The Brain is a Network of 100 Billion Neurons
The Brain is a Network of 100 Billion Neurons that Form Millions of Neuronal Circuits
The Brain has Quadrillions of Synapses
Synaptic Transmission
Long-Term Potentiation: Learning and Memory

AMPA receptors

NMDA receptors
Visualizing Receptors in Neurons in a Dish
Visualizing Receptors in Neurons in a Live Mouse
Visualizing Receptors in Neurons in a Live Mouse
Visualizing Receptors in Neurons in a Live Mouse
Visualizing Receptors in Neurons in a Live Mouse
Visualizing Long Term Potentiation in a Live Mouse
Visualizing Stable Strong Synapses in a Live Mouse
Protein Stability is Determined by Degradation Rate

Most Proteins last 1-7 days

Collagen (cartilage) and Crystallin (eye lens) last decades ~ 100 years

Are there Long Lived Proteins in Synapses?
Stable Isotope Labeling in Mice: SILAM

(A) Stable isotope labeling method for mice:
- Pulse Lys-^{13}C
- Chase Lys-^{12}C

3 days EE followed by 10 weeks of chase.

Sub-cellular fractionation with LC-MS/MS.

(B) RIA measurement for Syn., Cytosol, and Kidney fractions.

(C) Western blot analysis for PSD95, Synaptophysin, GluA1, and Tubulin.
Pulse/Chase Heavy and Light Isotope Abundance is Used to Measure Protein Turnover

Seok et al., PNAS, April 2, 2018
Pulse/Chase Heavy and Light Isotope Abundance is Used to Measure Protein Turnover

Seok et al., PNAS, April 2, 2018
What Happens to Long Lived Proteins Over Time?

Does Damage to Synaptic Long Lived Proteins Contribute to Age Related Memory Disorders?
Regulation of Receptors and Cognitive Function
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