

What is real? How do you define 'real'?



" If you're talking about what you can feel, what you can smell, what you can taste and see, then 'real' is simply electrical signals interpreted by your brain. This is the world that you know."

2

Morpheus, in the Matrix.





Membrane potential and action potential

• lons channels across the membrane, allowing ions to move in and out, with selective permeability (mainly Na+, K+, Ca2+, Cl-)

- Vm: difference in potential between interior and exterior of the neuron.
- at rest, Vm~-70 mV (more Na+ outside, more K+ inside, due to N+/K+ pump)
- · Following activation of (Glutamatergic) synapses, depolarization occurs.
- if depolarization > threshold, neuron generates an action potential (spike) (fast 100 mv depolarization that propagates along the axon, over long distances).







Synapses

- Axon terminate at synapse. AP-> opens ion channels, influx of Ca2+, release of neurotransmitter in the synaptic cleft, which bind at the post-synaptic receptors, causing ion-conducting channels
- Glutamate: main excitatory neurotransmitter -- bind to AMPA, NMDA, mGlu receptor, induces depolarization.
- · GABA: main inhibitory neurotransmitter --GABA receptor, induces hyperpolarization.









Describing neurons' activity one aim of experimental neuroscience: describing the activity of neurons: what are they 'responding to'? sensory neuroscience: activity as a function of sensory stimulus (eg. visual image, skin stimulation, sound, odor etc..). 2 alternatives: describe spike sequence, or number of spikes, or rate r in time window (somewhat arbitrarily defined) -- depending on assumptions about the code (spike times or rate?)



number of spikes /T=r





s (orientation angle in degrees)

Neurons in the visual cortex

In retina, LGN and visual cortex, the activity of neurons (spike count) is correlated with some aspects of the visual image (contrast, orientation, color, spatial frequency, ... in early visual cortex ... towards more complicated features such as faces and object shapes in 'higher' areas).



