O35-07 : Single-Cell Resolution Activity Mapping Indicates Syntrophy with Non-diffusive Transfer of Intermediates or Direct Electron Transfer in Natural Microbial Consortia

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To investigate metabolic coupling between cells in a natural syntrophic community, we analyzed activity relationships in the archaea-bacteria consortia responsible for anaerobic methane oxidation by employing $^{15}NH_4$ as a general marker for biosynthetic activity. Determination of the biosynthetic activity of thousands of ANME affiliated archaea and deltaproteobacteria by nanoSIMS from multiple, distinct consortia provided us the opportunity to investigate biosynthetic relationships between co-aggregating cells. We found that across phylogenetic groups, a 1:1 relationship in activity exists between co-aggregating archaea and bacteria, indicating intra-consortia coordinated growth and substantiating the existence of a shared metabolic dependency between co-aggregating cells in this system. Within consortia, we found no evidence that individual cell biosynthetic activity is related to proximity to the aggregate-solution interface, nor to proximity to a nearest neighbor syntrophic partner. These data, together with modeling efforts and genomic data, appear to obviate diffusive intermediates as candidates for syntrophic coupling. We speculate that direct electron transfer between cells at multiple cell distances - occurring as is thought to in well established model systems - could explain these data.

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