What are Pathogenic bacteria?

Pathogenic bacteria: are bacteria that can cause infection. Although most bacteria are harmless or often beneficial, some are pathogenic.

What distinguishes a pathogen from a non-pathogen?

The terms pathogenic and non-pathogenic are often are applied to various microbes. By definition, a pathogen is a specific cause of a disease, while a non-pathogen is considered harmless. In reality, the distinction is not always clear. In 1890, the German physician Robert Koch formalized the criteria to classify bacteria as pathogenic. While these definitions made sense at the time, advances in microbial sampling and identification have shown that they are unable to account for microbes that cause disease in some individuals but are also present in normal individuals without causing disease. A harmless microbe could become an opportunistic pathogen, especially in an immune-compromised host. For example, *Staphylococcus aureus*, a bacterium that is part of the normal human skin flora is also a common cause of nosocomial (hospital-acquired) infections.
Pathogens such as *Staphylococcus*, *Vibrio cholera* and *Mycobacterium tuberculosis* differ from normal non-pathogenic microbes in that they cause damage to the host. This damage allows the pathogen to colonize novel sites, antagonizes the host immune response, and facilitates spread of the pathogen. pathogens impose damage on their hosts by many virulence factors on host.

Biosafety (Precautions when working with pathogenic bacteria): is about the intrinsic hazards of living organisms and how to handle them safely. Genetic material such as (‘naked’ DNA) can be dangerous as well. Before start working with pathogens or genetically modified organisms (GMOs) in a laboratory one should stop and think about the possible hazards of these organisms and take proportionate measures to minimize any risks for human health and the environment. ....Safety first...!

What are the hazards?

1- The pathogenicity of an organisms
2- Toxicity: Toxicity means poisoning.
3- Allergenicity: Allergenicity is a non-toxic, immune system mediated, undesired reaction of the body to a substance or agent.
4- Disturbance of ecological balances: Disturbance of an ecological balance may happen when a GMO possessing a certain characteristic is accidentally spread to the environment, or when genetic material originating from that organism spreads to other organisms in the environment.
5- Other harmful effects: Sometimes there are other unwanted effects that urge one

to be even more cautious when handling biological material. It is not possible to give an exhaustive list of these effects.

The Seven Basic Rules of Biosafety:

The most common means of exposure can be essentially eliminated as occupational hazards by following the seven basic rules of biosafety:

1- Do not mouth pipette.
2- Manipulate infectious fluids carefully to avoid spills and the production of aerosols and droplets.
3- Restrict the use of needles and syringes to those procedures for which there are no alternatives; use needles, syringes, and other "sharps" carefully to avoid self-inoculation; and dispose of "sharps" in leak- and puncture-resistant containers.
4- Use protective laboratory coats and gloves.
5- Wash hands following all laboratory activities, following the removal of gloves, and immediately following contact with infectious materials.
6- Decontaminate work surfaces before and after use, and immediately after spills.
7- Do not eat, drink, store food, or smoke in the laboratory.

Biological waste:

Biological waste must be disposed of an important distinction should be made between biological waste that has been inactivated before disposal, and biological waste that has not been inactivated before disposal. The latter has to be treated as hazardous medical waste and should be transported to an incinerator that is suited for the incineration of hazardous medical waste.

Biological waste includes:

• All genetically modified and/or pathogenic biological material: cell cultures, cultures of Microorganisms, tissues, blood, etc.

• Typical laboratory waste of organic origin: gels, etc.

• All kinds of biologically contaminated material: gloves, paper tissues, disposable culture flasks, pipettes, etc.

• Materials that are not necessarily contaminated but cannot be thrown into an ordinary waste disposal bag because they have sharp edges or look dirty (bones, blood, etc.).

Biological waste does not include:

• Radioactive contaminated material. Such material should be dealt with separately.

