# BGGN 284 BIPN 194 - Adv Topics-Phys/Neuro - Synapse and Autism - Jin [WI24]

**BIPN194/BGGN284 Advanced Topics in Physiology/Neurobiology:   "Synapse and Autism"**

Tuesdays 9-10:20 am, York 3010

Professor Yishi Jin

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[*please include BIPN194 or BGGN284 in subject line of any emails concerning the class*]

Office Hours: Fri 10-11 am, in person @ Bonner Hall 2418, or by appointment.

**General Description of the Course**

Synapses are where the actions in the nervous system take place!  Many neurological diseases are associated with synapse dysfunction.  Recent genetic studies of Autism or Autism spectral disorders (ASD) have implicated many mutations affecting genes that function in synapses. The goals of the course are to provide basic knowledge on how synapses are formed and regulated, and to discuss cutting-edge research on understanding the causative associations of genes in Autism.  Specifically, we will first focus on the key studies that reveal the tripartite components of the synapse.  We will then discuss representative research on understanding autism-associated genetic mutations on synapses and behaviors using animal models.

After the introductory lectures by the instructor, each class will be student-led presentation and discussion of primary research literature.  The course is highly interactive, and everyone must speak and give feedback to each other!

Evaluation: There is NO final exam. Your grade will be based on:

(1) Your performance in your group presentation.

(2) Your attendance and audible participation in each class.

(3) Your presentation and participation in roundtables (last two classes)

(4) Your constructive feedback to presenters.


***Bonus:  Submit at least one question, prior to the start of the class,*** *on the discussion paper when you are NOT a presenter.* Questions can range from clarification of scientific concepts or hypothesis, research jargon, data analysis, experimental procedure, authors' conclusions.

**Brief outline of the course:**

Jan 9:  Introduction to class organization and background (Jin).

Jan 16: Lecture on synapses and autism and literature reading (Jin)

Jan 23: pre-synaptic terminal

Jan 30: post-synaptic terminal

Feb 6: synaptic adhesion

Feb 13: autism genetics

Feb 20: literature search and review

Feb 27: animal model for autism

Mar 5: animal model for autism therapeutics

Mar 12:  final presentation and discussion

Prerequisites: *This course will assume strong knowledge of molecular biology, genetics, cell biology, and neurobiology.*  BICD 100 (Genetics), BIPN 100 (Mammalian Physiology), BICD 110 (Cell Biology), and BIPN140 (cellular neurobiology) are strongly recommended.

Readings

All reading materials are primary research papers and review articles, which are freely available online through UCSD library, so along as you use a UCSD IP address to access the research papers. For reading, PDFs of the papers are convenient; hard copies will not be provided.  For your presentation, nearly all data figures can be downloaded as ppt or equivalent format.  To find any primary papers, use Pubmed (https://www.ncbi.nlm.nih.gov/pubmed/) or Google Scholar (scholar.google.com).

There is no textbook for this course.  Use your textbooks from other classes (such as BIPN140) for general knowledge on neuroscience. Scholar review articles are recommended to help understanding the general background.

**Expect to spend at least 4 hours a week on the reading, 8-10 hours when you are presenting a paper.**

Group presentations

*PRESENTERS:*

A group of 2-3 will work together to present one of the assigned research papers.  The total presentation should be within 45 minutes, including 2-3 breakout time during presentation to discuss questions with non-presenters. Each presenter should be prepared to answer questions and engage class discussion of their portion of the presentation.

*NONPRESENTERS:*

You are expected to read **EVERY** discussion paper **before** coming to class and to be prepared to discuss it.  During the class presentation you are expected to actively participate in discussion.  After each presentation (except your own), you will submit a constructive evaluation of the presentation.

## PRESENTATION FORMAT

Presentation should be prepared in ppt or a format agreeable by the presenters. The entire presentation should be on one computer and uploaded to class website after presentation.  Presenters are advised to come to classroom ~ 5 minutes early to set up.

## PRESENTATION CONTENT

1. *Background/Introduction*: What is the *biological problem*? What are the authors attempting to show? How does this work fit into the overall findings of the field? What tools or methodologies are going to be used to approach the problem?
2. *Results /data*: recommend that each group member present one or two Figures/Tables each. For each Figure or experiment, address (a) what is being shown, and (b) why and how was this experiment done, in the context of the paper. Discuss reservations or questions you have about the data.  It is required that you read and understand all the data, including those in "supplemental information", which is often in a separate file from the pdf of the article.
3. *Conclusions/Discussions:* What are the conclusions? How strong does the data support the model or hypothesis?  What are the 'next steps' or remaining questions?

## GROUP MEETINGS PRIOR TO PRESENTATION

It is essential that presenters meet prior to the presentation, exchange phone numbers and e-mail addresses and arrange to meet at least twice to prepare for the presentation. Research papers are complicated, and the level of background knowledge among classmates varies.  By working as a team you can give an effective presentation.

