Structure formation and dynamics studied with single-molecule techniques

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Strains of pathogenic bacteria that exhibit multiple resistances to common antibiotics pose a significant threat to human health. After their first discovery in the 1950s, it was shown that these strains developed faster than mere mutation and selective pressure on the population would allow. Further studies indicated that bacteria possessed a mechanism to exchange and collect genetic sections, which code for such resistances or other adaptive traits. This mechanism is implemented with integrons, genetic elements that provide the means for a gene cassette transfer system between bacteria of the same or even different species.

Crucial to the function and recognition of gene cassettes is most likely the formation of a secondary DNA structure, in which the initial double-stranded DNA of the bacterial genome opens and forms a cruciform structure. We employ a selection of single-molecule techniques to study the formation, structure, dynamics and recognition of this cruciform structure.