

The Physicochemical Code of RNA-Protein Biology

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The notion of physicochemical complementarity is one of the most important mechanistic paradigms in molecular biology. Recently, we have characterized a robust, statistically significant matching between the nucleobase-density profiles of mRNA coding sequences and the nucleobase-binding profiles of the protein sequences they encode. Overall, our results both support and redefine the stereochemical hypothesis concerning the origin of the genetic code, the idea that the code evolved from direct interaction preferences between amino acids and the appropriate bases. Moreover, our findings support the possibility of direct, complementary, co-aligned interactions between mRNAs and their autogenous proteins even in present-day cells, especially if both are unstructured, with implications extending to different facets of nucleic-acid/protein biology. In this talk, I will focus on different lines of evidence regarding the complementarity hypothesis, with a particular focus on computational and experimental tests as well as functional implications. Finally, I will provide evidence in support of a proposal that proteins may in general interact with RNAs that are compositionally related to their own autogenous mRNA, as a simple, yet powerful organizational principle behind the structure of RNA-protein interaction networks in the cell.