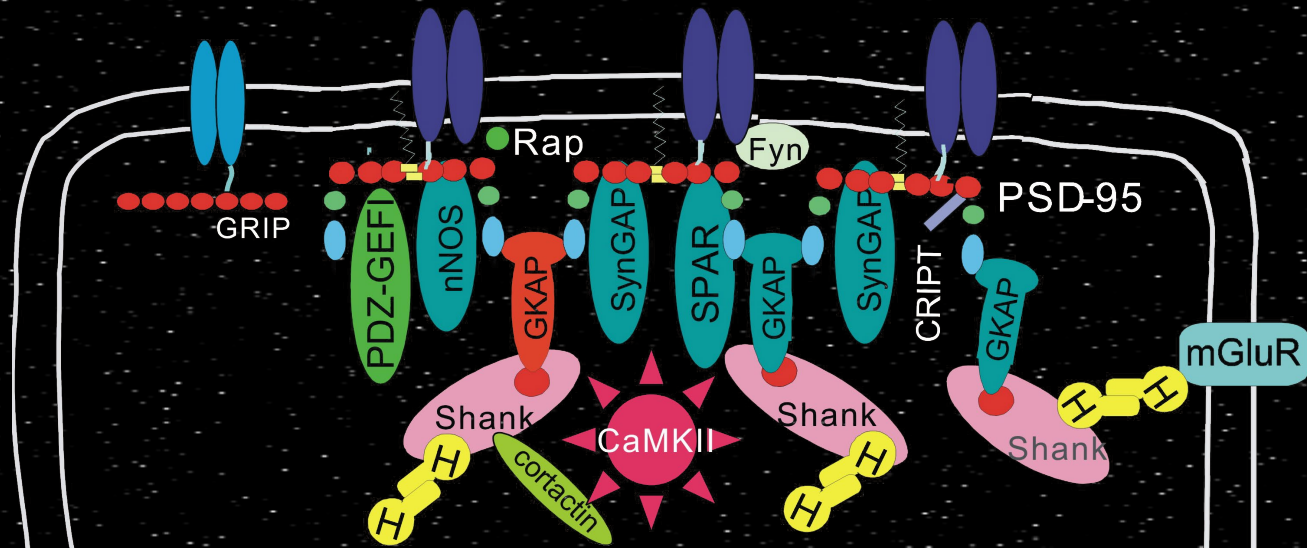
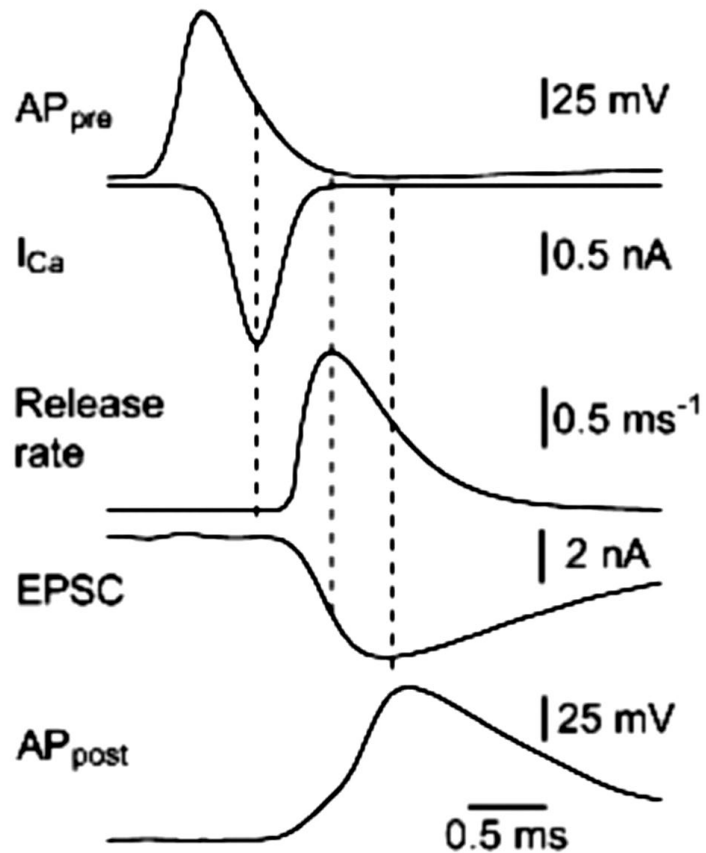




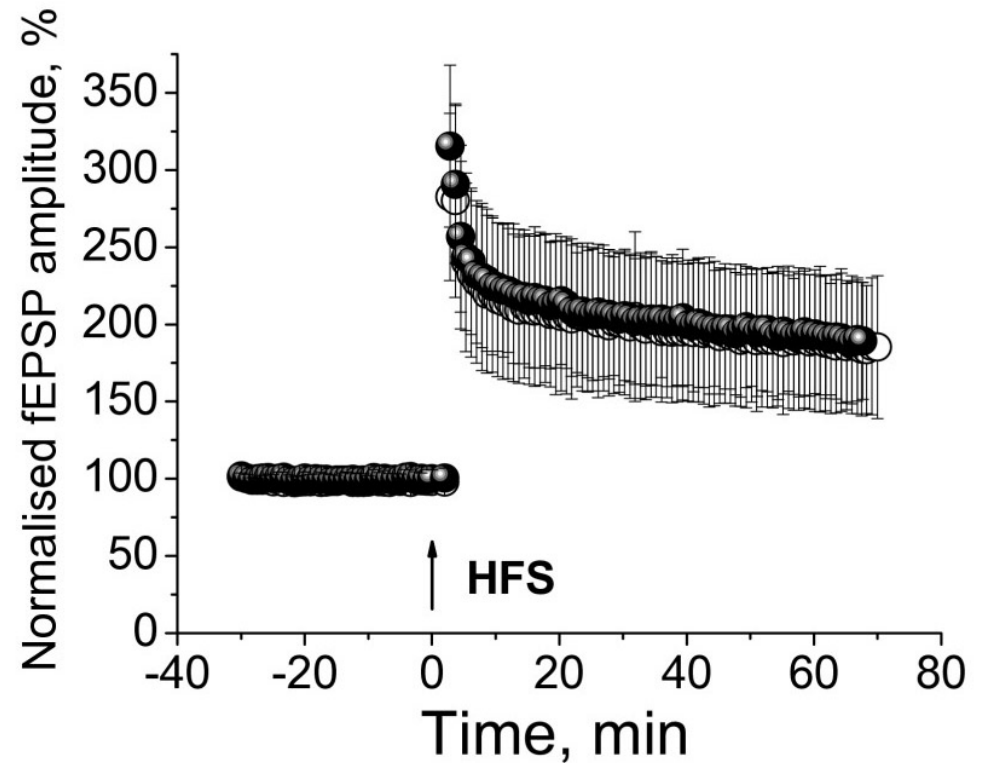
David Santucci
Quantitative Biology
Bootcamp
2009



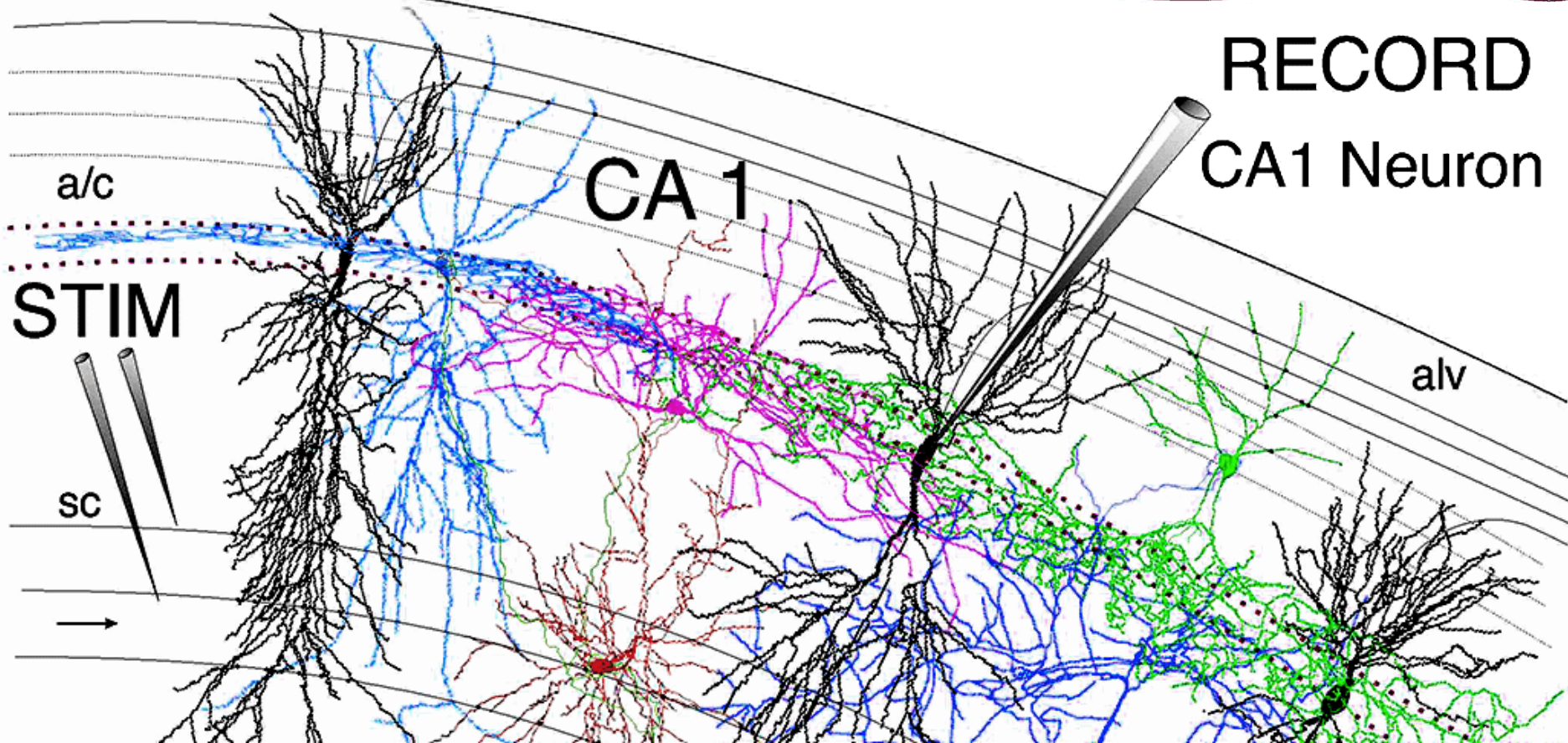
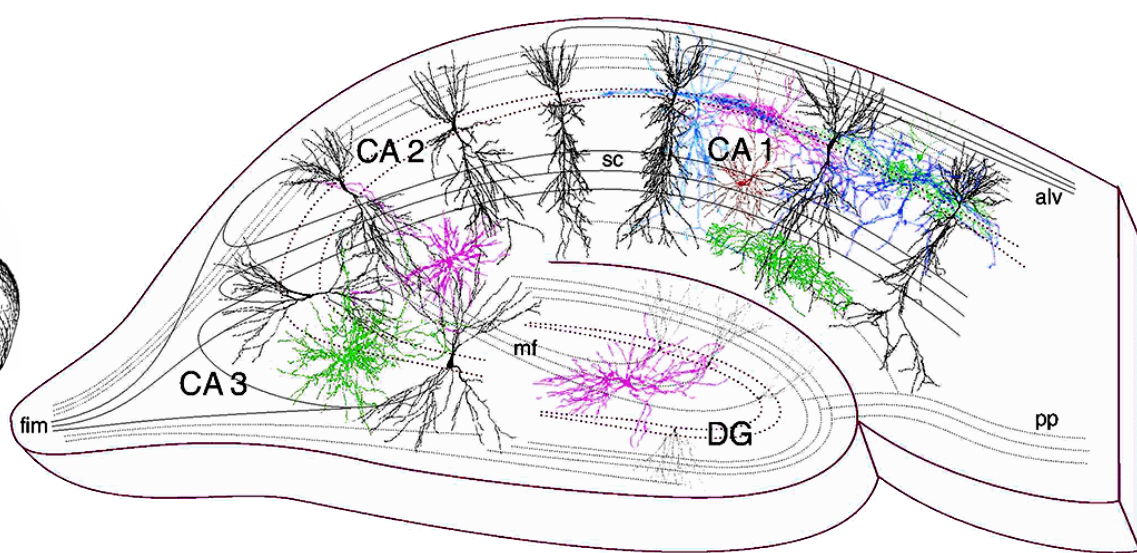
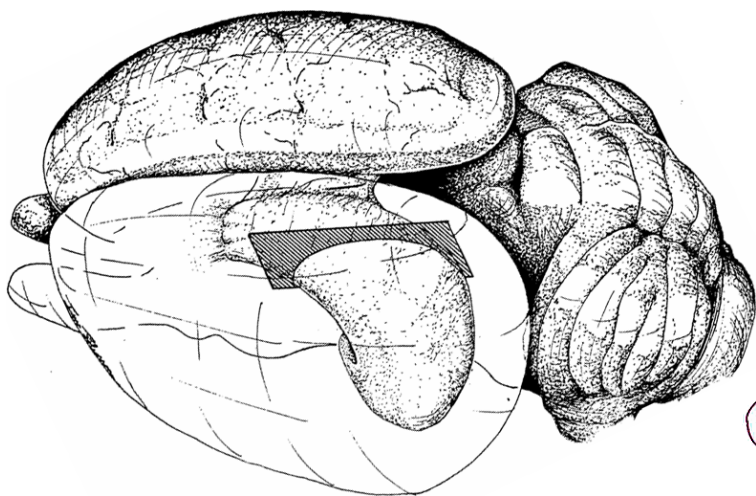
Presynaptic Release



