

Evolution by tumor neofunctionalization and phenomenon of TSEEN genes

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Earlier hypothesis of possible evolutionary role of tumors was formulated. This hypothesis suggests that tumors supply evolving multicellular organisms with extra cell masses for the expression of newly evolving genes. After expression of novel genes in tumors cells, tumors differentiate in new directions and give rise to new cell types, tissues and organs.

In the lecture, the bulk of data supporting the positive evolutionary role of tumors will be reviewed, obtained both in the lab of the author and from the literature sources.

The following issues will be addressed: the widespread occurrence of tumors in multicellular organisms; features of tumors that could be used in evolution; the relationship of tumors to evo-devo; examples of recapitulation of some tumor features in recently evolved organs; the types of tumors that might play the role in evolution; examples of tumors that have played the role in evolution.

The discussion of experimental confirmation of nontrivial predictions of the hypothesis will include the analysis of evolutionary novelty of tumor-specifically expressed EST sequences; *ELFNI-ASI*, a human gene with possible microRNA function expressed predominantly in tumors and originated in primates; *PBOV1*, a human gene of the recent *de novo* origin with predicted highly tumor-specific expression profile; and the evolutionary novelty of human cancer/testis antigen genes.

The conclusion is made that expression of protogenes, evolutionarily young and/or novel genes in tumors might be a new biological phenomenon, a phenomenon of TSEEN (Tumor Specifically Expressed, Evolutionarily New) genes, predicted by the hypothesis of evolution by tumor neofunctionalization.

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