A handshake from a hairpin on the way to a double helix

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We have designed a minimal set of oligonucleotides that can interact with each other in a sequential fashion. The process resembles an enzyme mediated turnover from a substrate to a product. All players in this series are, however, oligonucleotides. The key element is a metastable hairpin, the enzyme that binds a substrate, a 16mer single strand, to its single stranded loop sequence, the binding site. The single stranded 16mer binds to the loop sequence that consists of 6 triplet repeats (CAG)6 to form a double helix with two mismatches (the enzyme/substrate complex). The 16mer can reversibly dissociate from the loop at an elevated temperature that does not yet denature the stem of the hairpin. On addition of a perfectly complementary sequence to the substrate, the 16mer linear double helix product is formed and the enzyme hairpin returns to its initial state. New substrate can be bound, the intermediate metastable helical complex is formed that can again be challenged by the second single strand 16 mer. All states can be characterised by gel electrophoresis and the series of steps can be followed by UV-absorbance and CD-spectroscopy.

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