

# Polly Want a Somnogram? Activity 3E

## Objectives:

Students will be able to:

- ◆ Analyze a polysomnogram to identify what each line is measuring, i.e. **EEG**, **EEK** etc.
- ◆ Observe a polysomnogram and identify the stage of sleep and/or specific wave patterns, sleep disorders, etc.
- ◆ Compare (labeled) polysomnograms of patients with unknown (unlabeled) patient polysomnograms to infer the stage of sleep and/or specific wave patterns and sleep disorders found in the unknowns.

## Activity Description:

Students will investigate polysomnogram printouts (used by sleep diagnostic centers) that include multiple measurements such as the **EEG** (brain waves), **EMG** (leg movement) and **EOG** (eye movements) along with other measurements taken while a patient sleeps. Since many different bodily function measurements are recorded on the printout, students will learn to identify each line of a polysomnogram. In activity 3F, they will use their newly found skills to examine several labeled (known) polysomnograms and compare them to unlabeled (unknown) samples in order to complete their analysis.

## Activity Background:

During a sleep study, electrodes are placed on the body to collect information about the way our body functions during sleep (See *Figure 1 Electrode Placement*). All of this information is important in understanding what is happening to our bodies during sleep because all of the major organ systems are affected by sleep.



**Figure 1 –  
Electrode Placement**

When all of these measurements are taken during a sleep study, there is a *lot* of information that needs to be analyzed. It is much easier to keep track of all information if it is placed on *one* report. The printout that has all of this information in one place is called a **polysomnogram**.

