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Phase Separation and Liquid Crystallization of Complementary Sequences in Mixtures of Random Oligonucleotides[1] GIULIANO ZANCHETTA, Universita di Milano, MICHI NAKATA, University of Colorado, MARCO BUSCAGLIA, TOMMASO BELLINI, Universita di Milano, NOEL CLARK, University of Colorado — We have investigated the phase behavior of mixtures of DNA oligomers, 8-22 bp in length. When only a fraction of the sample is composed of mutually complementary sequences, and hence the solution is effectively a mixture of single strands (ss) and double stranded helices (ds), the system is found to phase separate via the nucleation of ds-rich liquid crystalline domains from an isotropic background rich in ss. This spontaneous partitioning is the combined result of the free energy gain from the end-to-end stacking and LC ordering of duplexes, and of depletion-type interactions favoring the segregation of the more rigid duplexes from the flexible ss. Phase separation and liquid crystallization are also found in mixtures of oligos with various degrees of randomness in the sequence, enabling to establish the phase behavior in an extended phase space including a radomness axis. The observed phenomena offer a new route to the purification of duplex oligomers and, if in the presence of ligation, could provide a mode of positive feedback for the preferential synthesis of extended complementary oligomers, a mechanism of possible relevance in prebiotic environments.

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