



**Breach Candy
Hospital Trust**



Fighting the Next Gen War in Microbiology Laboratory: Solutions & Savior for Next Gen Disease

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Case

- 60 yr /Male admitted for an elective surgery for ABG
- k/c/o – DM , HT, CAD, multiple hospitalizations in the past 3 months
- Post Sx was extubated on day 2, stayed in the ICU
- Cough reflexes were weak
- Day 5 post op – fever, hypotension, tachypnea, crackles, patch on X ray
- Hospital acquired pneumonia
- Rx- IV Meropenam 1 gm TID
- Intubated, blood and respiratory secretions sent for culture
- No improvement in the next 3 days
- Expired on Day 8 post op
- Day 8 : blood culture reported as Kpn resistant to meropenam

SUPERBUGS

Bad Bugs, No Drugs: No ESKAPE! An Update from the Infectious Diseases Society of America

Helen W. Boucher,¹ George H. Talbot,² John S. Bradley,^{3,4} John E. Edwards, Jr.,^{5,6,7} David Gilbert,⁸ Louis B. Rice,^{9,10} Michael Scheld,¹¹ Brad Spellberg,^{5,6,7} and John Bartlett¹²

IDSA report published in *Clinical Infectious Diseases* 2009; 48:1–12

- *E* – *Enterococcus faecium*
- *S* – *Staphylococcus aureus*
- *K* – *Klebsiella pneumoniae*
- *A* – *Acinetobacter baumannii*
- *P* – *Pseudomonas aeruginosa*
- *E* – *Enterobacter species*

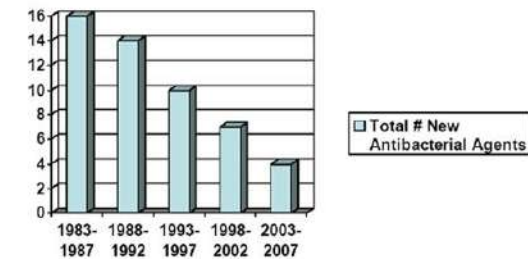
IDSA
Infectious Diseases Society of America

BAD BUGS, NO DRUGS



As Antibiotic Discovery Stagnates ...
A Public Health Crisis Advances

Total Approved Antibacterials: US



Spellberg, et al., *CID* May 1 2004, Modified



WHO priority pathogens list for R&D of new antibiotics

Priority 1: CRITICAL

- *Acinetobacter baumannii*, carbapenem-resistant
- *Pseudomonas aeruginosa*, carbapenem-resistant
- *Enterobacteriaceae*, carbapenem-resistant, ESBL-producing

Priority 2: HIGH

- *Enterococcus faecium*, vancomycin-resistant
- *Staphylococcus aureus*, methicillin-resistant, vancomycin-intermediate and resistant
- *Helicobacter pylori*, clarithromycin-resistant
- *Campylobacter* spp., fluoroquinolone-resistant
- *Salmonellae*, fluoroquinolone-resistant
- *Neisseria gonorrhoeae*, cephalosporin-resistant, fluoroquinolone-resistant

Priority 3: MEDIUM

- *Streptococcus pneumoniae*, penicillin-non-susceptible
- *Haemophilus influenzae*, ampicillin-resistant
- *Shigella* spp., fluoroquinolone-resistant

according to the urgency of need for new antibiotics

AMR the silent pandemic?

Global burden of bacterial antimicrobial resistance in 2019:
a systematic analysis

*Antimicrobial Resistance Collaborators**

Lancet 2022; 399: 629–55



Approx 4.95 million people who died , suffered from at least one drug-resistant infection

AMR directly caused 1.27 million of those deaths

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WHO declares the new coronavirus outbreak a Public Health Emergency of International Concern

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Credits 8:54 AM 31/01/2020

Novel Corona virus pandemic (2019-nCoV)

WHAT IS THE CORONAVIRUS?

These are a large family of viruses that cause illnesses from the common cold to more severe diseases such as MERS and SARS

OTHER RECENT EPIDEMICS

Middle East Respiratory Syndrome (MERS-CoV)



- First identified in Saudi Arabia in 2012
- Over 800 killed in Middle East since
- From dromedary camels to humans



Severe Acute Respiratory Syndrome (SARS-CoV)



- Identified in 2003, first infected humans in China in 2002
- Killed nearly 650 people in China/Hong Kong 2002-2003
- Thought to be from bats, spread to civet cats to humans



NEW STRAIN

New China strain SARS-like virus.



