

Optimization of Real Time ddPCR using Deep Learning

A presentation template

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1 Introduction

- PCR
- Literature Review

2 Current Status

- Optical Subsystem
- Computational Subsystem

3 Future Steps

4 Conclusion



What is PCR

- Polymerase Chain Reaction is a chemical reaction widely used for creating copies from a specific DNA sequence for diagnosis and forensic applications.



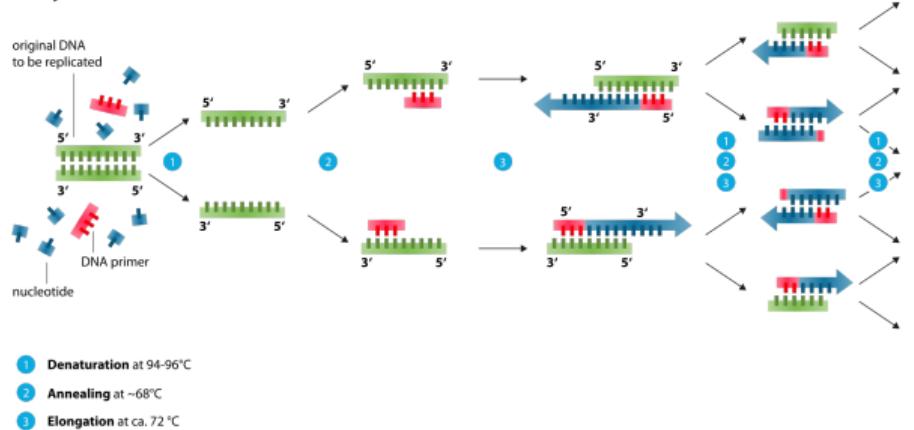
IAEA Bulletin, Infectious Diseases, June 2020



PCR Cycle

- 1 Denaturation in $90^{\circ}\text{C} - 95^{\circ}\text{C}$
- 2 Annealing in $65^{\circ}\text{C} - 68^{\circ}\text{C}$
- 3 Extension in 72°C

Polymerase chain reaction - PCR



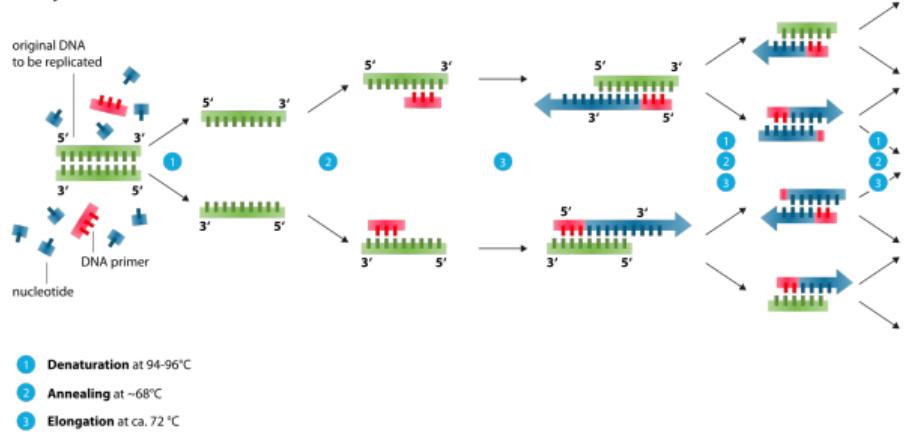
Polymerase Chain Reaction (PCR): Steps, Types, Applications, Microbeonline, 2021



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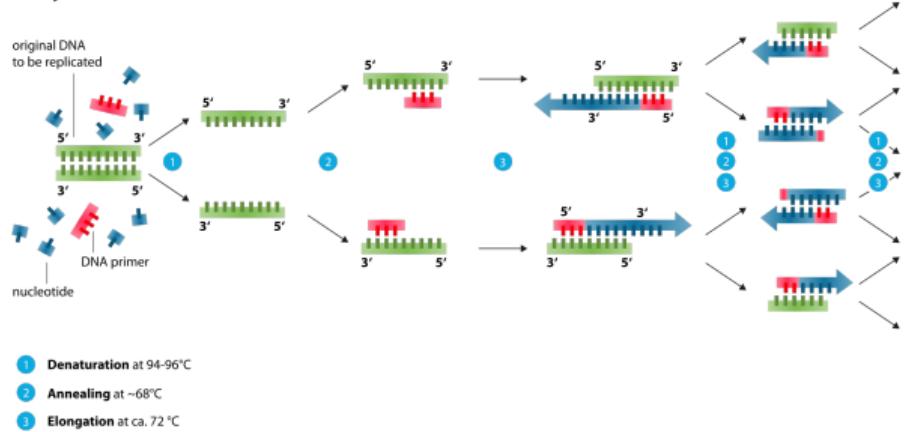
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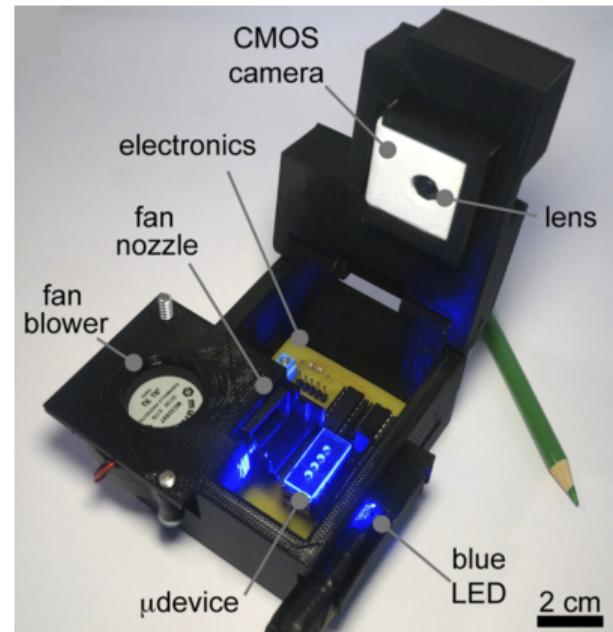


Polymerase Chain Reaction (PCR): Steps, Types, Applications, Microbeonline, 2021



Low Cost PCR device

- There has been many efforts on creating Low-Cost PCR device. Most of them only supported low number of reaction chambers (4 to 8) due to their small size.



Mendoza et al., Analytical Chemistry, 2018



Low Cost PCR device

- There have been novel ideas to make it cost even less!



Chan et al., Plos One, 2016



PCR analysis and ML

- ML has been used for designing the primers, predicting the result of a PCR reaction and etc.
- Most of the packages have been written using R programming language



Future Steps

- 1 Completely Implementing the New Optical Subsystem.
- 2 Real-Time File Transfer and Processing using Wireless Connections.
- 3 Running more tests to obtain data.
- 4 Implement ML algorithms to Image Processing and Temperature Control Subsystems .



Conclusion

- Basics of PCR process was described.
- A brief literature review on the subject.
- Progress made on Optical Subsystem and Computational Subsystem reported.
- Future roadmap explained.



References I

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An affordable and portable thermocycler for real-time PCR made of 3D-printed parts and off-the-shelf electronics.
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A Rapid and Low-Cost PCR Thermal Cycler for Infectious Disease Diagnostics.
PLOS ONE, 2016
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How is the COVID-19 virus detected using real time RT-PCR?
IAEA Bulletin, 2020
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