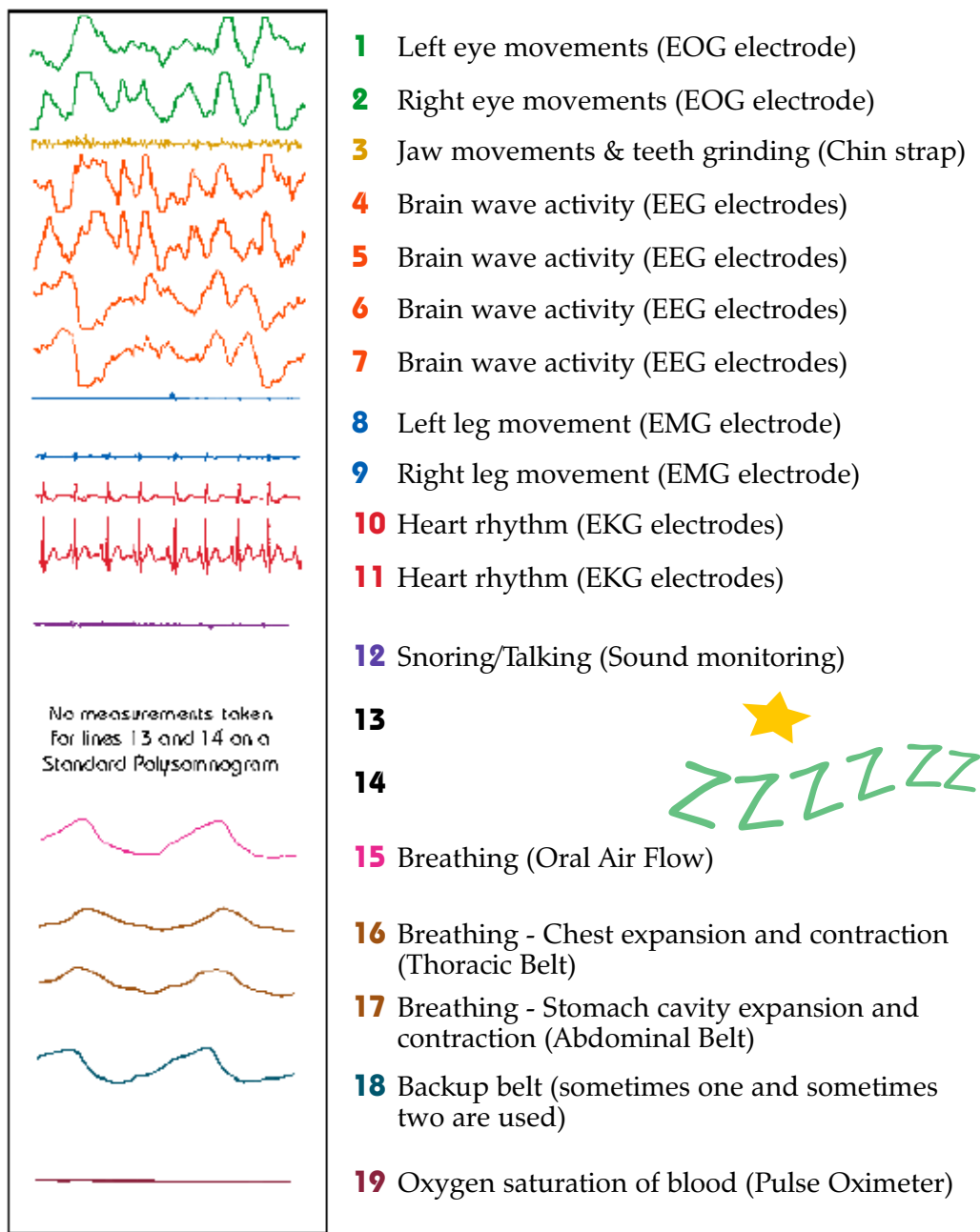


# Activity Overview



Explain to students that this looks like a complicated word, but is really made from three simple root words. *Poly-* means many, *somn-* means sleep and *-gram* means graph, record or picture. When put together, these root words mean, loosely, “a printout showing many graphs about sleep”. More precisely, it is a printout gathered to test sleep cycles and stages through the use of continuous recordings of eye movement, electrical activity of muscles, brain waves, heart rhythm, snoring and/or talking, air flow during breathing, breathing rate, blood pressure and blood oxygen and direct observation of the person during sleep. *Figure 2, Standard Polysomnogram* below is an example of a standard polysomnogram. Notice each section has information about a specific body function. Once trained to read these waves, a sleep specialist can provide detailed report about what is happening to a person during sleep.

**Figure 2 – Standard Polysomnogram**



# Activity Overview Continued



LESSON 3  
ACTIVITY 3E

ZZZZZ World

## Activity Materials: (Per Student)

- Colored Map Pencils or Markers
- 1 Copy of Standard Polysomnogram Page
- 1 Copy of Visual Polysomnogram Page



## Activity Management Suggestions:

### Modifications:



### Extensions:

## Activity References Used:

Geyer, JD; Payne; TA, Carney; Aldrich, MS. (2000). *Atlas of digital polysomnography*. Philadelphia. Lippincott Williams & Wilkin

## Useful Websites:

[www.sleepnet.com](http://www.sleepnet.com)

<http://www.nhlbi.nih.gov/about/ncsdr/index.htm>

(National Center on Sleep Disorders Research)

[www.sleepfoundation.org](http://www.sleepfoundation.org)

(National sleep foundation)

<http://faculty.washington.edu/chudler/sleep.html>

(Neuroscience for kids)



# Activity Overview Continued



LESSON 3  
ACTIVITY 3E

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# Activity "Administrivia":

Intended Grade Level:

6-8

## Key Concepts:

Reading data from a unique source (polysomnogram), compare/contrast known and unknown samples of polysomnograms, diagnosing sleep disorders

## Process Skills utilized in lesson:

Observe, analyze, compare/contrast, apply and infer

## Previous learning assumed:

Understanding wave patterns, sleep-related vocabulary, stages of sleep, changes in organ systems during sleep

## Relevant TEKS:

- 6.2 (C) analyze and interpret information to construct reasonable explanations from direct and indirect evidence;
- 6.2 (D) communicate valid conclusions;
- 7.2 (C) organize, analyze, make inferences, and predict trends from direct and indirect evidence;
- 7.2 (D) communicate valid conclusions;
- 7.4 (B) collect and analyze information to recognize patterns such as rates of change.
- 7.11 (A) analyze changes in organisms such as a fever or vomiting that may result from internal stimuli; and
- 8.2 (C) organize, analyze, evaluate, make inferences, and predict trends from direct and indirect evidence;
- 8.2 (D) communicate valid conclusions;
- 8.4 (B) collect and analyze information to recognize patterns such as rates of change.
- 8.11 (A) analyze changes in organisms such as a fever or vomiting that may result from internal stimuli;



