Laboratory of Biology of the Cell Nucleus

Cell nucleus, nucleoskeleton, nuclear actin, myosin, microscopy, ultrastructural methods

Pavel Hozák

pavel.hozak@img.cas.cz

In diploid mammalian cells, some $6x10^9$ base pairs of DNA fold as a nucleoprotein complex (i.e. chromatin) into higher-order arrays so as to fit in a nucleus measuring only 10 μm. The nucleus also contains machineries for transcription of genes and processing of RNA products, and for precise DNA replication, repair and recombination. Nuclear interior is therefore functionally highly compartmentalized, and the recent evidence points strongly to structure-related regulation of nuclear functions – however, the mechanisms forming the 3D-structure of the nucleus are still mostly obscure. We therefore employ a multi-disciplinary approach in order to study nuclear functions in relation to the higher-order nuclear structures, e.g. nuclear bodies, the nucleolus, and the nucleoskeleton. Our research concentrates on: (1) the relationship between nuclear compartmentalization and regulation of gene expression, (2) structure, dynamics, and function of the nucleoskeleton, which might direct nuclear compartmentalization, (3) functions of nuclear myosin I and actin in transcription and gene expression, (4) development of new microscopy methods for ultrastructural studies.

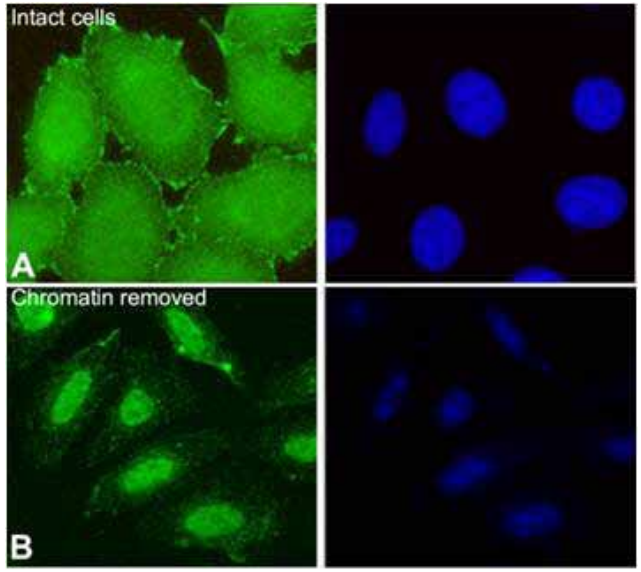

Fig. 1. Vinculin is an actin-binding protein which is considered to be exclusively cytoplasmic. We demonstrate for the first time nuclear localization of vinculin in intact cells (A). The intensity of the signal becomes stronger after the removal of chromatin (B). Green: anti-vinculin antibody; blue: DNA.

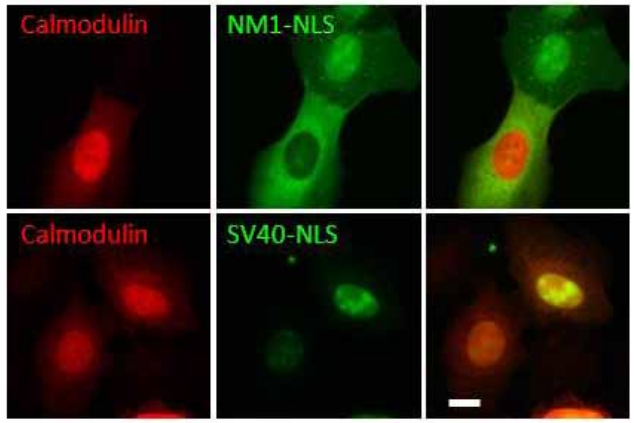

Fig. 2. Nuclear transport mediated by NM1 nuclear localizing signal (NLS) is inhibited by calmodulin. This suggests that NM1 transport to the nucleus might be regulated by calcium levels.

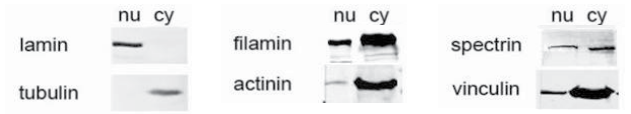

Fig. 3. Various actin-binding proteins were identified in nuclear extracts of Hela cells. Lamin and tubulin antibodies were used for control of purity of nuclear (nu) and cytoplasmic (cy) fractions. This information forms a basis for studying new components of nuclear structures.

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