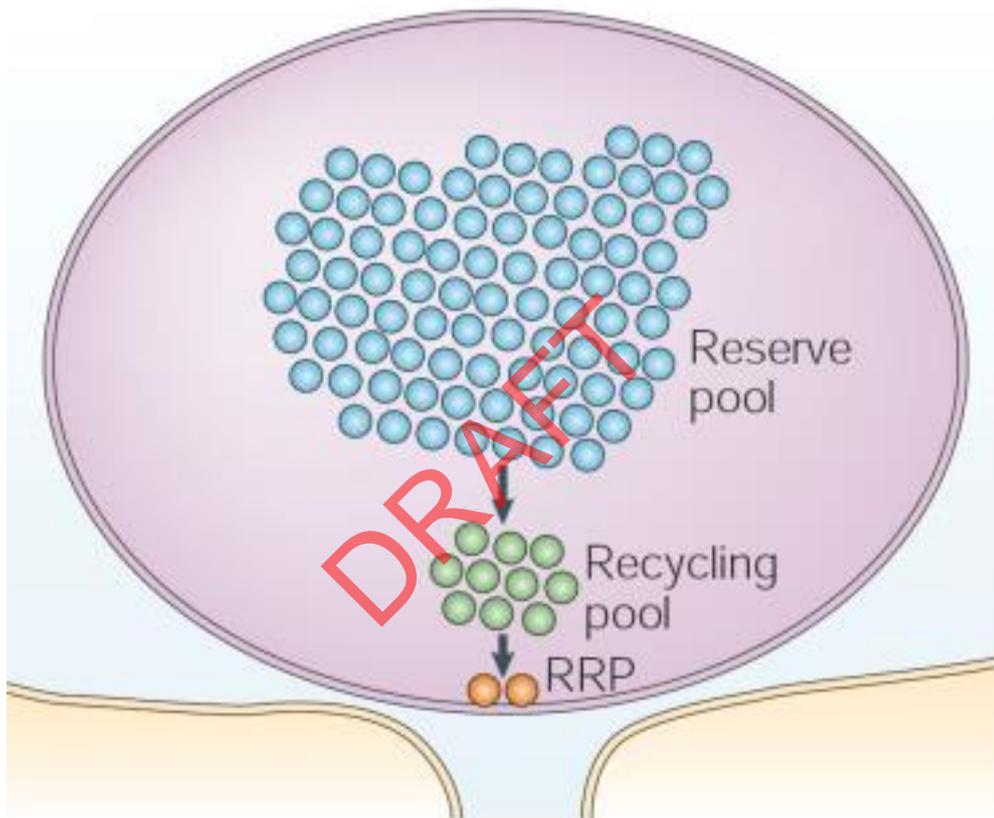


**University of St. Andrews**

**School of Psychology and Neuroscience**

**PN4234**

**Synaptic Transmission**



**Academic session 2016-2017**

**Organizer: Dr Wen-Chang Li**

**Email: [w121@st-andrews.ac.uk](mailto:w121@st-andrews.ac.uk)**

DRAFT

## Summary

Nervous system functions, including the complicated use of language and thinking in humans, rely on how neurons are connected with each other via synapses in the brain and the intrinsic properties neurons possess. However, synaptic transmission is not only diverse but also dynamic. It is critically important to understand the basic mechanisms that underlie transmission at central synapses and how synaptic connections and strengths change during normal function and development.

This course will focus on several important topics relating to synaptic transmission that have been under intensive investigation in recent years. They include 6 broad topics: synaptic vesicle release mechanisms, transmitter corelease, transmitter clearance and glial transmitters, retrograde signalling, short-term synaptic plasticity, long-term synaptic plasticity.

## Learning objectives

To achieve knowledge and understanding of

- How neurotransmitters are released at chemical synapses.
- How transmitters act on their pre- and postsynaptic targets to generate fast electrical signals.
- How synaptic strength changes with neuronal activity and during development.

