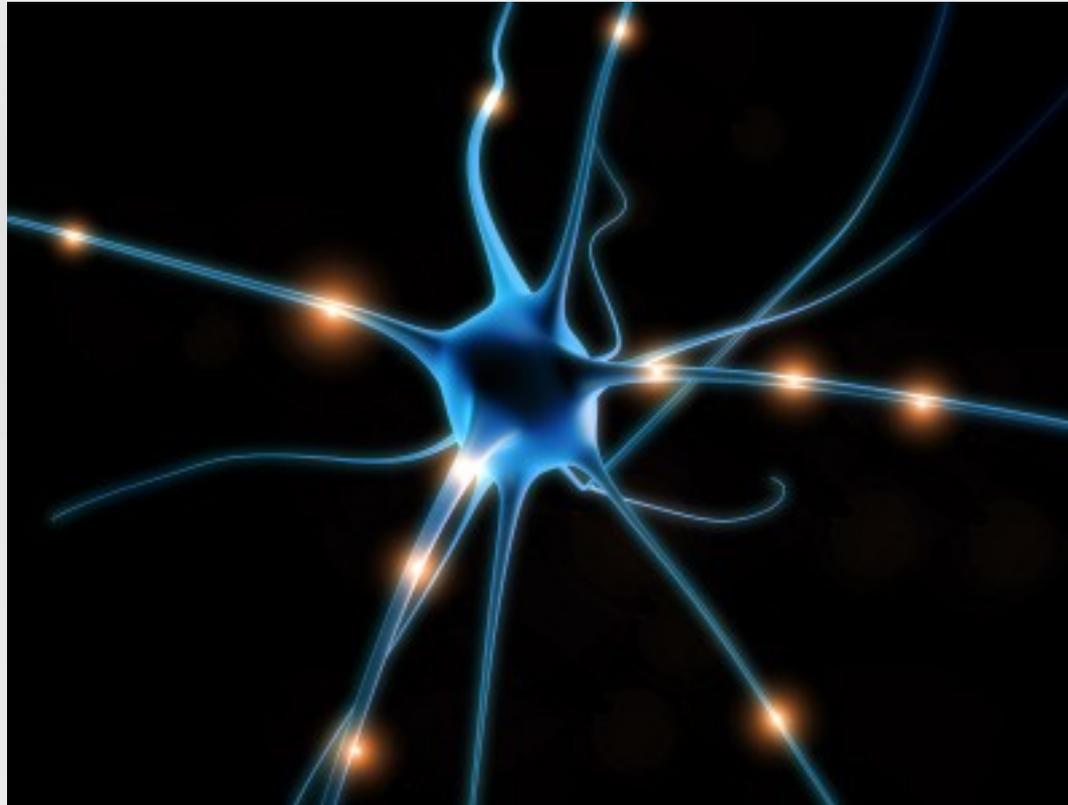


Tuning Your Brain



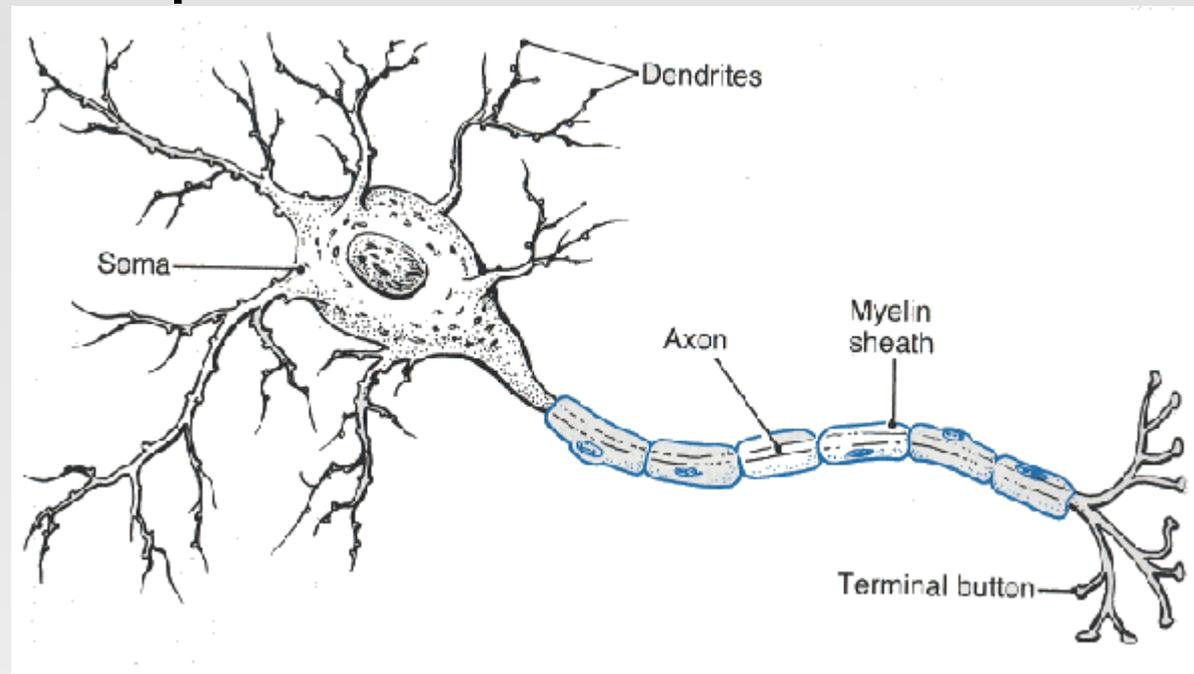
Tuning Your Brain

- Why does certain music get you out of a black hole?
- Often when we're stuck in a black hole, or just can't figure the problem out - the right music will get us out of it. Why does this work? It seems motivating, and it seems like we solve problems easier, and it seems to create a flow. I'll be going over the basics of the brain structures, neurons, synapses and neurotransmitters, before getting to how music effects the brain, and how we think.

Your Brain

- Your brain is made of cells called neurons
- Neurons are in 3 basic parts

- cell body
- dendrites [input]
 - presynaptic membrane is polarized.
- axon [output] –
 - movement along axon weakens as it travels
 - Could be seen as analog



Your Brain

- Neuron cells are cells are interconnected by synapses. from the neuron terminals [axon] to the membrane of the dendrite.
