

*Ask not what your laboratory can do for you, but what you can do for your laboratory*

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Tallaght University Hospital

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### What does a Clinical Microbiologist do?



- Biology of microbes: bacteria, viruses, fungi, parasites
- Benefit and harm of microbes to humans
- Understand how microbes become resistant to antimicrobial agents

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### What does a Clinical Microbiologist do?

**THE MEDICAL BIT...**

- Clinical and laboratory diagnosis of infection
- Treatment of infection – **right drug for the right bug**
- Understand antimicrobial resistance and **how to reduce it – avoid unnecessary antimicrobial use = also called 'antimicrobial stewardship'**
- Infection prevention & control – integral to **patient safety**
- Surveillance and feedback – **information for action**
- Education

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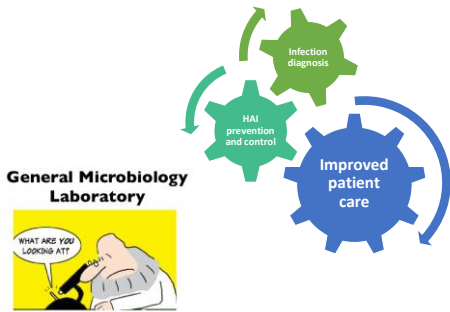
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### What do you want from us?

- Is the patient infected?
  - Although this is usually a clinical decision
- If so, with what?
- What will we treat them with?

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### How do we do this?

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### First we have to detect bacteria in the microbiology laboratory

But first of all, you must:

- Take the RIGHT specimen from the RIGHT patient (and from the RIGHT place)
- Get it to the lab at the RIGHT time

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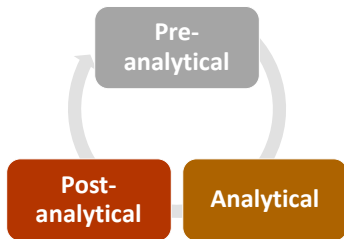
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### Laboratory work flow cycle



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### Specimen arrives in lab



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### Need to make sure it's the right specimen type in the right container!

- Adequate patient identifiers (matching on request form and sample)
- Specimen container in date
- Refer to laboratory user manual
  - Both for your local lab
  - Also NVRL for virology / serology

Otherwise:

- Sample rejection
- Processed for wrong thing (e.g. viral -v- bacterial swabs)

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### How do we detect organisms in the microbiology laboratory?

- Microscopy / Gram stain
- Culture
- Molecular methods: PCR
- Serology

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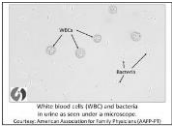
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## 1. Examine it under the microscope

### • Urine microscopy

- Bacteria
- White blood cells/pus cells
- Red blood cells
- Epithelial cells
- Casts



### • Gram stain



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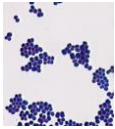
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## BACTERIA

Initial identification based on Gram stain (what does it look like down the microscope)

Colour:



Gram positive (purple)



Gram negative (pink)

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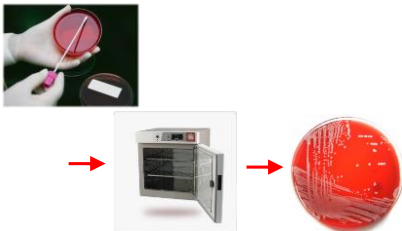
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## 2. Set up culture



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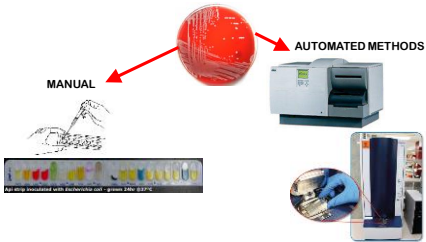
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### 3. Give the bug a name



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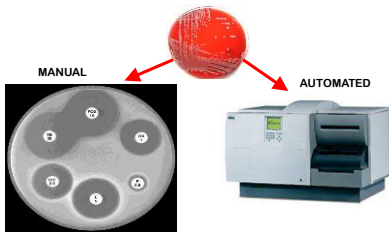
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### 4. Susceptibility testing - What antimicrobial will work?



