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BSS2015 Hands-On Tech Breakfast

SCORING SLEEP USING AASM GUIDELINES: A BRIEF INTRODUCTION

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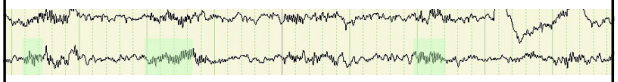
AIMS

- **To review criteria for staging sleep as defined by international guidelines (AASM V2.2, 2015).**
- **To discuss the benefits and drawbacks of these guidelines.**
- **To apply the current AASM guidelines by identifying sleep stages during a practical exercise.**



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EXPERIENCE

- **Completely new to scoring?**
- **A little experience of scoring PSG?**
- **Regularly scoring PSG?**
- **RPSGT (Registered Polysomnographic Technologist)?**
- **EST (ESRS Somnologist – Technologist)?**

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POLYSOMNOGRAPHY

- **Objective measurement of sleep & wake (overnight or during the day)**
- **Gives information on**
  - Duration/amount of sleep
  - Patterns of sleep
  - Quality of sleep
  - Behaviours during sleep
- **Information from PSG can be used to define sleep stages**

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POLYSOMNOGRAPHY

Sensors applied in standard positions

Studies scored using standard rules by skilled technolologist
This workshop

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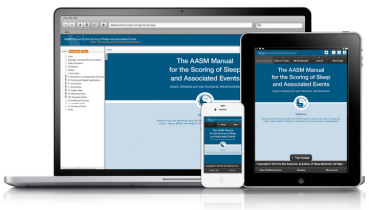
AASM VERSION 2.2 - 2015

- **Current version of guidelines**
- **Published July 2015**
- **Online access only**



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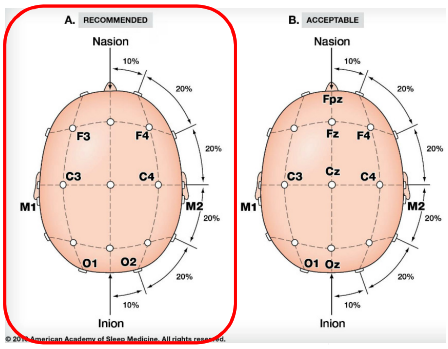
AASM MONTAGE



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BENEFITS OF AASM GUIDELINES

- **Standardised international guidelines**
- **Comprehensive manual**
  - Setting up lab
  - Training staff
  - Reference guide
  - Lab accreditation
- **Flexible online format**
  - Updated annually

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LIMITATIONS OF AASM GUIDELINES

- **Staggered implementation → variation between centres**
- **Frequent revisions → "shifting goalposts"**
  - Many changes related to US Medicare reimbursement
- **Based on scoring full PSG**
  - AASM also recommends use of portable monitoring
    Collop et al, JCSM, 2007
  - Transferable to limited studies?
  - ERS Task Force TF-2014-02 (2014-2016)

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SCORING SLEEP STAGES

This session based on adult scoring rules –

AASM Version 2.2 (2015)

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SCORING SLEEP STAGES

- **Based on unit of epoch**
  - 30s in most labs
- **Each epoch reviewed in turn and assessed as a whole for its sleep stage**
- **In some situations, the page before or after can influence the decision**
- **To score a certain stage of sleep at least half the epoch (15 seconds) must be classified as that stage**

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STAGE W

- **Alpha rhythm / posterior dominant rhythm**
  - 8-13Hz
  - Majority of individuals(~10% do not generate alpha)
  - clearest on occipital EEG

AND / OR

- **Other findings consistent with W**
  - Eye blinks
  - Rapid eye movements (REMs) with normal/high chin EMG
  - Reading eye movements

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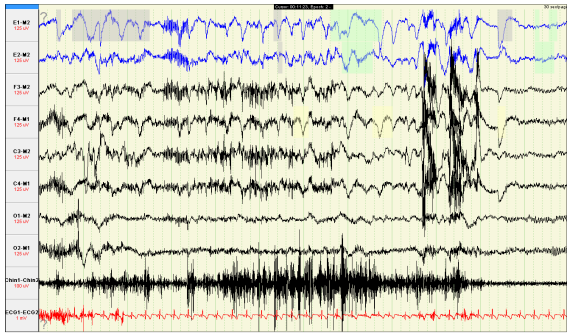
STAGE W – EYES OPEN



