

Walking through old routes to reach new destinations: unraveling the origin of the mammary gland

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The mammary gland is closely related to the evolutionary success of Mammals. It is responsible for pup's nutrition and immunity at the beginning of pup's life, which gives it advantage in the fight for survival. However, despite the significance of the mammary gland to Mammals, the understanding about the molecular mechanisms which control the development of this organ is incipient. And, regarding to its origin and evolution, the lack is still bigger. Thus, the aim of this work was to estimate the origin of the genes involved in the development of the mammary gland and, then, estimate the origin of the mammary gland. Therefore, the first step consisted in collecting information on the relevant genes (and the interactions between them), through text-mining tools, and assembling a pathway diagram and a description for each phase of the mammary gland development (embryonic development, puberty, pregnancy & lactation and involution). Subsequently, the origin of each gene was estimated by determining the lowest common ancestor of the organisms containing copies of each gene, discovered with homology-clustering tools. The origin of the system was inferred based on the origin of the genes. Four pathways were generated in this work, one for each stage of mammary gland development, and they are accompanied by their descriptions. In total, 310 genes and 795 biointeractions were found. With respect to evolutionary origin, genes were found to be present since cellular organisms up to Boreoeutheria, and 80-97% of genes were already present in fishes (among Gnathostomata, Teleostomi and Euteleostomi). The comparison between subpathways revealed that embryonic development and puberty involve genes with predicted origin up to Tetrapoda-Amniota, while pregnancy & lactation and involution comprise genes with predicted origin up to Mammalia-Eutheria-Boreoeutheria. A common process along the history of life is co-option, i. e., the recruitment of pre-existing pathways to generate new structures and functions. This seems to be the case of the mammary gland, since the genetic potential to generate this organ had already existed long before the Mammals' origin. That is evolution walking through old routes to reach new destinations.