- Between the terminal of the axon and membrane of the dendrite is known as the pre-synaptic gap

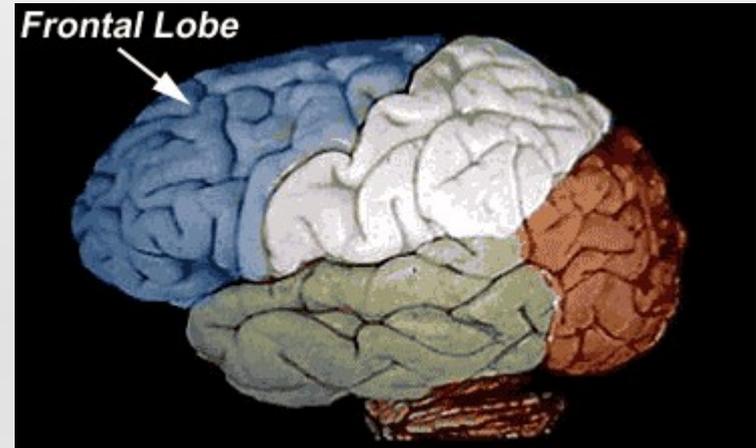
Your Brain

■ Neurotransmitters

- First discovered by Otto Loewi
- There are approximately 100 billion neurons in the human brain.
- Neurotransmitters are released from presynaptic terminal and across to the receptor membrane on the dendrite.
- This causes either depolarization (excitatory – increased likelihood of firing) or hyperpolarization (inhibitory- decreased likelihood of firing) of the membrane. If there is enough (action potential)– the charge passes along the axon to the terminal and the process repeats. Neurotransmitters are inactivated after release – either through re-uptake mechanisms or enzyme action.
- Neurotransmitters are inactivated after release – either through re-uptake mechanisms or enzyme action.