# Activity "Administrivia"

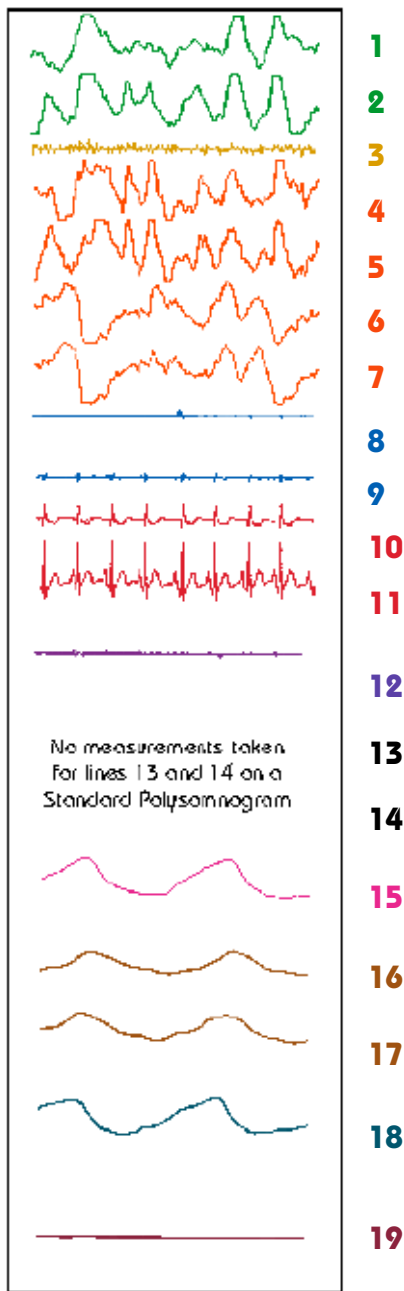


LESSON 3  
ACTIVITY 3E

ZZZZZ World



Each line has information about a specific body function. Once trained to read these waves, a sleep specialist can provide a detailed report about what is happening to a person when they sleep.



ZZZZZZ



**Figure 2 – Standard Polysomnogram**

Remember from **Activity 4 D, Somnosurfin'** that you studied four types of brain waves. *Beta waves* are *shorter and closer together* and they have the highest frequency and lowest amplitude. These waves are produced when a person is *alert*. *Delta waves* are *taller and farther apart*, so they have the lowest frequency and the highest amplitude. These waves are produced as a person relaxes and produces slow rolling eye movements. It is important to remember that waves with low energy have low amplitude and high energy waves have high amplitude. Also, high energy waves have shorter frequency while low energy waves have lower frequency. This information will help you interpret the waves on a polysomnogram – higher energy waves will be higher and closer together.

## Activity Materials: (Per Student)

- Colored Map Pencils or Markers
- 1 Copy of Standard Polysomnogram Page
- 1 Copy of The Visual Polysomnogram Page



## Activity Instructions:

First, read the background material very carefully and check what you learned by answering the questions that follow. You will create a visual polysomnogram by illustrating the process in each section of the polysomnogram.

1. List ten measurements that are made during human sleep studies.

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

2. How can Delta brain waves be distinguished from Alpha brain waves on an EEG?

\_\_\_\_\_

\_\_\_\_\_

3. When a person is relaxed, which type of brain wave would be produced?

\_\_\_\_\_

4. What is a polysomnogram?

\_\_\_\_\_

\_\_\_\_\_

5. Making a Visual Polysomnogram Instructions



- Using **Table 1, Standard Polysomnogram Information** on next page as a guide, label each section in the **Visual Polysomnogram**.
- Color the lines in the **Visual Polysomnogram** as indicated in the table on the next page (Standard Polysomnogram Information).
- Next, draw a picture in the box beside each section on the **Visual Polysomnogram** page included in this activity. Your picture should illustrate clearly what body process each section measures.
- You will have a unique **Visual Polysomnogram** when you finish.

