Using machine learning to map form and function across the virome Evolving virus-like assemblies in the lab

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1. Abstract

Viruses consist of a protective proteinaceous shell that packages an RNA or DNA genome. The emergence of protein cages that could load, protect, and transfer their own genetic information was therefore likely to be a critical step in the evolution of all primitive viruses. Using a combination of design and directed evolution, this process can now be recapitulated in the laboratory. We have converted a bacterial enzyme called lumazine synthase into an artificial nucleocapsid that efficiently encapsulates its own encoding mRNA and have elucidated the structural changes in cargo and container that made this transformation possible. In addition to providing insight into the origins of natural viruses, such constructs may serve as non-viral carriers for diverse vaccine and delivery applications.