

# Game Plan

## Lecture

Taxonomy  
Identification and classification  
of microbes  
Dichotomous keys

APO-4: Bergey's Manual and dichotomous  
keys

## Lab

DNA Fingerprinting

Microbial Diversity- phage  
infection

Microbial Diversity- survey

## Next Lab

Lab Exam

# Scientific names and meanings

| Scientific binomial           | Source of Genus name                        | Source of Specific epithet     |
|-------------------------------|---|--------------------------------|
| <i>Klebsiella pneumoniae</i>  | Honors Edwin Klebs                          | The disease                    |
| <i>Pfiesteria piscicida</i>   | Honors Lois Pfiester                        | Disease in fish                |
| <i>Salmonella typhimurium</i> | Honors Daniel Salmon                        | Stupor (typh-) in mice (muri-) |
| <i>Streptococcus pyogenes</i> | Chains of cells (strepto-)                  | Forms pus (pyo-)               |
| <i>Penicillium notatum</i>    | Tuftlike (penicill-)                        | Spores spread in wind (nota)   |
| <i>Trypanosoma cruzi</i>      | Corkscrew-like (trypano-, borer; soma-body) | Honors Oswaldo Cruz            |

Organisms within a genus share **93%** similar rRNA  
Organisms within a species share **97%** similar rRNA