Long Term Potentiation



Difference in time scale > 6 orders of magnitude

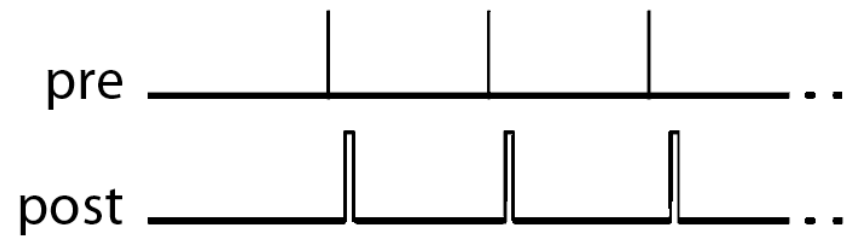


Early

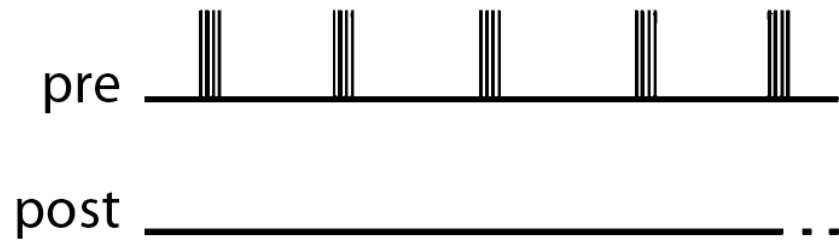
tetanus



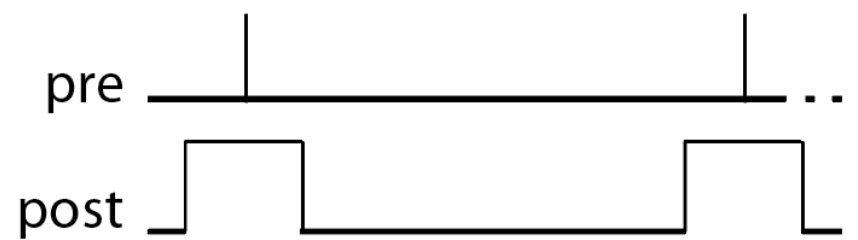
pairing



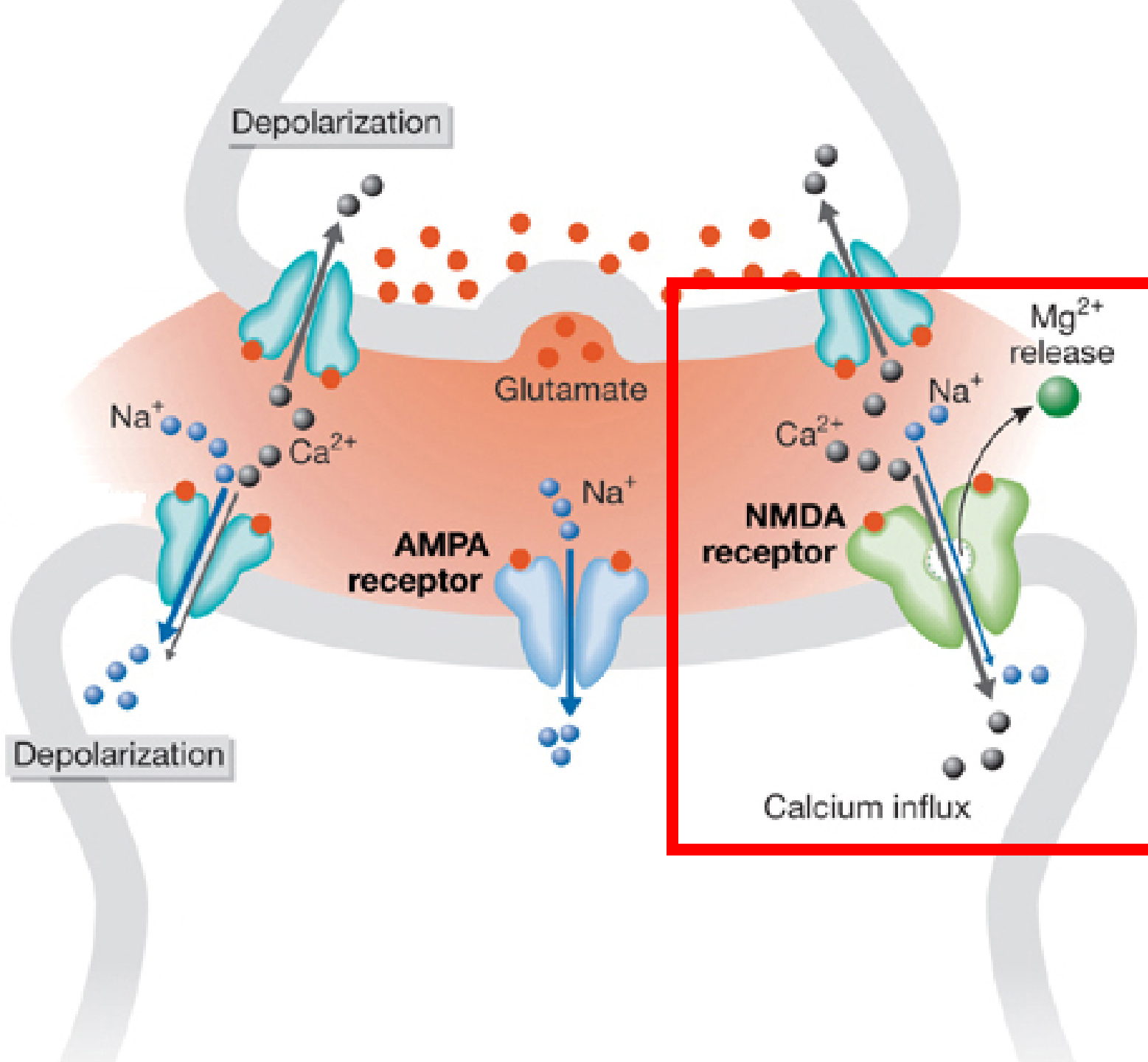
theta burst

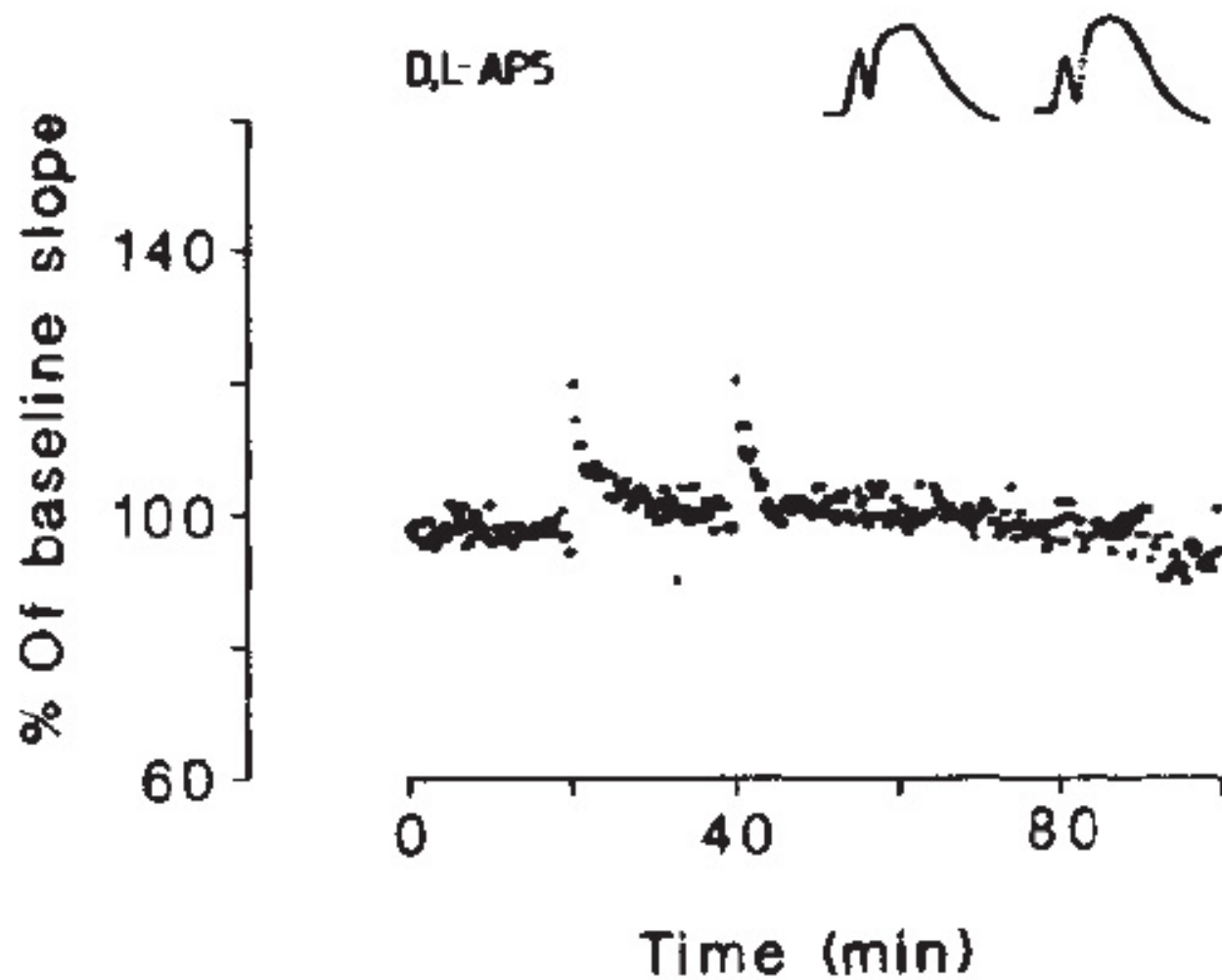


STDP

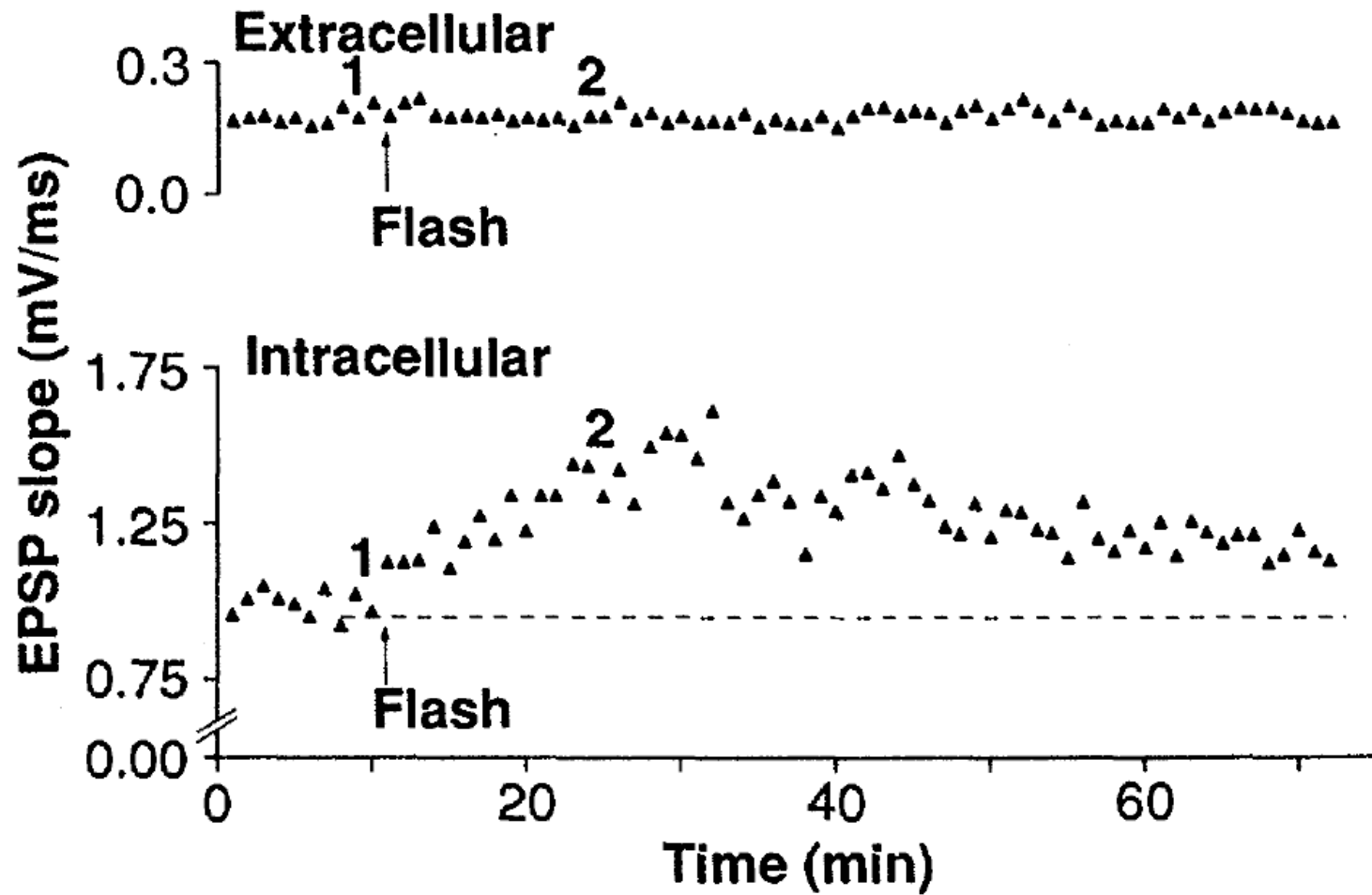


LTP Induction Protocols

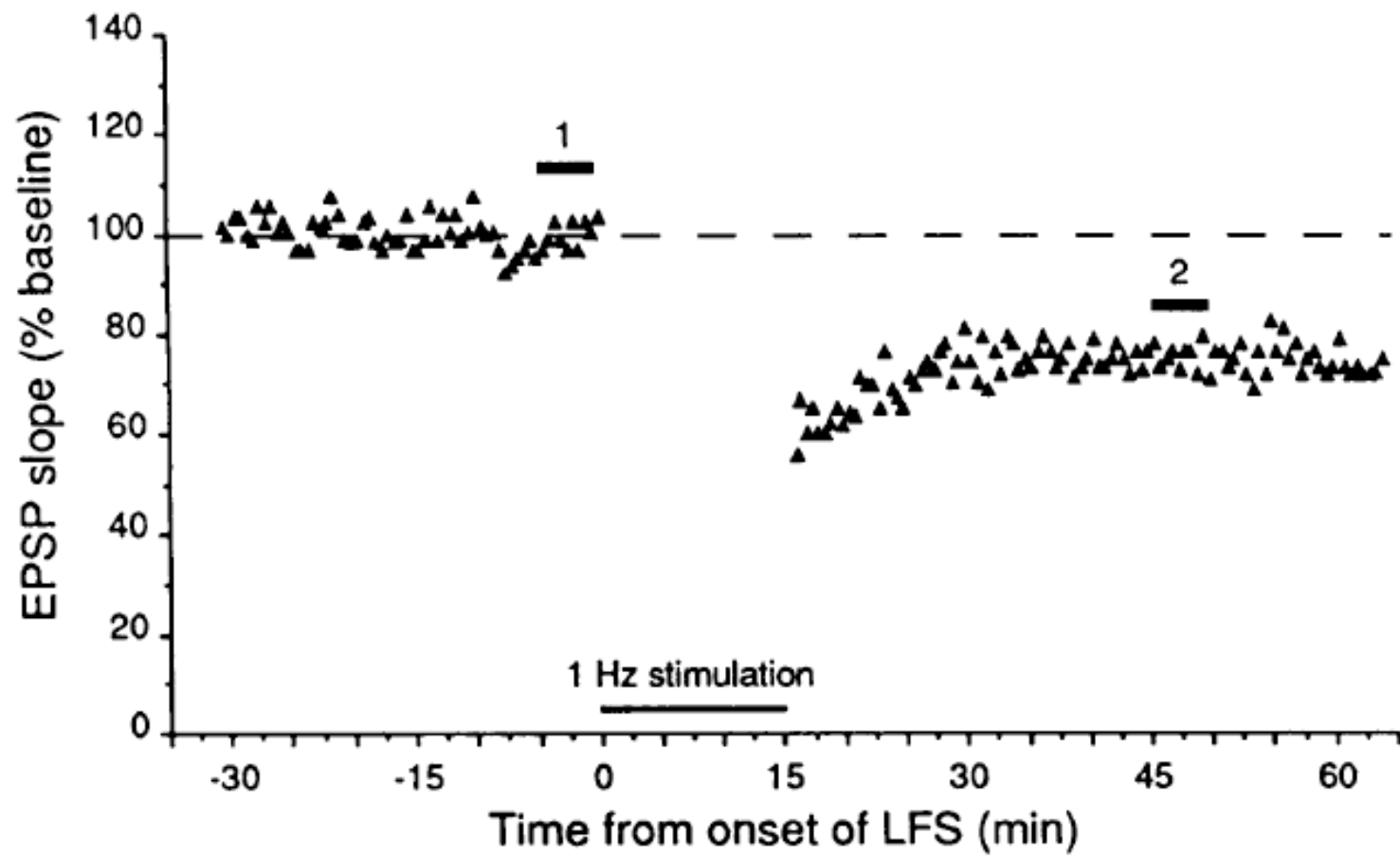




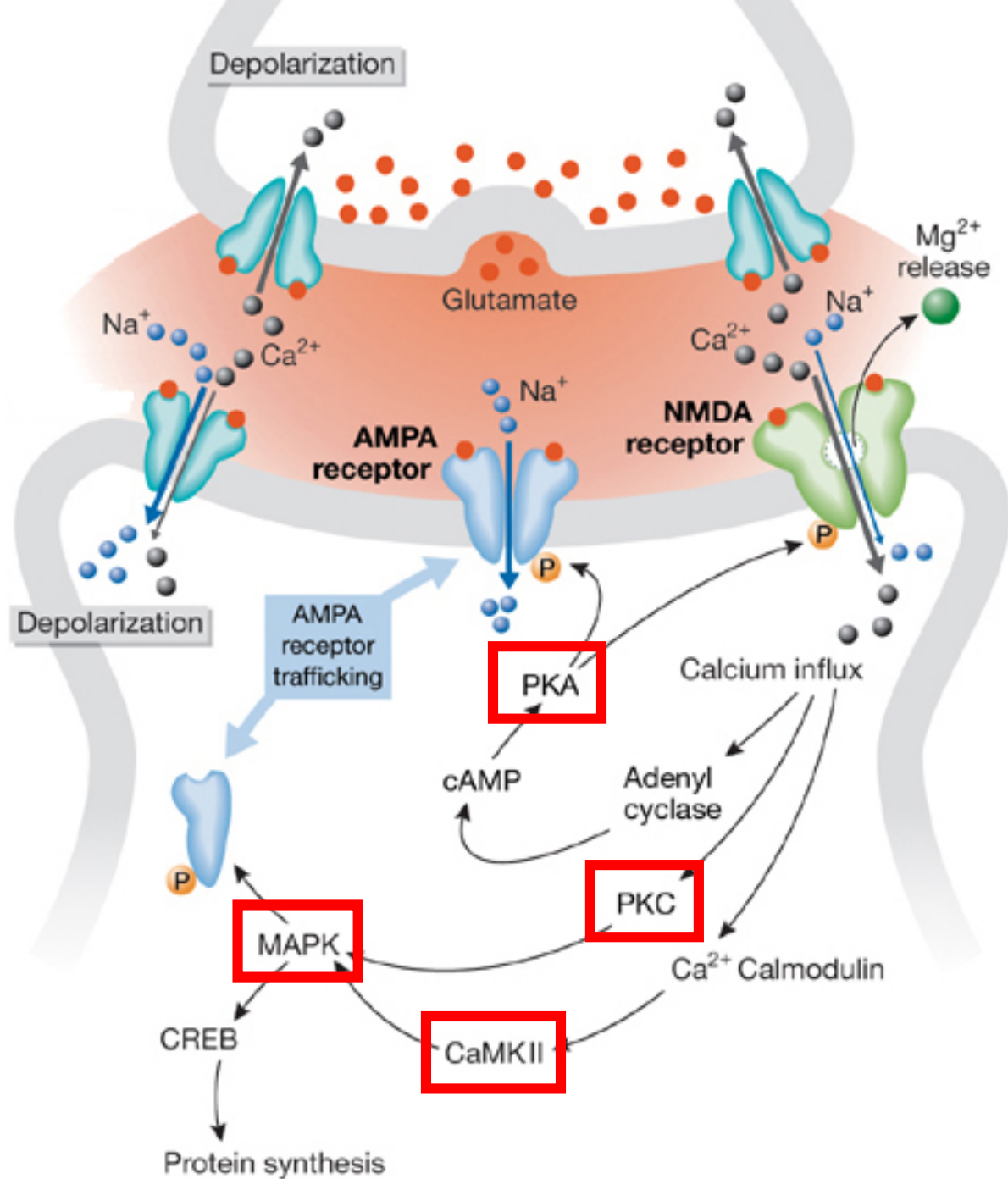
Blocking NMDA Receptors Blocks LTP

