

“Cellulær neurofysiologi - Ionekanaler og membraneksitabilitet” BMED358

“Cellular neurophysiology - Ion channels and membrane excitability” BMED358

Teachers:

Prof. Espen Hartveit

Prof. Meg Veruki

Practical information:

1. Lectures will be held in the "Grupperom 7" (143F; Dept. Biomedicine; level 3).

2. Laboratory sessions will be held as indicated below. On any given day, we typically start at 12.00 and continue until finished, but no longer than 16.00 (lunch 11-12). Details on time and location might change, depending on the final number of students. Stay tuned.

3. For the lectures, it is strongly recommended that students bring a printout of the presentation. All material will be posted to "Mi Side / My Page". The presentations are considered part of the "pensum" (curriculum). See also "Reading list" below.

Schedule:

Wednesday Jan 22

9.15 - 11.00 "Grupperom 7 (143F)"

Opening remarks, basics of how course will be run, schedule, handouts.

Introduction (1) to patch clamp techniques, ion channels and cell signaling.

Wednesday Jan 29

9.15 - 11.00 "Grupperom 7 (143F)"

Introduction (2) to patch clamp techniques, ion channels and cell signaling.

Wednesday Feb 5

9.15 - 11.00 "Grupperom 7 (143F)"

Introduction (3) to patch clamp techniques, ion channels and cell signaling.

Data acquisition software: PatchMaster.

Introduction to data analysis (IGOR Pro, curve fitting).

12.15 -> Room 6B144A (laboratory E. Hartveit / M. Veruki)

Acquire data with PatchMaster and model cells.

Wednesday Feb 12

9.15 - 11 "Grupperom 7"

Introduction to data analysis (IGOR Pro, curve fitting).

Overview of equipment for patch-clamp electrophysiology (amplifiers, microscopes, cameras, computers, pipettes, etc.).

12.15 -> PC-room or room 6B144A (laboratory E. Hartveit / M. Veruki), will be announced!

Analysis of data from model cells in IGOR Pro.

Wednesday Feb 19

9.15 - 11 "Grupperom 7"

Overview of equipment for patch-clamp electrophysiology (amplifiers, microscopes, cameras, computers, pipettes, etc.).

Excitability and ion channels.

12.15 -> Room 6B144A (laboratory E. Hartveit & M. L. Veruki)

Patch-clamp recording from an *in vitro* slice preparation (or equivalent, depending on the background of the students attending the course).

Other important dates:

Wednesday Feb 26

Lab. protocol (report) must be submitted (preferably electronically as a PDF file on "Mi side / My Page"). Further instructions will be given during the course.

Wednesday Mar 05

Lab. protocol (report) will be returned (pick up at "Studie!").

Questions for Home Exam will be published on "Mi Side / My Page" (12.00).

Wednesday Mar 12

Home Exam must be submitted (electronically on "Mi Side / My Page", preferably as PDF).

(Submission can take place any time after Mar 05, 12.00).

Deadline for submission: 12.00! (Mar 12)

Reading list:

1) *Lecture presentations (PDF files, will be uploaded to "Mi Side / My Page")*

All presentations used for the lectures will be posted to "Mi Side / My Page" as PDF files. The presentations are considered part of the "pensum" (curriculum).

2) *Articles (PDF files, will be uploaded to "Mi Side / My Page")*

Hamill, O.P., Marty, A., Neher, E., Sakmann, B. & Sigworth, F.J. (1981) Improved patch-clamp techniques for high-resolution current recording from cells and cell-free membrane patches. *Pflügers Arch* **391**, 85-100.

Neher, E. (1992) Ion channels for communication between and within cells (NOBEL Lecture). *EMBO J* **11**, 1673-1679.

Sakmann, B. (1992) Elementary steps in synaptic transmission revealed by currents through single ion channels (NOBEL Lecture). *EMBO J* **11**, 2003-2016.

Stuart, G.J., Dodt, H.-U. & Sakmann, B. (1993) Patch-clamp recordings from the soma and dendrites of neurons in brain slices using infrared video microscopy. *Pflügers Arch* **423**, 511-518.

Margrie, T.W., Brecht, M. & Sakmann, B. (2002) In vivo, low-resistance, whole-cell recordings from neurons in the anaesthetized and awake mammalian brain. *Pflügers Arch* **444**, 491-498.

Sakmann, B. (2006) Patch pipettes are more useful than initially thought: simultaneous pre- and postsynaptic recording from mammalian CNS synapses in vitro and in vivo. *Pflügers Arch* **453**, 249-259.

Barbour, B. (2011) Electronics for electrophysiologists (http://www.biologie.ens.fr/~barbour/electronics_for_electrophysiologists.pdf).

3) *Recommended textbook*

Molleman: "Patch Clamping: An Introductory Guide to Patch Clamp Electrophysiology", 2002.

Background literature:

1) *General*

Aidley: "The Physiology of Excitable Cells", 4th ed. 1998.

Boron & Boulpaep: "Medical Physiology", 2nd ed. 2009.

Fain: "Molecular and Cellular Physiology of Neurons", 1999.

Hammond: "Cellular and Molecular Neurobiology", 3rd ed. 2008.

Johnston & Wu: "Foundations of Cellular Neurophysiology", 1995.

Kandel, Schwartz & Jessell: "Principles of Neural Science", 5th ed. 2012.

Matthews: "Cellular Physiology of Nerve and Muscle", 4th ed. 2003.

Nicholls, Martin, Wallace & Fuchs: "From Neuron to Brain", 5th ed. 2012.

2) *Books on ion channels and excitability*

Aidley & Stanfield: "Ion Channels - Molecules in Action", 1996.

Ascroft: "Ion Channels and Disease", 2000.

Hille: "Ion Channels of Excitable Membranes", 3rd ed. 2001.

Sakmann & Neher: "Single-Channel Recording", 2nd ed. 1995.

Sterratt et al.: "Principles of Computational Modelling in Neuroscience", 2011.

3) Practical analysis

Bretschneider & de Weille: "Introduction to Electrophysiological Methods and Instrumentation", 2006.

Dempster: "Computer Analysis of Electrophysiological Signals", 1993.

Dempster: "The Laboratory Computer - A Practical Guide for Physiologists and Neuroscientists", 2001.

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