

ANTISUPERBUGS

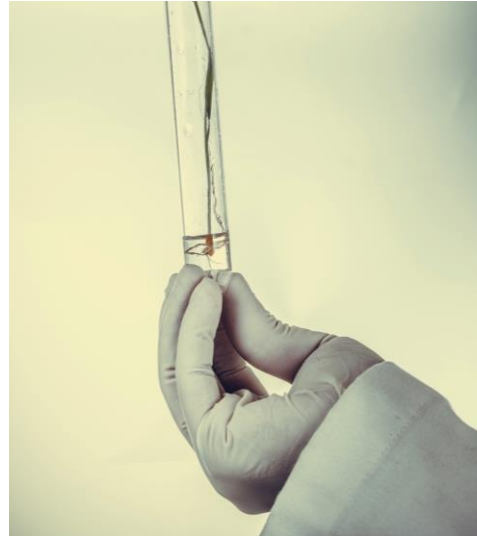
DETECTION OF RESISTANT MICROORGANISMS IN HOSPITALS

STATE OF THE ART

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May 2017

**RI
SE** Swedish ICT
Sensor Systems



Nosocomial infections - What to detect?













- A number of different infectious agents on the list
- Detect one, or a set, or all at once ?
- Resistance
 - Staphylococcus aureus
 - Methicillin resistant Staphylococcus aureus (MRSA)
 - Candida albicans
 - Pseudomonas aeruginosa
 - Acinetobacter baumannii
 - Stenothrophomonas maltophilia
 - Clostridium difficile
 - Escherichia coli
 - Tuberculosis
 - Vancomycin-resistant Enterococcus
 - Legionnaires disease

Classical methods – in use

- Culture and isolation for identification
 - Selective media
 - Biochemical analyzes (enzymes etc.)
- Culture in presence of antibiotics to detect possible resistance to antibiotics that permits growth
- Amplification/detection of signature genes for the pathogen and possible resistance to antibiotics
 - PCR



Examples of big actors 1) bioMérieux

INFECTION CONTROL	IDENTIFICATION	ANTIBIOTIC SUSCEPTIBILITY TESTING	OUTBREAK MANAGEMENT & SURVEILLANCE	ANTIBIOTIC PRESCRIPTION GUIDANCE
<ul style="list-style-type: none"> • chromID™ RANGE Chromogenic culture media 	<ul style="list-style-type: none"> • FilmArray® Multiplex PCR system 	<ul style="list-style-type: none"> • VITEK® 2 Automated ID/AST* system 	<ul style="list-style-type: none"> • bioMérieux EpiSeq™ service NGS** solution for epidemiological monitoring 	<ul style="list-style-type: none"> • VIDAS® B-R-A-H-M-S™ PCT Specific marker of severe bacterial infections/sepsis 
<ul style="list-style-type: none"> • RAPIDEK® CARBA NP Biochemical test for detection of carbapenemase-producing bacteria 	<ul style="list-style-type: none"> • VITEK® MS Mass spectrometry system 	<ul style="list-style-type: none"> • Etest® Agar gradient method 		<ul style="list-style-type: none"> • bioNexia® Strep A and bioNexia® Influenza A+B 
<ul style="list-style-type: none"> • Environmental infection control range Air, surface, water monitoring 	<ul style="list-style-type: none"> • VITEK® 2 Automated ID/AST* system • API® ID range Standardized ID* strips 	<ul style="list-style-type: none"> • RAPIDEK® CARBA NP Biochemical test for detection of carbapenemase-producing bacteria 		

*ID/AST = Identification / Antibiotic Susceptibility Testing **NGS = Next-Generation Sequencing

Examples from big actors 2) Alere

- MRSA from colony in 5 min



- Legionnaires disease in 15 min from urine

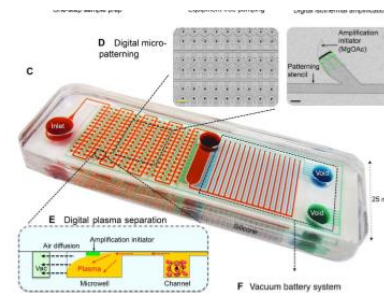
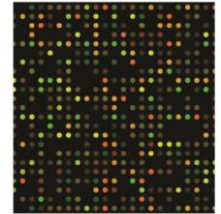


- Clostridium difficile in 30 min

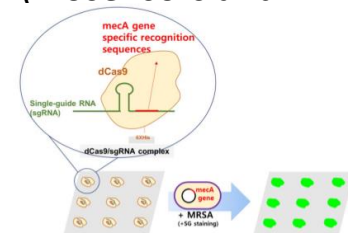


New developments

- Detect “everything” - bugs and resistance
 - Whole genome sequencing of tbc for resistance profiling (Lancet 2015)
 - LLMDA - identify 6000 targets within 24 hrs – based on DNA based hybridization array (2013)
- Detect specific infectious agents
 - ISDA (Isothermal strand displacement amplification) 20 min (2015)
 - RPA (Isothermal recombinase polymerase amplification + integrated sample prep on chip (Science Adv. 2017)



- Detection of MRSA using a CRISPR-mediated DNA FISH method in 30 min (Biosensors and Bioelectronics 2017)



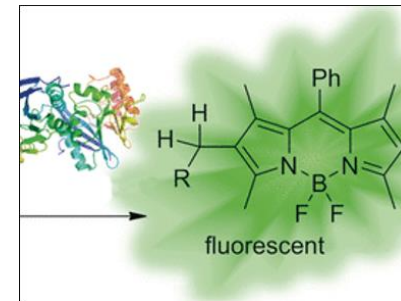
In general:

- DNA based methods going from PCR to isothermal amplification opening up for simple equipment (P.o.C.)
- Sample preparation a challenge for point of care device

New developments- continuation

- Antibiotic resistance
- HPLC/MS
 - Detection of ESBL by detecting hydrolysis of β -lactamase
Within 90 min (EMBL are looking for partner/licensee)

- Light-up probes
 - Modified Carbapenem turn fluorescent upon cleavage by β -lactamase



- In summary:
 - New, or modified old methods making analyses faster/simpler
 - However, sample preparation and/or cultivation often required
 - Many publications from universities – but most are still far from the market

Where should the focus be?

- Detection/characterization of infectious agents
 - Important!
- Prevention
 - Reduce spread of nosocomial infections (mention trials with bactericidal surfaces that reduce airborne spread)
 - Minimize use of ab that in itself drives development of resistance
- Routines/efficiency of routines
 - If appropriate routines are followed nosocomial infections will be reduced! (e.g.at Barnes St.Louis VAP down 50 % after training program)

Thus, it might be equally important with methods for verifying that hospital routines are efficient to prevent nosocomial infections

TACK/THANK YOU!

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