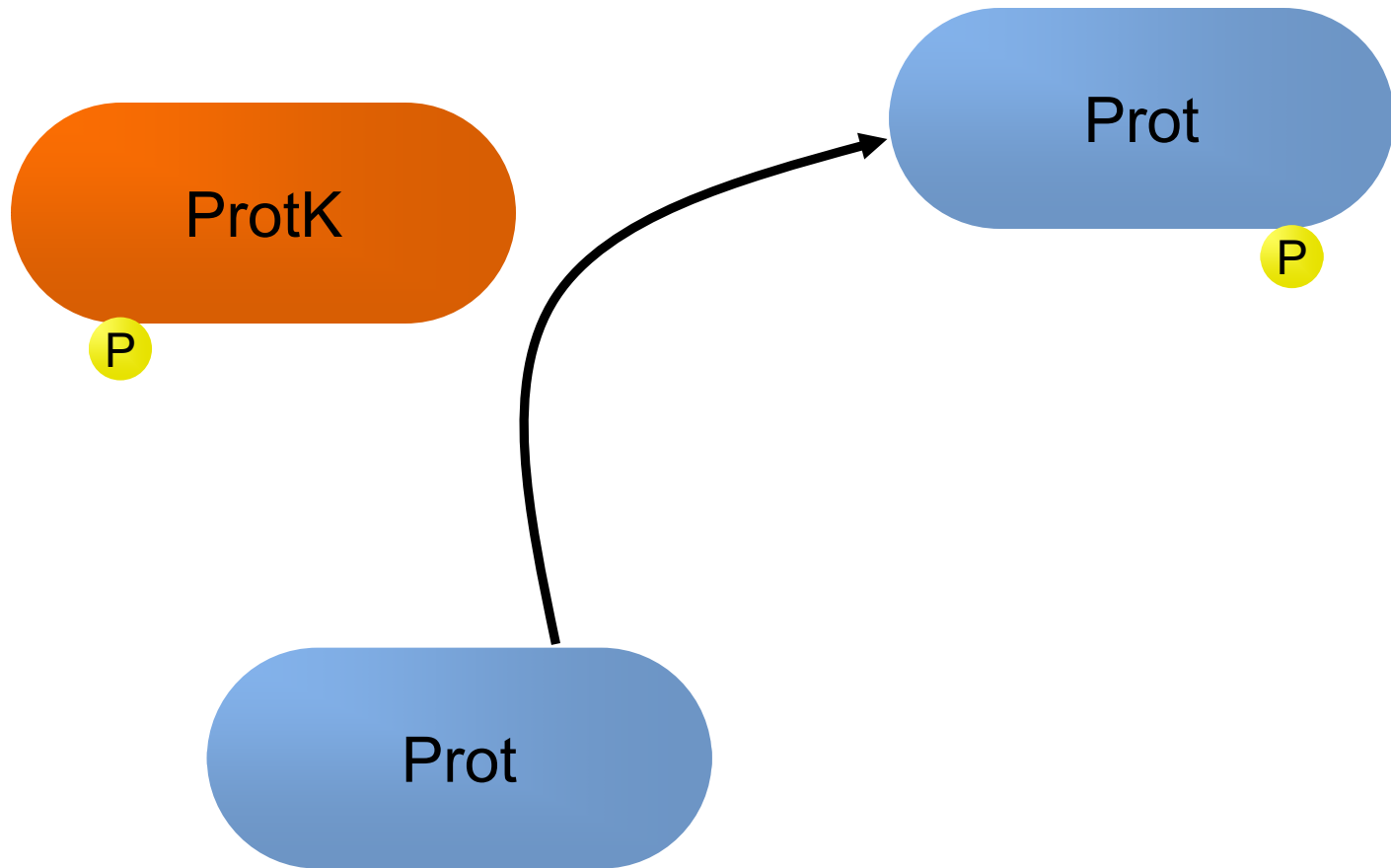


Uncaging Ca^{2+} Alone Can Induce LTP

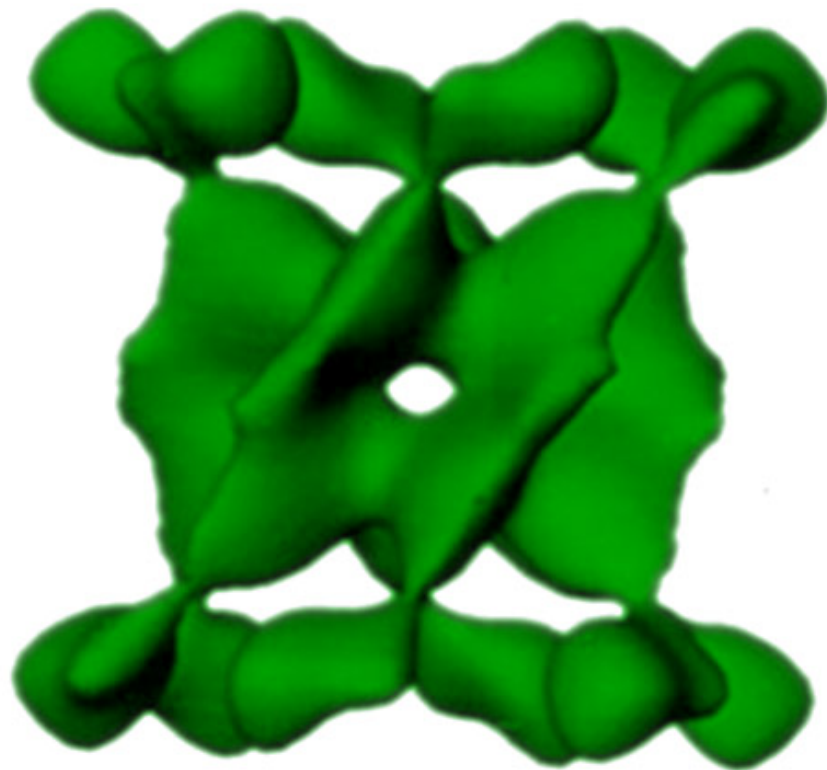
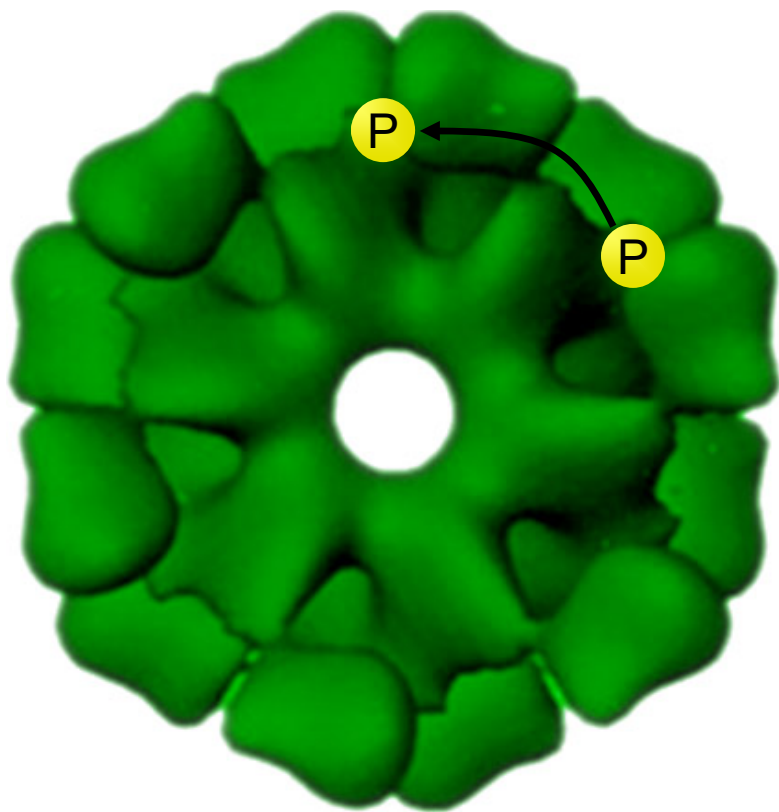


Long Term Depression



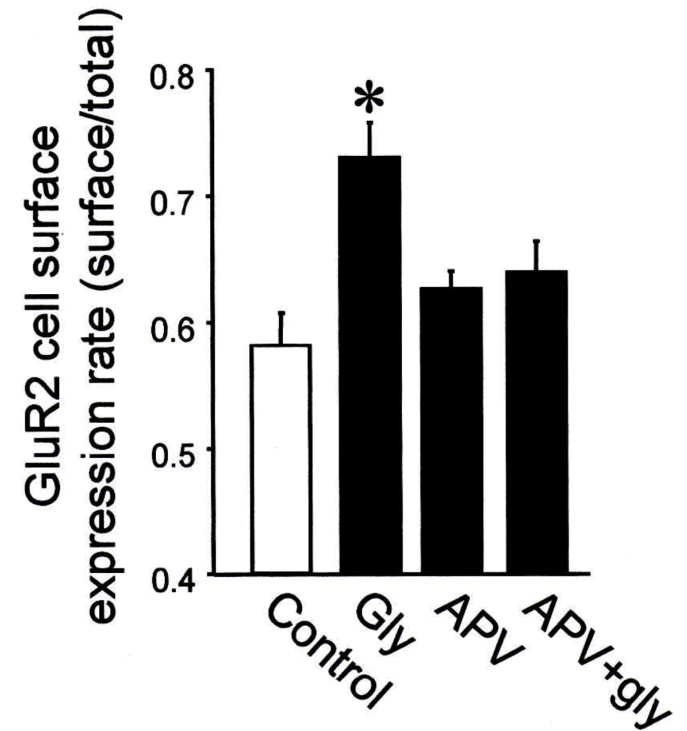
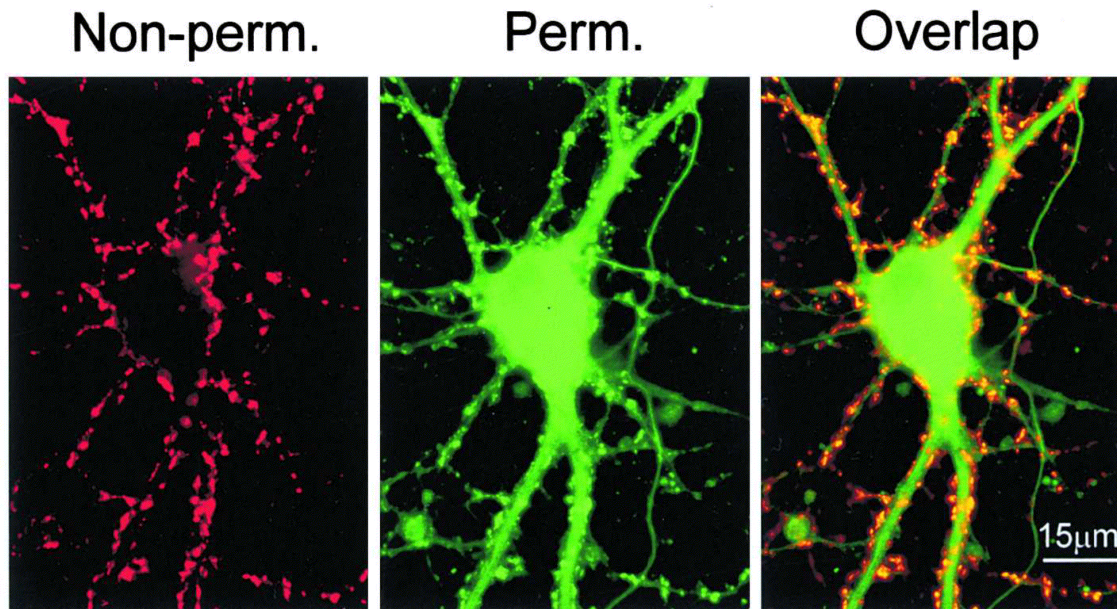


Protein Kinases Catalyze the Phosphorylation of Proteins

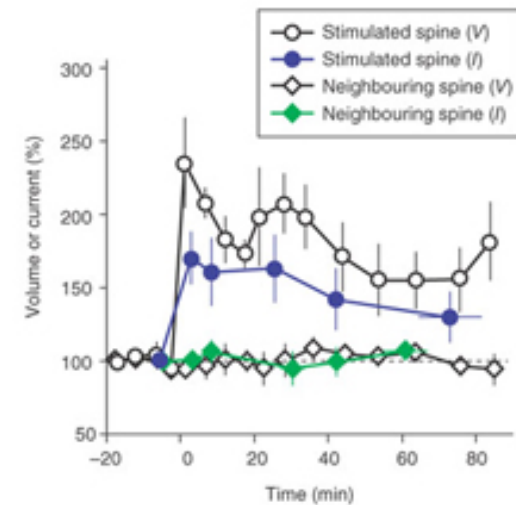
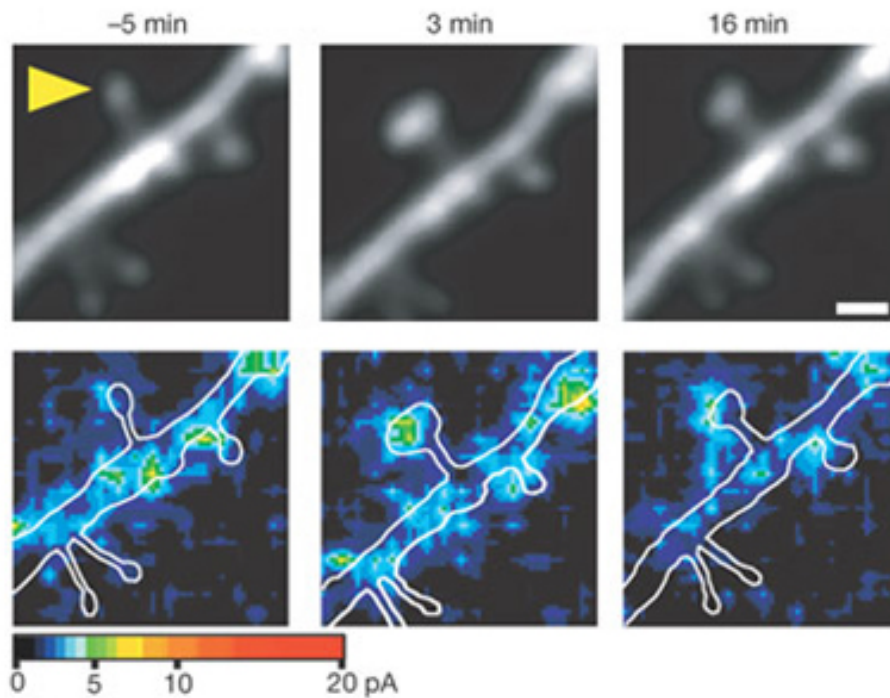
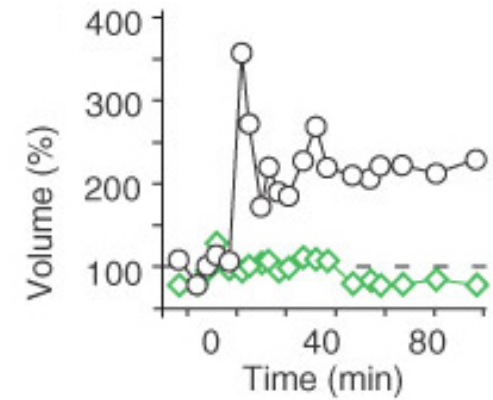
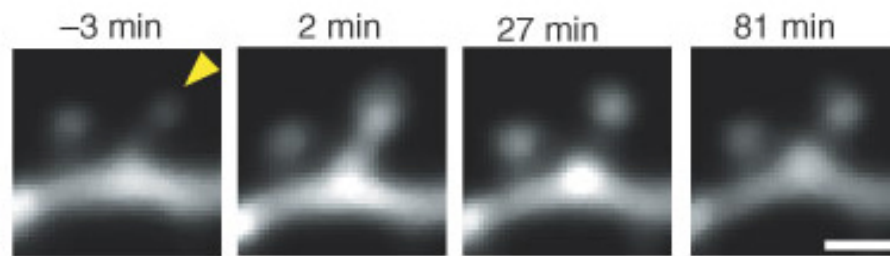