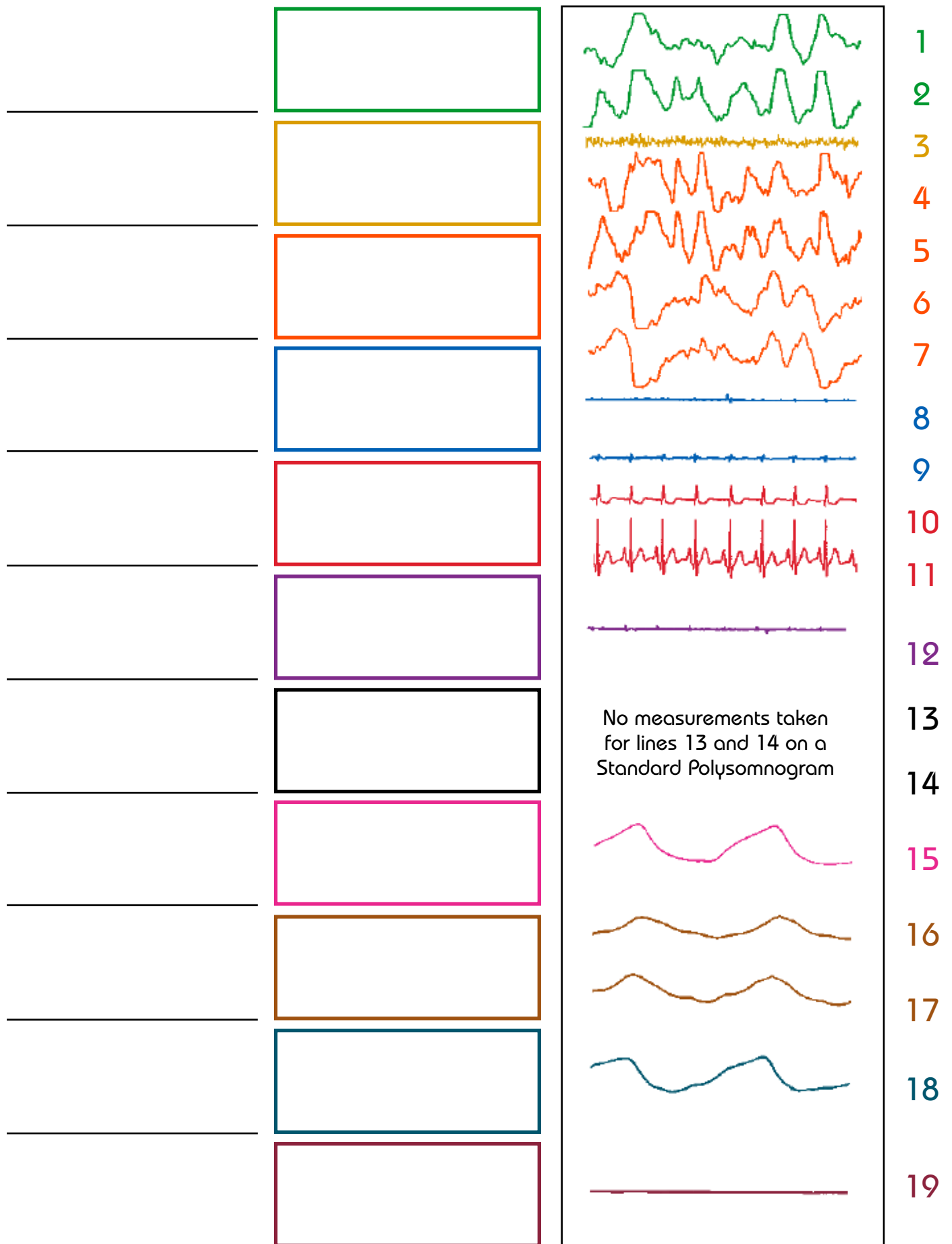


**Table 1 Standard Polysomnogram Information**

#	What this part of the Polysomnogram Measures	Color
1	Left eye movements (EOG electrode)	Green
2	Right eye movements (EOG electrode)	Green
3	Jaw movements & teeth grinding (Chin strap)	Yellow
4	Brain wave activity (EEG electrodes)	Orange
5	Brain wave activity (EEG electrodes)	Orange
6	Brain wave activity (EEG electrodes)	Orange
7	Brain wave activity (EEG electrodes)	Orange
8	Left leg movement (EMG electrode)	Blue
9	Right leg movement (EMG electrode)	Blue
10	Heart rhythm (EKG electrodes)	Red
11	Heart rhythm (EKG electrodes)	Red
12	Snoring/Talking (Sound monitoring)	Purple
13	Breathing (Oral Air Flow)	Pink
14	Breathing - Chest expansion and contraction (Thoracic Belt)	Brown
15	Breathing - Stomach cavity expansion and contraction (Abdominal Belt)	Brown
