

# The Effects of Dynamin In The Development of the Cells Function and Structure

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***Dictostelium* dynamin is a protein that in the correct amount or even an over abundance enables the cell to develop correctly and properly. However, a lack in dynamin can and has shown to have adverse affects on the cells development and even some defects in different areas of cellular development. Dynamin has shown to have effects on adhesion, cytoskeleton development, alterations in mitochondrial, nuclear, and endosomal morphology. Further study revealed that dynamin B affects the functionality of the plasma membrane, peroxinsomes, and the contractile vacuole system. Vps1p is a yeast dynamin related protein that is required for normal actin cytoskeleton organization. It is found that the functions of dynamin-related protein and the function of Vps1p in the actin cytoskelton dynamics and the vacuolar protein sorting are related to each other. In the results of the conducted research, we can come to the conclusion that there is a relation between dynamin and the deformation of certain cellular developments. The conclusion can be made that dynamin has a more adverse affect when there is a lack in its presents and no significant changes or deformities in its over abundance.**

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## Introduction

Dynamin is a GTPPhase that is responsible for endocytosis in the eukaryotic cell. Dynamin has shown to have a role in many processes such as cellular division, cytokinesis and pathogen resistance. Initial studies of *D. melanofaster shibire* mutation and mammalian cells showed forms of dynamin and an increase in the presence of invaginations at the plasma membrane [1]. There are still many questions in regard the structure and function of dynamins, especially in the areas of the potential role in the organization of the cytoskeleton and the regulation and upkeep of cell shape [3]. There have been five members of the dynamin family discovered in the eukaryotic cell; dynamin A, dynamin B, dynamin-like protein A, dynamin-like protein B, and dynamin-like protein C. Dynamin-like proteins A,B, and C are very closely related to each other, and look as if they were plant proteins in the sense that they have a role in cytokinesis and chloroplast division [1]. If these dynamins-

like proteins were disrupted there would be result of abnormal cytokinesis. Several studies have established the functionality of dynamin to respond with different actin regulatory factors including profilin and the actin binding protein Abp1. Disruption of dynamin A causes major changes in the morphology and behavior of *D. discoideum* cells. The mutant cells are large and multinucleated and grow more slowly than wild-type cells. Cells lacking a functional copy of dynamin A show a marked reduction in cell polarity, display aberrant motile behavior, and frequently fail to complete cytokinesis [3].

## Recent Progress

*D. discoideum* AX2 cells were used throughout this work, unless otherwise indicated. Cells were grown on plates or in culture flasks stirred at 180 rpm at 21\_C in HL5C media Fatty acids (Sigma-Aldrich) were added to the media from ethanol stocks and mixed by vortexing

followed by ultrasonication for 5 minutes in warm water. Identical concentrations of ethanol (usually less than 0.5%) were added as controls. Multiple microscopy techniques were used to further identify the structural and other mutations or deformations with respect to the amount or type of dynamin present. PCR techniques were used to identify Dynamin A which is the gene encoding dynamin. Both cDna and gDna libraries were used to obtain the full length dynamin A clone. Dynamin B has 2,760 base pairs and does not have any introns. dynamin B has a molar mass of 405.3 kDa, which makes it the largest member of the dynamin family [3]. Dynamin A revealed, in secondary structure studies, which in the region where dynamin A is, is hydrophilic and has a high surface probability. Dynamin B is produced as a preprotein with an abnormally long presequence containing of 136 amino acids, where normal presequence proteins contain 15-50 amino acids [2].

### Discussion

Dynamin A is a representative of the family of dynamin related proteins. With the results we can come to the conclusion that *D. discoideum* protein shares features, like the tripartite GTP-binding motif, the consensus pattern LPRGSGIVTR, and a high degree of sequence identity. Dynamin B is a nuclear-encoded protein, which is synthesized as preprotein in the cytosol, shuttled for processing to mitochondria, and returned in mature form to the cytosol, where it interacts with a distinct subset of organelle membranes, the plasma membrane, and cytoskeletal structures [2]. Regardless of being hypothesized and tested for relation to mitochondria, dynamin B has no substantial or observable affect in division and maintenance of mitochondria. Analysis of dynamin B-depleted cells shows significant changes in the morphology and function of the contractile vacuole system, a highly specialized osmoregulatory organelle, which is driven by actomyosin with respect to the microtubule-associated motors. Increased tubulation of the contractile vacuole system that was observed in dynamin B-deficient cells is also seen with F-actin enrichment at the cell edge and can be a minor effect resulting from changes in actin organization [1]. However, the experiential relationship of dynamin B with contractile vacuole membranes suggests a more direct connection of the protein in the dynamics of the contractile vacuole system. Results show that dynamin B plays still another role as a modulator of cell-surface relations and cytoskeletal dynamics. The observed increase in ability for the more particles and the quicker growth rate displayed by dynamin B cells on bacterial lawns appears to be directly linked to the development of stronger cell-surface points of contact [1]. To gain insight into the cellular function of dynamin A, gene replacement techniques were used to create *D. discoideum* cells that no

longer produce the protein. The resulting dynamin A2 cells are viable under all conditions tested, indicating that the dynamin A gene product is not vital for *D. discoideum* growth [2]. However, dynamin A-deficient cells showed pleiotropic phenotypic changes in contrast to the parental Ax2 wild-type cells. In summary, the data shows that the low presence of protein dynamin B reacts with many critical structures and has a vital role in a large range of cellular processes, which require very specific classical and non-classical dynamin family members in other organisms. Dynamin B is primarily formed as a preprotein with an abnormally long 136-residue presequence that is usually focused to mitochondria for processing [1]. Processing involves a brief connection with the outer mitochondrial membrane and goes to completion. The mature 92-kDa form of the protein operates in the context of actin-rich structures and multiple areas of focus membranes, including peroxisomes, the osmoregulatory contractile vacuole system, phagosomes, and the plasma membrane. Pleiotropic effects of *shibire* and dynamin-1 mutations are well known [1]. The disappearance of the closely linked yeast Dnm1p, which, like dynamin A and DLP1, is typically cytosolic, results in a double delay in the transport of endocytic matter to the vacuole [1]. However, latest studies offer significant evidence that Dnm1p localizes to the tip of mitochondria and operates mainly in the maintenance of yeast mitochondrial network morphology. Functions unconnected to vesicle trafficking have also been reported for the dynamin-like yeast proteins [3]. Future inquiries will be very much carried out by the fact that *D. discoideum* and dynium is easily available by biochemical, cell biological and molecular genetic studies. This will help to explain the connection of dynamin A in cytokinesis and define the exact role of the protein in vesicle targeting and transport processes.

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