CaMKII

Early



LTP Leads to an Increase in Surface AMPA Receptors



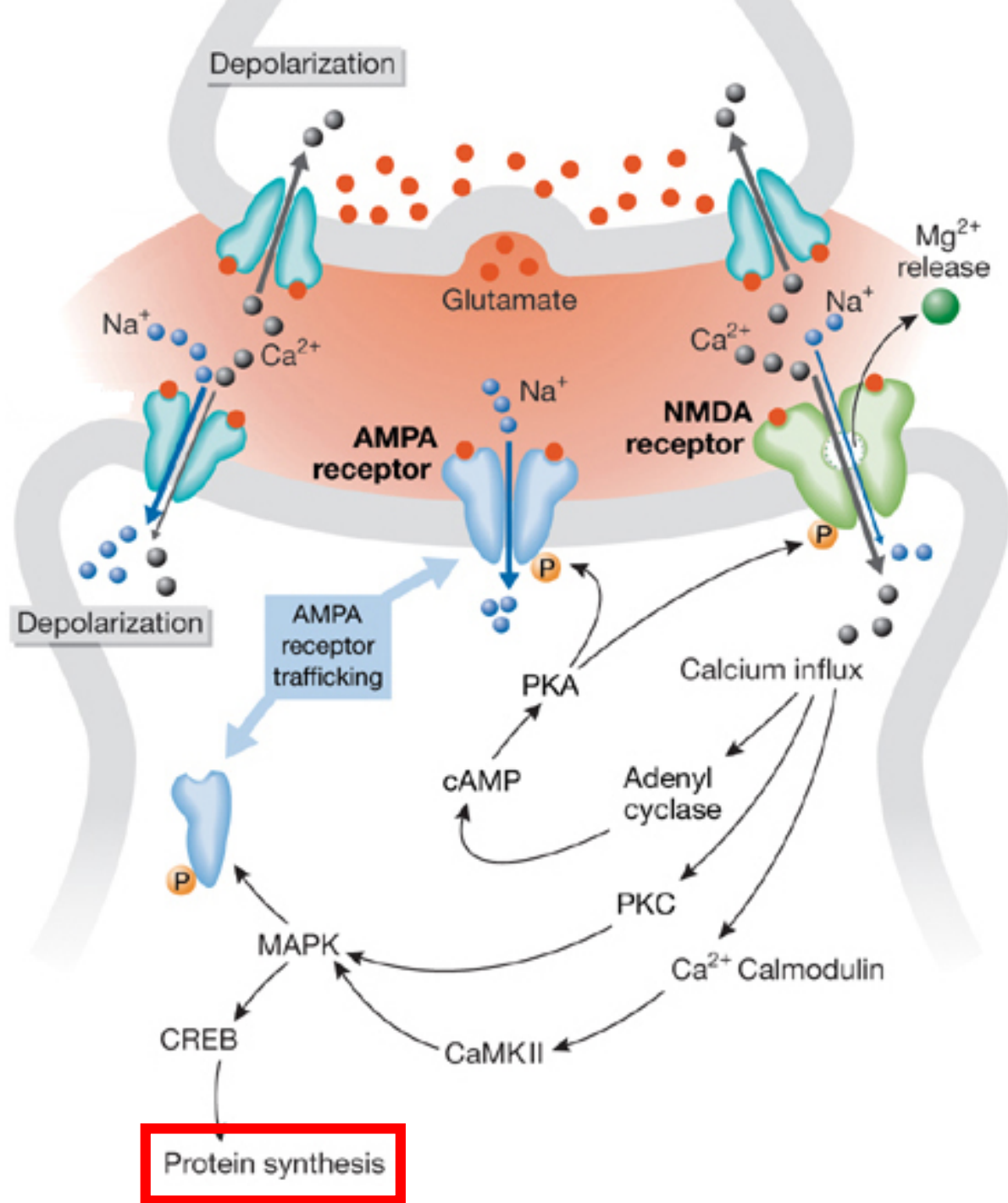
LTP Leads to an Increase in Spine Size

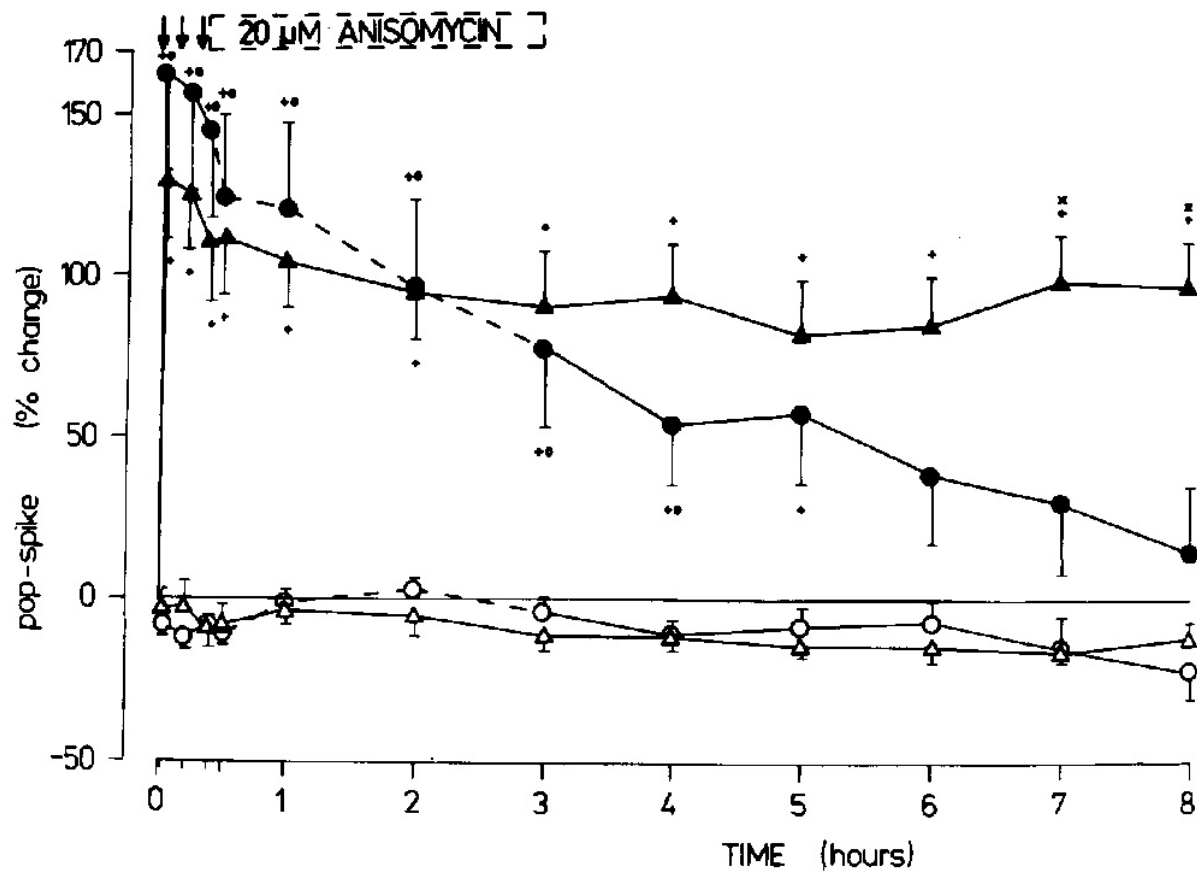
Induction

Expression

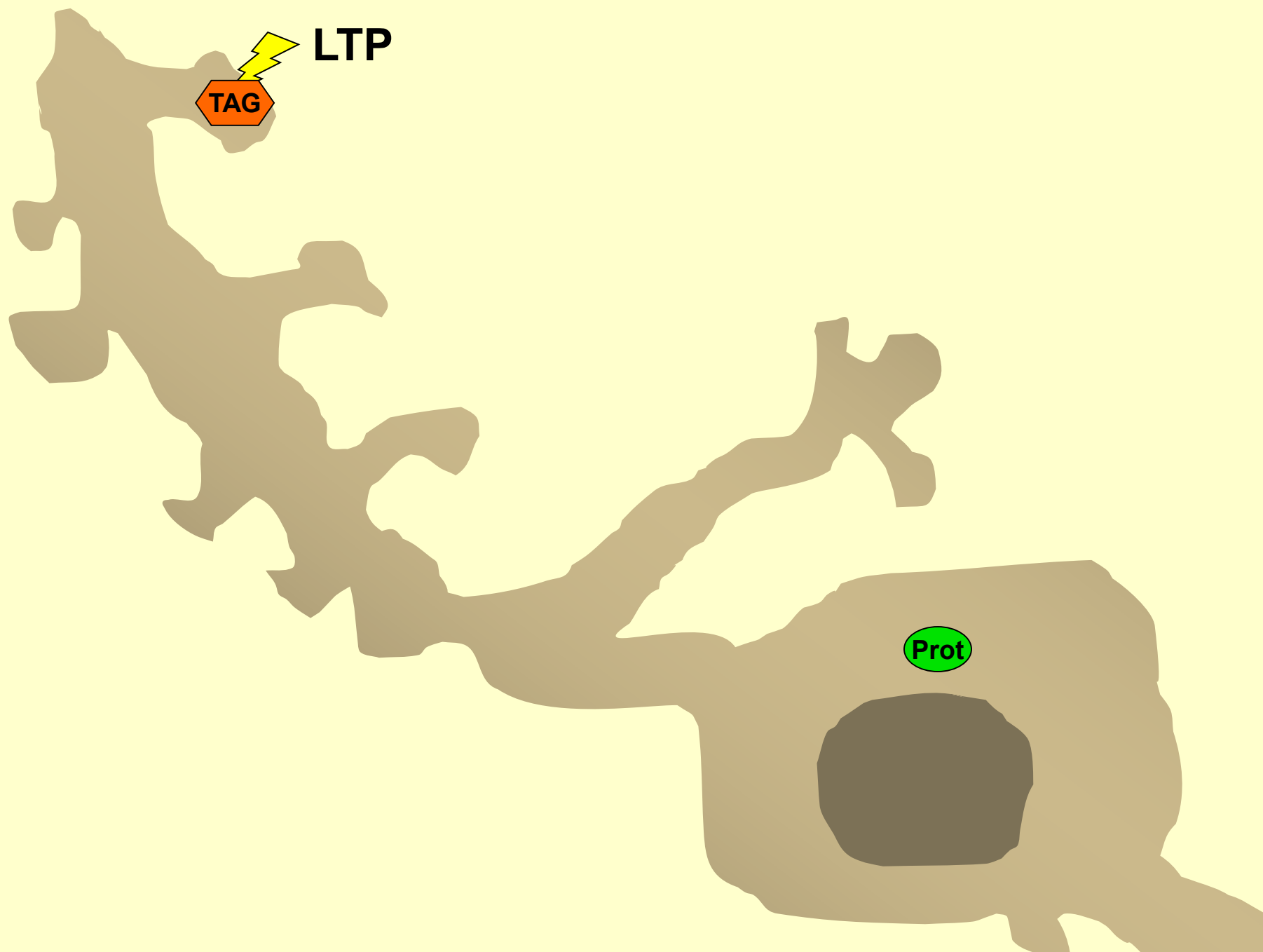
Early

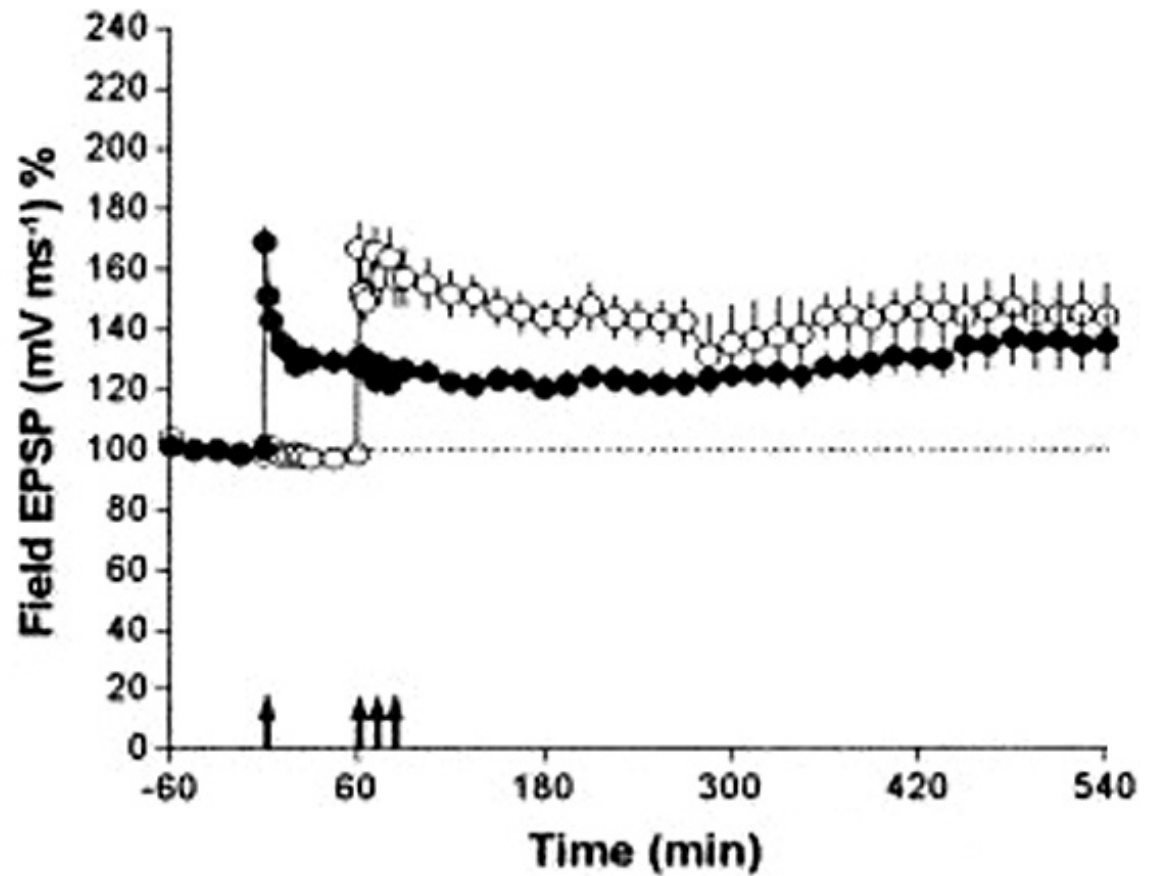
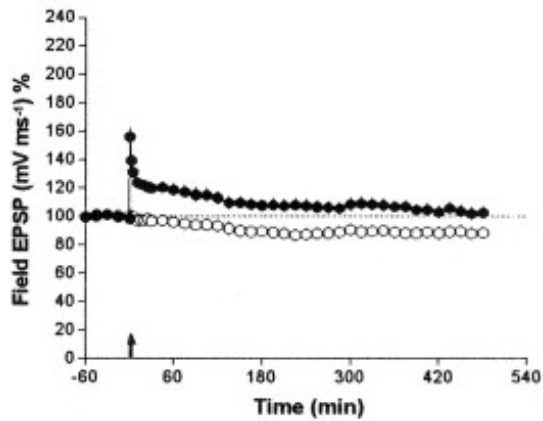
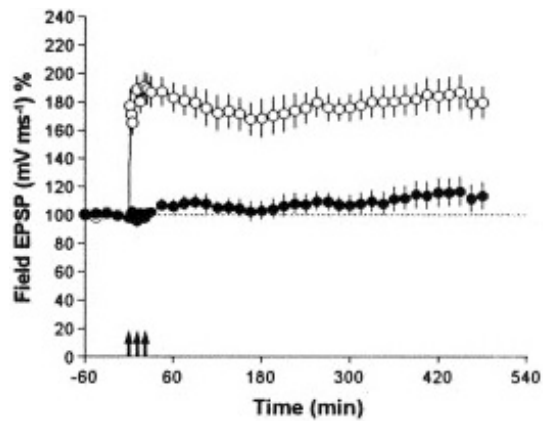
Late