16	Backup belt (sometimes one and sometimes two are used)	Aqua
17	Oxygen saturation of blood (Pulse Oximeter)	Maroon



**Figure 3 – Visual Polysomnogram**



6. Look at the polysomnogram in *Figure 4*, Drowsy below. It shows measurements taken from a person who is drowsy and about to enter Stage 1 of NREM sleep. Now look at the polysomnogram in *Figure 5*, below. *Figure 4, Drowsy* is labeled, so it is a *known* polysomnogram; *Figure 5 ?????* is not labeled, so it is an *unknown* polysomnogram. What do you think might be happening to explain the differences in most areas of the two polysomnograms?

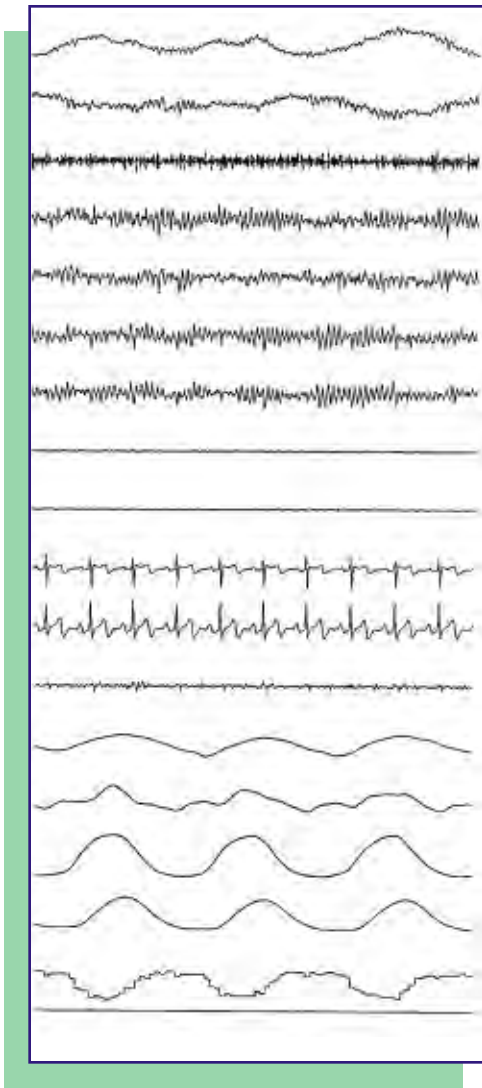
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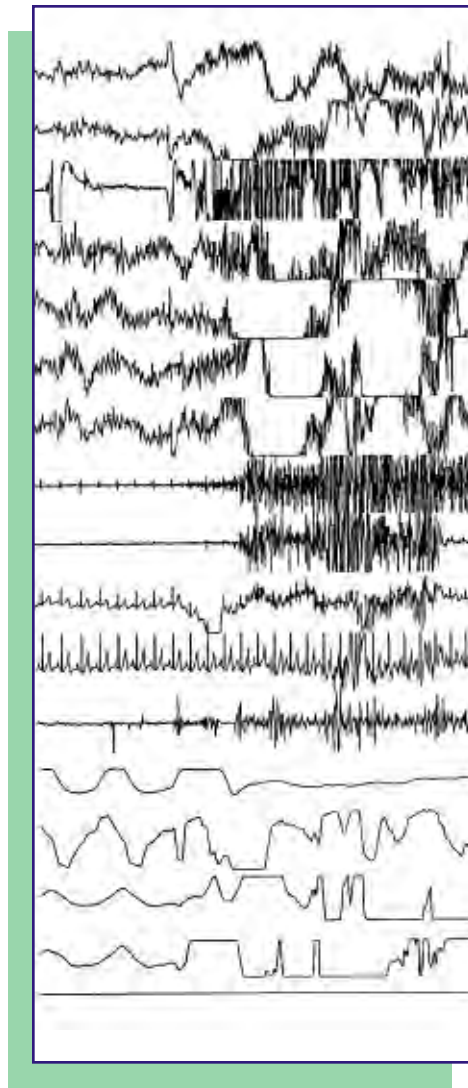
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**Figure 4 – Drowsy**



