

## Computational Neuroscience: Neural Dynamics

### Exercise 3, hand in by November 11, 2021

Read Chapter 1 “Neural Dynamics” by Gregor Schöner, Hendrik Reimann, and Jonas Lins from the book “Dynamic thinking” (G Schöner, J Spencer and the DFT Research Group, Oxford University Press, 2016) (downloadable under background reading on the course webpage).

Answer the following questions in writing. Use illustrations and/or mathematical formulae, but also provide text in complete sentences! Refer to figures in your text and make sure you cite correctly.

1. Go through the Einstein argument at the beginning of the chapter. Without the  $-u$ -term, the variance of the level of activation increases in time. Formulate in your own words, why the  $-u$  term limits that increase. For illustration, you may take Figure 1.8 of the chapter and expand it, annotate it, explain it.
2. Figure 1.12 illustrates how activation evolves when an input (a “stimulus”) is presented to the single neuron.
  - (a) Discuss and illustrate what happens when the input is removed again.
  - (b) Think through the role played by the duration over which a stimulus is presented. Is there a minimum length of presentation needed to get any positive activation? Illustrate.

[Note: You may use the web-based simulator at [https://dynamicfieldtheory.org/examples/two\\_neurons.html](https://dynamicfieldtheory.org/examples/two_neurons.html) to form an intuition for these questions). ]

3. Perform Exercise 2 a and b of the Chapter with the web-based simulator (see above). Report the parameter values you chose, how you changed parameters to perform the demonstrations, and describe in a paragraph what you observed.
4. Perform Exercise 3 a and b of the Chapter in the same way and report in the same way.