Gavin Conant, J Proteomics Bioinform 2013, 6:7
http://dx.doi.org/10.4172/0974-276X.S1.067

OMICS Group Conferences
Accelerating Scientific Discovery

3rd International Conference on
Proteomics & Bioinformatics
July 15-17, 2013 Courtyard by Marriott Philadelphia Downtown, USA

Protein interactions and the spatial organization of cellular functions

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Protein-protein interactions have been extensively studied at the structural, functional, network and evolutionary levels. Yet one of their properties is so elementary as to be occasionally overlooked: they result in the spatial co-localization of their component proteins.

We have recently explored the potential impact of such co-localization on metabolism and cellular organization. It has long been believed that cells are organized to allow metabolic channeling between sequential enzymes. I will discuss how indirect protein interactions between enzymes and non-enzymatic mediator proteins may help achieve such channeling in a modular fashion. I will also illustrate how the potential metabolic role of these interactions is supported by genome-scale flux and gene essentiality data.

Extending on this idea of spatial organization, I will discuss a new approach for modeling the protein organization of the cellular interior that is based on a discrete lattice. Using this model, I will present evidence that the set of know binary protein interactions from yeast give rise to emergent structures, such as micro-clusters of related enzymes and robustness to over expression. I suggest that this lattice model, while clearly incomplete, indicates that some degree of the complex organization of the cell may be derived from simple rules of aggregation and interaction.

Finally, I will present evolutionary evidence for the ancient character of most human protein-protein interactions, again suggesting that they may play important functional roles.

Biography

Gavin Conant received his Ph.D. from the Department of Biology at the University of New Mexico and went on to postdoctoral studies at the University of Leipzig and Trinity College, Dublin. He is currently an assistant professor at the University of Missouri.

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