Development of an Affordable Rapid Test for HIV using thermostable Griffithsin
Duke iGEM 2017

Griffithsin and HIV

HIV Stats
An HIV diagnostic cost up to $1367 USD
2.9 million new cases each year
Only 45% of patients know their status
HIV glycan shield prevents antibody targeting and neutralization

Griffithsin is an anti-HIV binding protein
Monomers can be linked together to increase affinity
HIV is bound by GRFT before it can infect patients. This same binding can be utilized to detect HIV virions in blood
Our goal is to produce a more stable GRFT from E. coli and use it in a diagnostic test to detect HIV virions

Human Impact: Affects of a New Rapid Test (RDT)

HIV Deaths and New Infections
- 1.1 million HIV related deaths in 2015
- 44% of new HIV infections in Sub-Saharan Africa (SSA)

41% of HIV+ patients on ART
ARTs could prevent 21 million deaths & 28 million new infections by 2030
75% uptake in rapid test usage in SSA
Projected 435 million users

Thermoengineering Modeling
Purpose: Create a more stable GRFT at transport/storage temperatures common in Sub-Saharan Africa using YASARA

Thermostable GRFT
Wild Type Monomeric GRFT

Rapid Test and Antiretroviral Therapy (ART) Use

Results & Conclusions

Figure 2: SDS Page Gel after staining. Samples heated for 30 minutes at variable temperatures up to 90°C. The band at 90°C (red box) indicates stability of the engineered variants at 90°C in comparison to 70°C. The band is currently at 35 kDa (~2X wild type) due to higher negative charge associated with the hydrophobicity added to the variant.

Figure 3: Novel Thermostability Testing for GRFT variant: SDS Page Gel. Samples heated for 60 minutes at temperatures ranging from 50 to 80°C.

Education
Science Lessons at Marbles Kids' Museum
On campus forums
Exploring science ethics and policy
YouTube Channel (Duke iGEM) for educating the public
Interviews with experts and fellow scientists

Rapid Test Assay Design

Finger Stick Blood
Fluorescently Labeled GRFT Tandemers
“Open” Locked Confirmation

HIV Virion Glycan shield Confirmation

Allows for viral detection
Grant was submitted to NIH in December
Affordable: low-cost materials bring price of test down which increases global access
Viral Load: allows for direct quantification of viral load
Early Detection: does not require patient seroconversion which allows for more patients to know their status in a single sweep as well as help pregnant mothers and newborns
Mobile: stable at temperatures associated with storage and transportation of rapid tests without cold storage in Sub-Saharan Africa which reduces costs

Sponsors & References

Lord Foundation of North Carolina