DESCRIPTING NORMAL ADULT SLEEP

1. Sleep Stages
   a. **Wake**
      EEG – “beta” rhythm (desynchronous, low voltage, fast rhythm)
      18-30 cycles per second or Hertz
      EMG – moderate to high
      Consciousness – active processing of cognitive information

      EEG – “alpha” rhythm (synchronous, moderate voltage, slower rhythm)
      8-12 cps/Hz
      EMG – low to moderate
      Consciousness – relaxed, unfocused, aware of environmental stimuli

   b. **State 1 Non-REM (NREM) Sleep (light NREM sleep)**
      EEG – “theta” rhythm (synchronous, moderate voltage, slower rhythm)
      6-8 cps/Hz
      EMG – low to moderate
      Consciousness – unconscious, unaware of stimuli, easy to awaken
      EOG – slow, rolling eye movements, not always conjugate

   c. **Stage 2 NREM Sleep (light NREM sleep)**
      EEG – “theta” rhythm
      “sleep spindles” – 12-14 cps/Hz (synchronous, short bursts)
      “K-complexes”
      EMG – low to moderate
      Consciousness – unconscious, unaware of stimuli, fairly easy to awaken
      EOG – no characteristic movements observed

   d. **Stage 3 NREM Sleep (deep NREM sleep)**
      EEG – presence of “delta” rhythm (< 50% of record)
      (synchronous, high voltage, very slow rhythm)
      ½ to 3 cps/Hz
      EOG – quiet
      EMG – very low    EKG, respiration, BP – low, steady
      Hormones – growth hormone secretion
      Consciousness – unconscious, unaware of stimuli, more difficult to awaken
1. **Sleep Stages** (cont.)

   e. **Stage 4 NREM Sleep (deep NREM sleep)**
      
      EEG – presence of “delta” rhythm > 50% of record
      
      Same as stage 3, except even more difficult to awaken
      
      When awakened may report vague “dreams”
      
      Many alternate names for this stage of sleep: Slow Wave Sleep (SWS), Quiet Sleep, Synchronous or “S” Sleep

   f. **Stage REM (Rapid Eye Movement Sleep)**
      
      EEG – “beta-like” (low voltage, desynchronous, fast frequency)
         
         Presence of “sawtooth” waves
      
      EMG – “flat-line”, active inhibition of skeletal muscles (except for those muscles involved in respiration)
         
         Muscle twitches in face, fingers, whiskers
         
         External muscles of eyeball still innervated
      
      Consciousness – unconscious, unaware of environmental stimuli, if awakened will report detailed dreams usually
      
      Relatively easy to awaken sleeper
      
      EOG – bursts of rapid, conjugate eye movements (“REMs”)
      
      “Phasic” vs. “Tonic” REM sleep:
         
         Tonic REM – EKG, respiration, BP, GSR, HR – slow, steady, low, no REMs
         
         Phasic REM – EKG, respiration, BP, GSR, HR – erratic, faster, higher, lots of REMs, HCl secreted in stomach
         
         Implies high arousal of SNS
      
      Penile/clitoral tumescence
      
      No temperature regulation (become “poikilothermic” within a limited range of temperatures)
      
      Alternate names: Active Sleep, Desynchronous or “D” Sleep, Dreaming Sleep, Paradoxical Sleep (especially used for animal REM sleep)

2. **Sleeper’s Perception of Sleep Stages**: When awaken the sleeper for each stage of sleep, what is his/her impression/perception? Does S know that he/she was asleep?

   Implications for clinical histories from patients
   
   “Lucid Dreamers”
3. **Total Percentages of Different Sleep Stages** in a Night

- Stage 1 – 5%
- Stage 2 – 45-55%
- Stage 3&4 – 20%
- Stage REM – 20%

4. **Sleep “Architecture” Across the Night’s Sleep**

- W --- Stage 1 --- Stage 2 --- Stage 3 --- Stage 4 --- Stage 3 --- Stage 2 --- REM
  - End of first cycle of sleep
  - Latency to start of first REM cycle
  - An expression of the BRAC?
  - Number of REM cycles in a night

- So…REM --- Stage 2 --- Stage 3 --- Stage 4 --- Stage 3 --- Stage 2 --- REM
  - Latency to start of second REM cycle
  - First “half” of night: mostly Stages 3 & 4 sleep

- Then…REM --- Stage 2 --- Stage 3 --- Stage 2 --- REM
- Then…REM --- Stage 2 --- REM --- Stage 2 --- REM --- Stage 2 --- REM --- W
  - Second “half” of night: mostly Stages 2 and REM
  - What happens if S sleeps for short time? For a longer time?