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# Genetic analysis of the cooperation between the *bxd* PRE and the neighboring embryonic enhancers

Viktória Kiss

*Drosophila* Developmental Biology Group, Institute of Genetics, Biológical Research Center of the Hungarian Academy of Sciences, Szeged, Hungary

During embryonic development, proliferating cells are getting committed to different cell fates to create different tissues. This process is regulated by epigenetic factors generating tissue specific gene expression profiles maintained during the life of a cell and transmitted to its descendants by modifications of higher order chromatin structure.

To study the process of epigenetic gene regulation, the homeotic bithorax-complex (BX-C) of Drosophila proved to be an excellent model-system. Subtle alterations of the chromatin structure of BX-C results in easily detectable segmental transformation. The three genes of BX-C are regulated by nine large, segment-specific *cis*-regulatory regions. The appropriate active or inactive conformation of these regulatory regions is maintained by the TRITHORAX or POLYCOMB group of proteins, binding to specific elements in the regulatory regions, called Trithorax- or Polycomb-Response-Elements (TRE or PRE), respectively.

Previously, we have analyzed a chromatin silencer, called PRE, in the *bithoraxoid* (*bxd*) *cis*-regulatory region of the *Ultrabithorax* (*Ubx*) homeotic gene. In the recent work we studied two embryonic enhancers, S1 and S2, straddling the *bxd* PRE. These enhancers have been identified in transgenic assays, but we wanted to reveal their role and the functioning in their natural chromosomal environment. For this purpose, the S1 and S2 enhancers were deleted using an advanced form of gene conversion developed by our group. We analyzed the mutant phenotypes in adults, as well as changes in gene expression patterns using immuno-histochemistry and native GFP fluorescence combined with high resolution confocal microscopy. In addition, we generated several other deletions, which removed additional regulatory elements in the *bxd* region. We found that S1 and S2 have significant roles in the initiation of the *bxd cis*-regulatory region. Our results also suggest that the S2 embryonic enhancer cooperates with the *bxd* PRE, but the mechanism of this cooperation is not fully understood yet. We try to explain the mechanism of this cooperation, hereby to answer how early initiators can affect chromatin structure and functioning of regulatory regions. We hope our experiments will contribute to the understanding of the general and the specific role of enhancer function.

Supervisor: László Sipos
E-mail: vikikiss@brc.hu

# The role of an anionic lipid, the phosphatidylglycerol, in the cyanobacterial cellular processes

Tímea Ottilia Kóbori

Laboratory of Plant Lipid Function and Structure, Institute of Plant biology, Biological Research Centre of Hungarian Academy of Sciences, Szeged, Hungary

Cyanobacteria are Gram negative photosynthetic bacteria.

Phospholipids play important role in the structure of cell membranes and actively participate in different membrane related cellular processes.

Cyanobacterial membranes contain four types of lipids, two neutral and two negatively charged lipid. The phosphatidylglycerol (PG) is the only phospholipid present in the cyanobacteria. It has been demonstrated that the PG plays important role in the structure formation and function of the photosynthetic complexes.

In case of PG deprivation, the *Synechocystis* sp. PCC6803 cells show enlarged cell volume and *Synechococcus* sp. PCC7942 elongated cell size. If the PG is re-added to the cultures, the normal cell morphology is recovered. This might suggest that the lack of PG affects the normal division process of the cyanobacterial cells.

Many cell division proteins have been identified mainly in *Escherichia coli* bacteria. The homologues of these proteins were found in cyanobacteria.

A determining step of bacterial cell division is the polymerization of the tubuline-like FtsZ protein in a ring like structure in the mid-cell region. The localization of the Z-ring is a highly regulated process. The regulation differs in Gram negative and Gram positive bacteria. The cyanobacteria possess proteins characteristic to Gram negative and Gram positive division along with cell division proteins unique to cyanobacteria or higher plant plastids. During the division process, a number of division proteins get in contact with the plasma membrane. Changes in the membrane composition might affect the cell division. Many studies suggest the importance of phospholipids in the division processes. In our studies, we follow the changes in cell division in a phospholipid-lacking live cyanobacterial system.

Supervisors: Bettina Ughy, Zoltán Gombos
E-mail: koboriotti@yahoo.com