INFECTIOUS DISEASES OF UNKNOWN CAUSES REMAIN HIGH

Although hospitals have extensive laboratory testing for infectious diseases, it is estimated that aetiology in over 30% of infectious disease cases remained unknown[1].

Current most common clinical diagnostics for infectious disease: **Blood Culture**

- ✖ Cheap (average $50 per test) but inaccurate
- ✖ Labour intensive
- ✖ Analytically insensitive
- ✖ Trial and error approach and takes up to 5 days to culture at which point the patient may already have worsened in condition

Without accurate data, clinicians typically are unable to prescribe appropriate medication or can only apply broad spectrum antibiotics or antivirals that may have limited efficacy on the patient.

Other technology used in current clinical diagnosis for infectious disease :

Other diagnostic technologies including PCR is affordable (average $130 per test) but is biased to "known" specific pathogens only and unable to detect broad spectrum of both known and unknown pathogens. – It is not ready for **new emerging infectious diseases (e.g. COVID-19)**

CONCLUSION

A new technology for a rapid, cost-effective, sensitive and unbiased detection for ALL type of pathogens is needed

1. Crit Care Med 2012 40(12): 3277-3282

OUR SOLUTION: RPIDD (Rapid Pathogen Identification and Detection Device Technology)

Executive Summary

OVERVIEW

- **RPIDD**: Next-generation molecular-based diagnostics for "unbiased" detection of any foreign pathogens (virus, bacteria, fungus, parasites) in infected patients using DNA/RNA
- <24 hours turnaround time + cost effective
- Blood sample and adaptable to others (including swab)
- Collaboration with technology from Nobel prize winner Sydney Brenner / A*Star Sg
- Patented proprietary technology to prepare and enrich the pathogenic DNA/RNA and deplete the background human host DNA simultaneously + AI analysis

TARGET

- Next generation technology to transform diagnostic procedures for infectious diseases
- To become a first line of diagnostics in line or ahead of traditional methods

OUR TECHNOLOGY
(based on internal results)

- ✓ Lower costs: < USD$400 wholesale costs vs >USD$2000 NGS sequencing services
- ✓ Unbiased and broad range of pathogen detection
- ✓ <24 hour turnaround time
- ✓ Unbiased detection of a wide range of foreign pathogens

VS

EXISTING METHODS

- × **Blood culture**: slow (5 days) and inaccurate (c. 80% accuracy)
- × **PCR-based diagnosis**: biased only to specific pathogens (selective)
- × **NGS sequencing**: expensive (may cost as much as US$2,000 per test)

CAPABILITIES

Based on internal tests, our technology can detect:

- A full range of DNA/RNA viruses, bacteria, fungi, parasites, including coronavirus such as COVID19
- Pathogen genes that cause antibiotic/antimicrobial resistance (e.g. MRSA)
- Previously unknown and novel mutated pathogens (e.g. new virus)

Based on internal tests, our technology can:

- REDUCE diagnosis time to 24 hours or less (vs avg. 3 – 5 days using blood culture)
- REDUCE cost of existing NGS-based diagnosis by more than 50%
- TARGET TO ACHIEVE analytical specificity >99.99% per pathogen + sensitivity >95%
- "Personalized Medicine" approach to infections allowing clinicians to prescribe suitable and targeted treatments at an early stage of patient's admittance

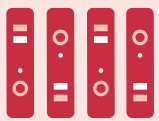
	Blood Culture	PCR and Film Array	Existing NGS Technologies	Our Technology
Rapid	No (5 days)	Yes (1 day)	Yes (2 days)	Yes (1 day)
Detect unknown pathogens	No	No (biased & specific to pathogen)	Yes	Yes
Detect antibiotic resistance	Yes (limited)	Yes (limited)	Yes	Yes
Average Costs	USD$100-150 per culture / pathogen BUT no broad range detection; specific only		>USD$2,000 cost	Current <USD$400 cost (target USD$100)

RPIDD Aims to Shift mRDT Methods to First-line Diagnosis

But Why Is Molecular Rapid Diagnostic Testing (mRDT) Currently Not First-line?

Current commercially available mRDT are **limited in scope** for pathogens and antimicrobial resistance marker due to a **lack of primers/probes**[1].

Emerging pathogens and known pathogens with new mutations **may not be detected**.



If a medical laboratory develops its own test using mRDT, the **quality of the results will be significantly influenced by the manufacturing source** of the reagents used. This limits the flexibility and adds extra costs to the labs.

Therefore, a technology for a rapid, cost-effective, sensitive and unbiased detection for ALL types of pathogens is urgently needed: RPIDD

RPIDD is an **NGS based** (Next generation sequencing) molecular diagnostic technology.

