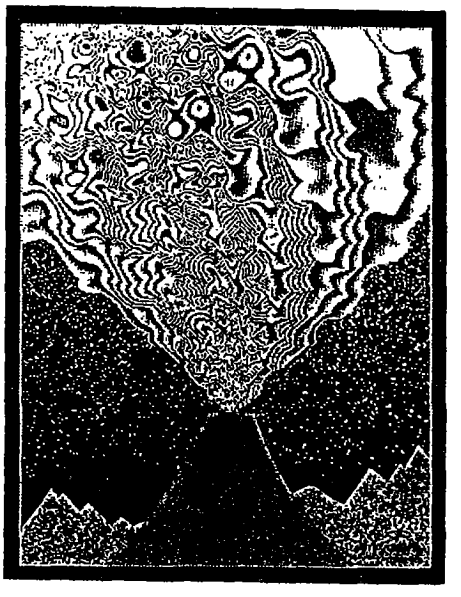
wagging its tail. If the people can understand my feelings in this picture, I may say the ART-4 system is quite good for computer art.

FUNCTIONAL CG-ART

Blue Bird

Dog in Dream



Mt. Fuji in Eruption #3

Few days ago, I sent the same letter by FAX.

Sincerely yours,

M. K. Sasaki

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SYMMETRY OF BIOLOGICAL TISSUES

EXHIBIT (POSTER)

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It is well known that symmetry is typical for numerous objects of various biological organization levels [1]. However, the symmetry of biological tissues is not known as yet. The reason of the situation is connected with the character of main histological method. The essence of the method is to cut and study thin and, practically, 2 - dimensional tissue sections. Both the method and modern formal theory of biological tissues organization [2] give no effective way of revealing the law of 3-D tissues structure and their symmetry. Hence a new approach to the investigation of 3 - dimensional shape and spatial arrangement of cells in epithelial sheets has been developed. As a result it was shown that symmetry is typical for epithelial tissues as well.

The approach is based on an assumption that tissues consist of cell groups rather than cells themselves. These groups result from the division of functions between cells and represent the elementary units of the tissues. Limited conditions for possible kinds of division of functions are found, and the classification of cell groups is proposed as a periodical law [3]. These groups or units represent a missed level of biological organization that is situated between cell and tissue levels. Therefore one may consider tissues as polymeric units.

There is a natural set of rules for 2-D units polymerisation. So the periodic cell mosaics with translational symmetry should be typical to simple cell sheets. According to this hypothesis, the theoretical evidence that as many as 11 topological variants of cell arrangements (cell mosaic patterns) are possible for simple epithelium instead of a single one suggested so far [1, 2], were found [4]. All these mosaics are known in mathematics as Kepler's

regular parquets. They can have "chromatic" variants [4] and are characterised by the translation symmetry and stoichiometry.

Up to now 8 variants of such epithelial mosaics in different animals have been found experimentally [4]. The discovery of others is possible in future. Also, some of them may appear in the future evolution of multi-cell organisms.

Basing on the data we have show that uninterrupted linear transformation of Kepler's parquets enables us to create a family of 3-D models of epithelial sheets [5 - 7]. According to the results both topological and geometrical aspects of 3-D organisation of real stratified and pseudostratified epithelia are studied, using serial sections, and biological reasons of epithelial symmetry are determined. The experimentally obtained data seem to confirm the models and indicate the parameters of the symmetry as a new and worthy markers of tissue structure.

We suggest that the family of models obtained limits the range of epithelial structure variability in onto- and phylogenesis. So the prediction of the tissue development is possible.

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