

<http://dx.doi.org/10.7124/bc.000AF9>

Top 30 enriched biological processes in placenta between first and second trimesters of physiological pregnancy

R.I. Dzhikirba¹, M.Yu. Obolenskaya²

¹ National Technical University of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute”
37, Beresteyskiy Ave., Kyiv, Ukraine, 03056

² Institute of Molecular Biology and Genetics, NAS of Ukraine
150, Akademika Zabolotnoho Str., Kyiv, Ukraine, 03143
dzhikirba.roman.bioi@gmail.com

Background/Aim. The placenta is a vital organ connecting mother and fetus, crucial for fetal development and maternal adaptation. Dysregulation can lead to the pregnancy complications, yet understanding of gene expression changes during normal pregnancy is limited. This study examines the 30 most statistically significant biological processes in which genes show coordinated and most pronounced changes in expression in the placenta between the I and II trimester of physiological pregnancy. **Methods.** The data from the open databases GEO and ArrayExpress is kindly provided by O.K. Lykhenko (IMBG NASU) in the form of a matrix with normalized values of annotated gene expression after batch effect removal. After that, the differential gene expression analysis was performed on these data using limma R library. Gene set enrichment analysis (GSEA) method available in the clusterProfiler R library was used to determine the biological pathways that contain certain sets of DEGs. The enrichment map and the clustered one were generated to demonstrate relationships between the enriched biological processes based on shared DEGs. **Results.** As a result of the analysis, 7 clusters were identified, which unite biological processes, genes of which most significantly show differential gene expression between the II and I trimesters of pregnancy. 1. Activation of cells participating in the immune response characterizes the processes involved in changes in the morphology and behavior of leukocytes and lymphocytes (B- and T-cells) under the influence of various stimuli that lead to the ini-

tiation or preservation of the immune response. 2. The adaptive immune response describes the processes associated with the functioning of the adaptive immune response based on the somatic recombination of immune receptors in T and B cells and the formation of immunological memory. 3. Negative regulation of leukocyte cell activation cluster involves processes that downregulate or halt leukocyte activation, maintaining immune homeostasis and fetal tolerance. 4. Regulation of lymphocyte proliferation cluster Controls lymphocyte multiplication, essential for immune regulation. 5. Cellular response to the molecules of bacterial origin describes the processes of cell response to various molecules of bacterial origin to fight them. 6. Inflammatory migration of leukocytes cluster regulates the movement of leukocytes in immune response. 7. The membrane organelle fusion cluster involves fusion processes critical for maintaining the structural integrity of the placenta. **Conclusions.** The transition from the first to the second trimester is characterized by dynamic immune tolerance, balancing immune activation and deactivation to protect the fetus and maintain a healthy placental environment. The study’s findings highlight the key genes and pathways that influence placental function and fetal development, particularly in early pregnancy stages where complications often arise.

Keywords: pregnancy complications, differential gene expression, gen-set enrichment analysis, placenta, enriched biological pathways.