Your Brain

- Major Brain Structures
 - Frontal Lobe
 - Parietal Lobe
 - Occipital Lobe
 - Temporal Lobe



[From Neuroscience For Kids]

Brainwaves

- What are brainwaves? How are they made?
- Records of the electrochemical transmission – polarization/ depolarization at the synapse, action potential at the axon and dendrite.
- Brainwaves frequencies are separated into 4 “states”
 - Beta (fully awake) – 14-40 cps
 - Alpha(relaxed) – 8-13 cps
 - Theta (deeply relaxed) – 4-7 cps
 - Delta(dreamless/unconscious) .5 – 3.5 cps

Brainwaves

- Stochastic resonance
 - Think Tuning Fork

“Today it is well established that noise plays important roles both in the encoding of sensory stimuli and in the planning and control of certain movements. This paradigm shift was initiated by physicists over the last 25 years who studied the effects of noise on threshold-type devices, including neurons, to subthreshold inputs. It was shown that information transfer improves because noise increases the threshold crossing rate through a mechanism known as stochastic resonance”

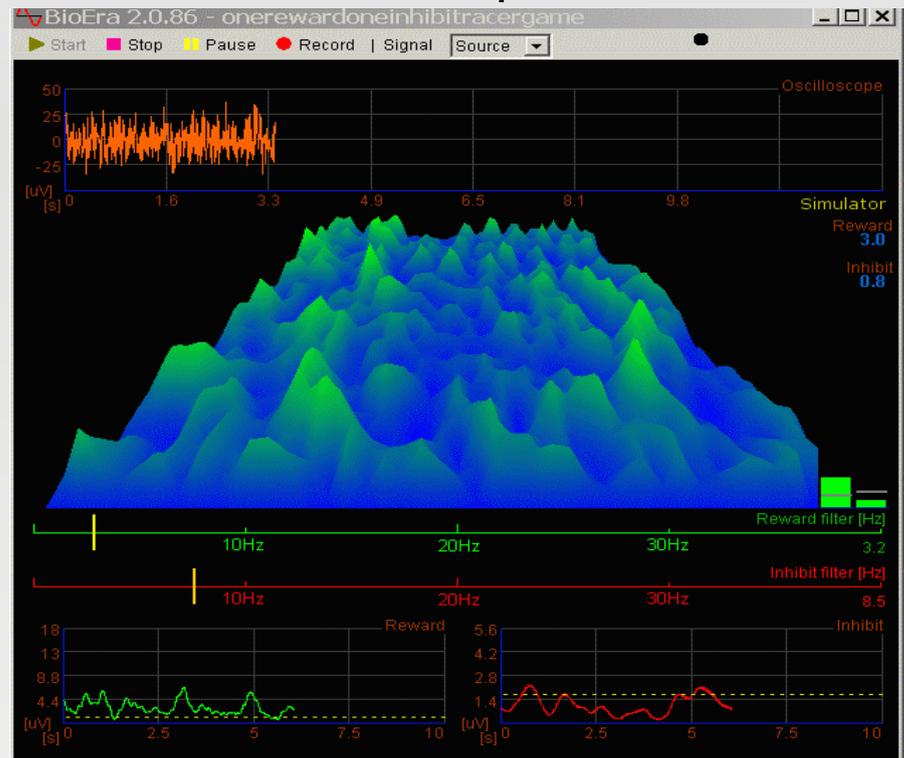
-- Noise as Therapy: A Prelude to Computationally-Based Neurology? *Annals of Neurology*.
Volume: 58, Issue: 2, Date: August 2005, Pages: 173-174

Binaural Beats/HBPM Music

- When a sound of a particular frequency is presented in one ear and a slightly higher or lower frequency is presented simultaneously in the other ear, the mid brain creates the middle frequency.
- Binaural Beats have been very popular in neurofeedback
- The beats can entrain brainwaves to their frequency via stochastic resonance.
- There is some suggestion however that Binaural beats are too fuzzy to be of as much use as any strong beat of the right frequency.
- Music, particularly high beat per minute music, listened to on headphones – stimulates the brain and thru resonance decreases the frequency of brain waves.
- High bpm music translates approximately to Alpha/ Theta hz.
- Changes heart rate.

