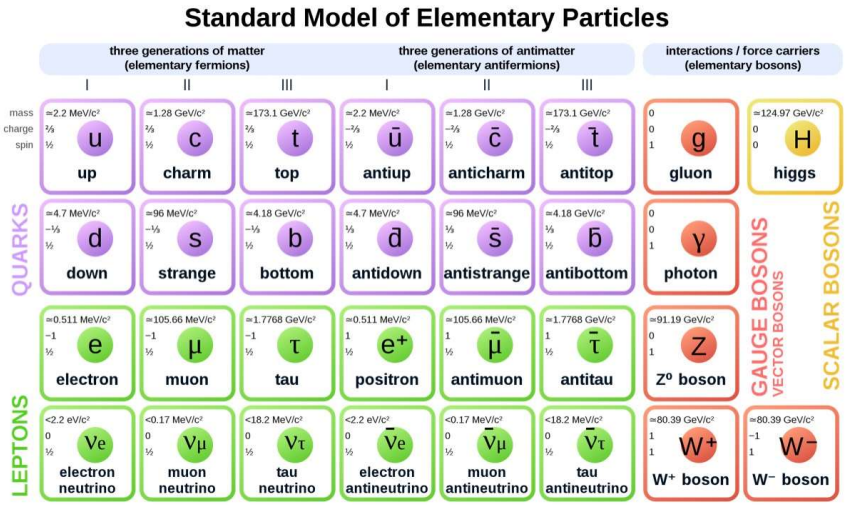
Towards neural mechanisms of intelligence:

W. M. Keck Center for Neurophysics
Center for Physics of Life
Departments of: Physics & Astronomy, Neurology, and Electrical and Computer Engineering, UCLA

http://www.physics.ucla.edu/~mayank/

W boson mass 0.1% > predicted by Standard model



The Standard Model
Quantum Physics, Relativity
Newton's laws
Kepler's laws
Galileo

$$\mathrm{Tr}[\bar{\varepsilon}(x)\gamma_\mu \tilde{h}(x,y)\tilde{G}(y,x)\gamma_\mu\lambda(x) - \bar{\varepsilon}(y)\gamma_\mu h'_{\nu\mu}(x,y)\tilde{G}(y,x)\gamma_\nu\lambda(x)]$$

$$= \int d^4x \int d^4z \frac{e^{-z^2/4t}}{16\pi^2 t^2}\,\mathrm{tr}\left\{\bar{\varepsilon}(x)\gamma_\mu \sum_{n=0}^{\infty}\sum_{m=0}^{\infty}\left[\frac{(z\cdot\bar{\partial})^m}{m!}[\bar{a}_n\delta_{\mu\nu} - (a'_n)_{\nu\mu}]\big|_{y=x}\right]\tilde{G}(x+z,x)\gamma_\mu\lambda(x)\right.$$

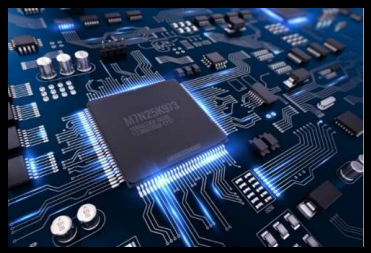
$$\left. - \sum_{l=1}^{\infty}\frac{(z\cdot\partial)^l}{l!}\bar{\varepsilon}(x)\gamma_\mu \sum_{n=0}^{\infty}\sum_{m=0}^{\infty}\left[\frac{(z\cdot\bar{\partial})^m}{m!}(a'_n)_{\nu\mu}\right|\right]\tilde{G}(x+z,x)\gamma_\mu\lambda(x)\Bigg\}, \qquad (53)$$

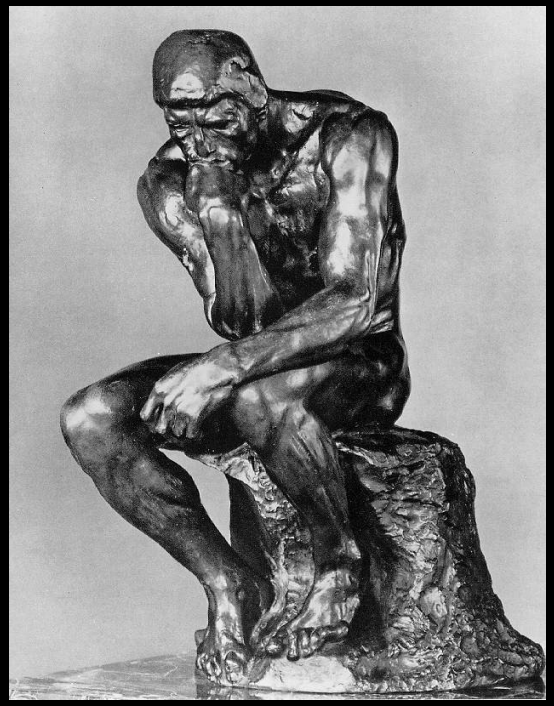
What's so special about the brain?

