



EUROPEAN UNION
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Operational Programme Research,
Development and Education



Zdroj: <https://predmety.fbmi.cvut.cz/cs/doktorske-bme>

Name of study subject: **Genesis and properties of biological signals**

Brief annotation of the subject:

The course deals with the genesis, recording, description and processing of most biological signals of electrical and non-electrical nature. The principles of signal genesis, the effects of the state of the organism on their characteristics and the pathological changes are studied. The properties required for their further processing are also studied. The most common methods for preprocessing, analysis and evaluation are presented for each type of biosignal. Interconnections between the signals are also studied. The course also covers the signals that are not commonly clinically used but are currently subject of research.

Brief Syllabus of Lectures:

1. Biopotentials, stimulation and evoked biosignals, division, parameters, recording, artifacts.
2. Electroneurogram, SNAP, M-wave, H-reflex, F-reflex.
3. Biosignals of skeletal muscles, EMG, MMG, tendon reflexes.
4. Vector of cardiac muscle depolarization. ECG leads.
5. Genesis of the ECG curve, relationship of ECG curve shape with alteration of cardiac muscle depolarization.
6. Vector-cardiography, isopotential mapping. Non-electrical manifestations of cardiac activity (introduction).
7. Phonocardiography, sphygmography, apex cardiography, MCG, polygraphic methods in cardiology.
8. Electrical activity of the brain, brain signal genesis, electrodes and leads for EEG.
9. Characteristic EEG rhythms, EEG system, evoked EEG, MEG.
10. Polysomnography. Genesis of signals in the eye, electroretinogram, electrooculography.
11. Genesis of auditory signals, audiometry, impedance audiometry, ERA, BERA.
12. Vestibular system signals, nystagmus, biosignals in obstetrics, rheological methods.
13. Biosignals of other organs and systems (gastrointestinal tract, cardiotocography, fetal ECG, etc.). Context with assessment of the state of the organism.
14. Experimental scanning of biosignals, use of imaging methods for derivation of biosignals (CT, EIT, etc.), non-traditional biosignals.

Required

1. Bronzino J. D., Peterson D. R., editors: Biomedical signals, imaging, and informatics. CRC Press, 2014, ISBN 978-1138748118.
2. Kolekar, M. H., Kumar, V.: Biomedical Signal and Image Processing in Patient Care. IGI Global, 2017, ISBN 978-1522528302.

Recommended

1. Blinowska, K. J., Zygierewicz, J.: Practical Biomedical Signal Analysis Using MATLAB®. CRC Press, 2011, ISBN 978-1439812037.
2. Akay, M.: Detection and Estimation Methods for Biomedical Signals. New York: Academic Press, 1996, ISBN 978-0120471430.