LAMP (Loop-Mediated Isothermal Amplification)

Part 1: Denaturation

Step 1. Denaturing unzips the template DNA

Forward Outer Primer (F3) unzips complementary strand from the template strand.

\[
\begin{align*}
3' & \quad F3c \quad F2c \quad F1c \quad B1 \quad B2 \quad B3 \quad 5' \quad \text{Strand A} \\
5' & \quad F3 \quad F2 \quad F1 \quad B1c \quad B2c \quad B3c \quad 3' \quad \text{Strand B}
\end{align*}
\]

Part 2: Setting up the left side of the dumbbell

Forward Inner Primer or FIP (F1c & F2) makes complementary DNA of template strand.

\[
\begin{align*}
3' & \quad F3c \quad F2c \quad F1c \quad B1 \quad B2 \quad B3 \quad 5' \quad \text{Strand A} \\
5' & \quad F3 \quad F2 \quad F1c \quad B1c \quad B2c \quad B3c \quad 3' \quad \text{Strand A2}
\end{align*}
\]

Forward Outer Primer (F3) unzips complementary strand from the template strand.

\[
\begin{align*}
3' & \quad F3c \quad F2c \quad F1c \quad B1 \quad B2 \quad B3 \quad 5' \quad \text{Strand A} \\
5' & \quad F3 \quad F2 \quad F1c \quad B1c \quad B2c \quad B3c \quad 3' \quad \text{Strand A2}
\end{align*}
\]

\[
\begin{align*}
3' & \quad F3c \quad F2c \quad F1c \quad B1 \quad B2 \quad B3 \quad 5' \quad \text{Strand A} \\
5' & \quad F3 \quad F2 \quad F1c \quad B1c \quad B2c \quad B3c \quad 3' \quad \text{Strand A3}
\end{align*}
\]

\[
\begin{align*}
3' & \quad F3c \quad F2c \quad F1c \quad B1 \quad B2 \quad B3 \quad 5' \quad \text{Strand A} \\
5' & \quad F3 \quad F2 \quad F1c \quad B1c \quad B2c \quad B3c \quad 3' \quad \text{Strand A2}
\end{align*}
\]
Part 3: Setting up the right side of the dumbell

Backward Inner Primer or BIP (B2 & B1c) makes complementary DNA of new template.

Backward Outer Primer (B3) unzips the new complementary strand.

Part 4: Using the dumbell for amplification

F1 & F1c and B1 & B1c complementary regions bind to form “dumbell” shape.

The same process occurs with the other strand of template DNA (Strand B).
Part 5a: Loop Amplification

The FIP and the BIP bind to the 3’ ends of the dumbell and begin amplification creating concatamers of different lengths with even more binding sites for the FIP and the BIP. Below is a representation of the FIP binding to the dumbell structure and beginning to amplify the DNA.
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