Based on internal results, RPIDD employs an untargeted approach for **detection of all known and mutated pathogens**, as well as genes that cause antibiotic resistance in a single test. It provides valuable information in a timely manner and the appropriate antimicrobial therapy would be initiated as rapidly as possible.

RPIDD is a **scalable service integrated in hospitals** to support local and regional hospital services for blood-based rapid pathogen diagnostics.

1. Karumaa, S.; Karpanoja, P.; Sarkkinen, H. PCR Identification Of Bacteria In Blood Culture Does Not Fit The Daily Workflow Of A Routine Microbiology Laboratory. Journal of Clinical Microbiology 2011, 50 (3), 1031-1033.

Proprietary method in DNA/RNA extraction

PROPRIETARY DIAGNOSIS WORKFLOW (24 HOURS)

1

Biofluid collection

- **~0.5ml of blood** is used in the current generation of method

2 6 hrs

Sample extraction

- Host **DNA** depletion
- Microbial **DNA/RNA** enrichment
- One-pot DNA & RNA library preparation
- Both **targeted** and **untargeted** workflows

Proprietary method

3 8-14 hrs

Next-generation sequencing (NGS)

- Tested on Illumina chemistry (NexSeq, HiSeq, MiSeq and iSeq100)
- Easy adapted to Nanopore workflow
- Compatible with other faster next generation sequencing machines (e.g Nanopore)

4 <2 hrs

Secure cloud-based artificial intelligence driven bioinformatics analysis & report generation

- Refined workflow for rapid diagnosis of infectious disease

Proprietary Software

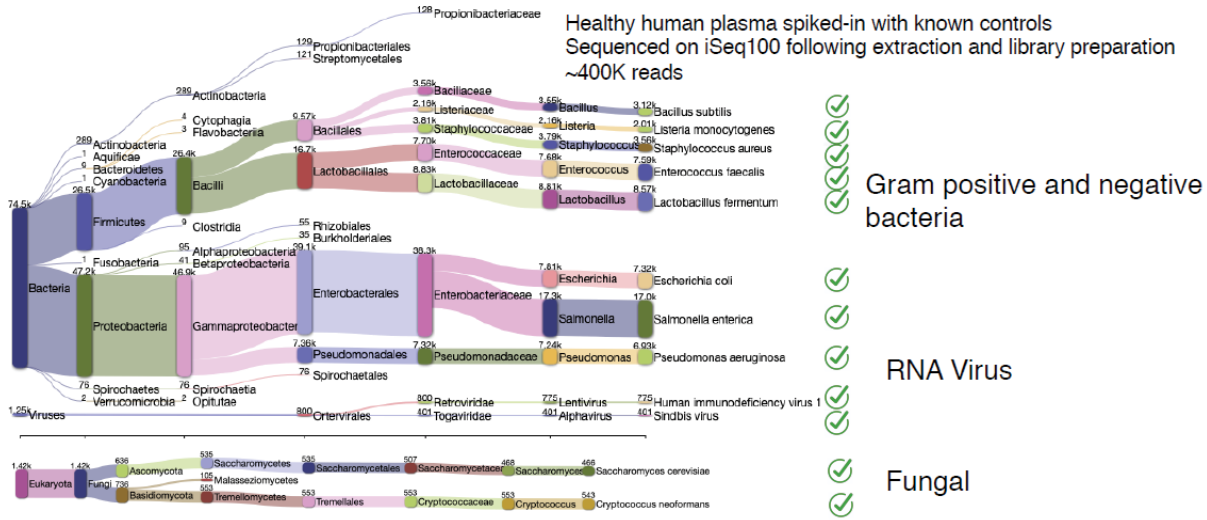
Analytical Performance: Sensitivity and Specificity

Based on internal results, RPIDD device detected organisms ranging from bacteria, RNA viruses and fungi in ONE TEST

Sensitivity	1.25 copies of DNA/RNA per µl plasma
Specificity	Controls: ZymoBIOMICS Microbial Community Standard, Lentivirus and Seracare AccuSpan recombinant virus

- **8** species of bacteria,
- **2** species of RNA virus, and
- **2** fungal samples were spiked into human plasma

All 12 species identified in ONE TEST



RPIDD : Summary of Clinical Validation

- **Sensitivity and specificity targeted to improve with further validation**
  - **Sensitivity**: Achieved 99.99%
  - **Specificity**: Achieved 90%, targeted to exceed 95% (subjected to ongoing clinical validation)

- **Clinical Validation in progress in Singapore**
  - 12 patients have been enrolled to the scheme
  - 53 reactions have been analysed as of 31 December 2021

- **Further clinical validation planned for 2022 including United States and Singapore.**

- **Further protocol updates to expand the use of RPIDD in different samples are progressing (e.g. Cerebrospinal fluid, nasal swab, saliva).**