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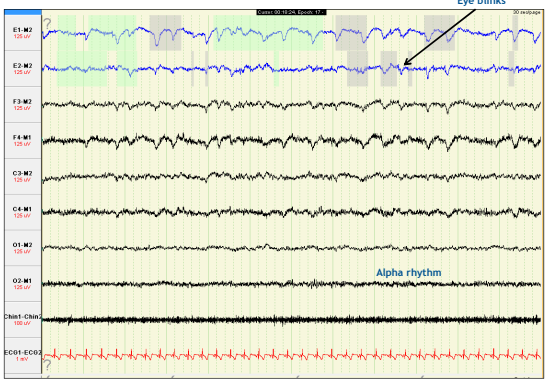
STAGE W – EYES CLOSED



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STAGE N1

Appearance of any of:

- **Low amplitude, mixed frequency EEG (LAMF)**
  - 4-7Hz
- **Vertex sharp waves (V waves)**
  - Central EEG
  - <0.5s duration
- **Slow eye movements (SEMs)**

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STAGE N1

- **Score N1 if majority of epoch meets criteria for N1 in the absence of evidence for any other sleep stage**
- **Keep scoring N1 until there is evidence of another sleep stage**
  - Usually W, N2 or R

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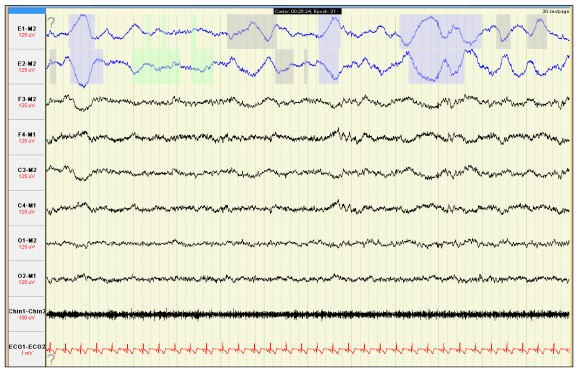
STAGE N1



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STAGE N2

Characteristic waveforms:

- **Sleep spindle**
  - fast burst (≥ 0.5s) of 11-16Hz activity
  - clearest on central EEG
- **K complex**
  - -ve EEG deflection followed by +ve (≥ 0.5s)
  - clearest on frontal EEG

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STAGE N2

- **Start scoring N2 if a K complex and/or sleep spindle is present in the first half of the epoch or last half of preceding epoch**
  - "Definite stage N2"
- **Continue to score N2 in absence of spindle/K-complex if no arousals**
- **Epochs after a page of N3 are scored as N2 if they do not meet criteria for W, N3 or R**
  - Do not score N1 after N3

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STAGE N2

- **Stop scoring N2 when**
  - Transition to stage W, N3 or R
  - Arousal followed by LAMF, but not meeting criteria for R (N1)
  - Major body movement followed by SEM and LAMF (N1)

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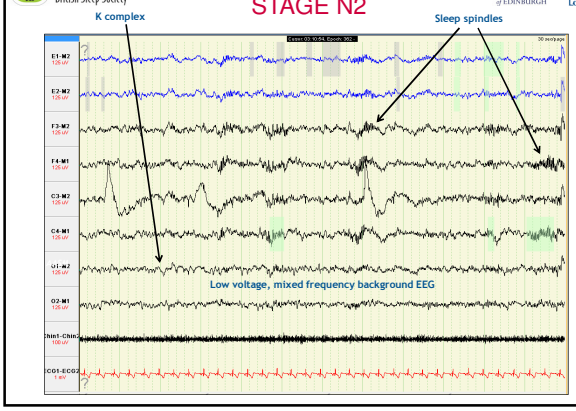
STAGE N2



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STAGE N3

- **Slow waves in ≥20% (≥6s) of epoch**
  - 0.5-2 Hz
  - ≥75μV in amplitude in frontal EEG
  - Irrespective of age
- **Do not confuse K complexes with slow waves**
  - K complexes separated in time
  - slow waves tend to occur in runs
  - K complexes develop into slow waves at transition from N2 to N3
- **Spindles can persist into N3**

