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Loop cost in RNA secondary structures and the long-range cooperativity between RNA-binding proteins[1] YI-HSUAN LIN, RALF BUNDSCHUH, Ohio State Univ - Columbus — The interactions between RNAs and RNA-binding proteins (RBPs) are significant in post-transcriptional regulation, and thus ensure that messenger RNAs can perform appropriate biological functions. Typically, in post-transcriptional regulation a single RNA is bound by multiple RBPs, which are likely to work together, resulting in "cooperativity." This cooperativity can be a consequence of a mechanism mediated by RNA secondary structures, without assuming any direct interaction between the RBPs. The basic idea is that a bound RBP prohibits the nucleobases in its footprint from forming base pair bonds with other bases, thus changing the ensemble of RNA secondary structures, resulting in a shift on the binding probability of the other RBPs on the same RNA. We focus on the simplest RNA-protein complex: one RNA with two RBP binding sites. We study this effect analytically in the simplest model of RNA secondary structure formation, the molten RNA model. We measure the cooperativity as the correlation function between the RBPs and demonstrate that an algebraic correlation function occurs, implying that the cooperativity is long-range, and that a free energy cost for loop formation in the RNA secondary structures is the crucial ingredient that generates this cooperativity.

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