## List of contributing staff and their contact details

Module organizer: Dr Wen-Chang Li (WCL) ([wl21@st-andrews.ac.uk](mailto:w121@st-andrews.ac.uk))  
Other contributors: Dr Stefan Pulver (SRP) ([sp96@st-andrews.ac.uk](mailto:sp96@st-andrews.ac.uk))  
Dr Gareth Miles (GBM) ([gbm4@st-andrews.ac.uk](mailto:gbm4@st-andrews.ac.uk))

## Reading material

### Books:

1. Proteins, transmitters, and synapses / David G. Nicholls. Oxford; Boston: Blackwell Scientific Publications, 1994. (10 copies)
2. Principles of neural science / edited by Eric R.Kandel, James H.Schwartz and Thomas M.Jessell. Norwalk, Conn.: Prentice-Hall, 1991. (5<sup>th</sup> ed, 8 copies and electronic; 4<sup>th</sup> ed, 7 copy; 3<sup>rd</sup> ed, 5 copies; 2<sup>nd</sup> ed, 2 copies; 1<sup>st</sup> ed, 2 copies)

### Reviews and Papers:

The majority of the key papers relevant to a particular topic will be made available to coincide with a particular class; PDFs will be downloadable from MMS and/or will be made available in hard copy in the classroom. You are expected to read this material.

### **Assessment:**

- A. CA =40%, CA will include: paper commentaries from non-speakers (~ 200 words: Your own bullet point style abstract, highlight the points you deem most important or interesting in **bold** text, raise 1-3 questions or discussion points, 20%); 2 lab write-ups (requirements will be outlined by the lecturers in the lab, 2 x10%).
- B. 2-hour exam = 60% (2 essays from the choice of 4).

## Class timetable and brief overview content

There will be a mixture of lectures, student presentations and discussion sessions. Lectures on the topic background will be given on Fridays (12-1pm). Students will have one week to prepare their presentation on 1 paper on the following Wednesdays (11-12:30 pm). Lectures and student presentations will take place in the Bute Room C28 unless informed otherwise.

The students who are not going to give presentations on a certain week will need to write a brief commentary on the papers (see CA) and have it sent to the responsible lecturer one day before the presentation. In the course of the module you will be involved in two labs (11am-2pm). This will generate some anatomical and physiological data which you will then analyze and write reports upon. The deadline for lab report submission is three weeks after the labs.

Week start date	Dates	Time	Place	Topic	Staff
1 23 <sup>rd</sup> , Jan	27 <sup>th</sup> Jan	12 -1 pm	Bute C28	Introduction lecture, Presentation Assignment	WCL
	3 <sup>rd</sup> Feb	12 -1 pm	Bute C28	Vesicle release	WCL
2 30 <sup>th</sup> , Jan	8 <sup>th</sup> Feb	11am-12:30pm	Bute C28	Student presentation	WCL
	10 <sup>th</sup> Feb	12 -1 pm	Bute C28	Transmitter corelease	WCL
3 6 <sup>th</sup> , Feb	15 <sup>th</sup> Feb	11am-12:30pm	Bute C28	Student presentation	WCL
	17 <sup>th</sup> Feb	12-1 pm	Bute C28	Retrograde signalling	SRP
4 13 <sup>th</sup> , Feb	22 <sup>nd</sup> Feb	11am-12:30 pm	Bute C28	Student presentations	SRP
	24 <sup>th</sup> Feb	x	x	x	x
5 20 <sup>th</sup> , Feb	1 <sup>st</sup> Mar	11am -2:00 pm	Bute C28	Lab work: Synaptic morphology	WCL/ SRP
	3 <sup>rd</sup> Mar	12 -1 pm	Bute C28	Short-term plasticity	WCL
6 27 <sup>th</sup> , Feb	8 <sup>th</sup> Mar	11am-12:30 pm	Bute C28	Student presentations	WCL
	10 <sup>th</sup> Mar	x	x	x	x
x	x	x	x	Spring holiday	x
7 6 <sup>th</sup> , Mar	29 <sup>th</sup> Mar	x	x	x	x
	31 <sup>st</sup> Mar	12 -1 pm	Bute C28	Long-term plasticity	WCL
8 27 <sup>th</sup> , Mar	5 <sup>th</sup> Apr	11am-12:30 pm	Bute C28	Student presentations	WCL
	7 <sup>th</sup> Apr	x	x	x	x
9 3 <sup>rd</sup> , Apr	12 <sup>th</sup> Apr	11am-2:00 pm	Bute C28	Lab work: plasticity	WCL
	14 <sup>th</sup> Apr	12 -1 pm	Bute C28	Transmitter Clearance	GBM
10 10 <sup>th</sup> , Apr	19 <sup>th</sup> Apr	11am-12:30 pm	Bute C28	Student presentations	GBM
	21 <sup>st</sup> Apr	x	x	x	x
11 17 <sup>th</sup> , Apr				revision	
12-13	TBA			exam	

