

Lecture 1. Introduction to “Omics” technologies.

Learning outcomes:

1. Explain, how you understand the term "Omics" technologies? Give the definition of this term.
2. Describe the main Omics technologies, their methods and the connections between them.
3. Describe the application of Omics technologies in medicine and pharmacy, their perspectives in the Future.

The branches of science known informally as **omics** are various disciplines in biology whose names end in the suffix -omics, such as genomics, proteomics, metabolomics, metagenomics and transcriptomics. Omics aims at the collective characterization and quantification of pools of biological molecules that translate into the structure, function, and dynamics of an organism or organisms.

The related suffix **-ome** is used to address the objects of study of such fields, such as the genome, proteome or metabolome respectively. The suffix -ome as used in molecular biology refers to a **totality** of some sort; it is an example of a "neo-suffix" formed by abstraction from various Greek terms in $-\omega\mu\alpha$, a sequence that does not form an identifiable suffix in Greek. For example, **genomics** is the study of the **genomes** of living organisms; **transcriptomics** is the study of **transcriptomes** (the sets of all RNA molecules, including mRNA, rRNA, tRNA, and other non-coding RNA, produced in one or a population of cells), their structures and functions; **proteomics** is the large-scale study of **proteins**, particularly their structures and functions;; **glycomics** is the comprehensive study of the glycome i.e. sugars and carbohydrates; **lipidomics** is the large-scale study of pathways and networks of lipids; **interactomics** study is clearly recognisable as relating to large-scale analyses of gene-gene, protein-protein, or protein-ligand **interactions**; **metabolomics** is the scientific study of chemical processes involving **metabolites** and etc. These disciplines use methods of molecular biology, biochemistry and biotechnology such as sequencing of nucleic acids and proteins, bioinformatical methods, polymerase chain reaction (PCR), different types of chromatography and mass-spectrometry, genetic engineering, cell cultures and etc. The main achievement of Omics technologies was the sequencing of **human genome** that opened the way for **personalized medicine** in the Future.

The questions for self - control:

1. What is the meaning of the term “omics” and the suffix “-ome”?
2. List and describe the main Omics technologies, their objects and methods of study.
3. The application of Omics technologies in medicine and pharmacy.

Recommended readings:

1. Barh D., Blum K., Madigan M.A. OMICS. Biomedical Perspectives and Applications / 2012 by Taylor & Francis Group, LLC. – 516 p.
2. Holtorf, Hauke; Guitton, Marie-Christine; Reski, Ralf (2002). "Plant functional genomics". *Naturwissenschaften*. 89 (6): 235–249. Bibcode:2002NW.....89..235H. doi:10.1007/s00114-002-0321-3. PMID 12146788. S2CID 7768096.
3. O'Connell, Mary J.; McNally, Alan; McInerney, James O. (2017-03-28). "Why prokaryotes have pangenomes" (PDF). *Nature Microbiology*. 2 (4): 17040. doi:10.1038/nmicrobiol.2017.40. ISSN 2058-5276. PMID 28350002. S2CID 19612970.
4. Tashiro, Satoshi; Lanctôt, Christian (2015-03-04). "The International Nucleome Consortium". *Nucleus*. 6 (2): 89–92. doi:10.1080/19491034.2015.1022703. PMC 4615172. PMID 25738524.
5. Cremer, Thomas; Cremer, Marion; Hübner, Barbara; Strickfaden, Hilmar; Smeets, Daniel; Popken, Jens; Sterr, Michael; Markaki, Yolanda; Rippe, Karsten (2015-10-07). "The 4D nucleome: Evidence for a dynamic nuclear landscape based on co-aligned active and inactive nuclear compartments". *FEBS Letters*. 589 (20PartA): 2931–2943. doi:10.1016/j.febslet.2015.05.037. ISSN 1873-3468. PMID 26028501. S2CID 10254118.