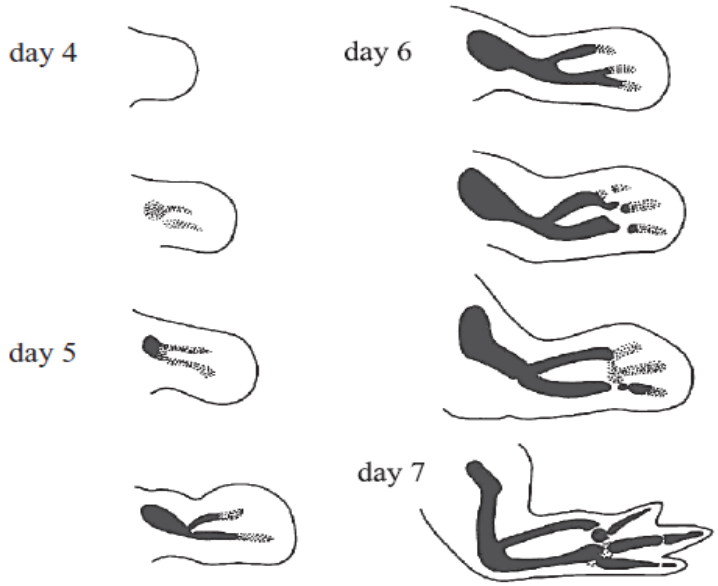
Mathematical and numerical analysis of pattern formation during morphogenesis

Supervisor: Assoc. Prof. **Bogdan Kaźmierczak**, Ph.D., Dr. Habil., contact: bkazmier@ippt.pan.pl

Description:

Morphogenesis is a whole set of different biochemical processes which aim at formation of a living organism from an embryo. It is commenced by an appearence of three different embryonal leaves, from which concrete organs are being created. From the biological point of view, it is extremely interesting, how from a homogeneous mass of non-differentiated cells a complicated organism can be created. A relatively simple example of spatial structures, which appear Turing morphogenesis, are chondrogenetic (bone) patterns. They appear during the limb formation process in vertebrates. Thus, first we have to do with the spatial structure consisting of one bone, then of two bones and then of bigger number of bones. This phenomenon is attempted to be explained by means of the Turing bifurcation, within a system of partial differential equations for the evolution of concentration of so called morphogenes (activator and inhibitor) and the density of mesenchymal cells in different stages of differentiation, the last of which are cartilage cells.



Formation of bones of an avian wing between 4 and 7 day of embronal growth.

References

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