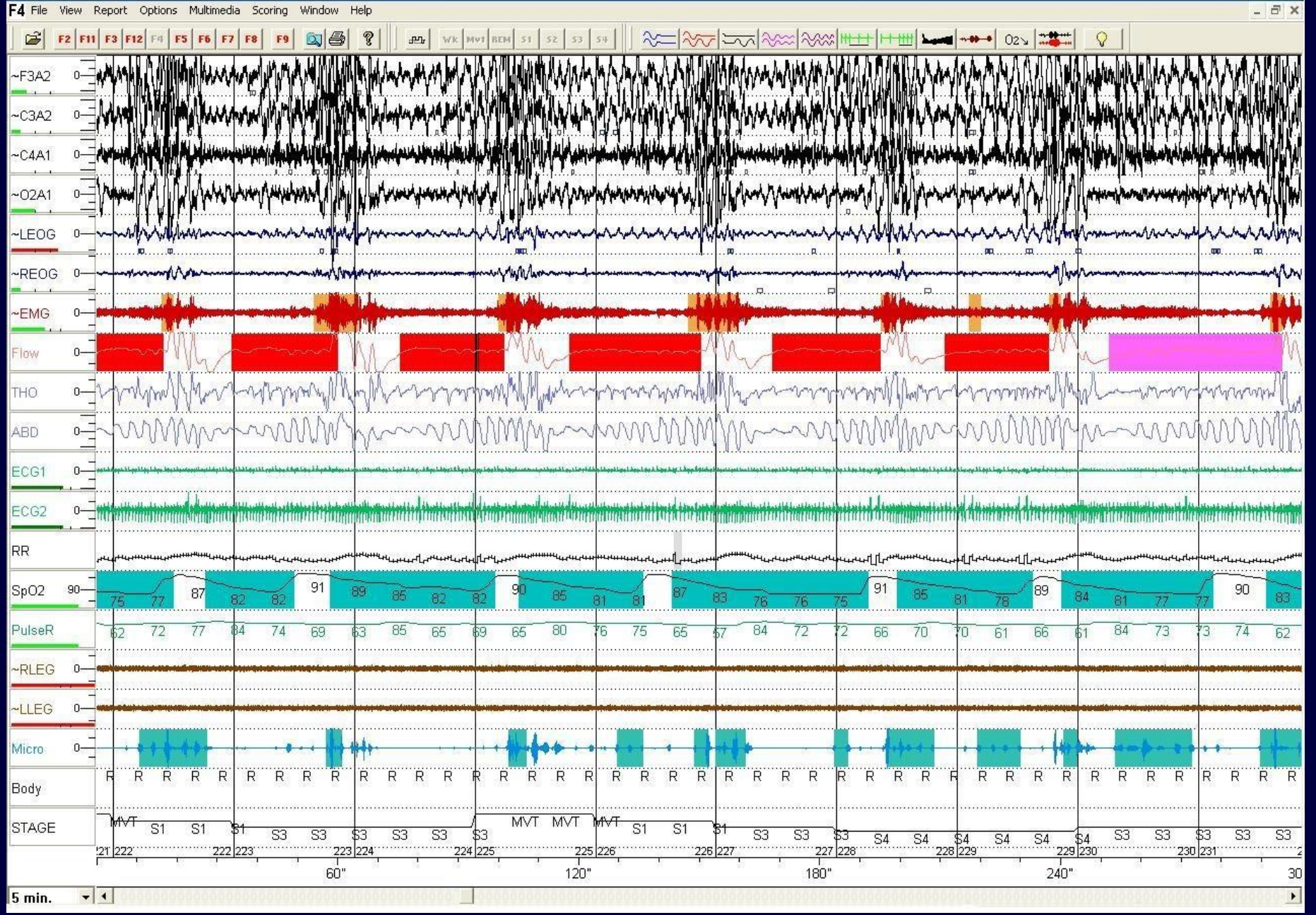
Nasal flow

Effort

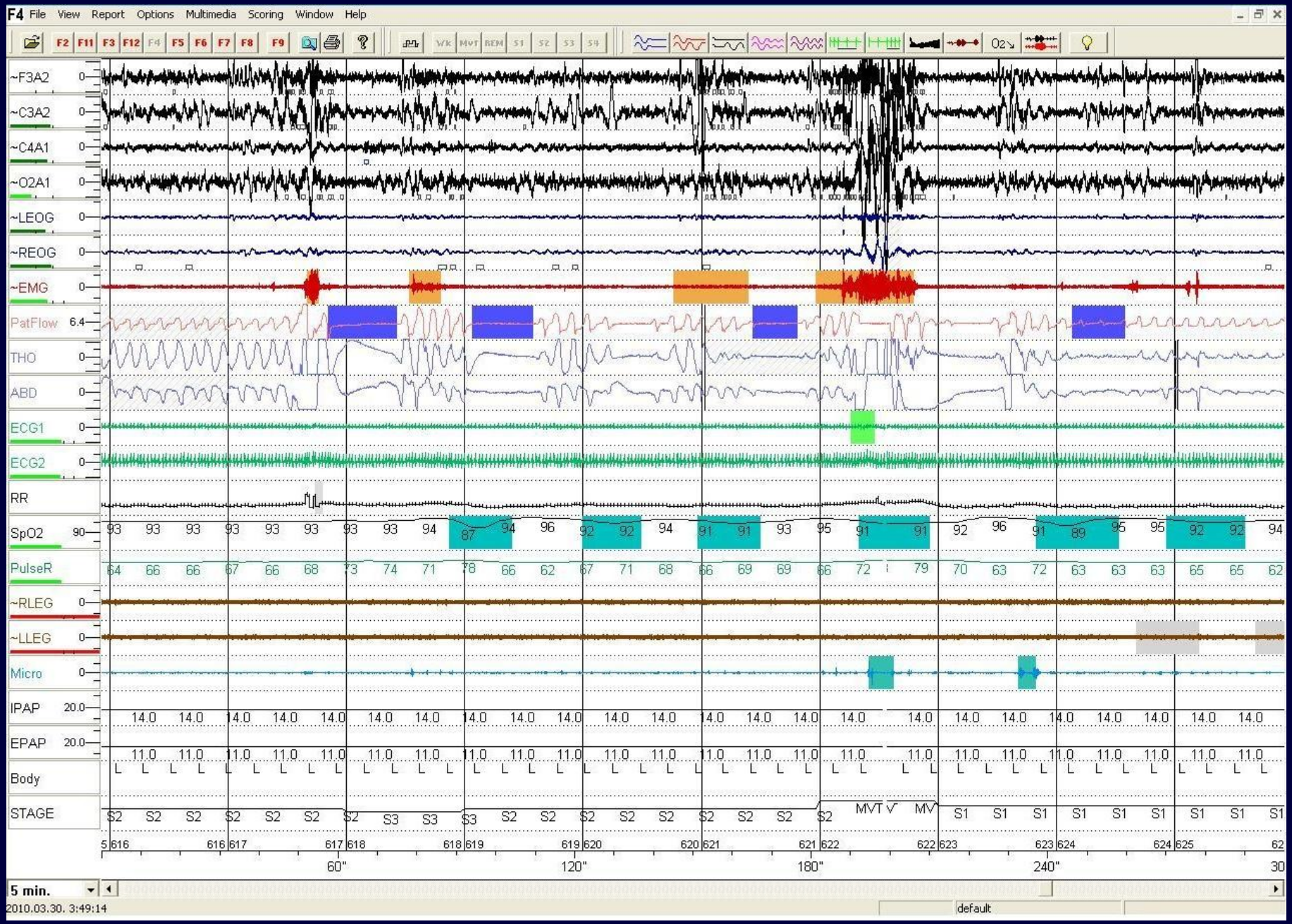
Snoring



Negative somnogram during snoring



Obstuctive sleep apnea



Central apnea

Apnea-hypopnea index (AHI)

- Numbers of apneas and hypopneas/ 1 sleeping hour

Severity of sleep related breathing disorders:

- Normal: AHI<5/h
- Mild: AHI: 5-15/h
- Moderate: AHI:16-30/h
- Sever: AHI>30/h

OSAS: symptoms

Daytime

- Excessive daytime sleepiness (Epwort Sleepiness Scale)
- Unrefreshing sleep
- Memory disturbances
- Morning headache
- Depression
- Decreased libido
- Stomachache

At night

snoring

apneas

choking, gasping

arousals

sweating

dry mouth

palpitation

nycturia

Risk factors of OSAS

- Obesitas
- Age
- Male gender
- Positive family history of OSAHS
- Alcohol consumption before bedtime
- Race
- Smoking
- Sedatives
- Craniofacial anomalies
- Hypothyroidism, acromegaly

OSAS

- Chronic intermittent hypoxia
- Symphatetic dysregulation
- Risk factor for (non-dipper) hypertension, cardiac arrhytmias, myocardial infarct, stroke, heart failure, sudden death

Treatment of bening snoring and mild OSAS:

- Weight loss, alcohol withdrawal
- Rarely Nasal, pharyngeal surgery (UPPP)
- Oral appliances

Treatment of OSAS: nasal CPAP/BIPAP

Narcolepsy

- Disorder of the regulation of wake and sleep
- Sleep attacks daytime, disturbed sleep at night
- Cataplexy, sleep paralysis, hallucination
- Orexin loss (post-Streptococcal, postvaccination)

Diagnosis

- Polysomnography to exclude other causes of daytime sleepiness
- MSLT (multiple sleep latency test)
- Orexin in CSF

Therapy

- For daytime sleepiness: modafinil, amphetamin
- For cataplexy: tricyclic antidepressants, venlafaxin

IV. Cirkadian rhythm sleep disorders

- Primary
  - Delayed sleep phase type
  - Advanced sleep phase type
  - Irregular sleep phase type
- Secondary
  - Jet lag type
  - Shift work type