### Student presentations

Two students will present one paper each on Wednesdays. The presentation will be about 30 minutes in length and there will be 15 minutes for questions and discussions. It's important to give clear and easily understandable presentations although they are not marked. Although speakers may use slightly different styles to deliver PowerPoint presentations, here are some tips that may help you generally:

- Keep your presentation structure clear. Each presentation should include introduction, methods, results and conclusion. Key papers will be provided following the introduction lecture on each topic. A good introduction on background (i.e. topic, preparation, method) can save you a lot of explanation later. Materials from other papers or books can be used for the introduction. When there are big sections or blocks in your talk, try to use the same structure slide between sections to help audience understand how far the talk has proceeded.
- Keep it simple. Use phrases instead of sentences wherever possible. The fonts should be big enough for audience at the back of the room. Try to just focus on only one or two bits of key information on each slide (e.g. splitting big figures by panels and making the image large enough that everyone can see it). Make good use of colours to make the contents stand out from background. Animations can help you lead the audience's attention but try to keep it basic and not over use them.
- Keep eye contact with your audience. The slides can help you remember what you should say next and show complicated graphs but you should present them as if you are talking to the audience. Do not just read the slides or your scripts.
- Practise your timing. Overhauling talks normally don't go well.

### Grade Descriptors

See SH handbook for 20 point scale conversion

Allowed grades	Descriptor
FAIL	Not University standard
0	No biological content at all.
1	Contains biological content, but either completely irrelevant, or completely wrong, or completely trivial.
3	Contains some relevant correct material, but not of university standard. Either extremely superficial throughout, or, where not superficial, wrong on the key points in the topic. Or makes only a small number of valid points, and misses out the key issues.
Pass, Ordinary	Not Honours standard
5, 7	Does not correctly utilise Honours-level material. Either too superficial, or omits to mention several issues of fundamental importance, or has major conceptual errors regarding those issues.
3 <sup>rd</sup> Class	Minimal Honours standard
9, 10	Some of the basic issues have been addressed, but there are important errors or omissions. There is little factual information and few relevant examples. The organisation is poor.
Lower 2 <sup>nd</sup> Class	Adequate Honours standard.
11, 12, 13	The answer shows a limited understanding of the issues without great depth. The arguments may be rather weakly articulated, with poor use of examples
Upper 2 <sup>nd</sup> Class	Good Honours standard.
14, 15, 16	The answer displays a reasonable understanding of the main relevant issues. There are no major conceptual errors regarding the most important aspects of the topic, but there may be minor errors. The essay is generally well written and comprehensible.
1 <sup>st</sup> Class	Very good to excellent Honours standard
17, 18	A good understanding of the major issues, with a clear, well-informed and well-structured argument around the topic. There is an appropriate mix of theory and evidence.
19, 20	As 17-18, except there is additional clear evidence that the student has valuable originality in perspective or exceptional depth of understanding, and/or has integrated appropriate material in addition to that presented by the question setter in the taught module.

**Specific School regulations** relating to absence reporting, penalties and rules for late submission of work, extensions for coursework, academic misconduct policy and Academic Alert can be found in the School of Psychology and Neuroscience Honours Handbook.

DRAFT