# Hierarchy of classification

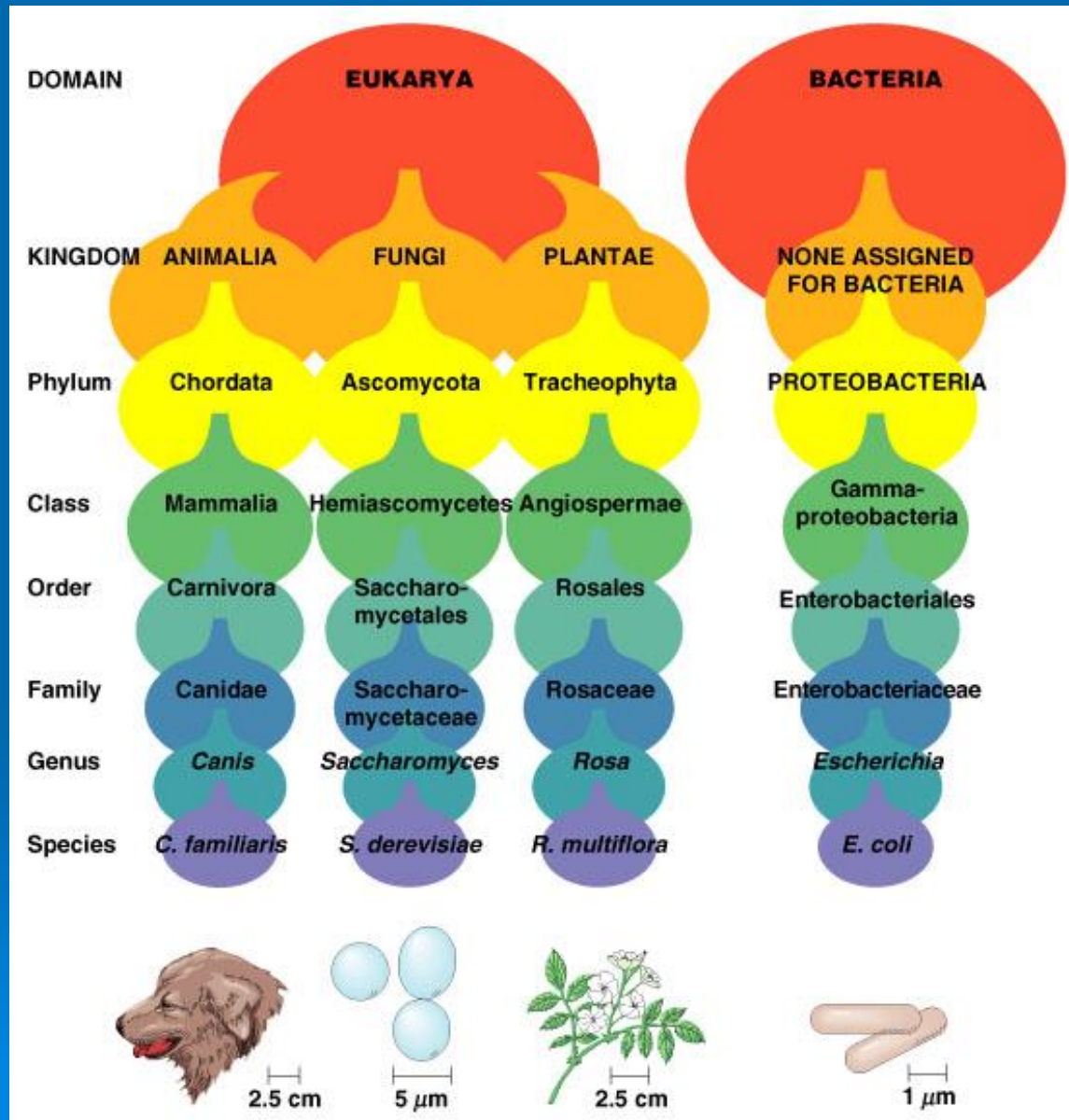


Figure 10.5 (2 of 3)

# Species defined

## Eukaryotic species:

A group of closely related organisms that breed among themselves

## Prokaryotic species:

A population of cells with similar characteristics

Clone: A population of cells derived from a single cell

Strain: A subgroup within a species with one or more characteristics that distinguish it from other subgroups in the species

## Viruses:

A population of viruses with similar characteristics that occupy a particular ecological niche

# Species identification and classification methods

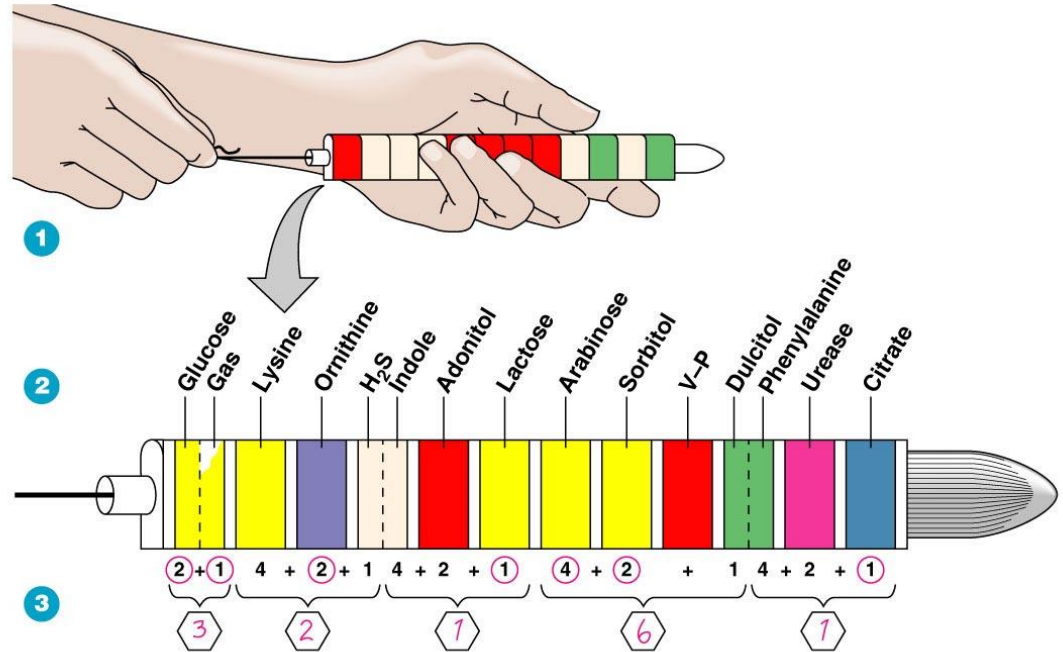
## General

1. Morphological characteristics

## Additional tests

1. Differential staining
2. Biochemical tests- determine presence of enzymes
  - Numerical identification
4. Genetic homology (similarity of DNA)
  - Base composition
  - DNA and RNA sequencing (16s rRNA gene)
  - DNA hybridization
5. Protein and amino acid homology (similarity of proteins)
  - Western blots
  - Amino acid sequences
6. Immunological methods
  - ELISA (enzyme linked immunosorbent assay)
  - Western blots

# Numerical identification: the Enterotube



| ID Value | Organism                      | Atypical Test Results | Confirmatory Test |
|----------|-------------------------------|-----------------------|-------------------|
| 32143    | <i>Enterobacter cloacae</i>   | Sorbitol <sup>-</sup> | -                 |
|          | <i>Enterobacter sakazakii</i> | Urea <sup>+</sup>     | +                 |
| 32161    | <i>Enterobacter cloacae</i>   | None                  | V-P <sup>+</sup>  |
| 32162    | <i>Enterobacter cloacae</i>   | Citrate <sup>-</sup>  |                   |

