

## Summary

Viruses are ubiquitous and infect all cellular life forms. Many viral infections cause severe symptoms, and can be fatal. One important component in the control of viral spreading is the detection of viruses. Current diagnostic methods require well-equipped institutions, are labour-intensive, time-consuming and can also be expensive.

We are developing an efficient and cost-effective viral diagnostic device for point-of-care detection. Our detection is nucleic acids based (Fig.1). The viral nucleic acids are amplified to obtain adequate amounts and then detected in field amenable assays.

We anticipate that our technology could operate as a generic nucleic acid detection device, whether it be for pathogen detection, genetic typing, or molecular computing outputs.

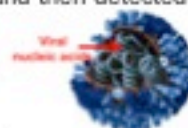


Figure 1 Viral nucleic acids

## Project Aim

- Amplify viral RNAs/DNAs using isothermal amplification<sup>1,2</sup>
- Detect amplified viral DNA using lateral flow devices
  - Lines or spots multiplex format
  - Text multiplex format

## Advantages

- Single device detects multiple viruses
- Small, portable in size
- Fast detection (e.g. 5 minutes)
- Easy result reading formats
- Low cost
- No power supply, on-site usage
- Apply to low-resource settings

## Methodology

- Viral RNAs/DNAs amplified by isothermal amplification (Fig. 2)
- Amplified products are applied to custom-made lateral devices (Fig. 3)

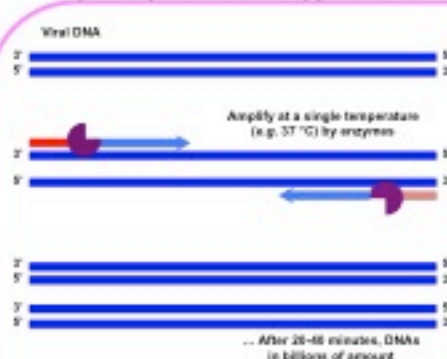


Figure 2 Isothermal amplification

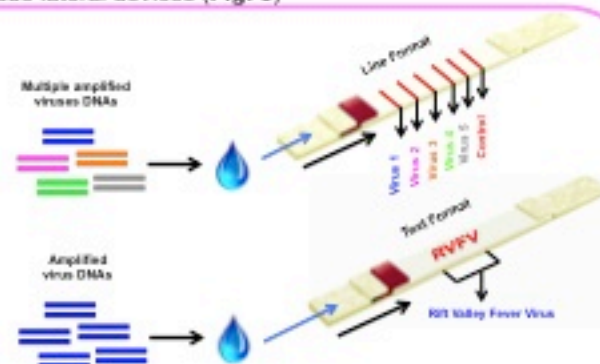


Figure 3 Lateral flow detection

- (Fig. 2) Amplify at a single temperature in a short time period, to generate large quantities of DNA copies
- (Fig. 3)
- Custom-made lateral flow devices diagnose multiple viruses via series of lines or dots
  - Inbuilt molecular networks diagnose viral identity and display result in text

## Sample Result

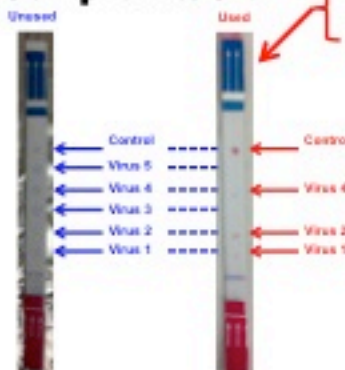


Figure 4 Sample multiplexed lateral flow dipstick result

- Red spots indicated 3 different viral nucleic acids present in the sample
- The control indicates that the solution has moved to the top as intended

## Future Perspectives

- The device could also be used for any nucleic acid detection (not just viruses, e.g. bacteria or parasites)
- Text diagnosis provides potential for detection of hundreds, thousands or even more species in a single device

## References

1. Notomi, T., et al., Loop-mediated isothermal amplification of DNA. *Nucleic Acids. Res.*, 2000, 28(12): p. E63.
2. Pfleiderberg, O., et al., DNA detection using recombination proteins. *PLoS. Biol.*, 2006, 4(7): p. e204.

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