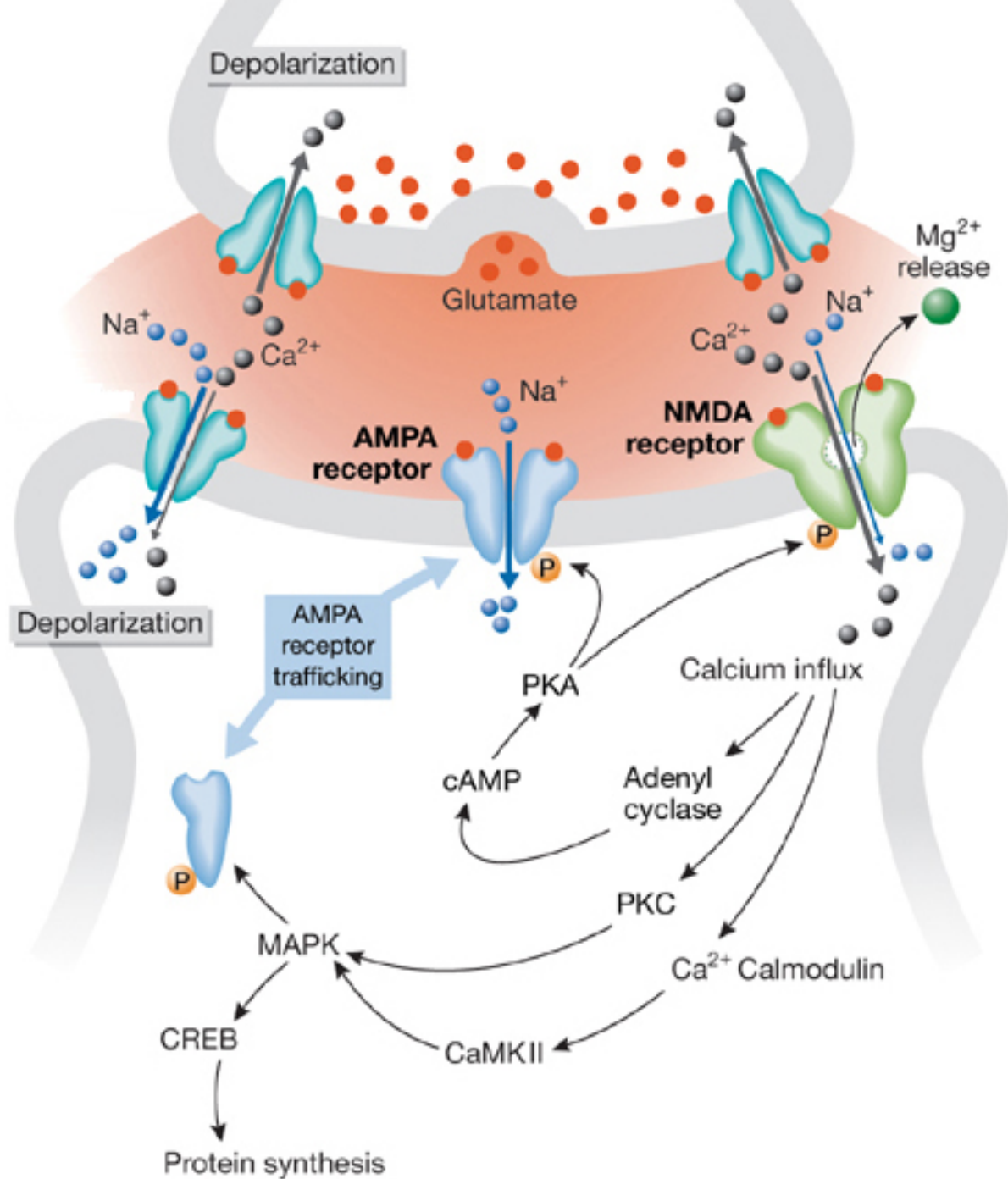


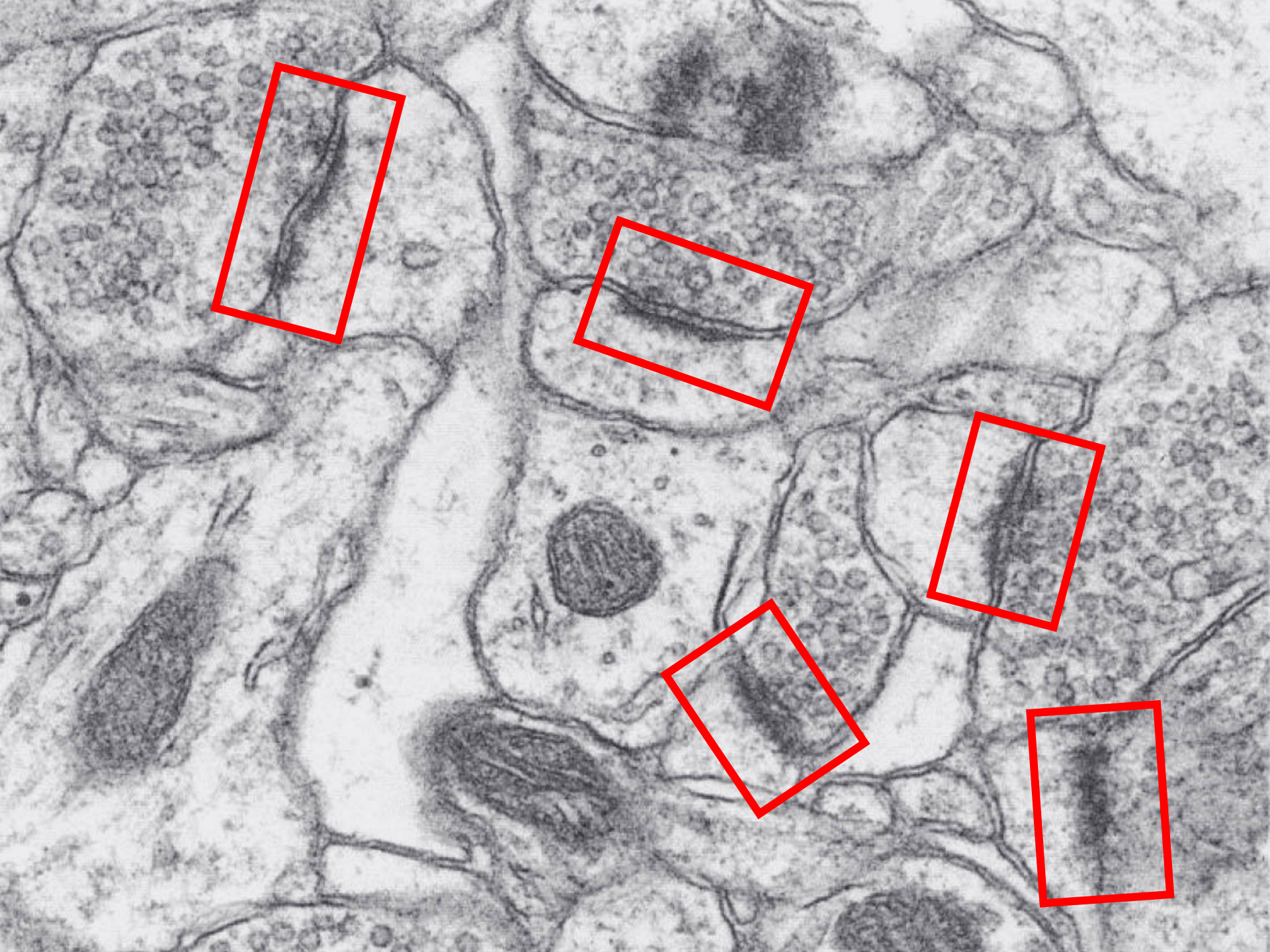
Blocking Protein Synthesis Blocks the Late Phase of LTP

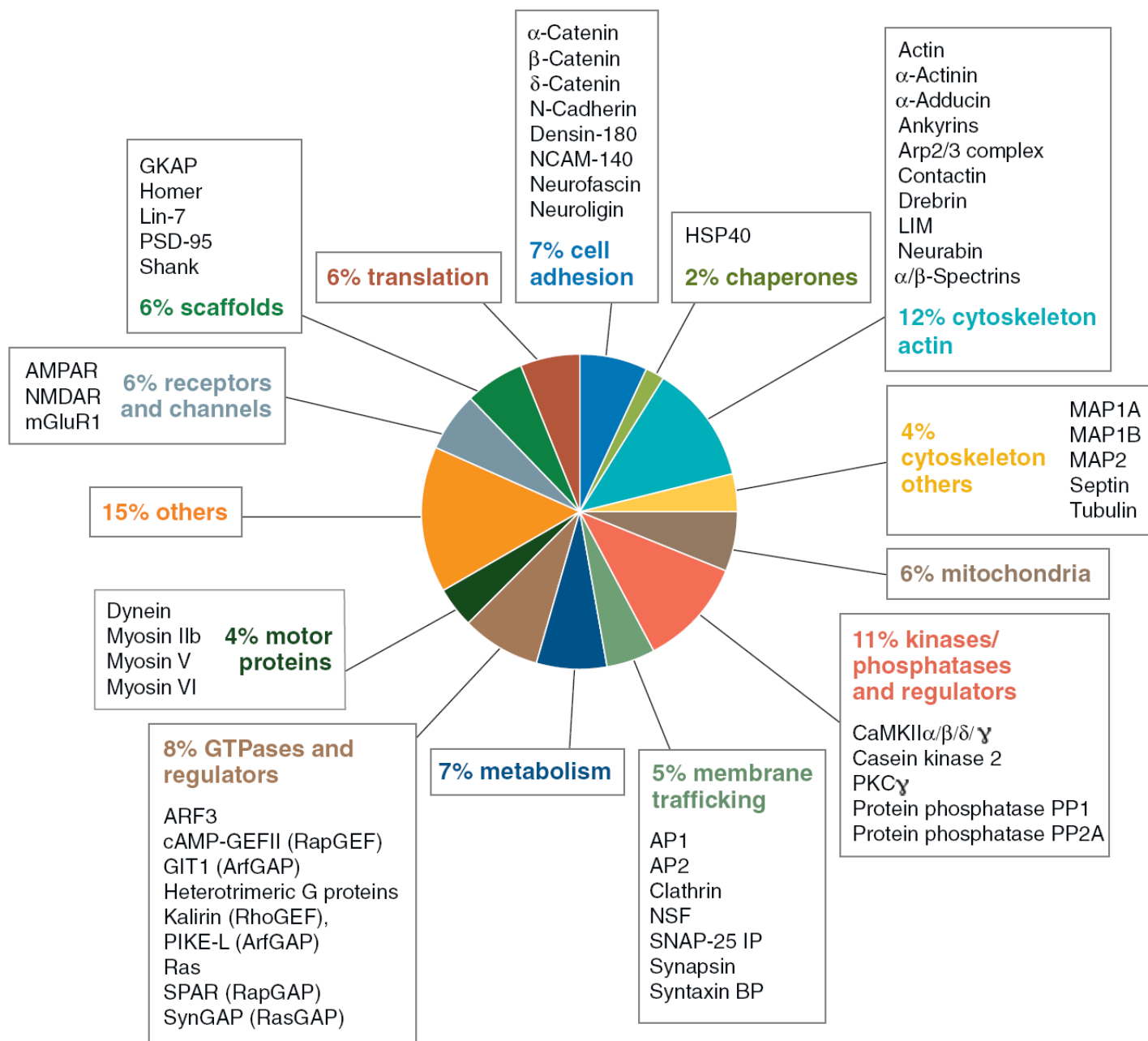




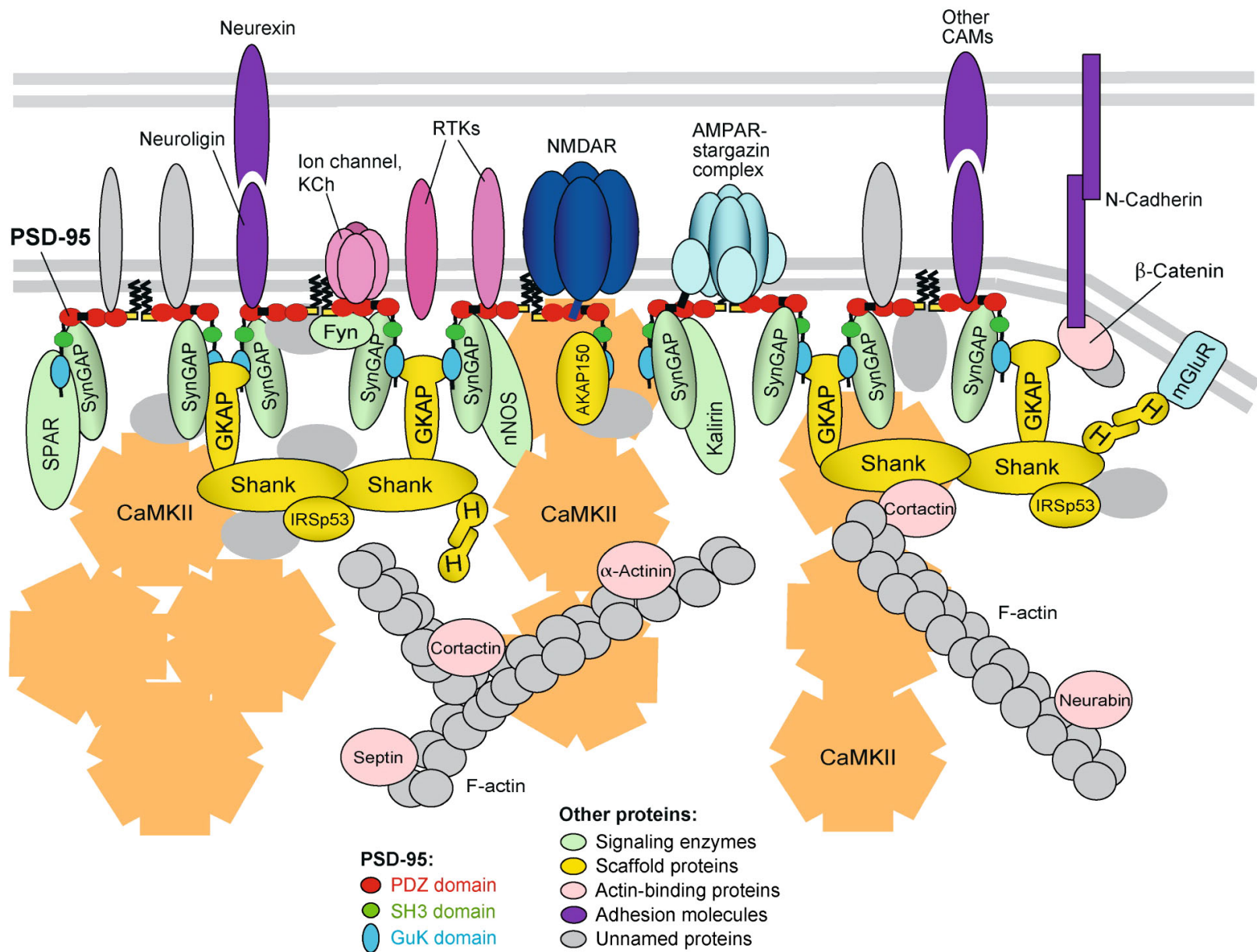
Weak Stimulus Followed by a Strong Stimulus Produces LTP



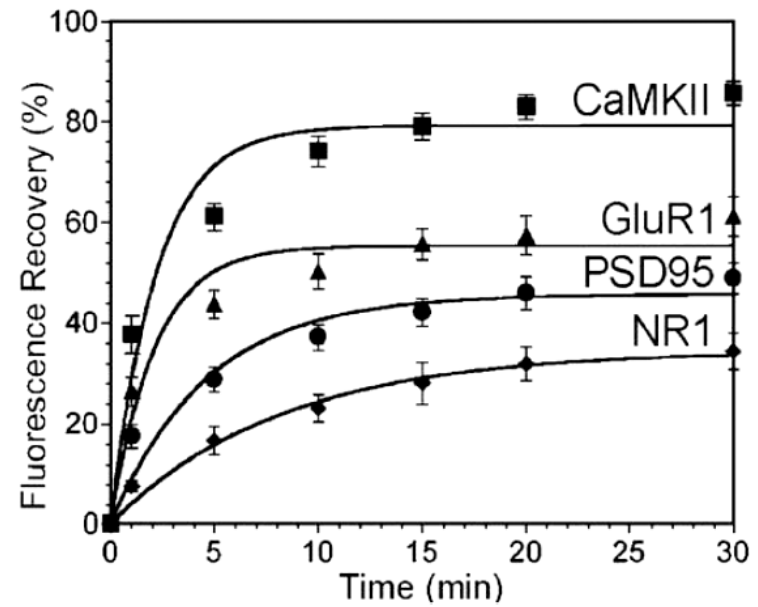
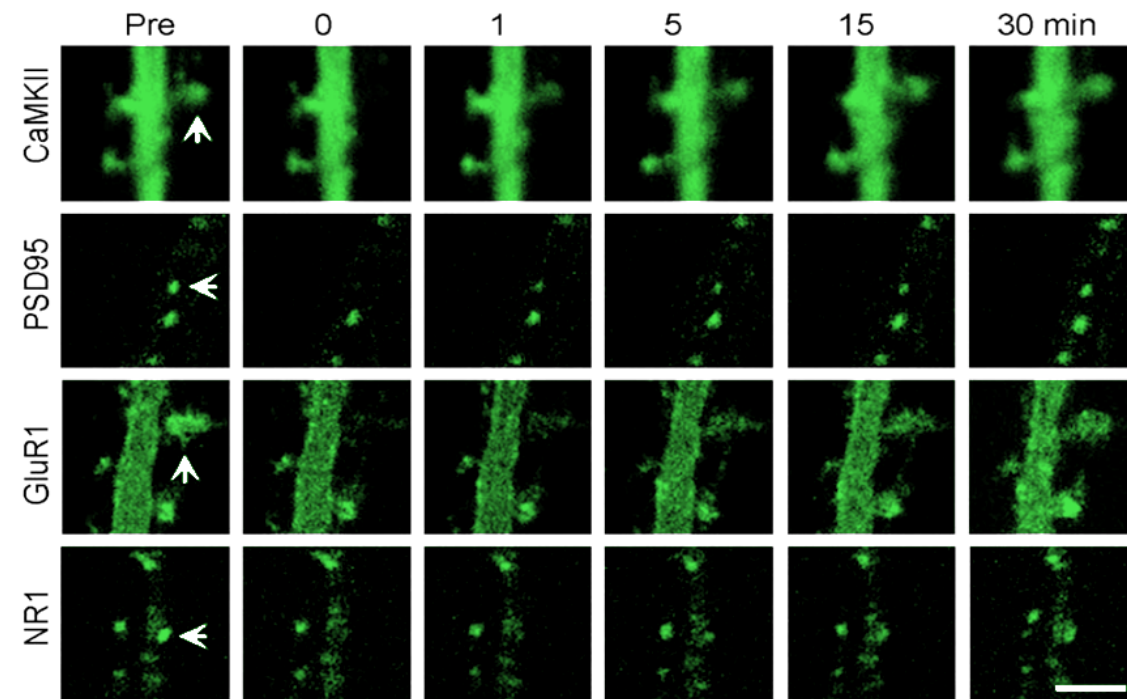