EEG

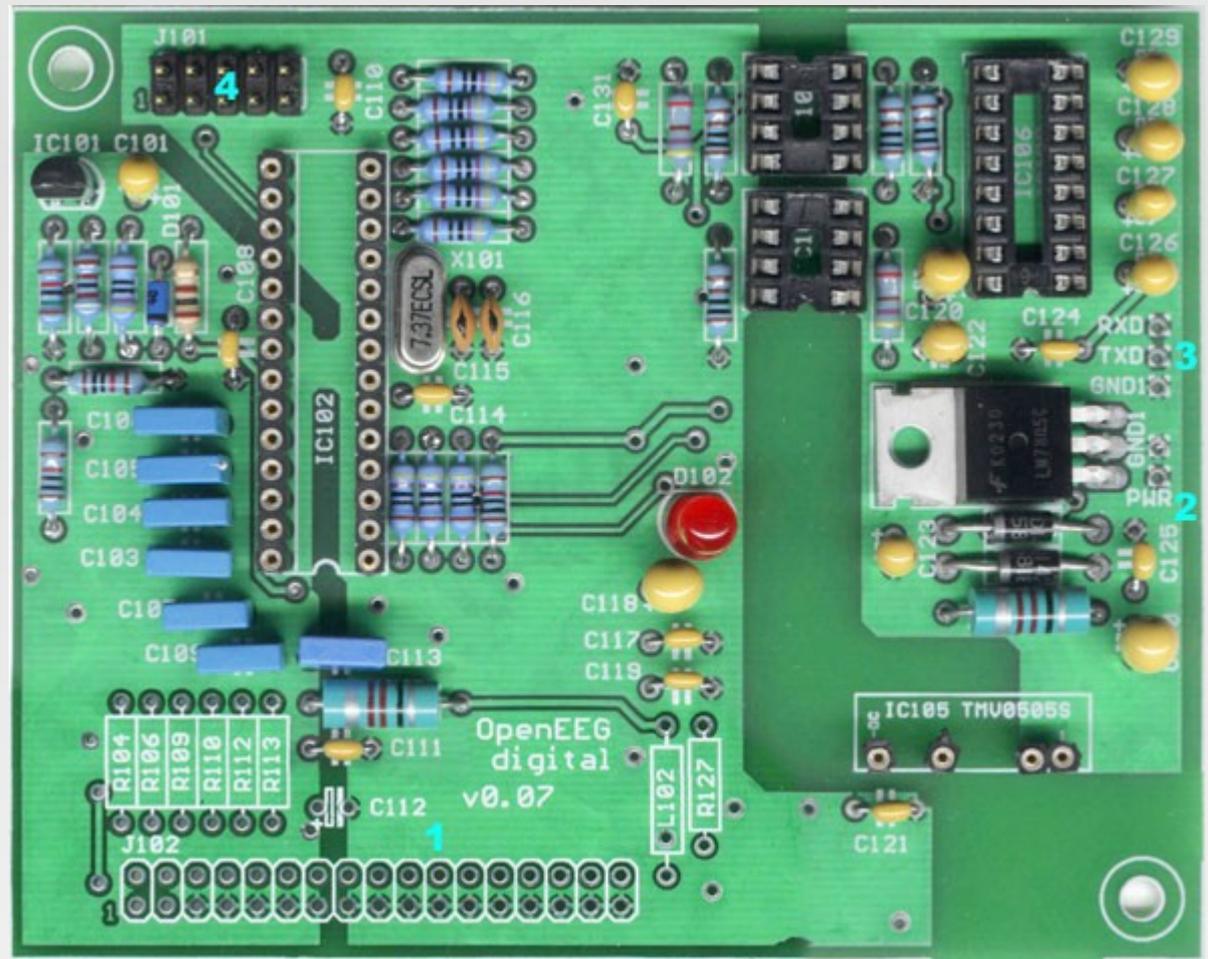
- Electroencephalograph
 - Reads and translates brainwaves into visual representations