Slow, sloppy, sleepy & Efficient

20W 10^3Hz 10^11

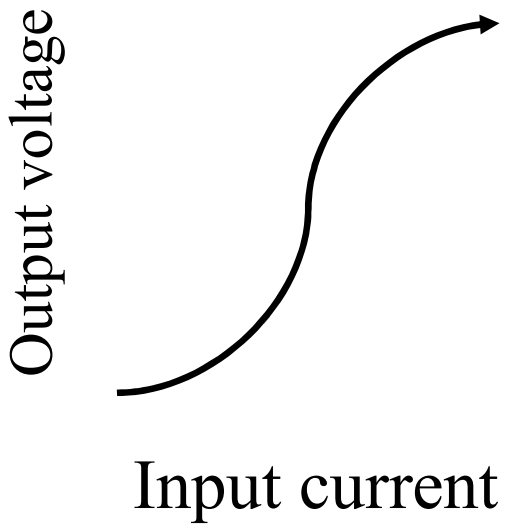
20KW 10^9Hz >10^11





ReLu

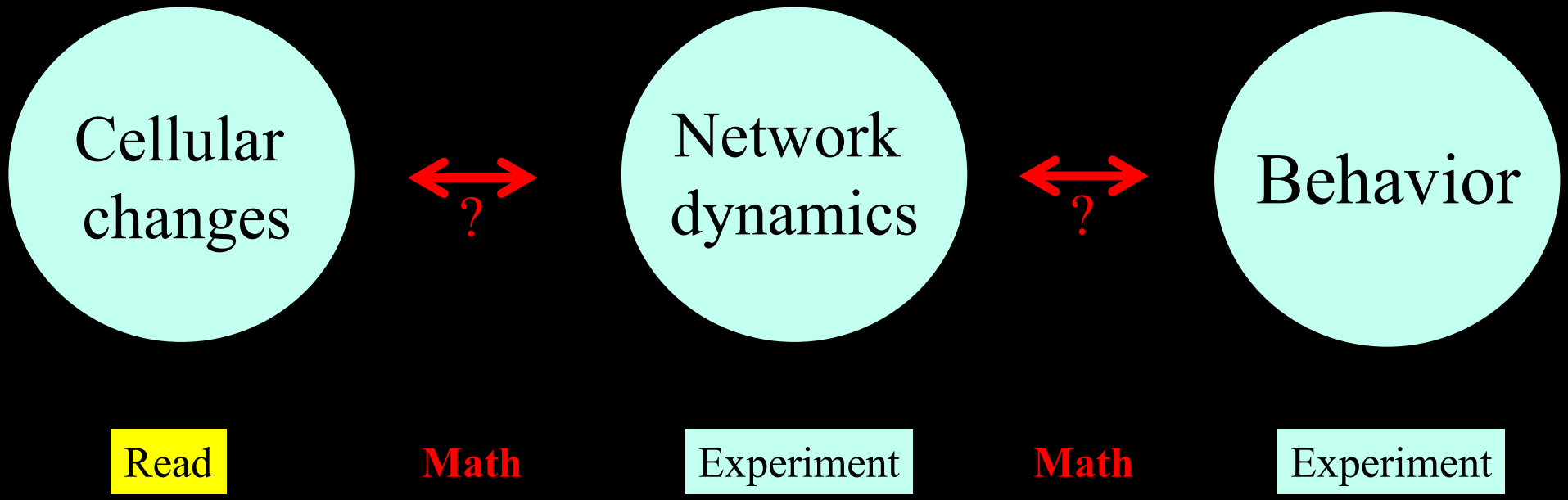
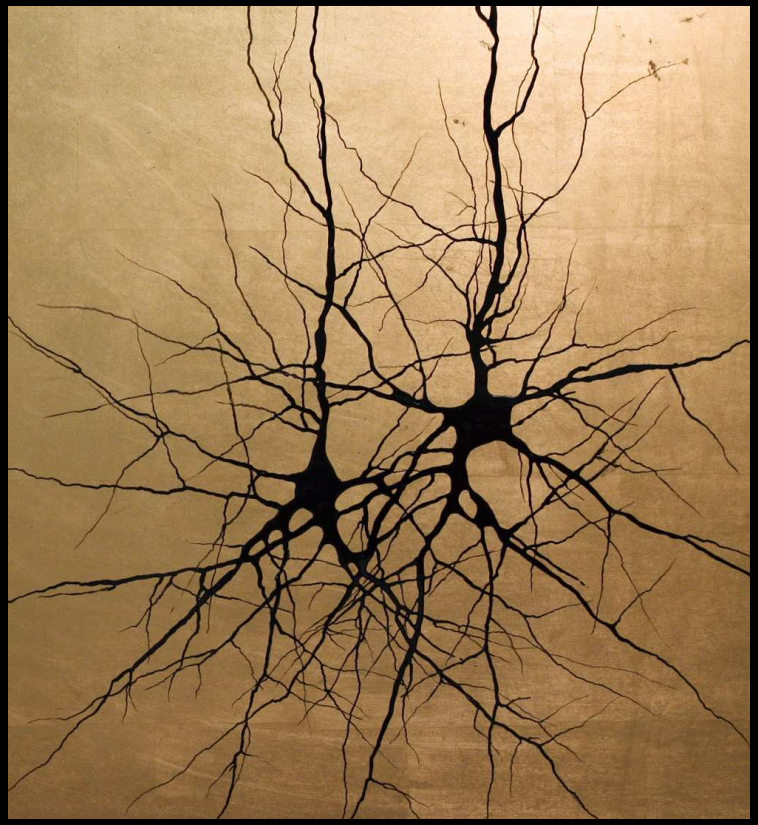
Response = tanh(input)



We can introspect about the mind
not the brain

Space & Time

Emergent Learning



Neuronal soma are the fundamental unit of neural computation: Digital code