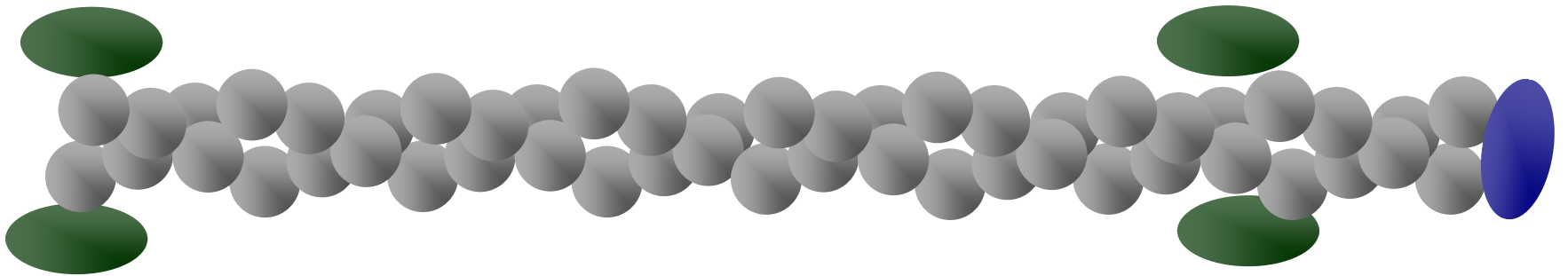
Molecular Makeup of the PSD



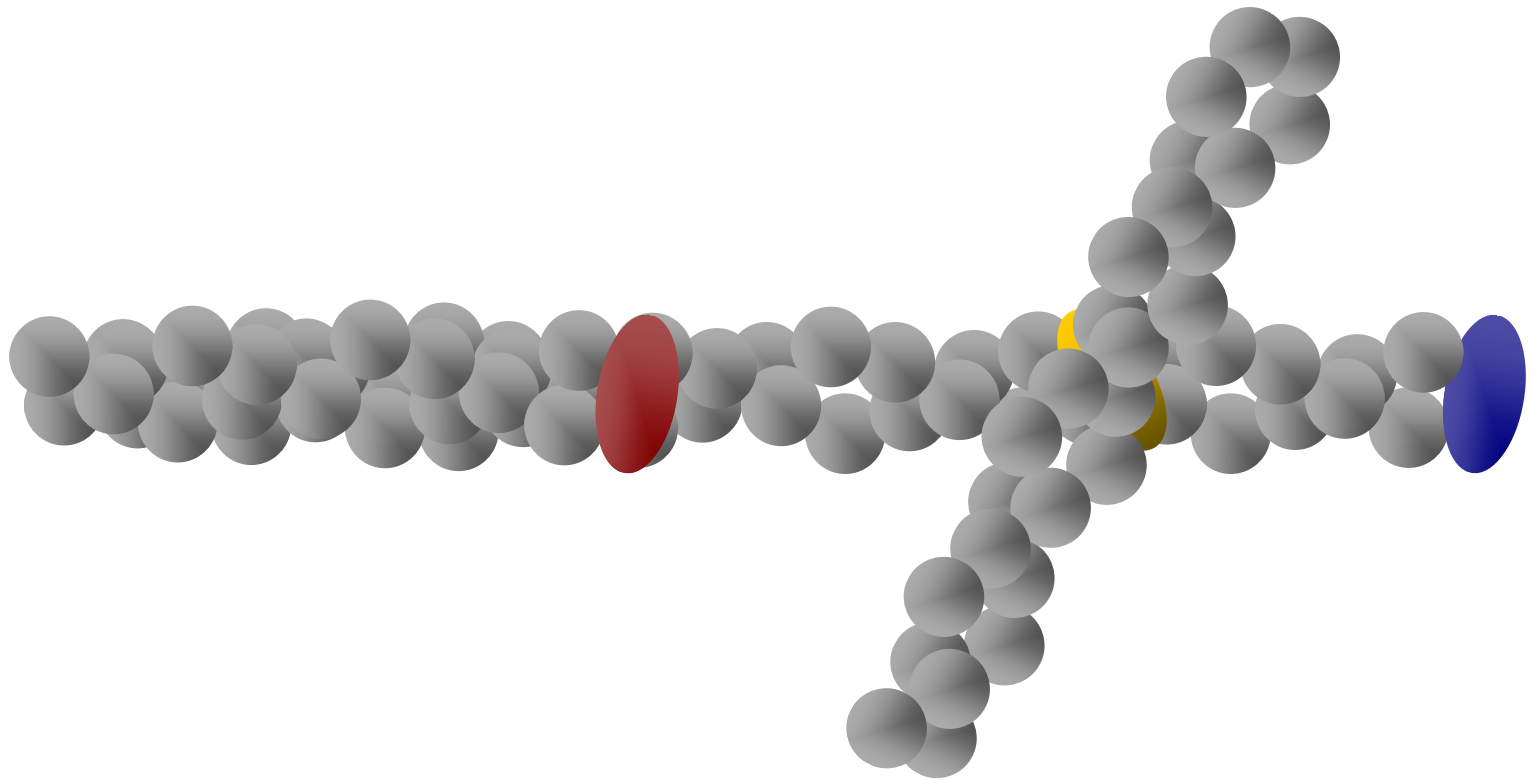
Scaffolding Molecules



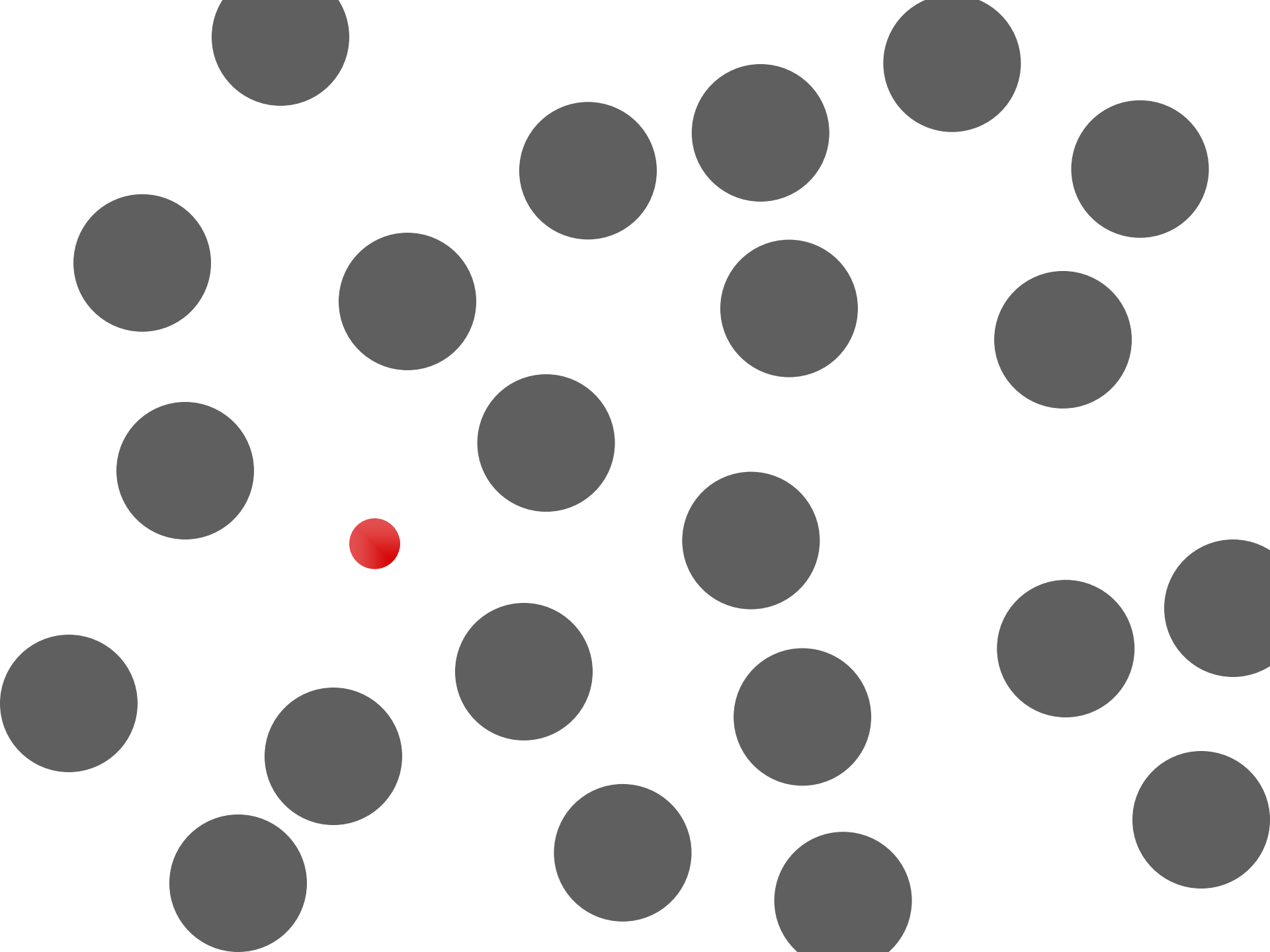
PSD Proteins Are In Flux

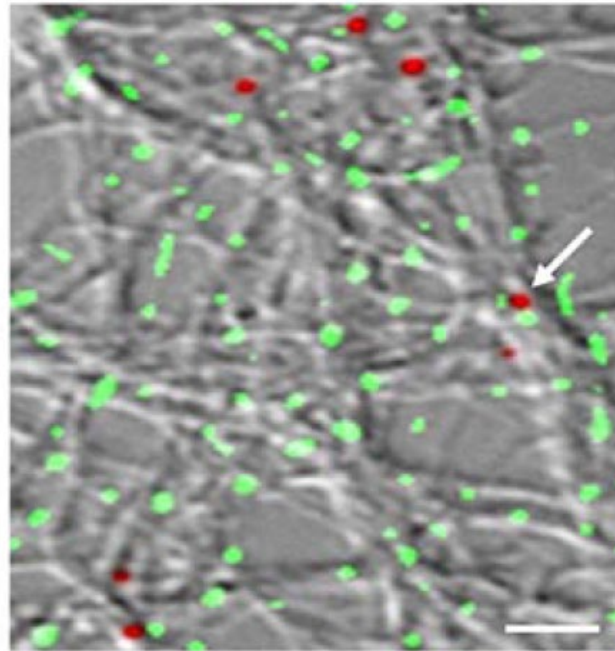
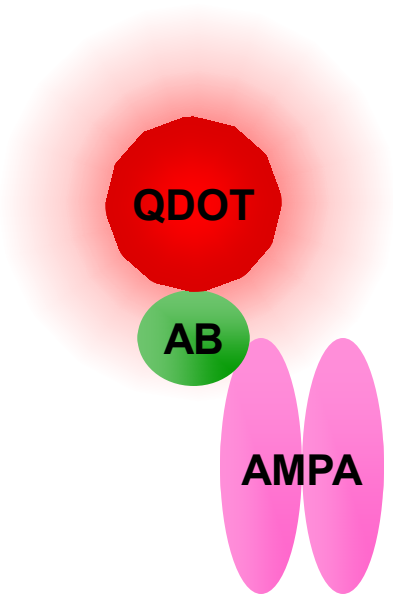


Actin Treadmilling, Capping, Cutting and Cross-Linking



Actin Treadmilling, Capping, Cutting and Cross-Linking



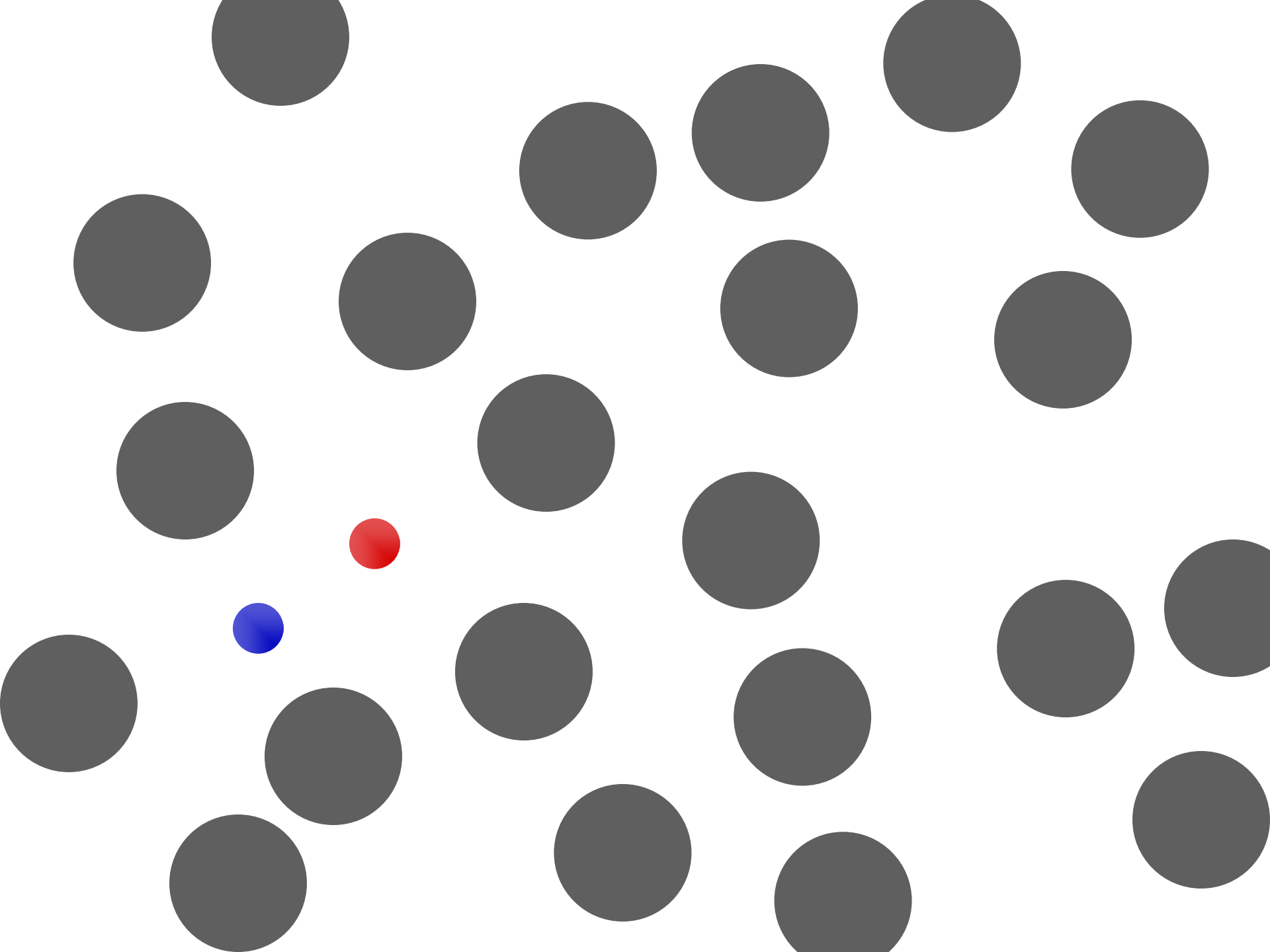


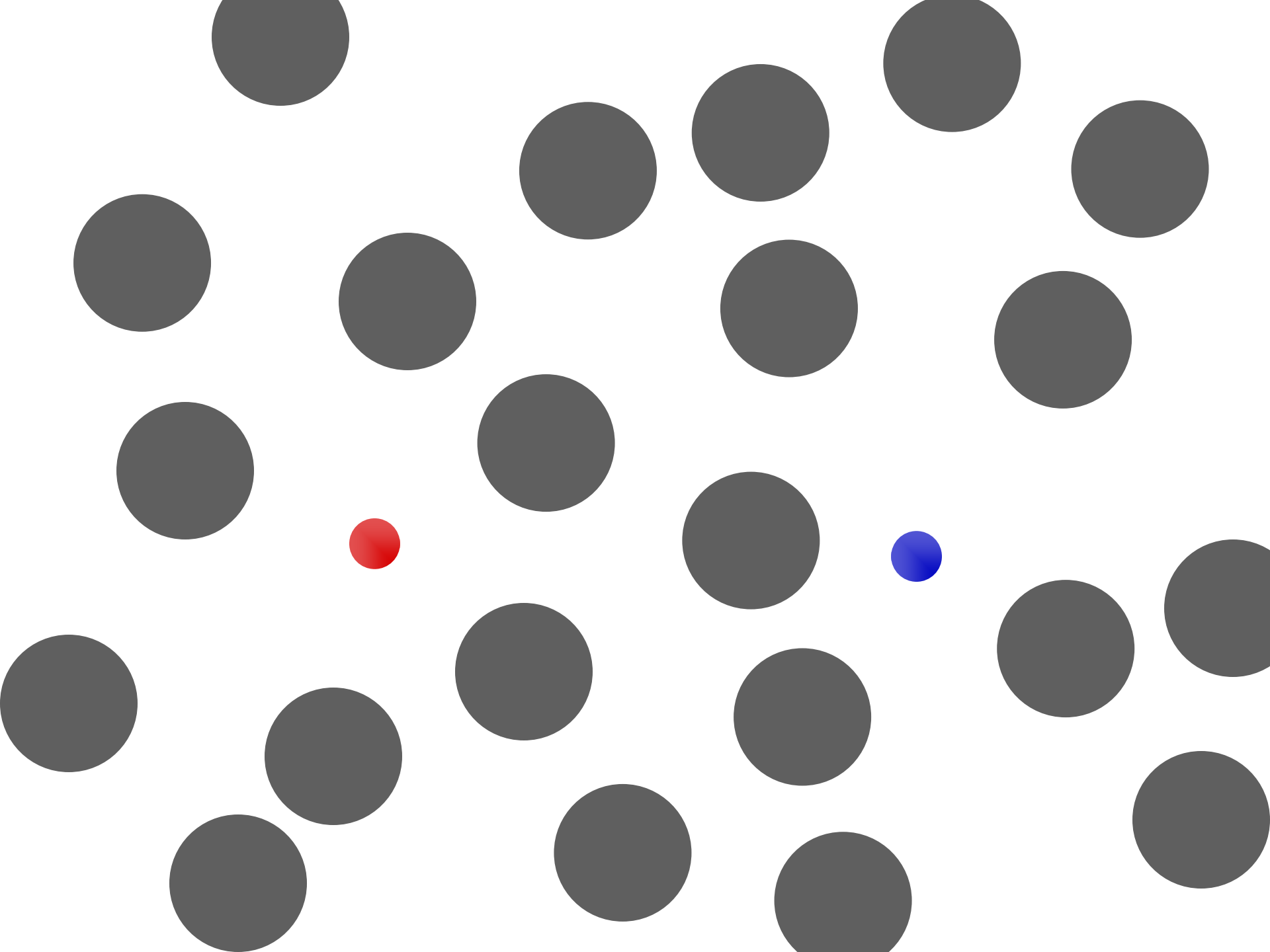
- Quantum dot
- Synapse (mitotracker)