From BioEra

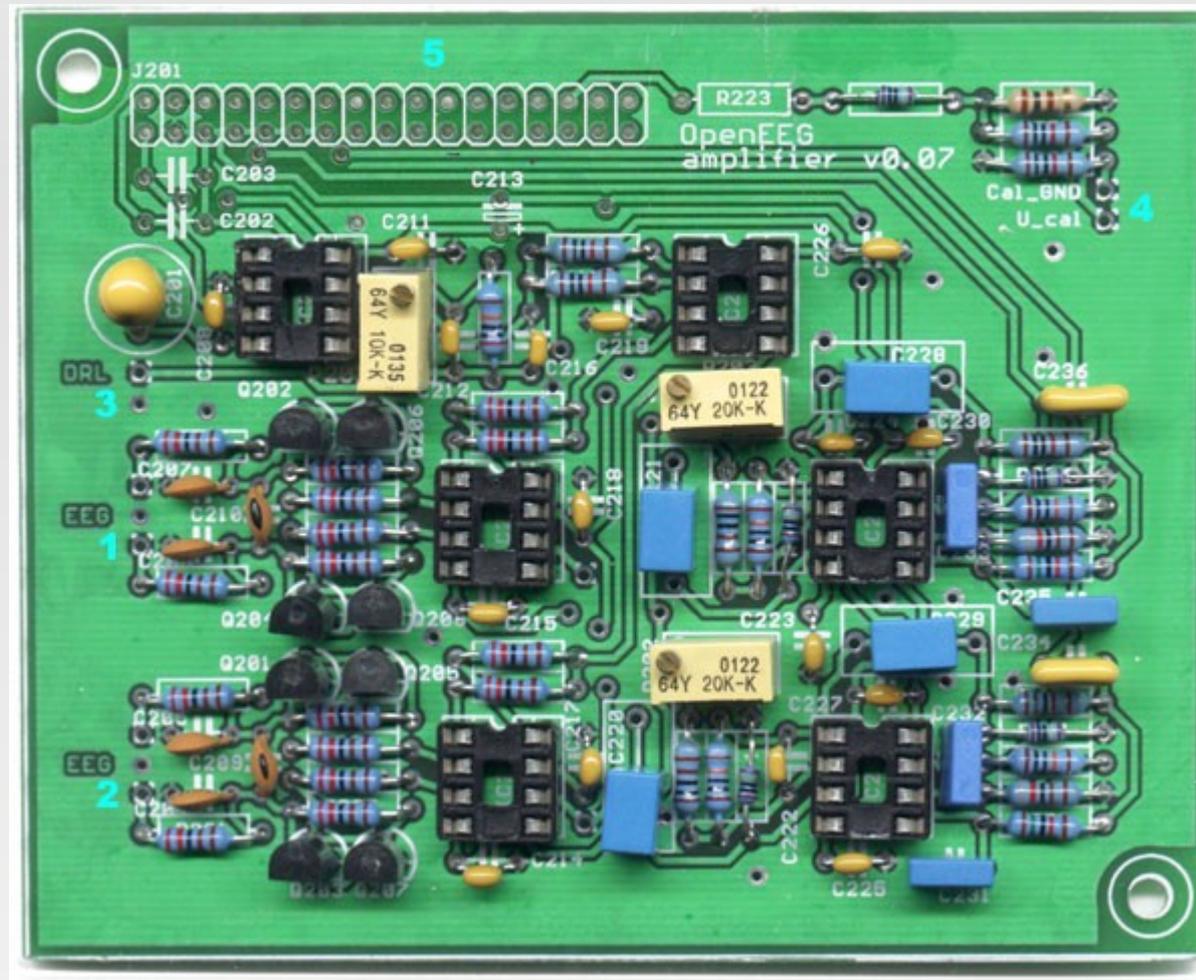
Hardware

- <http://openeeg.sourceforge.net/doc/>
- Digital Board



Hardware

- Analog Board



Finding the Optimal Music

- Generally speaking, most biofeedback, binaural beats, and brainwave entraining technologies and theories tend to aim for Alpha or Theta state. These are the more relaxed states often associated with learning and creativity.
- High bpm music translates approximately to Alpha/ Theta hz.
- My guess is that it's better on headphones – other sound is cut out, and you get the added stimulation through the jawbone.
- Training your brain to respond – neurons that fire together will eventually always fire together
- It's all about you– what music works for you individually