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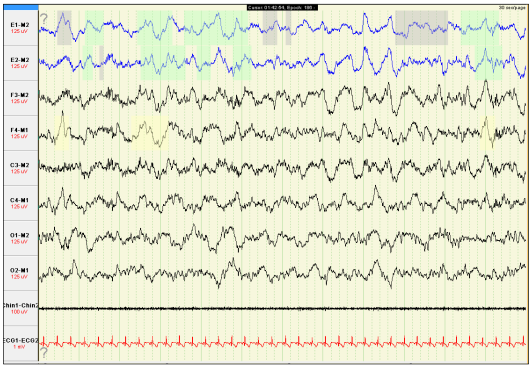
STAGE N3



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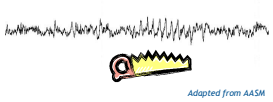
STAGE R

Characteristic waveforms:

- **Bursts of rapid eye movements (REMs) on EOG**
- **Very low amplitude EMG (atonia)**
- **Sawtooth waves**
  - clearest on central EEG
  - Often precede bursts of REMs



Adapted from AASM

- **Transient muscle activity**
  - Duration <0.25s

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STAGE R

- **"Definite stage R" scored in epochs with ALL of**
  - LAMF without spindles/K complexes
  - Low chin EMG tone (atonia)
  - REMs
- **Pages before and after "Definite stage R" scored as R in absence of REMs with ALL of**
  - LAMF without spindles/K complexes
  - Low chin EMG tone (atonia)
  - No arousal
  - No SEMs
- **R takes precedence over N2**

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STAGE R

- **Stop scoring R if ANY of**
  - Transition to W or N3
  - ↑ EMG tone and meets criteria for N1
  - Arousal followed by LAMF and SEMs (N1)
  - Major body movement followed by LAMF and SEMs without a sleep spindle or K complex (N1)
  - Sleep spindle or K complex in first half of epoch in absence of eye movements (even if chin EMG still low)

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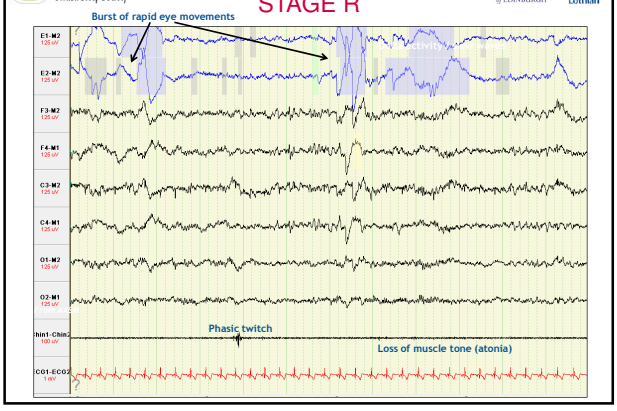
STAGE R



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PRACTICAL SESSION

- **Split into small groups**
- **Set of laminated sample epochs**
- **Assess each example as a group**
  - EEG frequency
  - Distinct, measurable features
- **Decide which sleep stage to score**

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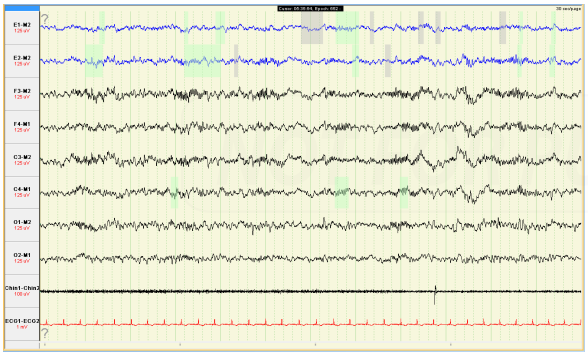
EXAMPLE 1



