Towards Comprehensive Fitness Landscapes of Random Peptides Interacting with Protocells
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At the earliest stages of life, primordial peptides could plausibly have already been able to confer some simple functions to protocell membrane properties such as, modulating permeability, growth, and division. Using the most likely earliest five amino acids, we are interested in studying the earliest simple functions of primordial peptides made up of these amino acids that can interact with fatty acid vesicles. Ultimately, a complete fitness landscape of the vesicles-interacting primordial peptides will be mapped and studied, which will contribute to our understanding of the evolution of peptides at the beginning of life. Specifically, a library of all possible 15-mer peptides from the five amino acid alphabet (complexity of $3 \times 10^{10}$) will be generated as mRNA-peptide fusions and used in selecting for primordial peptides, which interact by either binding to the membrane or becoming internalized into a vesicle. Currently, four rounds of selection have been performed with the GADVP library and enrichment can already be observed in the second round of selection. The complexity of the peptide library was $6 \times 10^{5}$ at the end of 4th round of selection. We aim to identify these vesicle interacting primordial peptides from these rounds of selection by NGS sequencing and eventually determine a complete fitness landscape of these peptides. This will further broaden our understanding on possible simple functions of the primordial peptides and the evolution trajectory that the primordial peptides take in the earliest stages of life.