- First identified in late December 2019 in Wuhan, China
- Hundreds of cases detected in China, a number of deaths. Cases detected in Japan, Thailand, South Korea
- Seafood/animal market in Wuhan is centre of outbreak. Human-to-human transmission confirmed by Chinese authorities

Sources: AFP/WHO/CDC/Chinese govt

Variants of concern

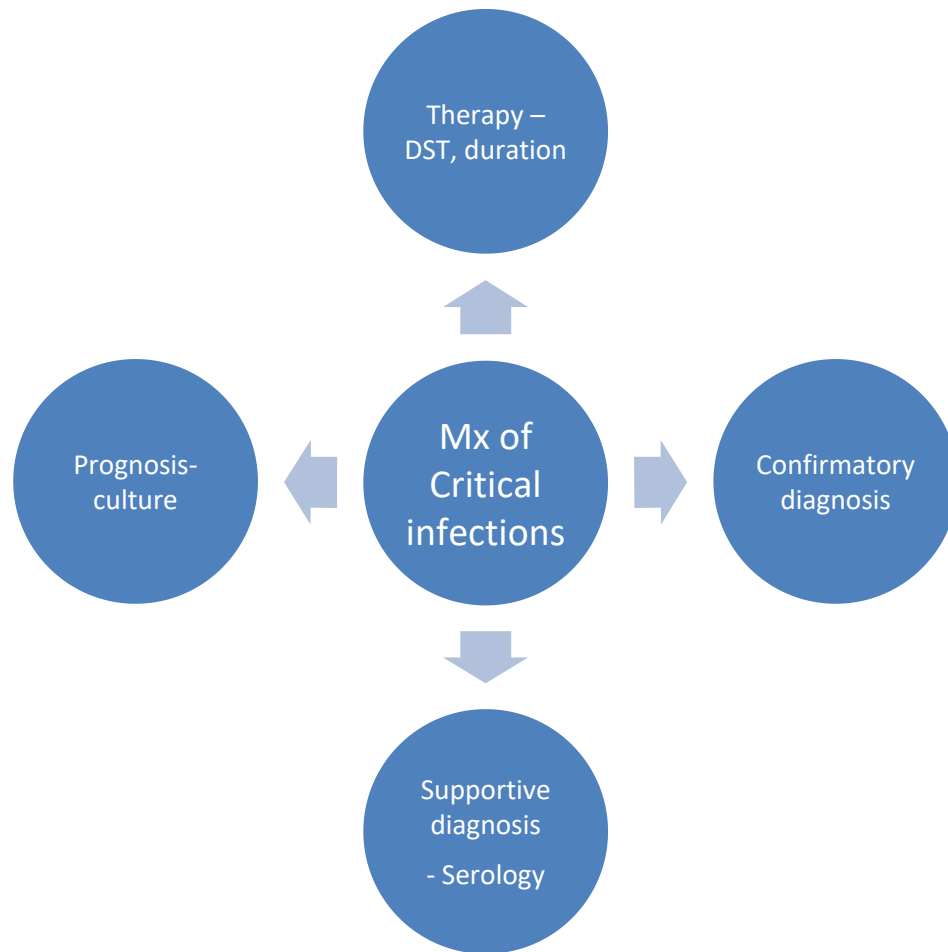
 B.1.1.7 Alpha	 B.1.351 Beta	 P.1 Gamma	 B.1.617.2 Delta	 B.1.1.529 Omicron
May 2020 UK	August 2020 South Africa	November 2020 Brazil	October 2020 India	November 2021 Multiple countries
Spreads more easily	Spreads more easily and some vaccines may be less effective against it	Spreads more easily and some vaccines may be less effective against it	Spreads more easily Symptoms may present differently May reduce vaccine efficacy Still protects against severe disease	Early studies show that it spreads more easily

MICROBIOLOGY DIAGNOSIS NEEDED

to wage the

NEXT GEN WAR against MICROBES

Role of Clinical Microbiology in Mx of Infectious diseases



- ✓ Wet preparation – cover slip mounts
- ✓ Stained preparation
- ✓ Culture based methods
- ✓ Serology – Antibody detection
- ✓ Antigen detection – Immunoassays, molecular methods

Present day challenges ...

