BIOCHEMISTRY SEMINAR

Chemical Signaling Regulates Multicellular Behaviors of Close Animal Relatives and an Anti-parasitic Protist

J.P. Gerdt

Assistant Professor, Indiana University

Abstract: Although few organisms "hear" sounds or "see" photons, the ability to "smell" or "taste" chemicals is likely universal across life. Therefore, chemical signaling was probably involved in every evolutionary transition in the history of life. For humans, the origin of the first animal is an important transition—complicated by the lack of fossil record. Efforts to reconstruct the genes and behaviors of the first animal have focused on studies of animals' closest relatives: the unicellular holozoans. These organisms share many genes that animals use for chemical signaling. Many also exhibit multicellular behaviors like aggregation and cooperative motility. However, the mechanisms by which they signal to each other and sense their environment are obscure. We unearth the chemical signals that regulate the multicellular behaviors of holozoans. We primarily study *Capsaspora owczarzaki*, which is also a snail symbiont that may curtail the spread of snail-borne parasitic diseases. We have found that *Capsaspora* senses environmental phosphatidylcholine lipids to regulate a reversible cellular aggregation behavior. This behavior is dependent on the endocytosis of the lipid signals, and it involves rapid post-translational activation of filopodium retraction. We have discovered a nearly identical aggregation behavior in the related free-living protist *Ministeria vibrans*, which suggests that this phenotype is ancient and possibly ancestral to animals. However, aggregation may have been adapted by *Capsaspora* to sense and respond to its unique host snail environment. We have also found that *Capsaspora* exhibits a chemokinesis (i.e., increased motility) response to proteins released from lysed prey cells, which may help *Capsaspora* feed efficiently on problematic parasites. The seminar will reveal our most recent results uncovering the chemical signals and mechanisms that may inform the evolution of animals and delay the spread of snail-borne parasites.

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James Tarpo Jr. and Margaret Tarpo Department of Chemistry