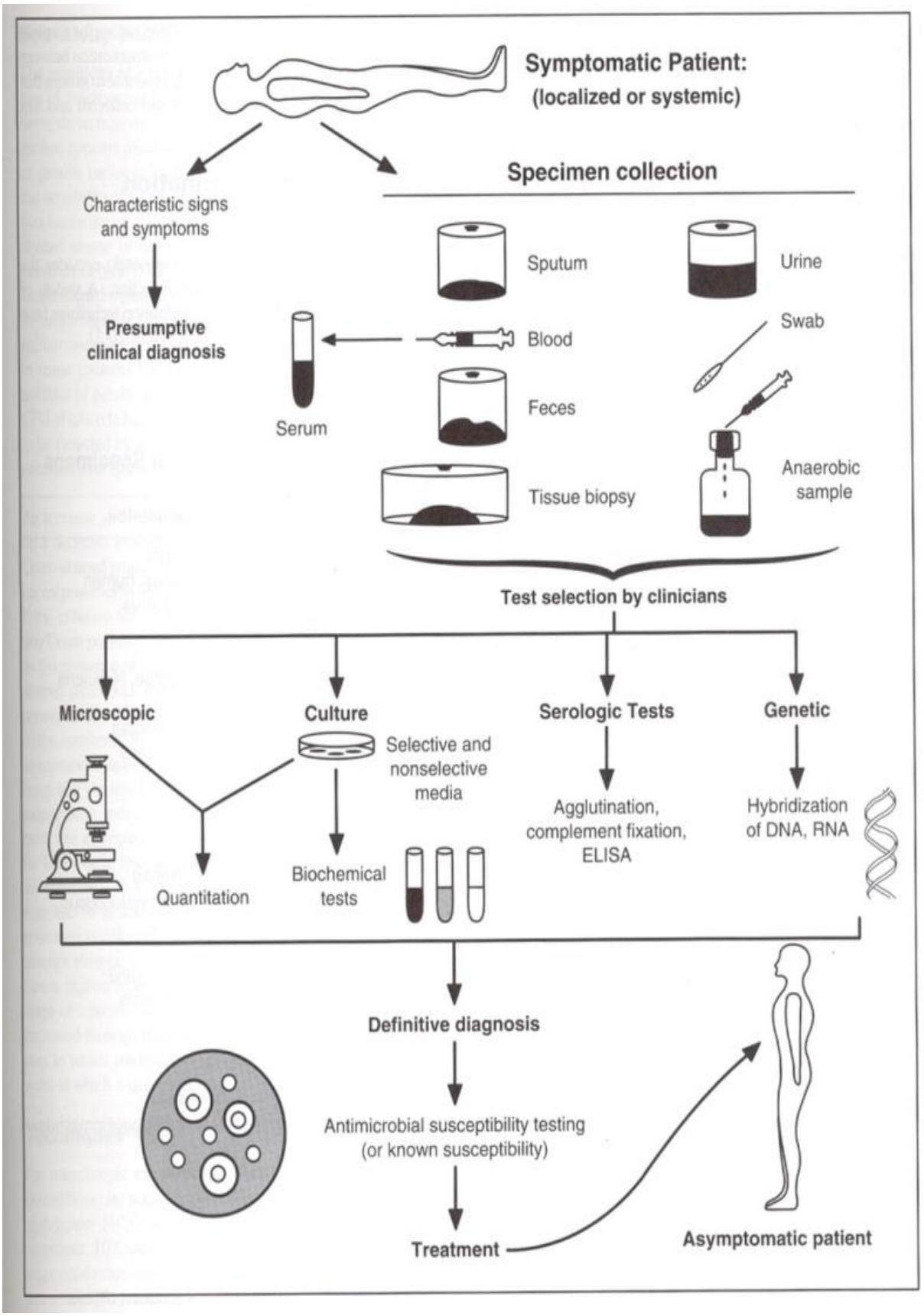
Why is Laboratory Diagnosis Necessary?

Laboratory identification of the agent causing an outbreak is crucial.

Diagnosis generally should not be based on clinical symptoms alone, because many agents can cause the same or similar symptoms in humans. For example, various agents that infect the gastrointestinal tract might all result in symptoms of abdominal cramping and diarrhea. Clinical symptoms may also be unclear or too general to definitively identify the pathogen. In addition, physicians recording symptoms might not recognize a rare disease that they have never encountered and then could misdiagnose a patient. Proper laboratory diagnosis is therefore important not only to connect individual cases that could be involved in an outbreak, but also, to ensure proper medical treatment for the patient.

There are many methods for identifying the agent causing an outbreak. The method used depends on the type of organism (e.g., virus, bacteria, fungus). Some methods are well established for particular organisms, and guidelines exist for identifying the organism. Various methods of detecting and identifying pathogens specific types of tests performed with each method, and some of the advantages and disadvantages of the different approaches are listed in table below.

Identification method	Tests	Pros (+) and cons (-)
Microscopy Examination of organisms under magnification.	•After preparation with various stains and reagents، specimen samples are put onto glass slides and examined with a light microscope. •Smaller microorganisms (viruses) may require use of an electron microscope.	(+) Relatively quick and may provide immediate answers (-) Clinical specimen may not contain sufficient numbers of microorganisms for visualization without culture
Culture Propagation of microorganisms in a growth medium.	• Organism is grown in a nutrient medium (culture plates, stab culture, slab culture, or liquid culture) OR • Organism is grown in live cells or tissue (cell culture or tissue culture)	(+) Is the "gold standard": growth of the organism provides a definitive diagnosis (-) Limited by the quality of the specimen from which the organism is grown (-) Not all pathogens can be cultured (-) Does not detect past infection
Antigen detection uses antibodies to detect antigens.	• Latex agglutination (LA), complement fixation (CF), enzyme-linked immuno-assay (EIA), fluorescent antibody (FA) assay.	(+) Results often discernable by eye (no microscope needed) (-) Does not detect past infection. (-) Not possible for all pathogens.
Serology Detects any past immunological response to pathogen.	• Latex agglutination (LA), complement fixation (CF), enzyme-linked immuno-assay (EIA), fluorescent antibody (FA) assay.	(+) Safe, because it does not require further growth of the pathogen (+) Routine methods of measurement available. (+) Detects past infection. (-) Not all pathogens create an immune response. (-) May require sequential specimens.


Symptomatic Patient:
(localized or systemic)
Specimen collection
Characteristic signs and symptoms
Presumptive clinical diagnosis
Sputum
Urine
Blood
Swab
Serum
Feces
Anaerobic sample
Tissue biopsy
Test selection by clinicians
Microscopic
Culture
Serologic Tests
Genetic
Selective and nonselective media
Agglutination, complement fixation, ELISA
Hybridization of DNA, RNA
Quantitation
Biochemical tests
Definitive diagnosis
Antimicrobial susceptibility testing (or known susceptibility)
Treatment
Asymptomatic patient

Microscopy:

Culture techniques will often use a microscopic examination to help in the identification of the microbe. Instruments such as compound light microscopes can be used to assess critical aspects of the organism. This can be performed immediately after the sample is taken from the patient and is used in conjunction with biochemical staining techniques, allowing for resolution of cellular features. Electron microscopes and fluorescence microscopes are also used for observing microbes in greater detail for research. There are different kinds of stains used to staining the bacterial cell for examples simple stain, Gram stain, acid fast stain, spore stain, capsule stain, flagella stain, nucleotide stain ……..etc.