- Slower detection
- Effect of empiric use/misuse of antibiotics
- Emerging , re-emerging infections & novel infections



Delay in diagnosis
Morbidity
Mortality
Rapid spread
Menace of AMR

The need of the hour...5G

January 2019 | 03:04 | 631-642 | JALM

REVIEWS

Direct Detection of Pathogens in Bloodstream During Sepsis: Are We There Yet?

Linoj Samuel^{1*}

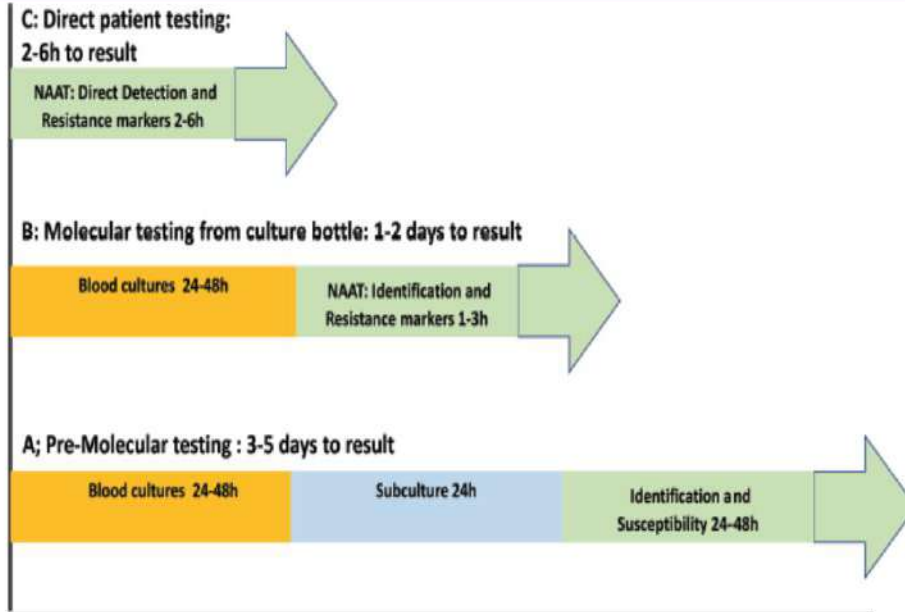
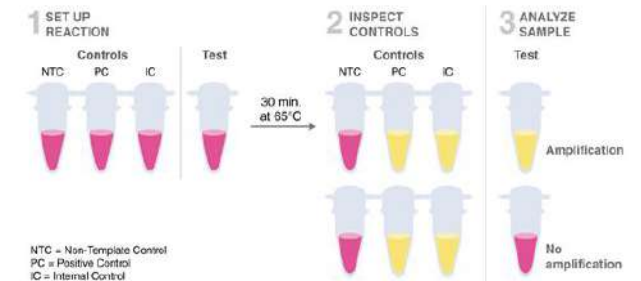


Fig. 1. Progression in blood culture diagnostics with the development of molecular technologies over time.