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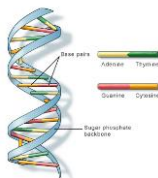
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### What if the organism won't grow in the lab (e.g. viruses)

#### PCR

- Molecular technique
- Directly detects genetic material of bacteria or viruses in a specimen – DNA or RNA
- Can tell you how much virus is present – viral load tests for hepatitis and HIV
- Test often selected based on clinical information – can only find what it is looking for



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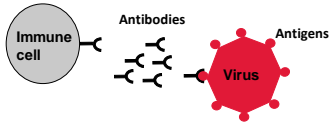
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**Serology**

- Detection of specific antibody or antigen in the blood
- Indicates current infection or past exposure to a pathogen OR vaccination

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**5. Provide a microbiology report**

<b>Patient details</b>	
Specimen type	Collection date
Lab specimen number	Clinical information
Microscopy result: White cell count, Gram stain	
Culture result: Micro-organism name	
Susceptibility results:	
Susceptible to A, B, C	
Resistant to X, Y, Z	
Result interpretation/ clinical comment	

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**However.....**

**What happens before the sample gets to us?**

**What happens with the report?**

**Does it matter??**

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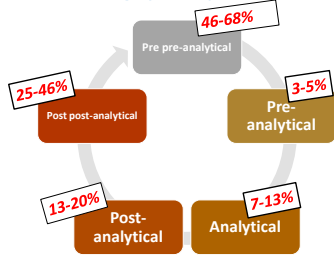
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### Errors influencing quality (of result / patient care)



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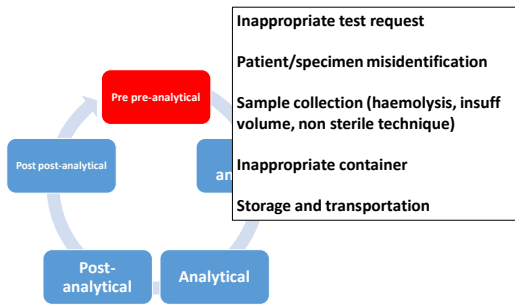
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### Blood cultures

- 3 month old child
- Admitted with sepsis and ? petechiae
- Good clinical response the next day
- Negative blood cultures at 48 hours
- Are you reassured by this?



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### Impact of preanalytical errors: One Friday afternoon.....

**Specimen type:** Stool  
**Request:** Stool PCR for enteric pathogens  
**Details:** none given  
**Location:** Emergency department



**Result:**  
PCR Campylobacter: **DNA DETECTED**  
PCR VTEC type 1 or 2: **Preliminary positive**

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### So what?

#### Clinical implications

Diagnosis: Infective gastroenteritis

- *Campylobacter*
  - Bloody diarrhoea, abdominal pain, colitis
- Verotoxigenic *E. coli*
  - Bloody diarrhoea
  - Haemolytic uraemic syndrome (haemolysis, renal failure)

#### Public health and infection control implications

- Person to person spread
  - Other patients
  - Food handlers, crèche etc
- Foodborne illness
  - *Need to find source*
  - Patient information important in tracing possible source
  - May be part of an ongoing outbreak
  - Could be the start of an outbreak

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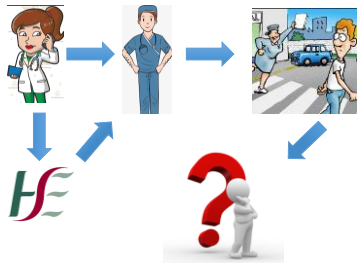
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Urgent result!



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## Impact

- Infected patient never identified
  - No appropriate clinical or public health follow up
- Time and energy!

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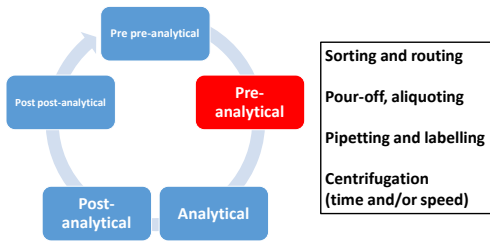
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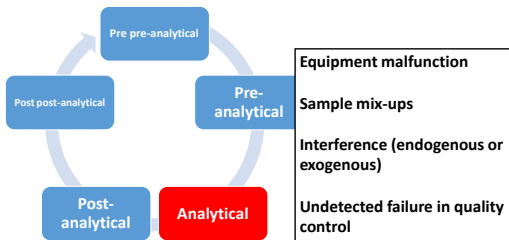
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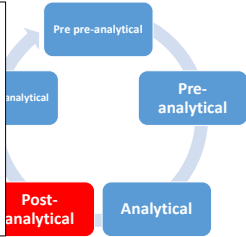
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Failure in reporting/addressing the report  
Excessive turn-around-time  
Improper data entry and manual transcription error  
Failure/delay in reporting critical values



