11.4.1

Electroencephalogram

An electroencephalogram (EEG) is the tracing recorded by an electroencephalograph. Although the awake brain doesn't constantly produce a regular, repeating pattern like might be seen in an electrocardiogram, there are some measurable patterns that appear in different conditions, and the information in those patterns can be very useful in evaluating activity in the brain. Indeed, a flat EEG is a sign of clinical death. Based on the frequency (number of cycles per second) and amplitude (height of the waves) of the tracings, four typical EEG patterns can be discerned. If we were to record your EEG right now as you are reading this paragraph, we should detect beta waves. Beta waves have a frequency of 13-30 Hertz (cycles per second) and are common when the subject is awake with their eyes open and their brains engaged. Now close your eyes and try to relax and let your mind wander. Alpha waves would be recorded under these conditions. Alpha waves have a frequency of 8-13 Hz and a higher amplitude than beta waves. These are the only two types of waves that we should see in normal, healthy adults while awake. Theta waves (4-7 Hz) can be seen in the early stages of sleep and in young children. Finally, delta waves (0.5-4 Hz) are only seen during deep sleep or in adults with serious brain injury. As the frequency decreases, the amplitude of the waves gets larger. The larger amplitude is because the activity is more synchronized. The sleeping cortex is not receiving stimulatory input from the reticular system, but it is receiving stimulation from pacemaker areas like the thalamus, which can initiate rhythms in the cortex that can be perpetuated even after the pacemaker activity stops (kind of like how a crowd keeps chanting even after the music stops playing). What do these wave patterns mean? We still don't know, but the theta and delta waves may play a role in blocking sensory input and allowing the restorative functions of sleep.

What is the significance of the alpha and beta waves? Consider the research from Harvard professor Eric Mazur in which he continually monitored brain patterns of students for one week. The data showed that brain waves were almost completely flat during two events, watching television and listening to a classroom lecture. Coupled with the Australian study of 11,000 adults that showed that for every hour of television watched 22 minutes of lifespan was lost, one begins to wonder if students will ever survive college as the two biggest time sinks are lecture and television. Studies like this don't capture what really happens in all situations though. We believe that BYU-Idaho students are closer to beta waves during their lectures ☺.