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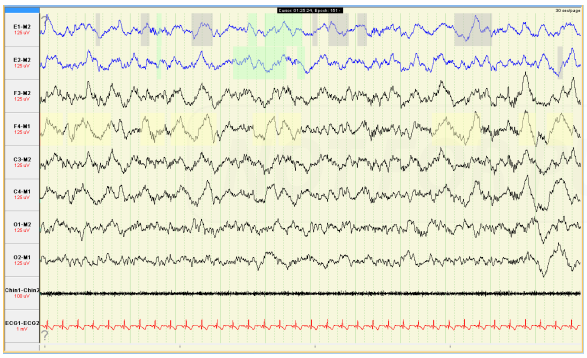
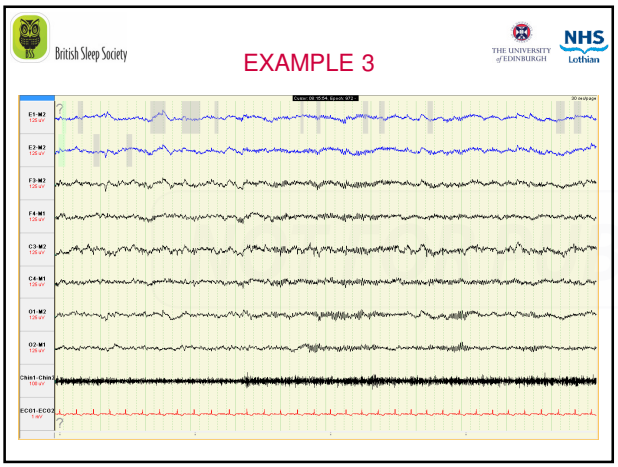
EXAMPLE 2

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EXAMPLE 3
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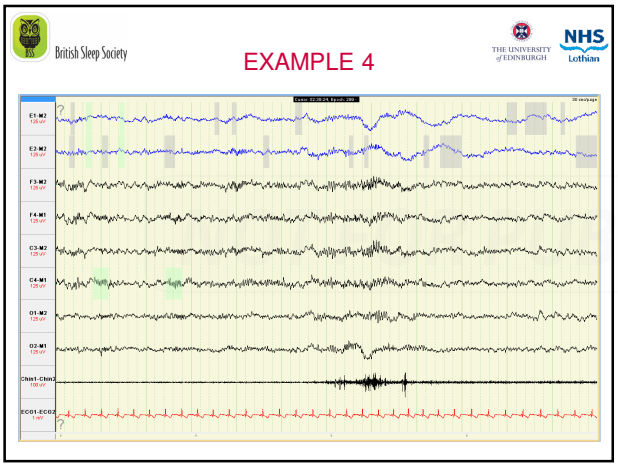
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EXAMPLE 4
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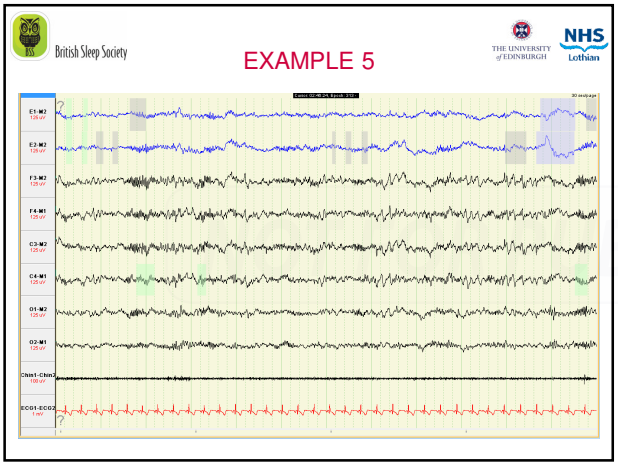
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EXAMPLE 5
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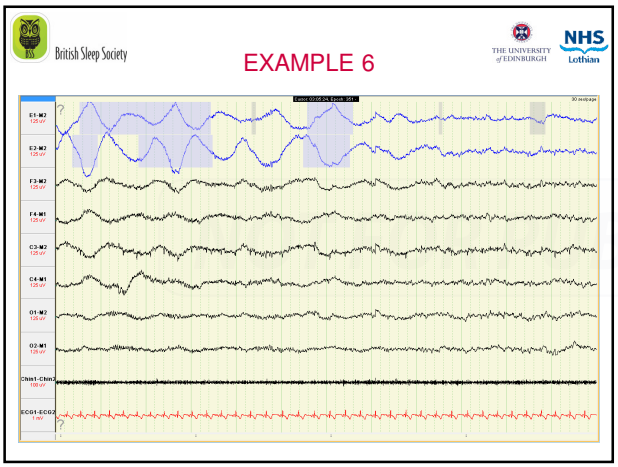
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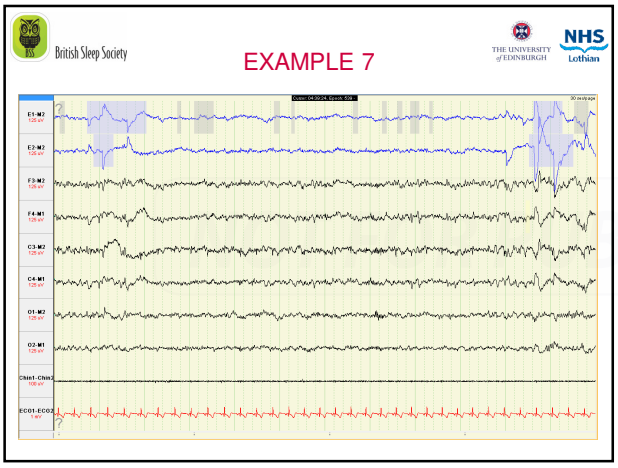
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EXAMPLE 7
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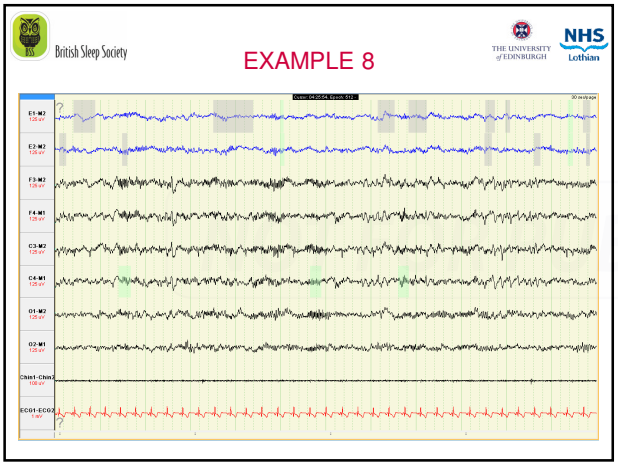
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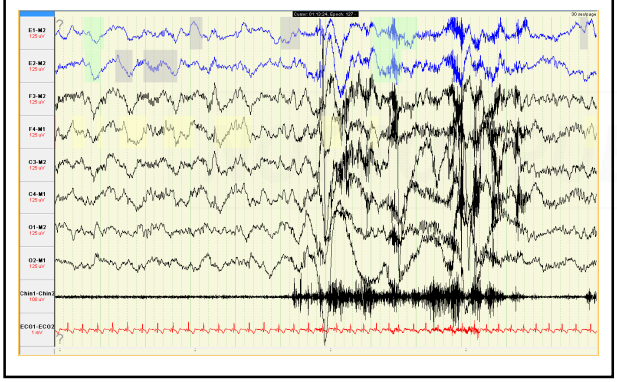
EXAMPLE 9