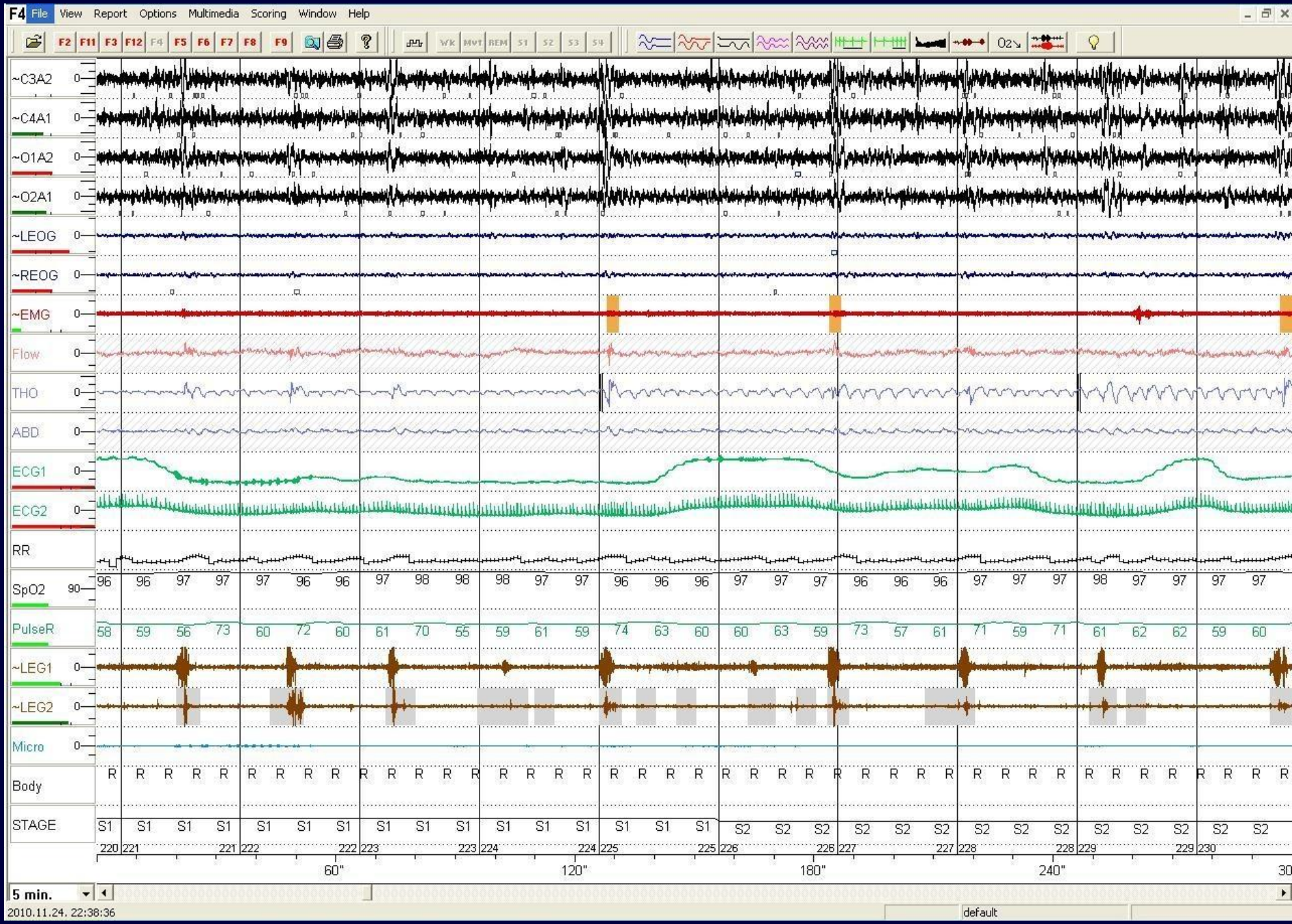
- Treatment
  - Sleep hygiena
  - Cronotherapy
  - Light therapy
  - Melatonin, zolpidem

V. Parasomnias

- In NREM
  - Myoclonus
  - Enuresis nocturna
  - Pavor nocturnus, night terrors
  - Sleep walking - somnambulism
  - Bruxism
- In REM
  - Nightmares
  - REM sleep behavior disorder

VI. Sleep related movement disorders

- Restless legs syndroma – clinical dg
- Periodic limb movement disorder (PLMD) – PSG dg
- Sleep related leg cramps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~EMG
Flow
THO
ABD
ECG1
ECG2
RR
SpO2
PulseR
~LEG1
~LEG2
Micro
Body
STAGE
60"
120"
180"
240"
5 min.
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default

Restless legs syndrome

- Major diagnostic criteria:
  - an urge to move the legs
  - that is present at rest
  - relieved by movement, and
  - symptoms occuring mainly at night or in the evening

- Minor criteria:
- PLMD by polysomnography
- Dopamin agonist therapy is effective
- Positive family history

Secunder RLS: pregnancy, iron deficiency, kidney failure, polyneuropathy, side effect of drugs (e.g. SSRI)

Therapy

- Dopamine agonists: pramipexole, ropinirole, rotigotine
- Benzodiazepines
- iron

Thank you for your attention!