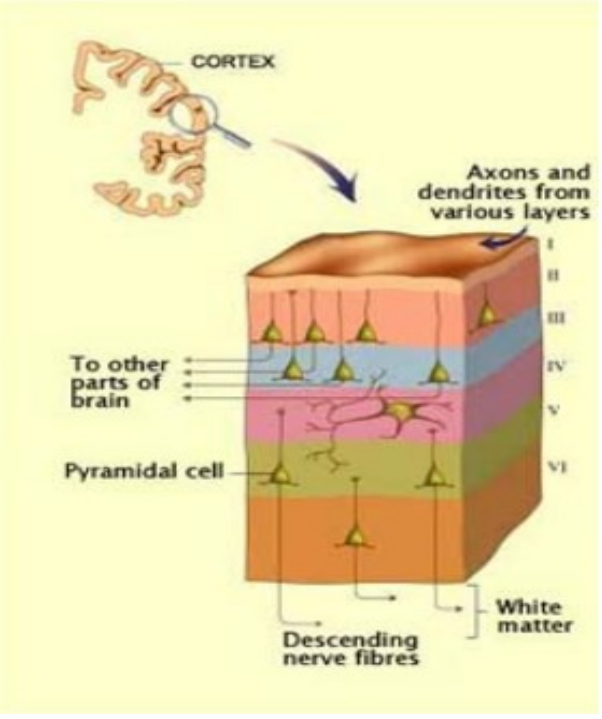
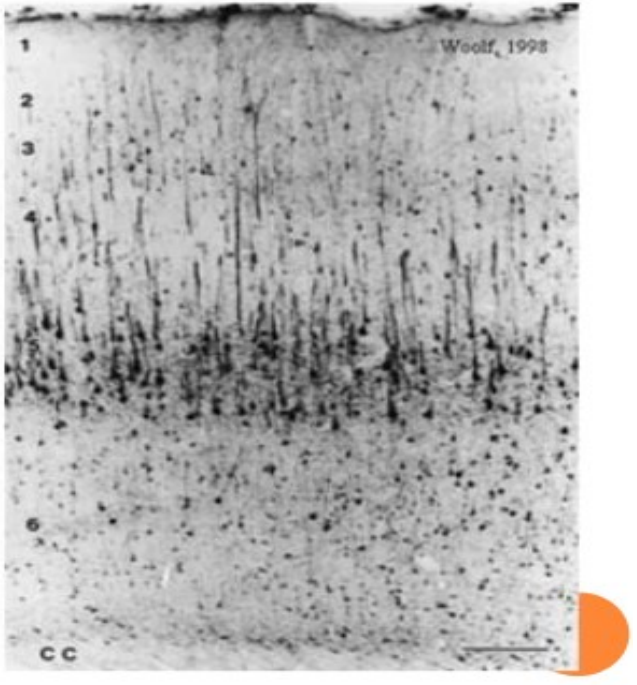
The origin of the MEEG signal

What generates the magnetic field and the electric potential?

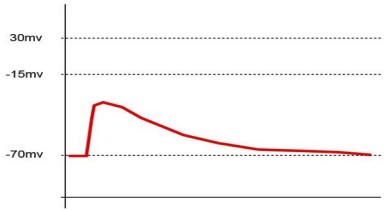
(Primarily) pyramidal cells in the neocortex





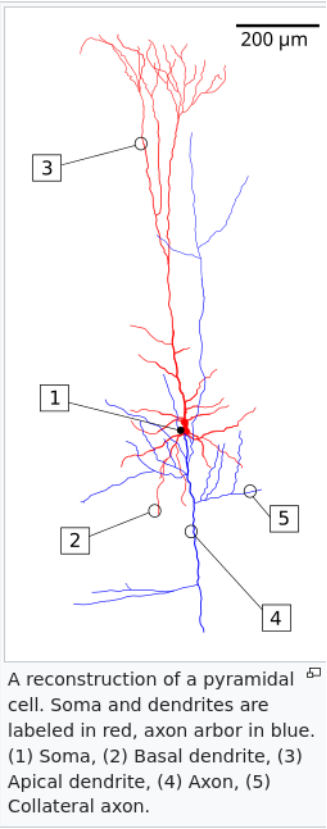
What generates the magnetic field?

