Starting from the modified GLV:

Where describes how each species and its concentration affect the growth of ; and describes how each species and its concentration modifies , the unit density (of ) pairwise ( and ) interaction matrix.

~~This equation relates the density changing rate and density of individual species:~~

~~If we take summation on both sides, on the left hand side, the summation of individual density changing rate would be the whole microbiome density change rate. On the right hand side, there would be a quantity that has to do with total density of the microbiome, which is the product of average density across species and the number of species in the microbiome.~~

~~Before the whole communities reaches a steady state, the faster the whole community grows, the sooner becomes 0.~~

From our preliminary studies, we noticed that the presence of higher order interaction (HOI) helps to stabilize the community. The effect becomes more apparent when more species participated in the community. This forms our first hypothesis.