

# MORPHOGENESIS OF PLANTS AS A DYNAMICAL SYSTEM

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Functional differentiation of cells allows to consider an organism as a family  $F = \{L_a, a \in A\}$  of non-intersecting subsets  $L_a$  which form this organism. Such a structure is called fibre bundle  $F$  with the fibre  $L_a$ . The set  $A$  marks functional specifics of fibres  $L_a$ . We deal with one fibre  $L_{a_0}$ , responsible for reproduction of apical leaves on a plant shoot. We will consider this fibre an independent cell organism interacting with other fibres equally with the environment.

The paper presents arguments which allow to consider the functional organization of fibre  $L_{a_0}$  as a hypercycle [1] stipulating the integrated action and the co-ordinated evolution of self-replicating units (cells) of this fibre. Hypercycle is a ring network of co-operative cyclic catalysis reactions:



The intermediates  $I_k$  of external co-operative hypercycle are internal autocatalytical cycles themselves. Hypercycle can be treated as a dynamical system, i.e. one-dimensional group of transformations  $G^1$  in a phase space of variables  $q^1$  ( $q^1$  being population of cells of  $i$ -th genotype). This dynamical system is not ergodic, and its phase space can be decomposed into invariant tori  $S^1 \times S^1$ . The movement on the torus is marked by angular coordinates  $(\psi, \varphi)$  which have the sense of chemical "movement" along external and internal autocatalytical cycles with frequencies  $\Omega$  and  $\omega$  respectively. Movements along the neighbouring internal cycles have a phase shift. At a certain phase of the  $k$ -th internal cycle, the apical leaf is born as a product of the hypercycle.

The paper analyses possible reflections of manifold events in the phase space of the organism on the three-dimensional Euclidean macroscopic space of an external observer. The parameters of hypercycle which bring the phyllotaxis phenomenon in the external space, have been studied.

1. M.Eigen, P.Schuster. The Hypercycle. Berlin, 1979.