Synaptic Inhibition in Brain Function and Disorders

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Open at upper undergraduate level only (Elective). Students who have already taken a similar course of mine the past, and graduate students, are not allowed. An intro or intermediate Neuroscience background is strongly preferred. A highly motivated student without such background may be permitted with the instructor's permission.

An overview of inhibitory circuits, plasticity and involvement in disorders will be presented. Each discussion will consider issues published in scientific reviews and classic as well as contemporary papers. A bottom-up approach will deal with cellular, synaptic, and some key biochemical mechanisms in relation to processing and functional imbalance. Precise content (animal models, human, CNS region) will be flexible and evolve during participation, especially when students choose their own presentations. Discussions will revolve around the following broad themes.

* $GABA_A$, $GABA_B$ and glycine receptors and their subunit stoichiometry, complexity in physiology and pharmacology at pre and postsynaptic levels. Heterogeneity of inhibitory interneurons; diversity in their biophysical, structural and synaptic physiology in the medial temporal lobe and neocortex. Over or under scaling of inhibitory transmission in disorders. Inhibitory cell-transplant based repair: pros and cons. Optogenetic and other genetic manipulations as experimental approaches. Epigenetic factors in inhibitory plasticity.

*   Oscillations and Rhythms: Gamma band, circadian, circannual, neuroendocrine, and sensorimotor. Role of inhibition in oscillations & propagation of waves.

*   Development, critical periods, deprivation, sexual maturation and alterations in GABAergic activity. Aging, and degradation of GABAergic function. Means to improve central deficits and performance.

*   Inhibition and disorders: Parkinson's, Alzheimer's, Epilepsy, Presbycussis, ASD, Angelman, Fragile X, Down, Rett, and other dysfunctions, depending upon time constrains. Every topic will likely touch base with overlying behavioral translational issues anyway.

Students are expected to present a classic or recent review, or a paper, and present and defend it in the class. The first presentation will be of 10 min while the second one for ~ 25 min. The 10 min presentation may be considered as a rehearsal for the final, and is geared to prepare students for possible formal presentations at future meetings. Both presentations should include motivation, specific hypothesis, approach and methods, novelty, major outcome, and potential broader impact to the biomedical community. The two presentations may be independent or interlinked.

No exams will be given. Grades will be based on students' own projects and class presence. Final grades will be based on the following.

30% →   Attendance
30% →   10 min presentation and a ~ 5 min defense
40% →   25 min presentation, defense, and written paper

Written paper will be based on final presentation. This should have your own summary and a critique from an objective standpoint, rather than a rehash of a published paper. The report can have conceptual figures or existing figures from the papers, novelty, and an impact aspect. The total length should not exceed 4 full pages including figures, legends and some key references.

TENTATIVE: First Lecture Friday 1/27
Spring break 3/17 through 22
Last Lecture Wednesday 5/9.
Once a week: Every Friday at 9:45a.m. Lecture Hall, 815 Meyer Bldg.
Two, ~ 70-minute lectures, 10 minute break. Total time commitment per week:
~ 2.5 hours, includes discussions