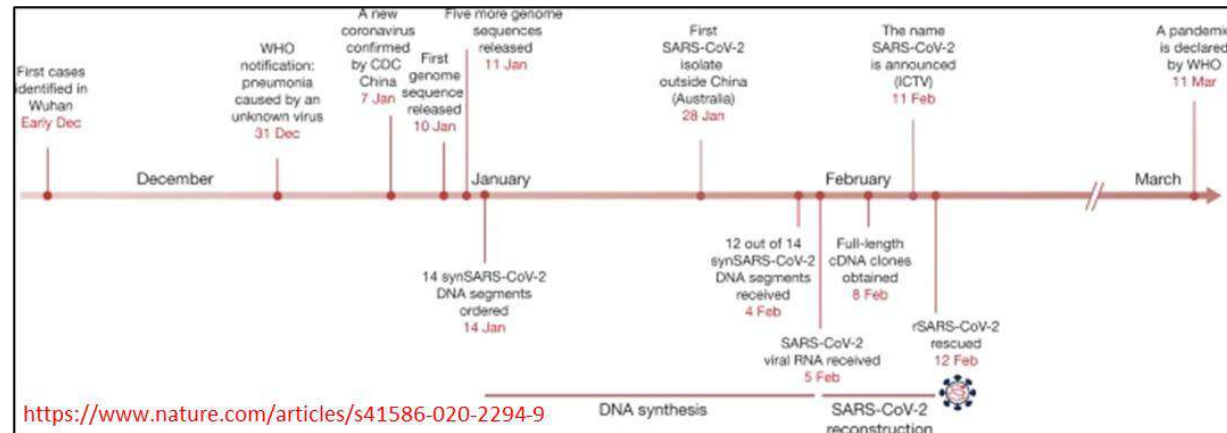
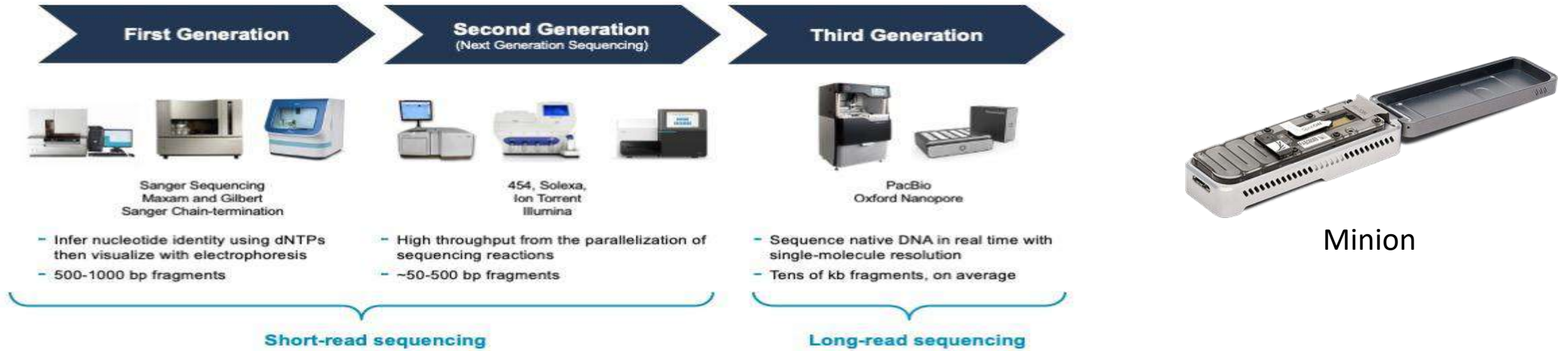


Next gen technologies

- Amplification based technologies – novel methods
- Rapid
- Syndromic approach based
- POC
- Little expertise
- Little infrastructure needs & capital budget



Sequencing – WGS/metagenomics

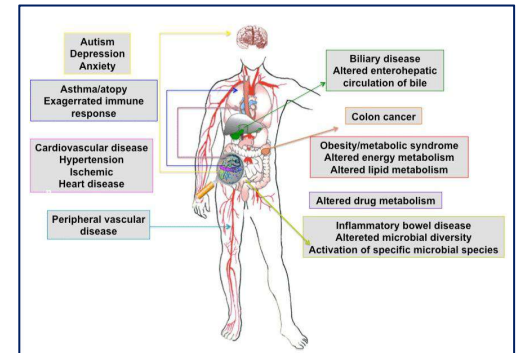


Role of Sequencing techniques


Identification of new pathogens & drug resistance mechanisms

Circulation of Third-Generation Cephalosporin Resistant *Salmonella* Typhi in Mumbai, India
 Silvia Argimón, Geetha Nagaraj, Varun Shamaana, Dharmavaram Sravani, Ashwini Kodlipet Vasanth, Akshatha Prasanna, Aruna Poojary, Anurag Kumar Bar, Anthony Underwood, Mihir Kekre, Stephen Baker, David W. Aanensen, Ravikumar Kadamalli Lingegowda
 Author Notes
Clinical Infectious Diseases, ciab897, <https://doi.org/10.1093/cid/ciab897>
 Published: 09 October 2021 Article history

Better Understanding of human microbiomes to manage infection syndromes



Strengthen epidemiological tracking

Variants of concern				
				
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Discovery of new therapeutics & vaccines

Adopting one health approach

One Health

One Health recognizes the connection between the health of people, animals, and the environment.

- Emerging & reemerging zoonotic infections
- New variants of pathogens jumping across living species
- AMR driven by misuse of antibiotics in fisheries/poultry/animal husbandry



To Summarize...

- The recent pandemic has consolidated the role of microbiology based diagnosis
- Early & rapid diagnostic tools are now available
- Need for genomic methods to adapt to clinical microbiology laboratories
- Antimicrobial stewardship & diagnostic stewardship
- One health approach



THANK YOU!!!!