CHAPTER 2
UNDERSTANDING THE MICROBIOLOGY LABORATORY
INTRODUCTION

• In order to identify which antibiotic to use need to identify organisms causing infection

• Functions of microbiology laboratory are
  – Assist in diagnosis
  – Identify organism
  – Provide best antimicrobial agent needed
  – Provide information that show any changes in causative organism and sensitivity to antibiotics
INTRODUCTION

• Laboratory will aim at reproducing conditions for the pathogenic microorganism to grow in order to be able to identify it
• In order to run the appropriate tests and interpret results need to rely on a variety of information including patient signs and symptoms.
• Specimen must be properly collected, transported, and stored in order to be able to detect the appropriate organism
• Along with interpretation of organism also can provide advice on how to treat
IDENTIFICATION OF BACTERIA

• Examining bacterial cells under microscope on glass slides can reveal important information about structure, shape, and arrangement.

• Three basic shapes
  — Cocci (round or spherical)
  — Bacilli (rod-shaped)
  — Spirella (spiral)

• Gram staining
  — Gram positive absorb dark blue dye and appear blue or purple under microscope
  — Gram negative do not absorb blue dye but when counterstained with red dye appear pink under microscope
IDENTIFICATION OF BACTERIA

• Culture methods—a variety of mediums are used to grow a specimen
• Cultures can take approximately 24, 48, or 72 hours to grow
• Cultures made need to be grown in an aerobic or anaerobic environment
• When grown on a solid media, bacteria will multiply many times; the distinct group will appear as a colony and can be seen by the naked eye
• Colony size, color, and shape vary between species
• Can grow in pairs, clusters, chain
• An experienced microbiologist is able to distinguish and identify the different colonies
IDENTIFICATION OF BACTERIA

- Cocci can be grouped by formation
  - Mono (bacteria in single formation)
  - Diplo (paired bacteria)
  - Strepto (chain-like formation)
  - Staphylo (clustered formation)
IDENTIFICATION OF BACTERIA

• Bacilli
  – Rod-shaped
  – May possess flagella
  – Pairs (diplobacillus) and chains (streptobacillus)
  – *E. coli* (normal flora of intestinal tract; may migrate to urinary tract causing UTI or to blood stream causing bacteremia)
  – May form spores
IDENTIFICATION OF BACTERIA

• Spirilla- Spirochetes
  – Gram negative
  – Spiral-shaped
  – For example, syphilis, Lyme disease
IDENTIFICATION OF VIRUSES

- Done by two methods—culture of virus or direct detection by electron microscope or detection of specific antibodies in blood by serology tests
  - Such as the ELISA test
  - Remember viruses do not culture the same as bacteria making it more difficult
COLLECTION OF SPECIMENS FOR MICROBIOLOGICAL INVESTIGATION

• Quality of the specimen sent to the lab has a major impact on the results
  – Collection
  – Transport
  – Storage
  – Patient illness and treatment
    • Such as ensuring specimen is collected prior to being given antimicrobial meds
COLLECTION OF SPECIMENS FOR MICROBIOLOGICAL INVESTIGATION

- Urine
- Sputum
- Feces
- Wound swabs
- Other swabs
- Blood cultures
- CSF
BIOHAZARD LABELS

• Should be used to indicate specimen may contain a particularly hazardous pathogen

• Usually used on specimens that are known or suspected of containing blood-borne pathogens

• Labels give the laboratory personnel ability to prepare for the particular handling of specimen during transportation and during testing
TRANSPORT OF SPECIMENS

- Potentially infectious material presents a hazard in transporting specimen
- Person that is collecting specimen is responsible for ensuring that they follow proper protocol
  - Specimen container is leak proof and sealed securely
  - The outside of the container is free of any body fluids
  - Container is not overfilled
  - Biohazard labels are placed on container if needed and specimen is placed in biohazard bag
  - Requisition form is accompanying specimen and is placed in separate pocket
INFORMATION ON REQUEST FORMS

