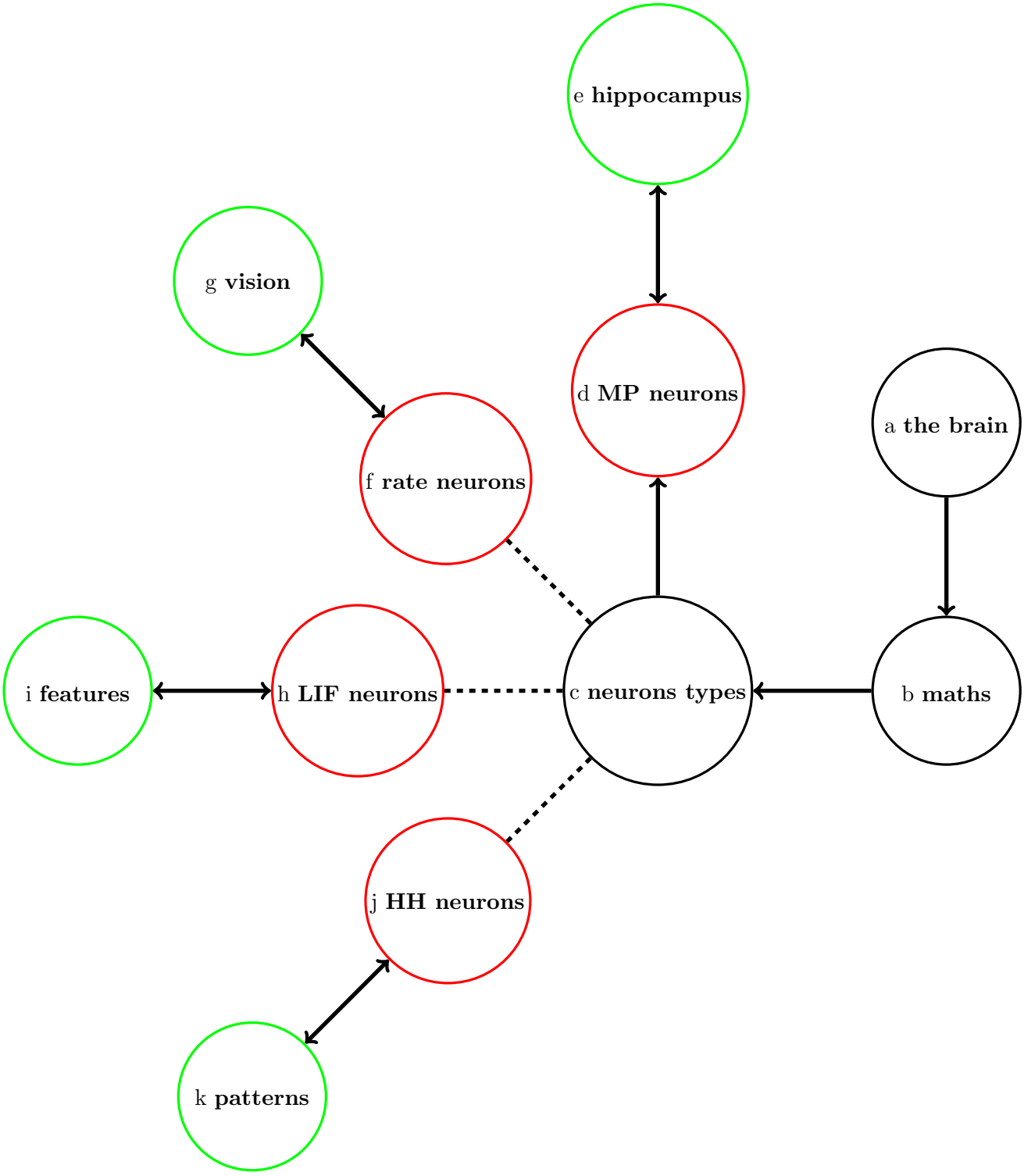
Course plan


e hippocampus
g vision
d MP neurons
a the brain
f rate neurons
i features
h LIF neurons
c neurons types
b maths
j HH neurons
k patterns

Key to the plan

(a) **the brain:** A quick and easy outline introduction to the brain and neuroscience.

(b) **some math:** An introduction to differential equations and their numerical solution.

(c) **neuron types:** An overview of neuronal modelling.

(d) **MP neurons:** The McCulloch-Pitts model of neurons, simple synapses.

(e) **hippocampus:** Description of the hippocampus and auto-associative memory computations.

(f) **rate neurons:** The rate model of neurons, including receptive fields.

(g) **vision:** The visual pathway; V1, receptive fields in V1 and sparse coding.

(h) **LIF neurons:** Spiking, spike triggered averages and time histograms, the leaky integrate and fire neuron.

(i) **features:** Spike timing dependent plasticity and feature extraction.

(j) **HH neurons:** Ion channels and Hodgkin-Huxley neurons; Morris-Lecar and other models.

(k) **patterns:** Some ideas from dynamical systems, central pattern generators.

Lecture list

1. Introduction to the course and to the brain. (a 28-01)
2. More on the brain. (a 30-01)
3. Still more on the brain. (a 04-02)
4. Introduction to differential equations. (b 06-02)
5. Numerical solutions to differential equations. (b 11-02)
6. Modelling neurons. (c 13-02)
7. The McCulloch-Pitts neuron, Perceptrons, and Hopfield networks. (d 18-02)
8. The Hippocampus. (e 20-02)
9. Models of hippocampal computations: Pattern separation, pattern completion, and path integration. (e 25-02)
10. Firing rates, dealing with neuronal data, receptive fields. (f 27-02)

    [Reading week]

11. The visual system. (g 10-03)

12. V1 and sparse coding. (g 12-03)
13. Spikes and analysing spike date. (h 17-03)
14. Leaky integrate and fire model neurons. F–I curves (h 19-03)
15. Synapses and synaptic plasticity. (i 24-03)
16. Short-term synaptic plasticity (i 26-03)

    [Easter break, 3 weeks]

17. Long term synaptic plasticity. (i 21-04)
18. Q+A session with lecturers (23-04)
19. Ion channels. (j 28-04)
20. The Hodgkin-Huxley equation and spikes. (j/k 30-04)

Taught last year but likely to be dropped this year to allow for revision week:

1. Dynamical systems approaches, the Morris-Lecar model, phase diagrams. (k)
2. Central pattern generators, bursting. (k)