Neurofunctional Techniques

Lesson 9

30 October 2026

Paper presentation

Calendar

- W 30 Sept: Course introduction (14-16)
- F 2 Oct: Review neurophysiology + Functional imaging (14-18)
- F 23 Oct: Functional imaging + introduction to paper presentation (14-18)
- W 28 Oct: Functional imaging (14-16)
- F 30 Oct: Introduction to paper presentations (14-18)
- W 4 Nov: Modeling + paper assignment (14-16)
- F 6 Nov: Molecular tools + optogenetics (14-18)
- F 13 Nov: X-genetics + paper discussion (14-18)
- F 20 Nov: Laboratory (14-18)
- F 27 Nov: Paper presentation (12-16, to be confirmed)
- F 4 Dec: Paper presentation (14-18)
- W 9 Dic: Prof. Agenor Limon (09-11)
- T 10 Dic: Prof. Agenor Limon (09-11)
- F 11 Dec: Paper presentation (14-18)
- Tue 15 Dec: Test (14-16)
- Fri 18 Dec: ----

What we want to achieve today

01 Understand the main scientific question

02 Choose a paper and form a working group

03 Identify the logic of one key experiment

04 Identify unresolved questions for further discussion

How does the brain select, store, and retrieve a particular memory?

A working definition: memory engram

A population of neurons that undergoes lasting changes during learning and contributes to the storage consolidation and retrieval of a specific memory.

Three papers, three scientific questions

MOCLE et al.

ALLOCATION

Why do some neurons become part of a memory engram?

RAMSARAN et al.

DEVELOPMENT

How do engram mechanisms change as the brain matures?

ROY et al.

RETRIEVAL

Which neuronal populations and circuits support memory retrieval?

Methods: the minimum you need today

We will study these techniques in more depth later.

01 Activity-dependent tagging

Label neurons activated during a particular experience.

02 *In vivo* calcium imaging

Monitor neuronal population activity in living animals during learning or recall.

03 Optogenetics / chemogenetics

Activate or inhibit selected neurons to test their causal contribution.

04 Behaviour

Measure learning, memory and recall to link neuronal activity to function.

Experimental evidence for memory engram

1 CORRELATION

Relationship

Example:

Neurons active during learning are reactivated during memory recall.

2 BLOCKADE

Necessity

Example:

Silencing tagged neurons impairs memory retrieval.

3 MIMICRY

Sufficiency

Example:

Activating tagged neurons evokes memory-related behaviour.

Choose your paper and form groups

1. Choose your preferred paper: Mocle / Ramsaran / Roy
2. Open the paper and select one figure to discuss

Group task: investigate your paper

25 minutes • Work together; do not try to understand every figure.

1. **What is the main scientific question?**
2. **Choose one important figure: What did the authors test, how did they test it, what did they conclude?**
3. **What is unclear or difficult to understand?**

Report back: three things from each group

~5 minutes per group

ONE SENTENCE

State the scientific question.

ONE EXPERIMENT

Explain what was tested and how.

ONE QUESTION

What is difficult to understand.