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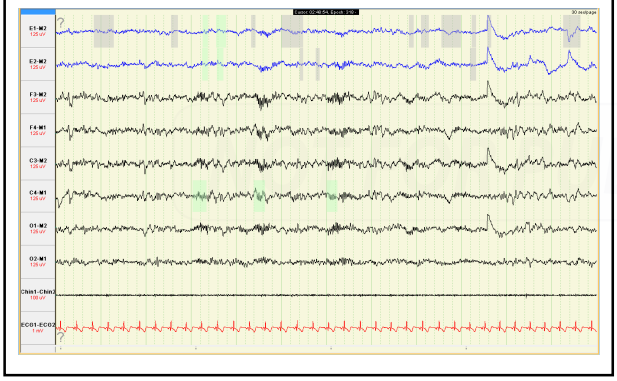
EXAMPLE 10



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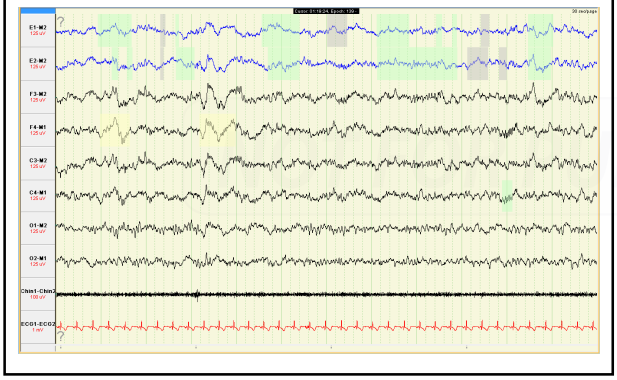
EXAMPLE 11