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# Species identification and classification methods

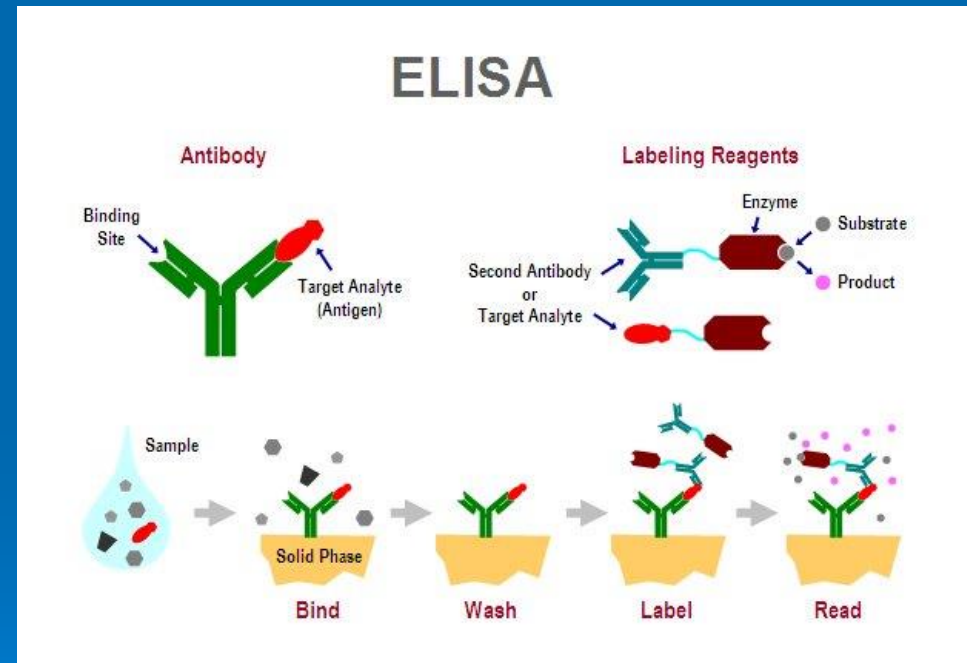
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# Enzyme Linked Immunosorbent Assay (ELISA)