**Figure 5 – ?????**



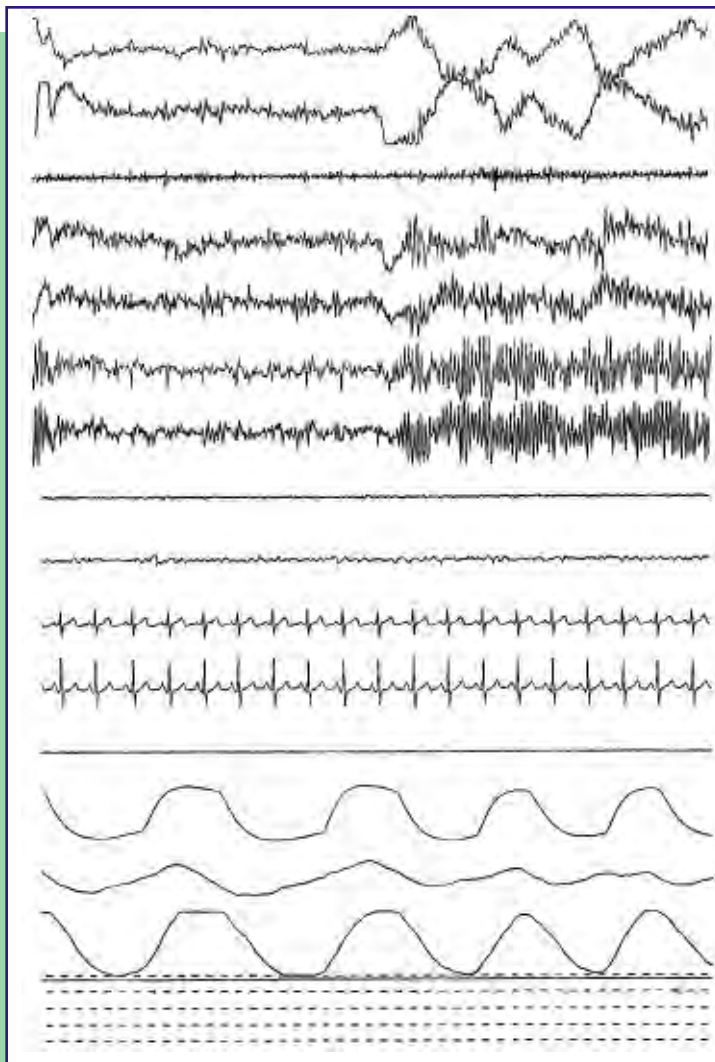
7. Look at the polysomnogram in *Figure 6 Stage Awake* (Eyes Closed and Eyes Open) below. Which line or lines of the polysomnogram will you be looking at to determine if the eyes are open or closed?



What evidence do you see in these lines that the person's eyes are closed?

Observe the appearance of the lines having to do with left and right eye movements and think about the characteristics of waves you learned about during the *Somnosurfin'* activity. How did the lines change when the eyes opened?

Why does this change indicate that the eyes were open?



**1** Figure 6 – Stage Awake  
**2** (Eyes Closed and Eyes Open)  
**3**  
**4**  
**5**  
**6**  
**7**  
**8**  
**9**  
**10**  
**11**  
**12**  
**15**  
**16**  
**17**  
**18**  
**19**

8. Upon completion of a sleep study to determine why you are not able to sleep throughout the night, the sleep specialist tells you that you are grinding your teeth at night and having trouble breathing regularly. By number, which sections of your polysomnogram might indicate these problems?



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9. How do you *think* polysomnograms would be used to detect breathing problems while a person is asleep?

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