Evolution of Neural Computation
Alessandro Treves, SISSA office 241, ale@sissa.it, http://people.sissa.it/~ale/

Rolls and Treves, Neural Networks and Brain Function, Oxford UP, 1998 (R&T) can serve as a reference text, even if now 20 years old – the relevant chapters are indicated, together with some of the milestone papers.

Thursday Nov 9: 9:00-11:00
1a: What are we after in the course?
1b: Pyramidal cells (& EUGenIO maybe)

Monday Nov 13, 9:00-11:00
2a: Chemical computation – neuromodulators. K Doya (2002) Simple models of
2b: reinforcement learning, then applied to human fMRI experiments. R&T Ch 5

Tuesday Nov 14, 9:00-11:00
3a: Elements of information theory. R&T App 2
3b: Geometrical computation – early vision in flies, in fish and in mammals
   JJ Atick, ecological theory of sensory processing, Network 3:213 (1992)

Thursday Nov 16, 9:00-11:00
4a: virtual guest lecturer Elena Marchiori – Perceptrons and back-propagation. R&T Ch 5
4b: Creative geometry in the basal ganglia and in the cerebellum. R&T Ch 9

--- phase transition into cortical systems

Thursday Nov 23, 9:00-11:00
5a: Cortical ingredients for models of associative learning – the Hopfield model. R&T Ch 1-3
5b: Simple associative nets in olfactory cortex, amygdala and orbitofrontal cortex. R&T Ch 7

Tuesday Nov 28, 9:00-11:00
6a: Competitive nets – & EUGenIO – extended to the self-organization of cortical maps. R&T Ch 4
6b: Lamination and arealization in sensory cortex. R&T Ch 8

Thursday Nov 30, 9:00-11:00
7a: Pure memory in the mammalian hippocampus – David Marr and beyond. R&T Ch 6
7b: The statistical physics of spatial maps, in flat and curved spaces.
   The legacy of David Marr, Oxford University Press (2017)

Tuesday Dec 5, 9:00-11:00
8a: Random number generators in the Dentate Gyrus, and neurogenesis
8b: slides by Sophie & Karel – analyzing charts and their transitions

Thursday Dec 7, 9:00-11:00
9a: Memory from statics to dynamics, from semantics to grammar
9b: Issues at the interface to higher cognition – the space of vowels

Wednesday Dec 13, 9:00-11:00
10a: Self-review in the format of an assessment, with multiple choice questions
10b: Collective assessment review and discussion of some controversial issues

\[ \delta = r(t) + \gamma V(t+1) - V(t) \]

\[ H = -\frac{1}{2N} \sum J_{ij} S_i S_j \]