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Amplification-free Nucleic Acid Detection for Rapid Point-of-care Diagnostics

Stanford scientists have developed a lateral flow diagnostic platform that detects pathogen DNA without nucleic acid amplification, delivering results visible to the naked eye in under 30 minutes. The platform uses computationally designed multivalent probes to achieve sensitive and specific detection in a format suitable for point-of-care settings.

Infectious diseases remain a significant global health burden, with pathogens ranging from bacteria and parasites to fungi posing ongoing diagnostic challenges across clinical, public health, and field settings. Current diagnostic methods present a tradeoff between accuracy and accessibility. Culture-based methods are time-consuming, often requiring days for results, while PCR-based molecular tests offer high sensitivity but depend on expensive equipment and trained personnel. These limitations restrict diagnostic availability in resource-limited settings and contribute to delayed treatment and continued transmission. Existing rapid tests address some of these barriers but often lack the sensitivity needed for reliable detection. A diagnostic approach that combines molecular-level specificity with a rapid, equipment-free format could meaningfully expand access to screening and enable timely treatment decisions.

The platform uses computationally designed oligonucleotide probes that bind to multiple sites along a target pathogen's genome, enabling highly specific detection of whole genomic DNA without nucleic acid amplification. This multivalent approach is inherently robust against minor genetic variations, as recognition relies on many binding sites rather than a single sequence match. Combined with enzymatic signal amplification, the platform delivers a colorimetric readout visible to the naked eye in a lateral flow format, eliminating the need for thermal cycling, specialized

equipment, or trained personnel.

Stage of Development:
Prototype

Applications

- Rapid point-of-care detection of infectious pathogens
- Equipment-free diagnostics for resource-limited and field settings
- Self-testing kits for at-home screening
- Multiplex testing panels for simultaneous detection of multiple pathogens

Advantages

- Detects whole genomic DNA without nucleic acid amplification
- Colorimetric readout visible to the naked eye
- Robust against minor genetic variations in target pathogens due to multivalent binding
- Compatible with less stringent DNA extraction methods
- Adaptable to a broad range of bacterial, parasitic, and eukaryotic pathogen targets

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