Prediction of Primary Structure of Single-Strand DNA in a Non-Denaturing Capillary Electrophoresis

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Single-strand conformation polymorphism (SSCP) is a genotyping method based on the sensitive separation of single-strand DNAs in a non-denaturing gel electrophoresis. Unlike denaturing gel electrophoresis, SSCP can separate DNA molecules by different folding even with similar molecular weight (i.e., length). Recently, adoption of capillary electrophoresis (CE) technology makes SSCP more reproducible, accurate and sensitive as a genotyping tool. Identification of DNA peak in SSCP is, however, major bottle-neck for genotyping. Practically, mutation analysis must be combined with DNA sequencing or large number of pre-analyzed DNA sequences. Therefore, if precise prediction of the electrophretic behavior based on its primary structure in SSCP is available, huge experimental effort can be avoided.

In this study, we developed a semi-mechanistic model of DNA molecule's electrophoretic behavior by the combination of fluid dynamic feature and thermodynamic secondary structure prediction. Parameters were estimated by the experimental data obtained from 150 randomly designed DNA sequences and the potentials in single nucleotide polymorphism (SNP) will be illustrated.