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### Transcription errors



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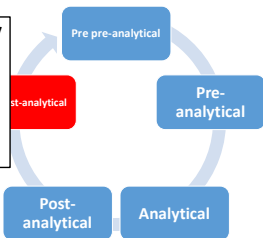
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Delayed/missed reaction to laboratory reporting  
Incorrect interpretation  
Inappropriate/inadequate follow-up plan



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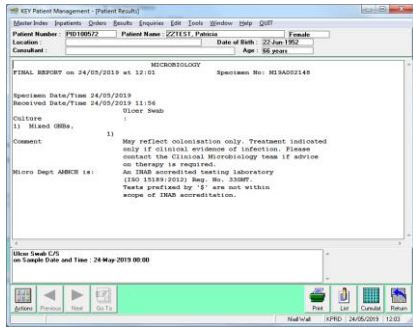
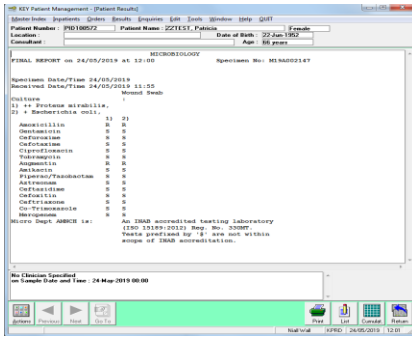
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MAJOR ARTICLE

[Clin Infect Dis](#), 2003 Jun 1;36(11):1418-23

Outcomes Analysis of Delayed Antibiotic Treatment for Hospital-Acquired *Staphylococcus aureus* Bacteremia

Thomas P. Lodise<sup>1</sup>, Peggy S. McElmurn, Linda Seiderwal, and Michael J. Rybak  
<sup>1</sup>Anti-Infective Research Laboratory, Detroit Receiving Hospital and University Health Center, and Wayne State University College of Pharmacy and Health Sciences, Wayne State University, Detroit, Michigan

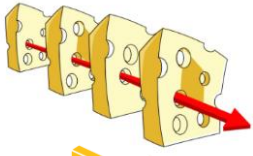
Delayed treatment was an independent predictor of infection-related mortality

- (odds ratio, 3.8)

Associated with a longer hospital stay

- (20.2 days versus 14.3 days)





Errors may occur at all stages of testing

Error in one stage may overlap with or lead to errors in other stages



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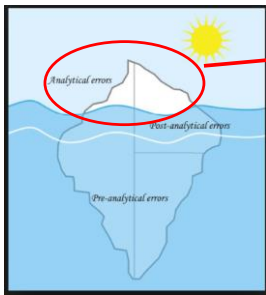
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**Easier to identify and manage**

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**Quality+ Safety**



**Patient should benefit**



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Internal quality assurance

External quality assurance (NEQAS)

Accreditation – quality management systems



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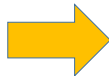
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### Technological advances



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*Can better, faster, and more accurately answer the questions:*

- Does patient have an infection
- If so, with what
- And what will we treat it with

Better patient outcomes

Better antimicrobial stewardship

*But only when properly implemented and applied*



*Can do more harm than good*

- Extremely sensitive molecular assays
- Detection of non clinically significant organisms
- Detection of colonising rather than pathogenic organisms
- Discrepant results

Misunderstanding of test limitations  
• e.g PCR (only find what you are looking for)

*Can end up treating the result – not the patient if not appropriately interpreted*

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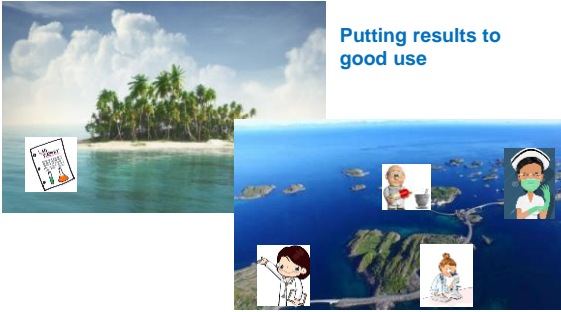
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Putting results to good use

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### It's good to talk!



#### Agree on appropriate testing

- reducing inappropriate demand – better manage precious lab resources
- Lab User Manual
- What does the user require?
- Follow up of patient / results

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**Quality in = Quality out**

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**Always ask:**

Why are we doing this test?

Is it the right test?

Will the patient benefit from this test?

Who do I involve / talk to?



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