***I will meet with the presenters <u>at the end of class on Tuesday</u> to guide organization of presentation.***

PEER EVALUATIONS

After each presentation, non-presenters will fill out a short evaluation of the presentation.  Did the presentation and discussion clarify the work?  Were your questions answered?  Do you have suggestions for improving the quality of the presentations?  Comments should be constructive. This is a very important factor in your course participation.


ATTENDANCE

You are expected to attend ALL class meetings (sign in at each class).  Late arrival (i.e.>5 minutes) will likely cause grade reduction.  Acceptable excuses for missing a class are:  documented medical emergency and family emergency; university sponsored events.  Vacation, oversleeping, or deadlines or demands from other courses/exams are not acceptable excuses for missing this class.


READING LIST (please download pdf from PubMed: http://www.ncbi.nlm.nih.gov/sites/entrez?cmd=search&db=pubmed)


***General readings for the entire course***

**The autism sequencing consortium: large-scale, high-throughput sequencing in autism spectrum disorders.** ⬀ **(http://www.ncbi.nlm.nih.gov/pubmed/23259942)** Buxbaum JD, Daly MJ, Devlin B, Lehner T, Roeder K, State MW; Autism Sequencing Consortium. *Neuron.* 2012 Dec 20;76(6):1052-6.

DOI: **10.1016/j.neuron.2012.12.008** ⬀ **(https://doi.org/10.1016/j.neuron.2012.12.008)**

**Current knowledge on the genetics of autism and propositions for future research.** ⬀ **(https://www.ncbi.nlm.nih.gov/pubmed/27289453)** Bourgeron T. *C R Biol.* 2016 Jul-Aug;339(7-8):300-7. DOI: **10.1016/j.crvi.2016.05.004** ⬀ **(https://doi.org/10.1016/j.crvi.2016.05.004)**


**Autism spectrum disorder: neuropathology and animal models.** ⬀ **(https://pubmed.ncbi.nlm.nih.gov/28584888/)** Varghese M, Keshav N, Jacot-Descombes S, Warda T, Wicinski B, Dickstein DL, Harony-Nicolas H, De Rubeis S, Drapeau E, Buxbaum JD, Hof PR.  Acta Neuropathol. 2017 Oct;134(4):537-566. DOI: 10.1007/s00401-017-1736-4.


**Weekly topics and discussion papers**

***Jan 9:  Introduction and organization of the course: Jin***

*Jan 16:  lecture*


**Jan 23: presynaptic terminal**

**Presenters: Samuel Kahn, Jianing Shi**

**Background reading:**

**[A molecular machine for neurotransmitter release: synaptotagmin and beyond.](http://www.ncbi.nlm.nih.gov/pubmed/24100992)** ⇨
**(http://www.ncbi.nlm.nih.gov/pubmed/24100992)**

Südhof TC. *Nat Med.* 2013 Oct;19(10):1227-31.

**Discussion paper:**

**[Synaptotagmin I: a major Ca2+ sensor for transmitter release at a central synapse.](http://www.ncbi.nlm.nih.gov/pubmed/7954835)** ⇨
**(http://www.ncbi.nlm.nih.gov/pubmed/7954835)**

Geppert M, Goda Y, Hammer RE, Li C, Rosahl TW, Stevens CF, Südhof TC.  *Cell.* 1994 Nov
18;79(4):717-27. doi: 10.1016/0092-8674(94)90556-8.


**Jan 30: postsynaptic terminal**

**Presenters: Gulshanbir Baidwan, Madison Bolinger**

**Background reading:**

**[The Shank family of scaffold proteins.](http://www.ncbi.nlm.nih.gov/pubmed/10806096)** ⇨ **(http://www.ncbi.nlm.nih.gov/pubmed/10806096)**

Sheng M, Kim E.  *J Cell Sci.* (2000) v113:1851-6.

**Discussion paper:**

**[A preformed complex of postsynaptic proteins is involved in excitatory synapse development.](http://www.ncbi.nlm.nih.gov/pubmed/16476664)** ⇨
**(http://www.ncbi.nlm.nih.gov/pubmed/16476664)**

Gerrow K, Romorini S, Nabi SM, Colicos MA, Sala C, El-Husseini A. *Neuron.* 2006 Feb 16;49(4):547-62.
DOI: **[10.1016/j.neuron.2006.01.015](https://doi.org/10.1016/j.neuron.2006.01.015)** ⇨ **(https://doi.org/10.1016/j.neuron.2006.01.015)**


**Feb 6: synaptic adhesion**

**Presenters: Anna Linnik, Lili Follett**

**Background reading:**

[**Neuroligins and neurexins link synaptic function to cognitive disease.**](http://www.ncbi.nlm.nih.gov/pubmed/18923512) ⬈
(http://www.ncbi.nlm.nih.gov/pubmed/18923512)

Südhof TC. *Nature.* 2008 Oct 16;455(7215):903-11.

