

Structural histology as a basis for 3-D reconstruction of epithelial tissue histoarchitecture

Nadezhda Grefner, Alexey Vorobiyov, Ekatherina Magnitskaya, Gennadiy Savostyanov
Cytology Institute RAS, Tikhoretskij av, 4, 196064 S-Petersburg, Russia
I.M.Sechenov Institute of Evolutionary Physiology and Biochemistry RAS
M.Toresa av.,44, S-Petersburg, Russia
grefner@mail.cytspb.rssi.ru

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Until recently the theory of the biological tissues spatial organization has been underdeveloped for several reasons. First, at present cell and local intracellular processes are the centre of attention while the cellular arrangement is not taken into account. Second, the researchers examine the flat microscopic sections having no idea of three-dimensional tissue organization. Empirical procedure of three-dimensional reconstruction by serial sections gives the cell form image with varied deformations while the tissue as a cell network with the intercellular connections remains unknown.

A new approach to investigation of three-dimensional tissue structure has been put forward. The approach is based on the idea that every tissue is a cellular lattice of modular (or histione) structure. Histiones are elementary morpho-functional tissue units appearing as a result of function separations between the cells. These tissue units present an independent level of biological organization which was unknown before. All the tissues are polymerized histiones, and their structure can be described by the families of 1-, 2-, 3-dimensional models, just like periodical coordination lattices. Their composition and structure is the subject of **STRUCTURAL HISTOLOGY**.

By using theoretical models, the histoarchitecture variants formally unknown have been predicted and found out experimentally. The whole series of epithelium sheets new properties have been displayed, for example, anisotropy, transmission symmetry and slice structure being among them. The complex of new informative characteristics for histoarchitecture description has been obtained.

A special computer program Histoarch has been produced basing on the theory. A series of three-dimensional epithelium sheet models and their sections have been made. At present to reconstruct some tissue organization, several microscopic sections of the investigated tissue are compared with slices collection of the tissue models. Then the most similar model is selected.

The approach presents distinct advantages. First of all, the necessary number of sections is significantly reduced. Then a superposition of sections is not required. As a result the method facilitates a tissue structure reconstruction and raises its resolution. It is important that the different cell arrangements are considered. Besides, the originating models are geometrically regular.

At present we have reconstructed three-dimensional organization of several two-layered covered and sensory epitheliums by means of the above theory.

Structural histology is a prognosis tool for tissue normal development. With the help of a new approach histoarchitecture of pathological neoplasm can be forecasted and the system of early tumor diagnostics can be created as well. The theory presents the necessary prerequisites for regeneration and tissue development regulation.

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