The maximum number of independently hybridizing DNA strands

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In the cell molecular information processing is based on molecular recognition and binding. Although DNA hybridization is sometimes understood as a lock and key interaction, it is not completely clear how the two molecules identify each other. Even with a few mismatched bases, hybridization still occurs and this makes hybridization in crowded and competitive environments difficult to predict. Here we study what amount of difference between two strands is required to avoid competition for the one and the same binding partner. In this work we numerically derive the maximum number of possible sequences that can coexist without competing for binding to the perfectly matching complements of the competitors. Experimentally we determine the appropriate minimum number of mismatched bases and investigate the behavior of DNA in a scenario where many sequences bind to their surface bound complements so that competition is minimized.

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