**Discussion paper:**

[**Neurexin mediates the assembly of presynaptic terminals.**](http://www.ncbi.nlm.nih.gov/pubmed/12796785) ⬈
(http://www.ncbi.nlm.nih.gov/pubmed/12796785)

Dean C, Scholl FG, Choih J, DeMaria S, Berger J, Isacoff E, Scheiffele P. *Nat Neurosci.* 2003
Jul;6(7):708-16. DOI: [**10.1038/nn1074**](https://doi.org/10.1038/nn1074) ⬈ **(https://doi.org/10.1038/nn1074)**

**Feb 13: autism genetics and animal models**

**Presenters: Ario Azarhoush, Patricia Chen, Kalani Piotrowski**

**Background reading:**

[**The autism sequencing consortium: large-scale, high-throughput sequencing in autism spectrum disorders.**](http://www.ncbi.nlm.nih.gov/pubmed/23259942) ⬈ **(http://www.ncbi.nlm.nih.gov/pubmed/23259942)**

Buxbaum JD, Daly MJ, Devlin B, Lehner T, Roeder K, State MW; Autism Sequencing Consortium.
*Neuron.* 2012 Dec 20;76(6):1052-6.

**Discussion papers:**

[**Mutations of the X-linked genes encoding neuroligins NLGN3 and NLGN4 are associated with autism.**](http://www.ncbi.nlm.nih.gov/pubmed/12669065) ⬈ **(http://www.ncbi.nlm.nih.gov/pubmed/12669065)**

Jamain S, Quach H, Betancur C, Råstam M, Colineaux C, Gillberg IC, Soderstrom H, Giros B, Leboyer
M, Gillberg C, Bourgeron T; Paris Autism Research International Sibpair Study. *Nat Genet.* 2003
May;34(1):27-9. doi: 10.1038/ng1136.

[**Autism-related neuroligin-3 mutation alters social behavior and spatial learning.**](http://www.ncbi.nlm.nih.gov/pubmed/24619977) ⬈
(http://www.ncbi.nlm.nih.gov/pubmed/24619977) Jaramillo TC, Liu S, Pettersen A, Birnbaum SG, Powell
CM. *Autism Res.* 2014 Apr;7(2):264-72. DOI: [**10.1002/aur.1362**](https://doi.org/10.1002/aur.1362) ⬈ **(https://doi.org/10.1002/aur.1362)**

**Feb 27: Shank and autism genetics**

**Presenters: TBD**

**Background reading:**

[The emerging role of SHANK genes in neuropsychiatric disorders.](http://www.ncbi.nlm.nih.gov/pubmed/24124131) Guilmatre A, Huguet G, Delorme R, Bourgeron T. *Dev Neurobiol.* 2014 Feb;74(2):113-22.

**Discussion paper:**

[Mice with Shank3 Mutations Associated with ASD and Schizophrenia Display Both Shared and Distinct Defects.](https://www.ncbi.nlm.nih.gov/pubmed/26687841)

Zhou Y, Kaiser T, Monteiro P, Zhang X, Van der Goes MS, Wang D, Barak B, Zeng M, Li C, Lu C, Wells M, Amaya A, Nguyen S, Lewis M, Sanjana N, Zhou Y, Zhang M, Zhang F, Fu Z, Feng G. *Neuron.* 2016 Jan 6;89(1):147-62.

DOI: [10.1016/j.neuron.2015.11.023](https://doi.org/10.1016/j.neuron.2015.11.023)

**Mar 5: Neuroligin and autism therapy**

**Presenters: TBD**

**Background reading:**

[Oxytocin as Treatment for Social Cognition, Not There Yet.](https://pubmed.ncbi.nlm.nih.gov/31998152/)

Erdozain AM, Peñagarikano O. Front Psychiatry. 2020 Jan 9;10:930.

doi: 10.3389/fpsyt.2019.00930.

**Discussion paper:**

[Rescue of oxytocin response and social behaviour in a mouse model of autism.](https://pubmed.ncbi.nlm.nih.gov/32760004/)

Hörnberg H, Pérez-Garci E, Schreiner D, Hatstatt-Burklé L, Magara F, Baudouin S, Matter A, Nacro K, Pecho-Vrieseling E, Scheiffele P. Nature. 2020 Aug;584(7820):252-256. doi: 10.1038/s41586-020-2563-7.

# Course Summary:

| Date | Details | Due |
|---|---|---|
| Wed Jan 24, 2024 | 📝 **[Please submit your feedback for the presentation on discussion paper 1 (https://canvas.ucsd.edu/courses/51933/assignments/751082)](https://canvas.ucsd.edu/courses/51933/assignments/751082)** | due by 12pm |