# Criteria for classifying/ identifying bacteria

**TABLE 10.5**

**Taxonomic Criteria and Methods for Classifying and Identifying Bacteria**

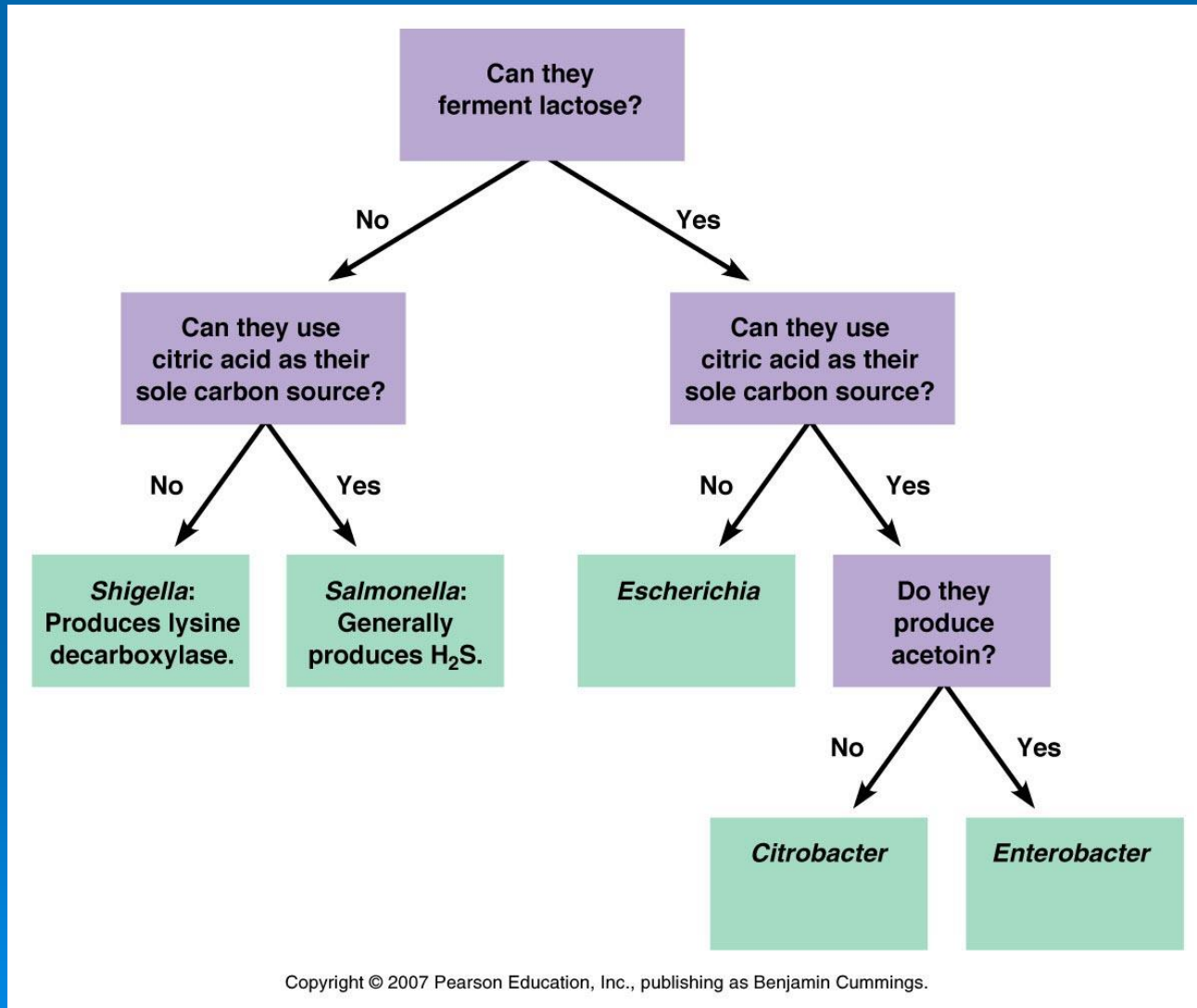
| Criterion or Method                          | Used for                   |                |
|--|----------------------------|----------------|
|  | Classification             | Identification |
| <b>Morphological characteristics</b>         | No (yes for cyanobacteria) | Yes            |
| <b>Differential Staining</b>                 | Yes (for cell wall type)   | Yes            |
| <b>Biochemical Testing</b>                   | No                         | Yes            |
| <b>Serology</b>                              | No                         | Yes            |
| <b>Phage Typing</b>                          | No                         | Yes            |
| <b>Fatty Acid Profiles</b>                   | No                         | Yes            |
| <b>Flow Cytometry</b>                        | No                         | Yes            |
| <b>DNA Base Composition</b>                  | Yes                        | No             |
| <b>DNA Fingerprinting</b>                    | Yes                        | Yes            |
| <b>PCR</b>                                   | Yes                        | Yes            |
| <b>Nucleic Acid Hybridization Techniques</b> | Yes                        | Yes            |
| <b>rRNA Sequencing</b>                       | Yes                        | No             |

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# Classification and identification references

|  |  |
|--|--|
| <ul style="list-style-type: none"><li>•• <i>Bergey's Manual of Determinative Bacteriology</i></li><li>• Provides identification schemes for identifying bacteria and archaea</li></ul> | <ul style="list-style-type: none"><li>• Morphology, differential staining, biochemical tests</li></ul> |
| <ul style="list-style-type: none"><li>•• <i>Bergey's Manual of Systematic Bacteriology</i></li><li>• Provides phylogenetic information on bacteria and archaea</li></ul>               | <ul style="list-style-type: none"><li>• Based on rRNA sequencing</li></ul>                             |
| <ul style="list-style-type: none"><li>•• <i>Approved Lists of Bacterial Names</i></li><li>• Lists species of known prokaryotes</li></ul>   | <ul style="list-style-type: none"><li>• Based on published articles</li></ul>                          |

# Tools of identification: the dichotomous key



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Figure 10.8

# Tools of identification: the dichotomous key

- I. Gram-positive
  - A. Catalase+
    - 1. Acid from glucose..... *Staphylococcus*
    - 2. Glucose-..... *Micrococcus*
  - B. Catalase-
    - 1. Coccus..... *Streptococcus*
    - 2. Rod..... *Lactobacillus*
- II. Gram-negative
  - A. Oxidase-
    - 1. Acid from lactose
      - a. Uses citric acid..... *Citrobacter*
      - b. Citric acid-..... *Escherichia*
    - 2. Lactose-
      - a. H<sub>2</sub>S produced
        - (1) Urease positive..... *Proteus*
        - (2) Urease negative..... *Salmonella*
  - B. Oxidase+
    - 1. Rod..... *Pseudomonas*
    - 2. Coccus..... *Neisseria*