• Request forms provide very important information, therefore Should be completed accurately
  – Identification of causative organisms that may influence testing
  – Accurate site of the specimen collection
  – Date and time of collection
  – Signs and symptoms including site of infection such as number of times of vomiting episodes
  – If person has traveled abroad
INTERPRETATION OF LABORATORY REPORTS

• Results of microbiological examination must be interpreted in combination with clinical evaluation
• Should treat the patient not the results of tests
• Sometimes specimen are contaminated at time of collection, therefore results may not warrant certain medications such as antibiotics such as being febrile
• When treatment is indicated the lab report(s) will provide information needed to choose suitable medication such as antibiotics
### A

**Name:** PARKER, Alice  
**Hosp. No.:** (0000) T456378  
**Age/D.o.B:** 47 YRS 03/02/47  
**Sex:** F  
**Location:** Female Surgical  
**Doctor:** Malcolm, C  

**MICROBIOLOGY – Routine cultures**  

<table>
<thead>
<tr>
<th>Source</th>
<th>Lab No.</th>
<th>Collection Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>WOUND CULTURE</td>
<td>MB–93–93678</td>
<td>20APR94</td>
</tr>
</tbody>
</table>

**Culture**  
STAPHYLOCOCCUS AUREUS: a heavy growth

**Sensitivity**  
ERYTHROMYCIN: S  
GENTAMICIN: S  
FUSIDIC Ax: S  
PENCILLIN: R  
METH/FLUCLOX: S  
VANCOMYCIN: S

### C

**Name:** SMITH, Alexander  
**Hosp. No.:** (0000) T345681  
**Age/D.o.B:** 60 YRS 03/05/34  
**Sex:** M  
**Location:** Male Surgical  
**Doctor:** Peters, D  

**MICROBIOLOGY – Routine cultures**  

<table>
<thead>
<tr>
<th>Source</th>
<th>Lab No.</th>
<th>Collection Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>URINE CULTURE</td>
<td>MB–93–93676</td>
<td>22APR94</td>
</tr>
</tbody>
</table>

**Microscopy**  
>50 White blood cells/cmm  
11–50 Red blood cells/cmm  
<1 Casts/cmm

**Culture**  
KLEBSIELLA AEROGENES: 10–100,000 organisms/ml

**Sensitivity**  
KLEBAER:  
AMP/AMOXY: R  
CEPHALEXIN: R  
NITROFURANTOIN: S  
CO–TRIMOXAZOLE: S  
GENTAMICIN: S  
TRIMETHOPRIM: S

### B

**Name:** GREEN, James  
**Hosp. No.:** (0000) T987654  
**Age/D.o.B:** 73 YRS 03/01/21  
**Sex:** M  
**Doctor:** Stringfellow, E  
**Ward:** Medical unit

**MICROBIOLOGY – Routine cultures**  

<table>
<thead>
<tr>
<th>Source</th>
<th>Lab No.</th>
<th>Collection Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESPIRATORY CULTURES</td>
<td>MB–93–93675</td>
<td>30APR94</td>
</tr>
</tbody>
</table>

**Microscopy**  
Acid fast Bacilli seen

**Preliminary report**  
AFB cultures incubated, further report to follow

### D

**Name:** BROWN, John  
**Hosp. No.:** (0000) T987654  
**Age/D.o.B:** 81 YRS 01/08/12  
**Sex:** M  
**Location:** Care of the elderly  
**Doctor:** Jones, B  

**MICROBIOLOGY – Routine cultures**  

<table>
<thead>
<tr>
<th>Source</th>
<th>Lab No.</th>
<th>Collection Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>WOUND CULTURE</td>
<td>MB–93–93674</td>
<td>30APR94</td>
</tr>
</tbody>
</table>

**Culture**  
ENTEROCOCCUS FAECALIS: a moderate growth  
PROTEUS SPECIES: a moderate growth  
LACTOSE FERMENTING COLIFORM: a scanty growth

**PRESSURE SORE**

 ENTEROCOCCUS FAECALIS: a moderate growth  
PROTEUS SPECIES: a moderate growth  
LACTOSE FERMENTING COLIFORM: a scanty growth