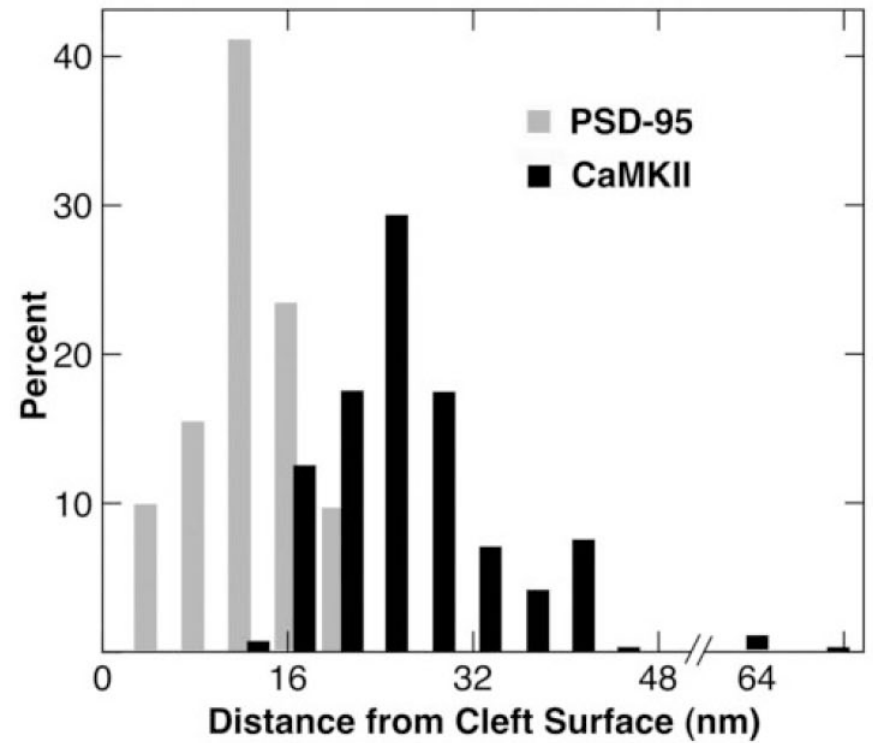
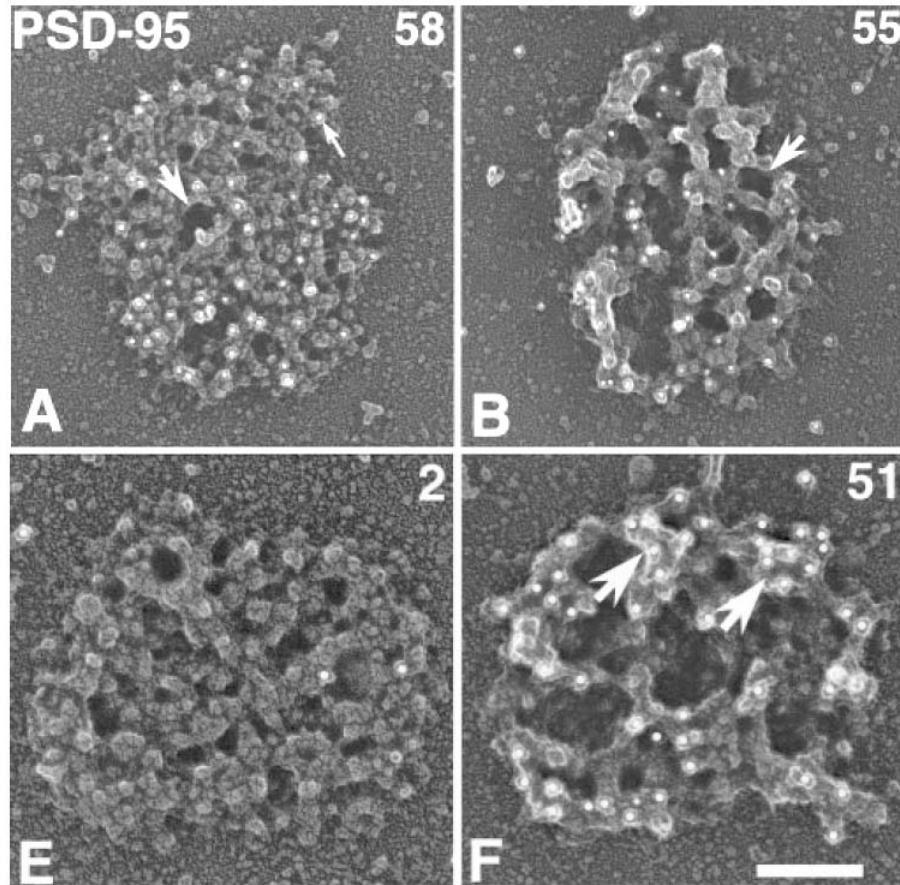


- Synaptic diffusion
- Extrasynaptic diffusion

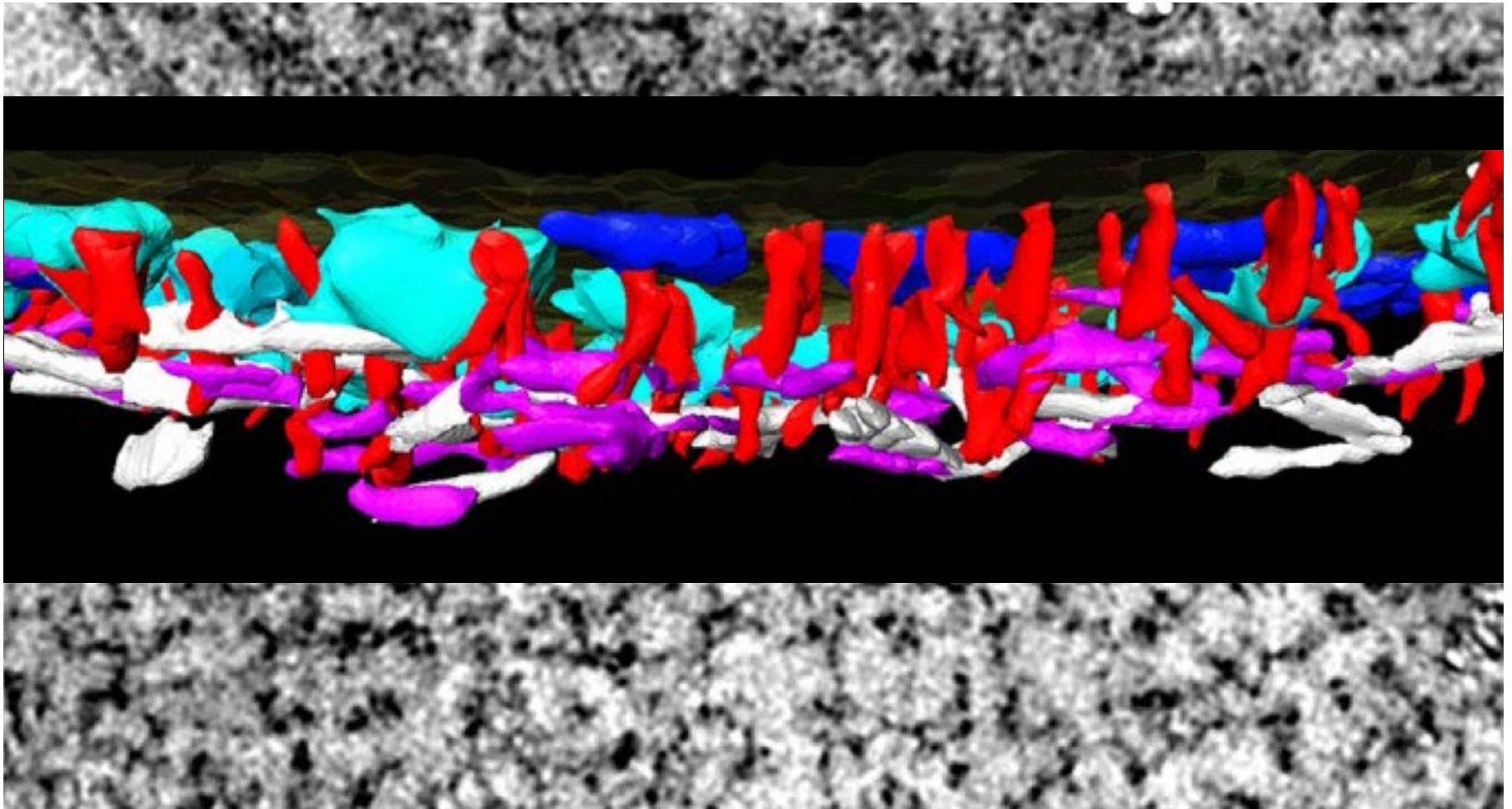
Single-Particle Tracking of AMPA Receptor Diffusion



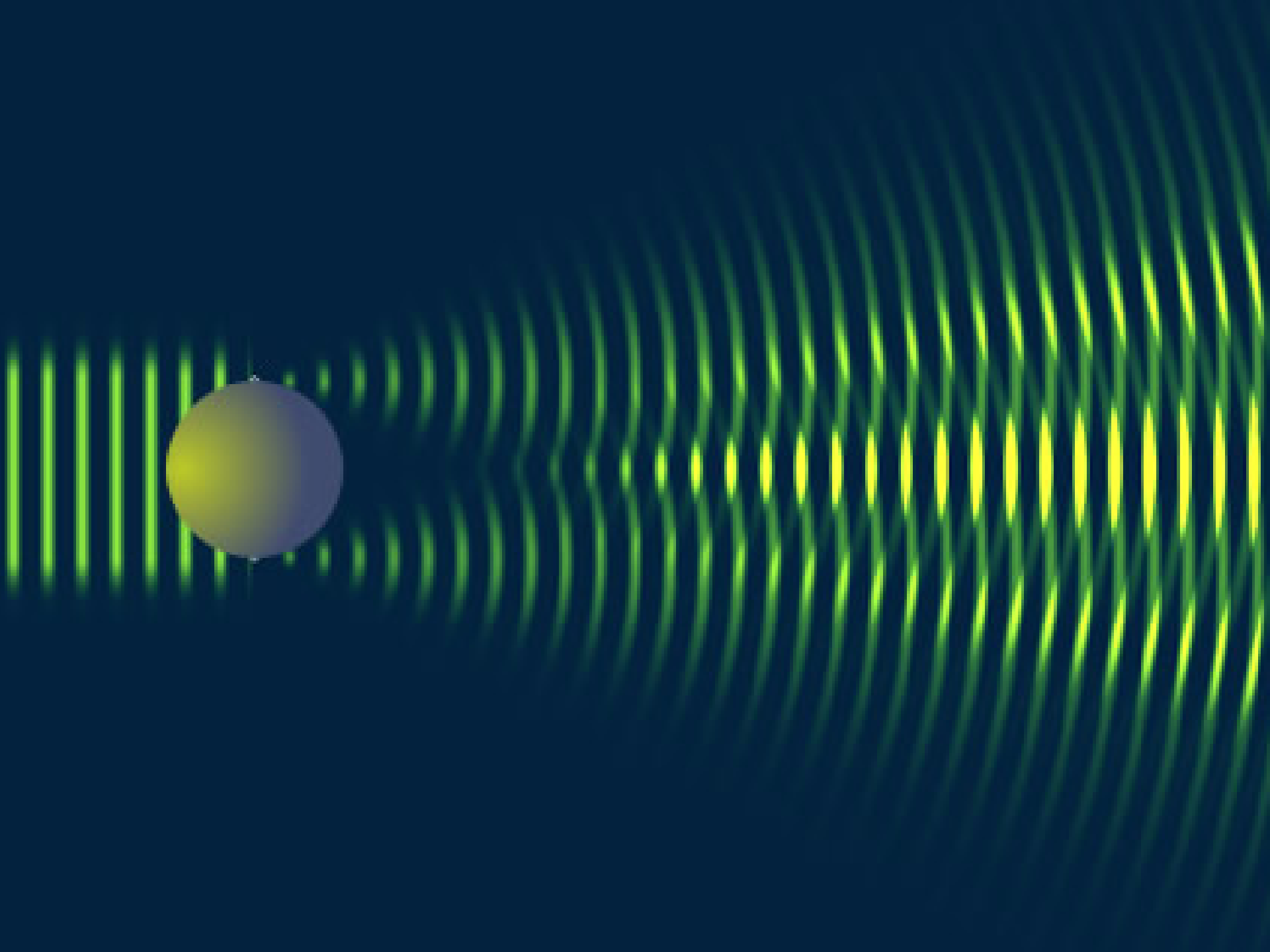


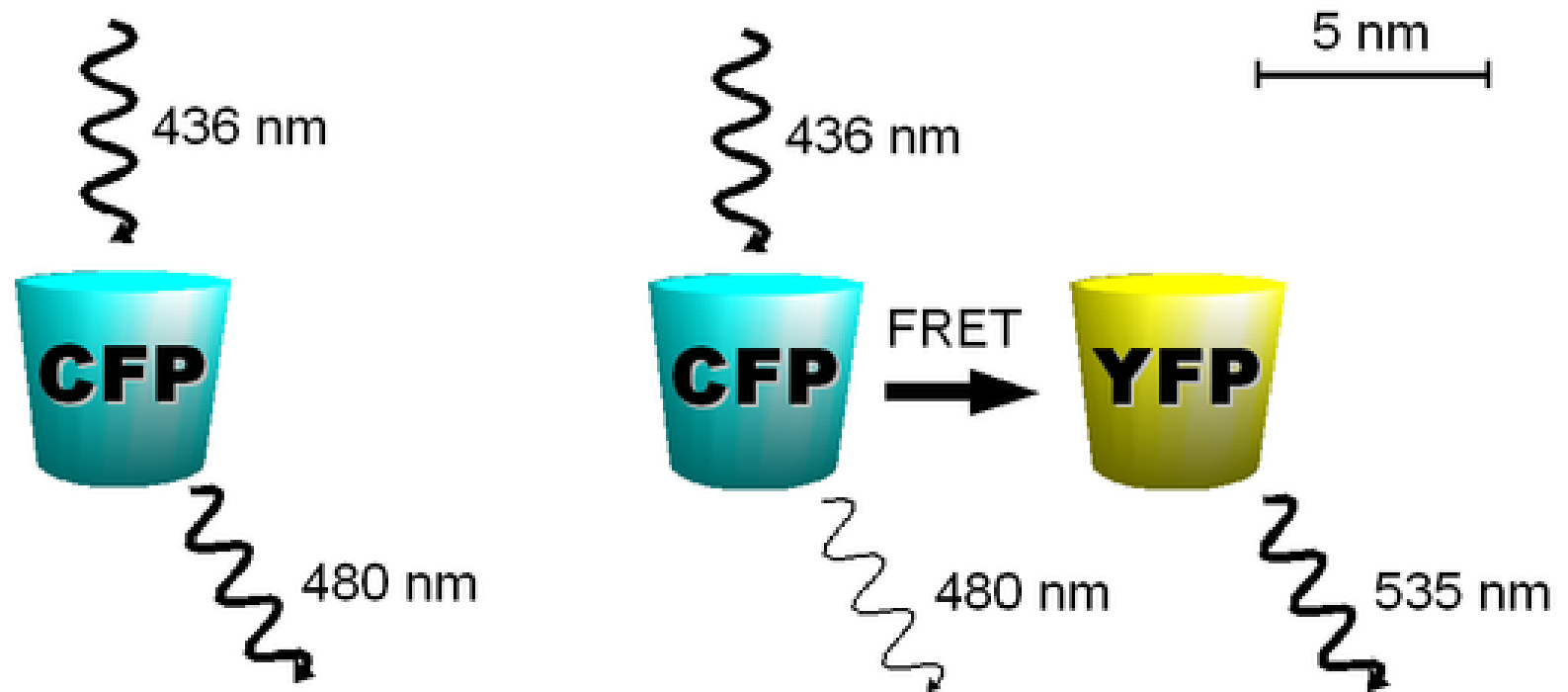


Imaging of Isolated PSDs with Immunogold EM



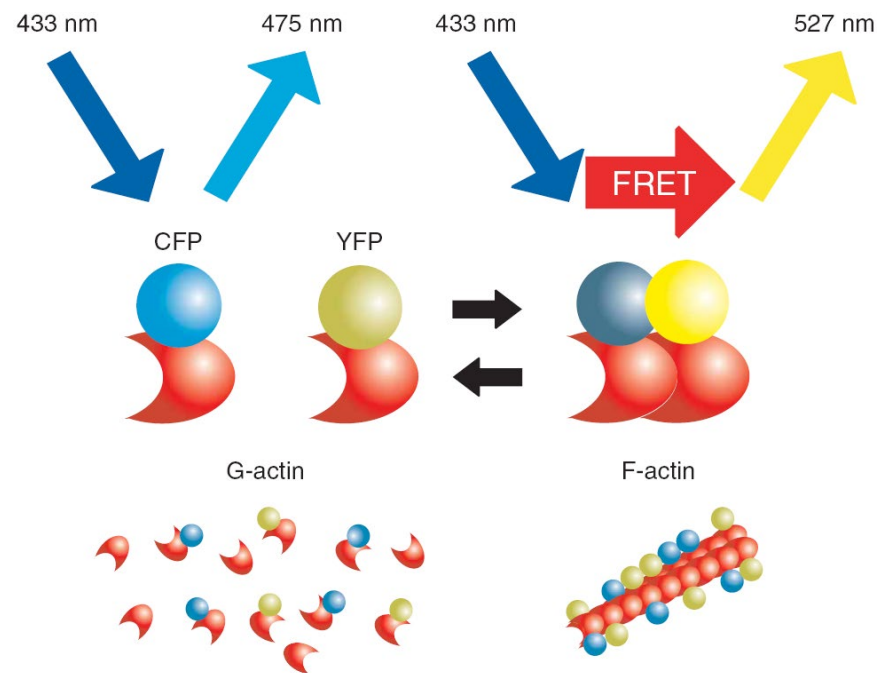
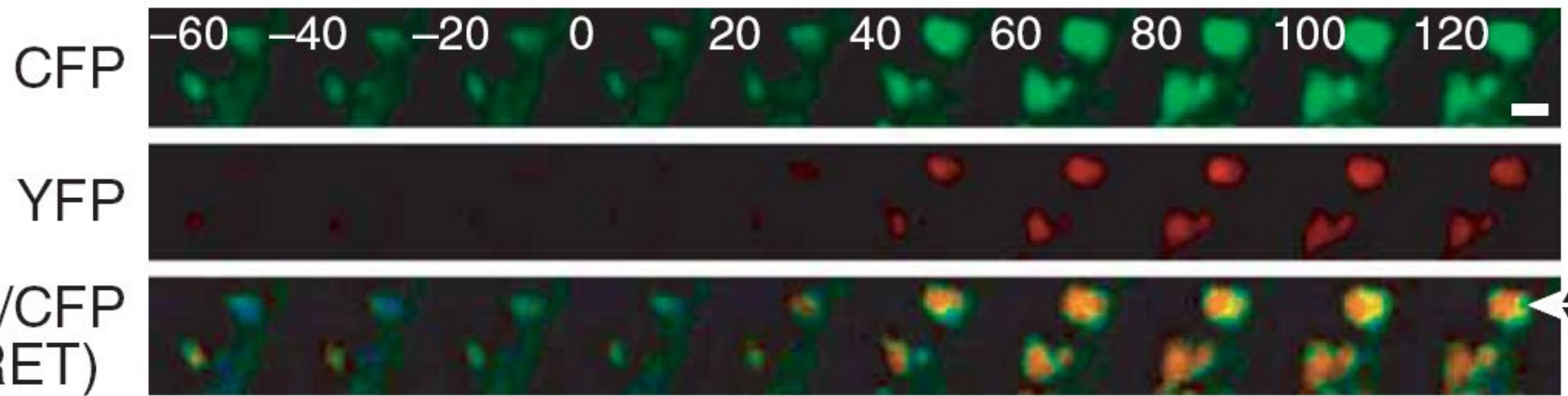
EM Tomography of Molecular-Scale Structures in the PSD