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EXAMPLE 12

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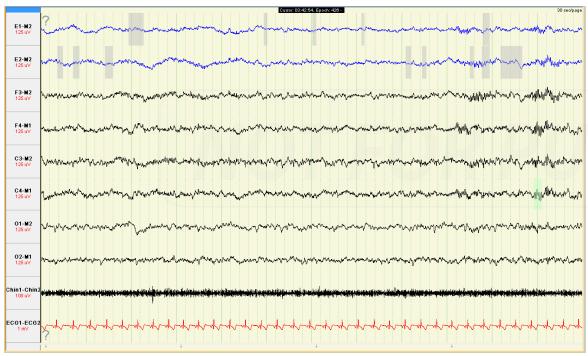

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EXAMPLE 13

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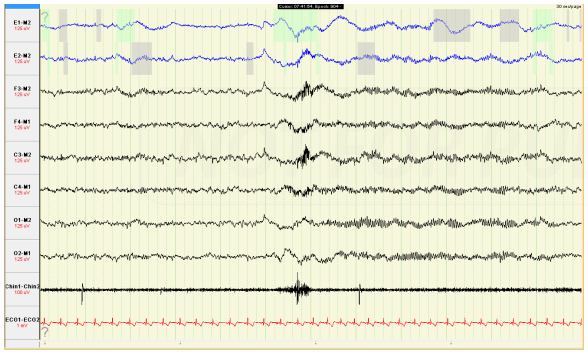

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EXAMPLE 14

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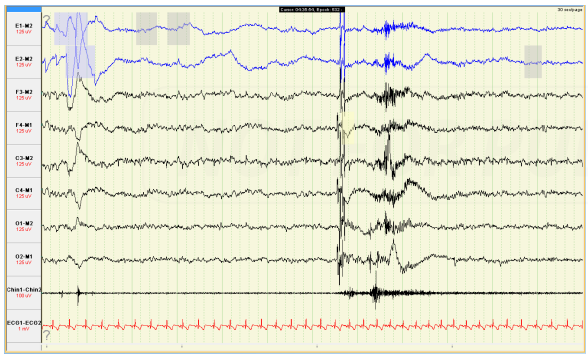

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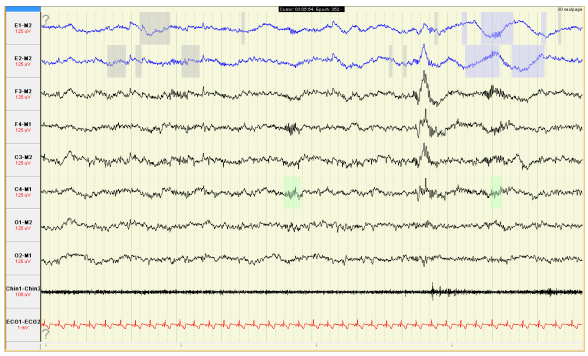
EXAMPLE 15



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CONCLUSION

- Electrophysiological changes during sleep can be measured using polysomnography.
- Distinct, measurable electrophysiological features are used to define different stages of sleep.
- International guidelines for sleep staging are available and are generally well-accepted as the "gold standard".

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FURTHER READING

- ***The AASM annual for the Scoring of Sleep and Associated Events: Rules, Terminology and technical Specifications Version 2.2.***
  American Academy of Sleep Medicine (2015)
- ***Essentials of Polysomnography 2nd Edition.***
  William H. Spriggs; Jones & Bartlett Publishers (2014)
- ***Essentials of Sleep Technology***
  Richard S. Rosenberg; American Academy of Sleep Medicine (2010)

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FURTHER TRAINING

- **Practical Polysomnography – Edinburgh, UK**
  - Various dates
- **Edinburgh Sleep Medicine Course – Edinburgh, UK**
  - March 2016
- **International Sleep Medicine Course – Cardiff, UK**
  - June 2016
- **BSS Hands-On – Cardiff, UK**
  - June 2016

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