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Boris Y Zaslavsky

Cleveland Diagnostics, USA

Properties of membrane-less organelles and aqueous two-phase systems

Coordination of numerous cellular biochemical reactions in space and time is achieved by compartmentalization. In addition to intracellular membranes acting as physical barriers for several cellular organelles there is a multitude of membrane-less organelles formed by liquid-liquid phase separation. The principles governing phase separation and functions of such organelles *in vivo* are poorly understood as of now. However, the much better studied aqueous two-phase systems formed by two polymers may serve as a model of membrane-less organelles. Such systems originate from polymer influence on the solvent properties of water. The phase forming polymers may include proteins and polysaccharides. The differences between solvent features of aqueous media in the two phases may be quantified and manipulated by polymers concentrations and additives of inorganic salts or small organic compounds, such as sucrose, sorbitol, etc. The differences between electrostatic properties of the phases as well as those between solvent features may be quantified using partitioning of homologous series of charged compounds and solvatochromic dyes as molecular probes for the solvent dipolarity/polarizability, solvent H-bond donor acidity and solvent H-bond acceptor basicity. The differences between solvent features and electrostatic properties of the phases govern unequal distribution of proteins and other natural compounds in aqueous two phase systems and in membrane-less organelles. This solvent-driven partitioning and not the "normal" protein-protein interactions, might cause enrichment of some proteins within the membrane-less organelles. It will be shown that proteins may influence solvent features of water and their effects are similar or exceeding those displayed by common macromolecular crowding agents and organic osmolytes. It is suggested that the effects of proteins on the solvent features of aqueous media may regulate the phase separation *in vivo*.

Biography

Boris Y Zaslavsky is a Bioanalytical Chemist. He graduated from Moscow State University in 1967, PhD in 1972; DSc in 1985 from USSR Academy of Sciences, Moscow, USSR. From 2012-present, he is a Chief Scientific Officer of Cleveland Diagnostics, Cleveland, OH, from 1997-present, he is a Vice President, Director of Research and Cofounder of Analiza, Inc., Cleveland, OH. He has over 180 publications in peer-reviewed journals, 1 monograph, over 10 USA and international patents issued. His research interests are: Clinical proteomics, role of water in biology and aqueous two-phase systems.

bz@analiza.com

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