(Primarily) the excitatory post-synaptic potentials in apical dendrites in pyramidal cells in the neocortex



Excitatory Post-Synaptic Potential

Action potentials are too brief to sum temporally, and the axons do not sum spatially

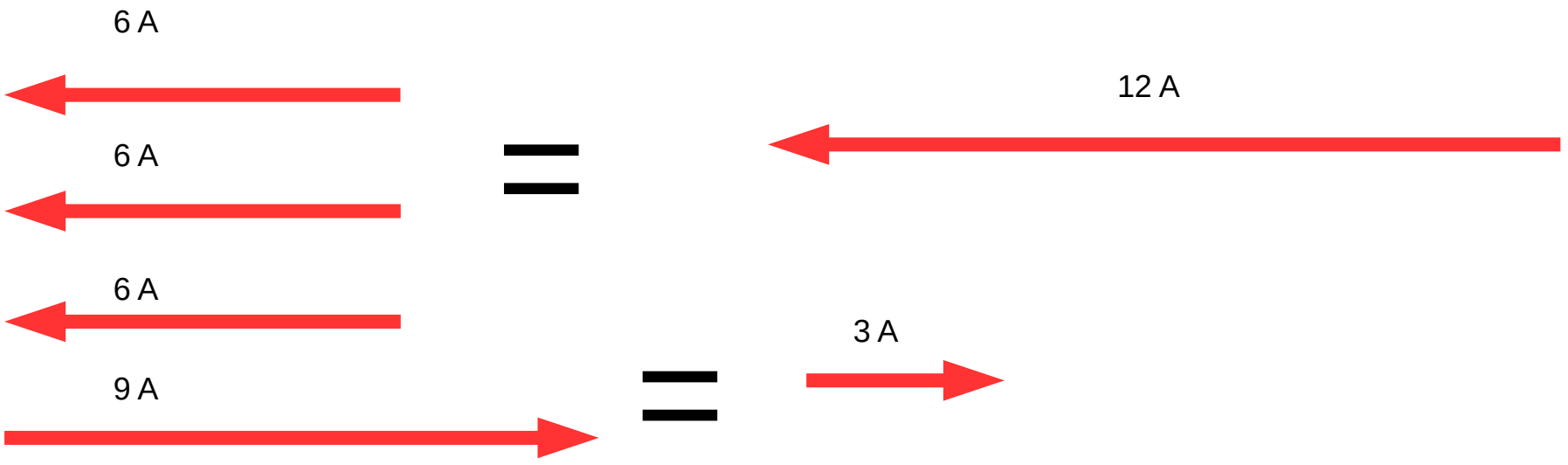


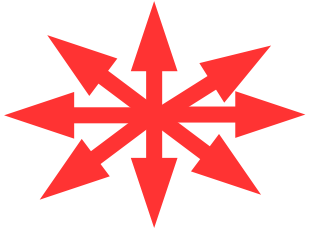
A reconstruction of a pyramidal cell. Soma and dendrites are labeled in red, axon arbor in blue. (1) Soma, (2) Basal dendrite, (3) Apical dendrite, (4) Axon, (5) Collateral axon.

Single neurons can be seen with intracranial recordings, but generate signals many orders to weak to be seen at the scalp where we measure

Can we see the SPATIAL and TEMPORAL summations if there are “many” neurons firing at the same time?

SPATIAL Summation of currents





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SPATIAL Summation of currents

The ordering of the dendrites of pyramidal neurons creates good conditions for seeing the SPATIAL summation of post-synaptic potentials, but not the action potentials along the axons