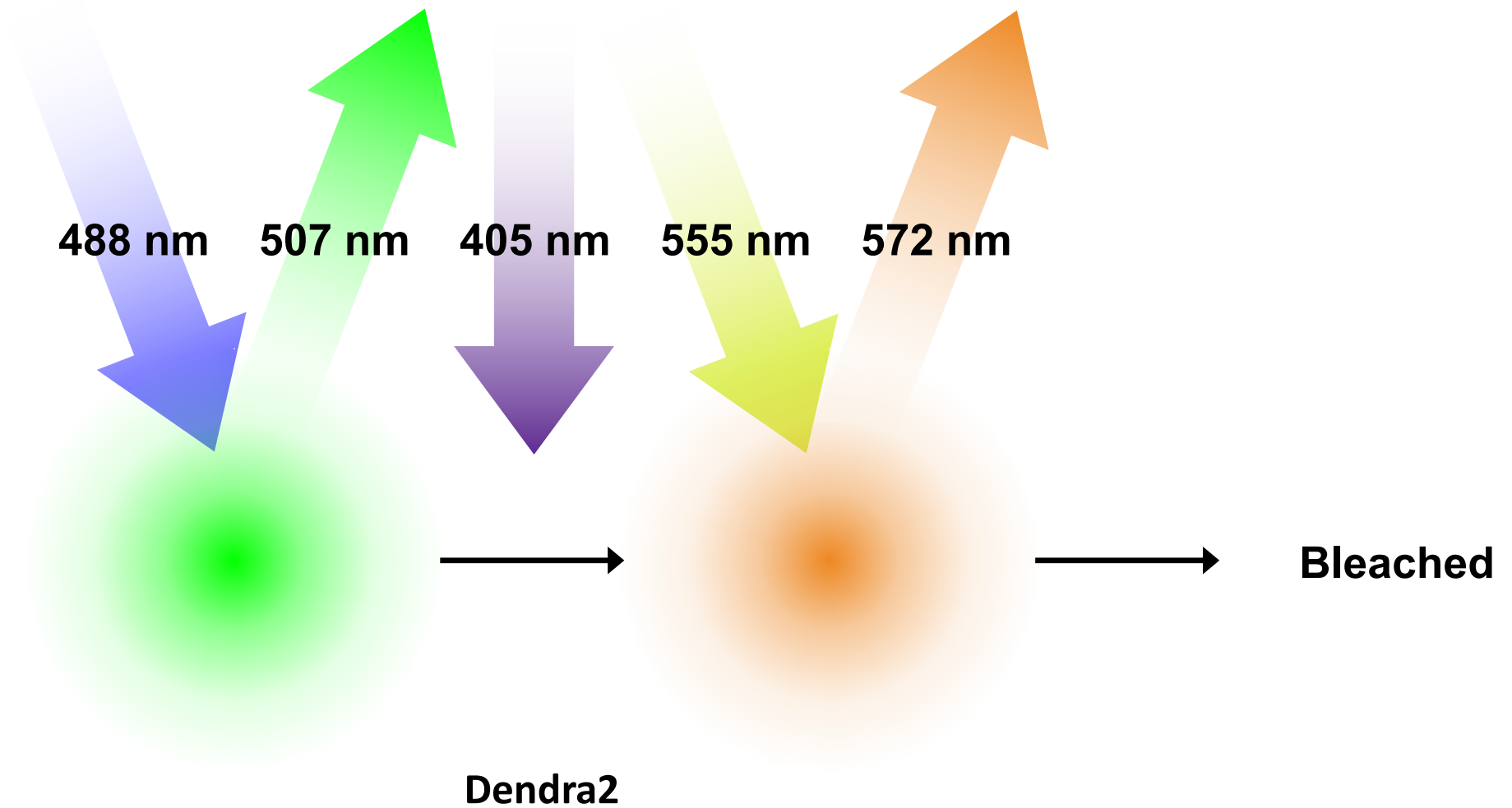




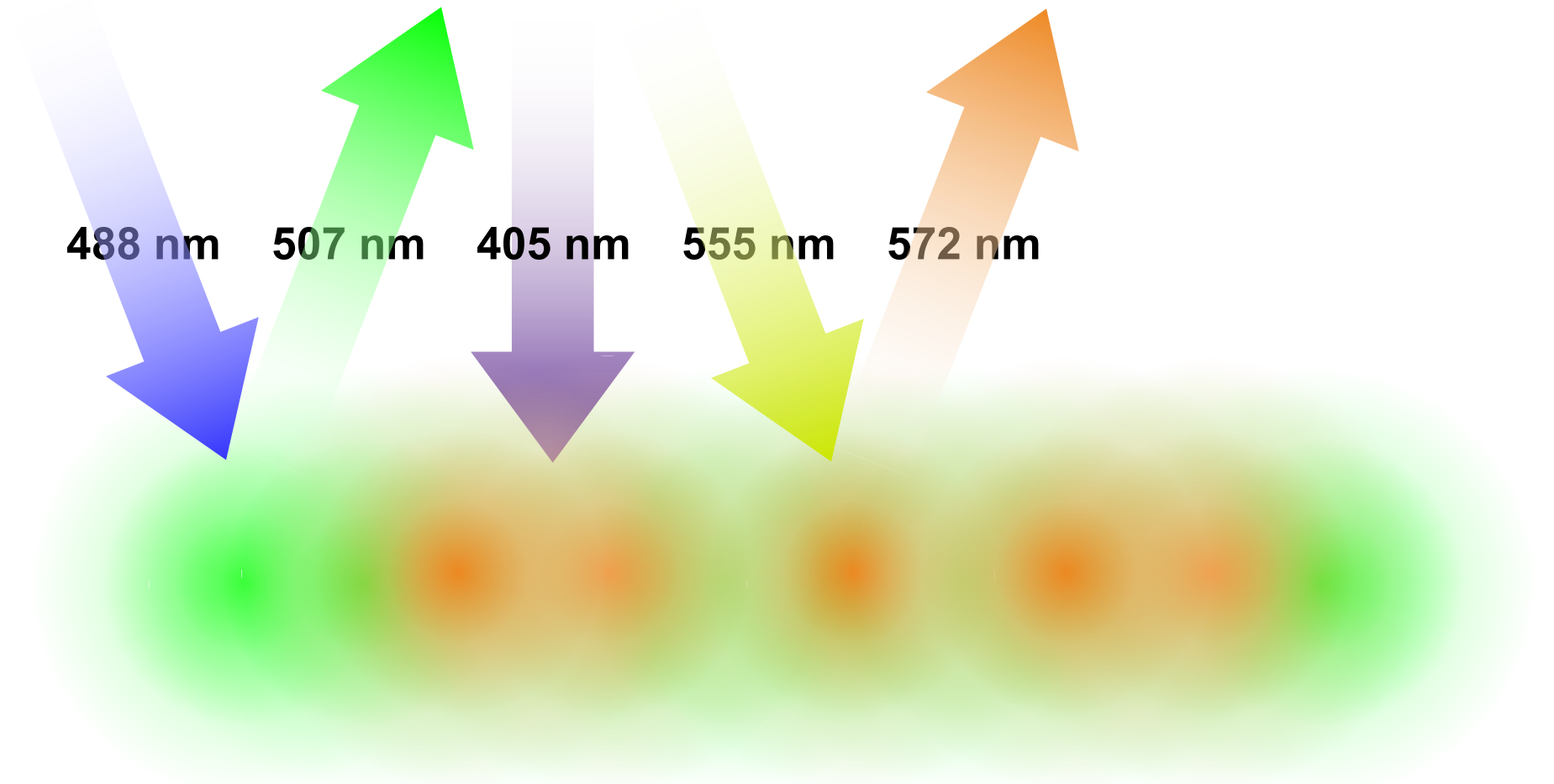
Förster Resonance Energy Transfer (FRET)

↓ Tetanus

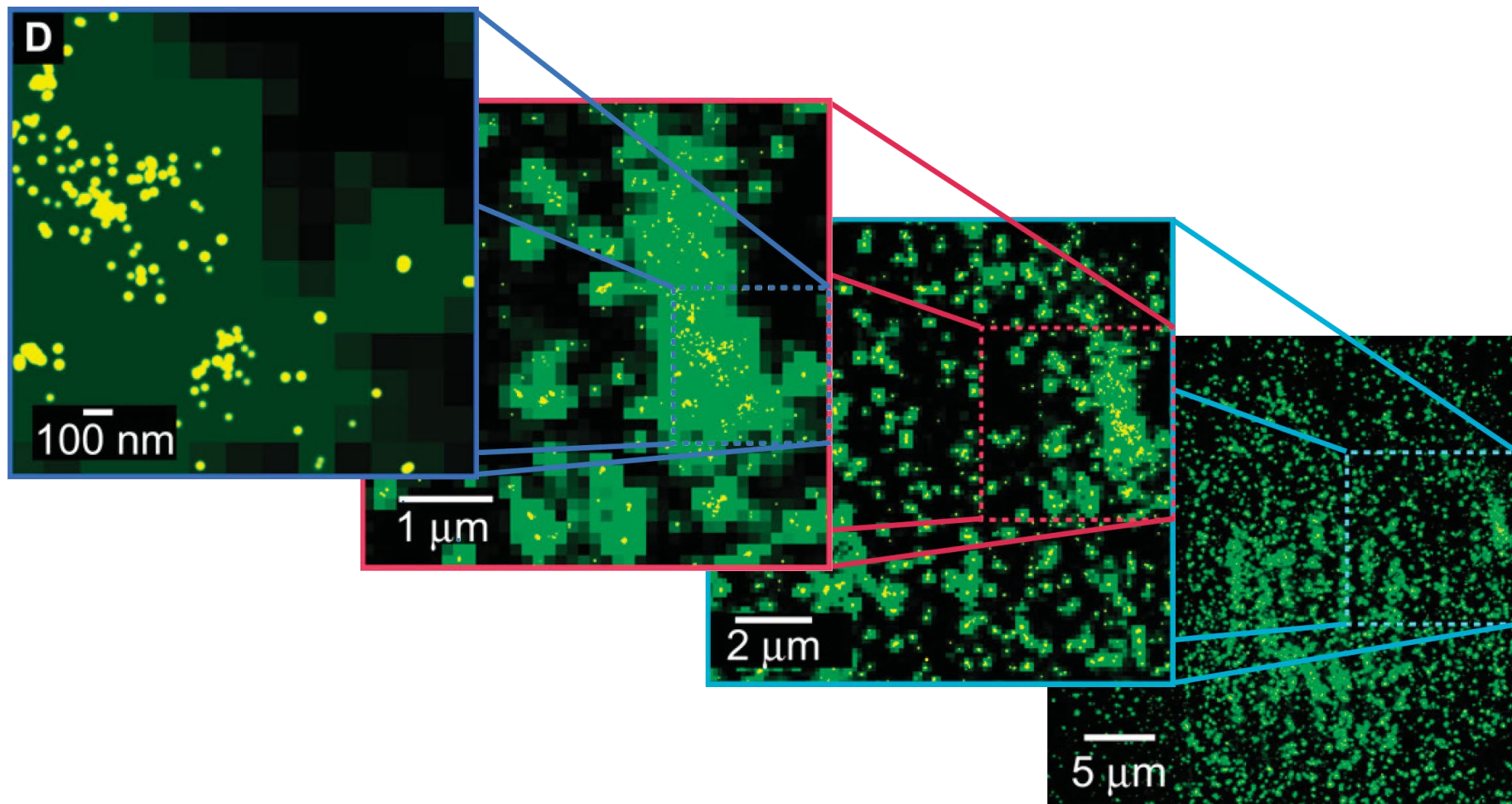




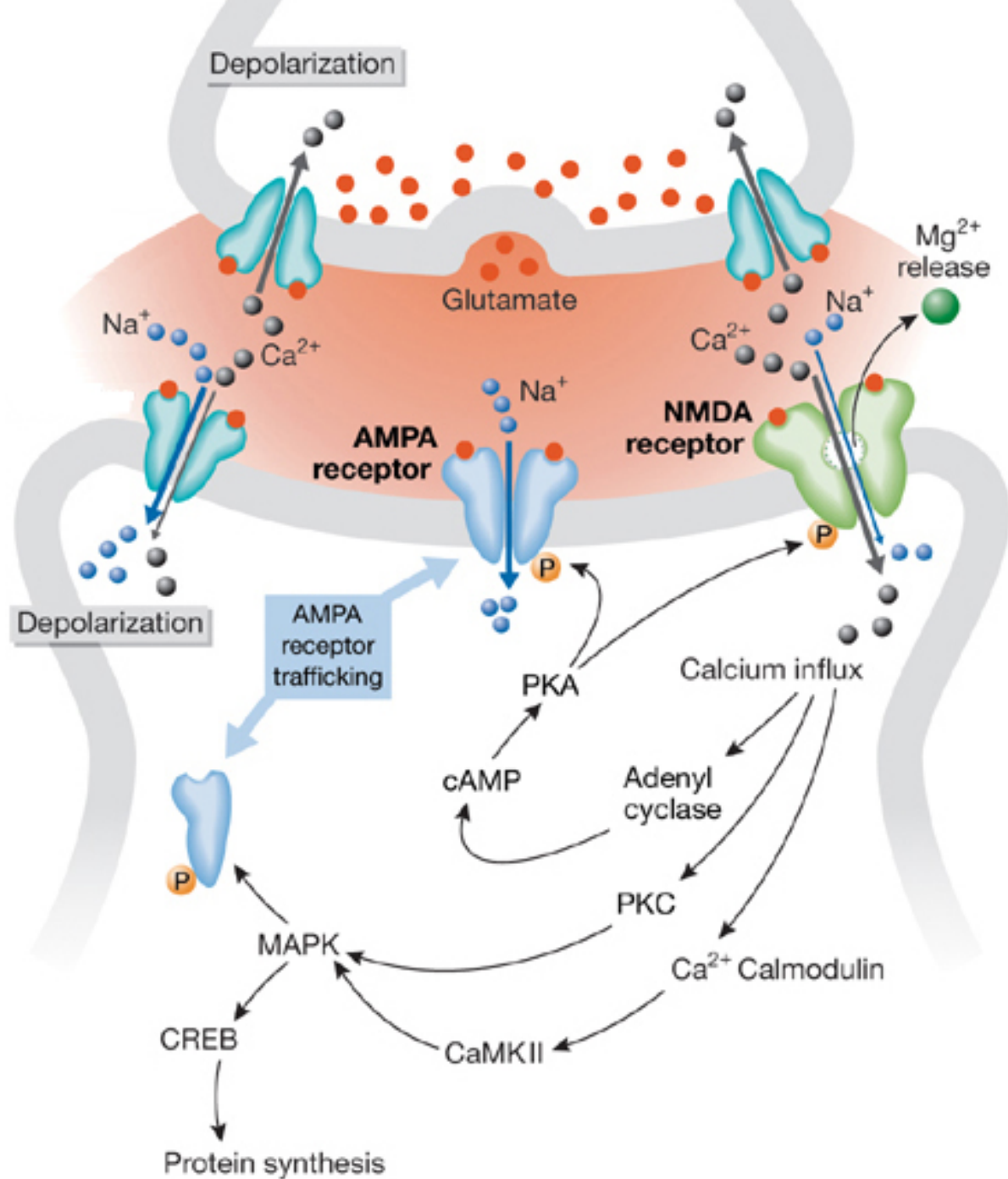
Super-Resolution Imaging Using FPALM



Super-Resolution Imaging Using FPALM



Super-Resolution Imaging Using FPALM



Thanks to

QB Program

Jané Kondev

Jeff Gelles

Trisha Murray

John Lismann

Sri Raghavachari

All of you...