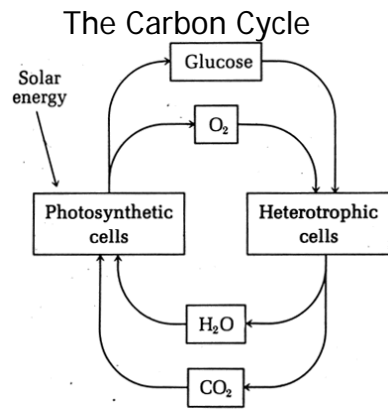




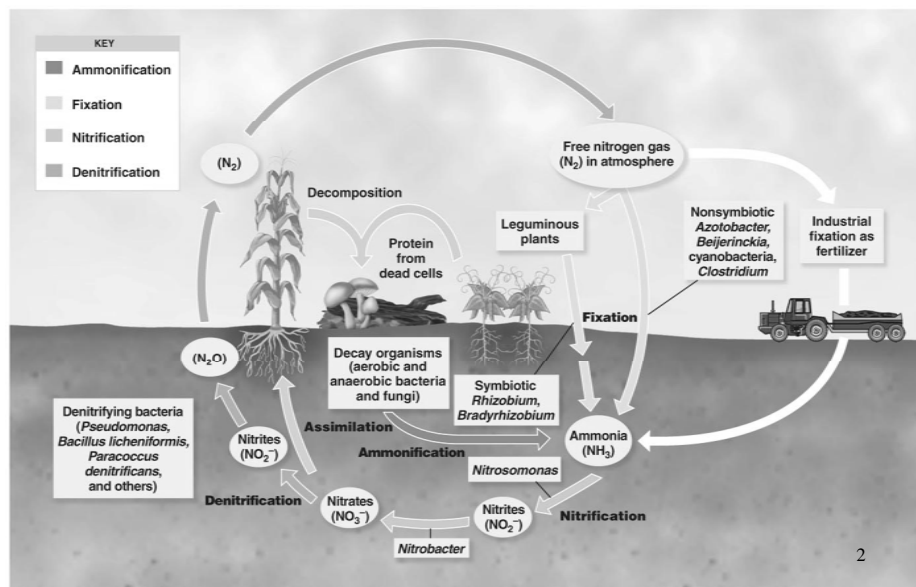
Course: Biological Processes for Wastewater Treatment  
Semester 92-2

Lec1:  
**Microorganisms  
in environment**



1

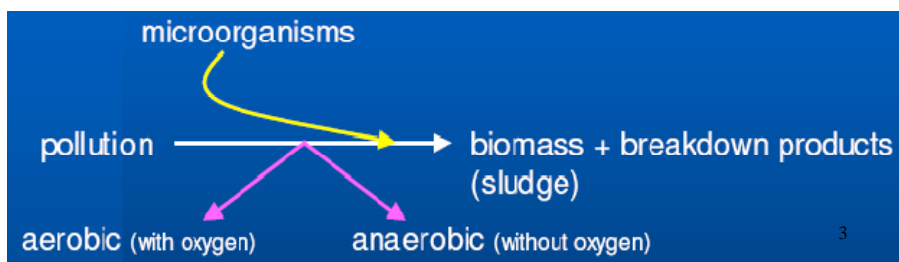
## The Nitrogen Cycle



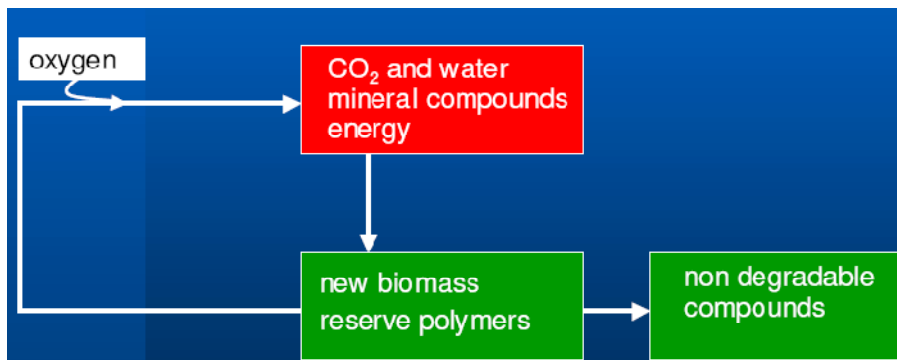
2

# Microorganisms in environment

Env problems naturally solved by  
microorganisms such as bacteria, fungi  
Which break down contaminant into a form  
less harmful or not harmful



- Endogenous respiration



- Occurred when low organic load: minimal sludge production

4

## A little Microbiology

Microbial cell  
Classification  
Bacteria  
Archaea  
Fungi  
Algae  
Protozoa

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## Microbial cell

- توانایی تبدیل مواد غذایی به مواد زنده فعال

-قابلیت پاسخگویی به محرکهای محیطی مانند دما، فشار، رطوبت

-قدرت رشد و تولید مثل

- توانایی تجزیه مواد غذایی (آلی) به منظور تولید انرژی و ساختارهای سلولی

6

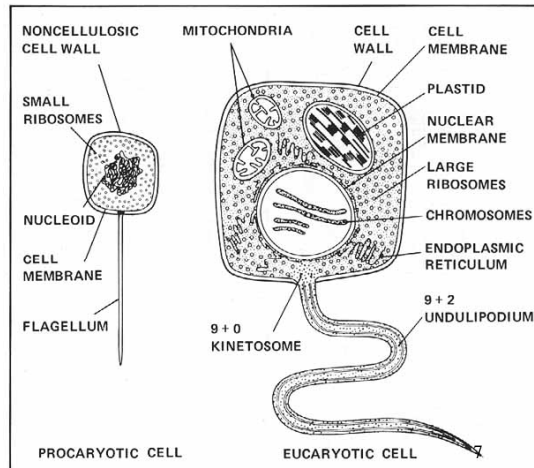
# Classification

Prokaryotes

Bacteria  
Archaea

Eukaryotes

Fungi  
Algae  
Protozoa



# Classification

example

*Protists*

*Proteobacteria*

*β-Proteobacteria*

*Bulkholderiales*

*Ralstoniaceae*

*Ralstonia*

*basilensis*

Kingdom

phylum

class

order

family

genus

species

سلسله

شاخه

رده

راسته

خانواده

جنس

گونه

*Ralstonia basilensis* R25C6

*Escherichia coli*

*Pseudomonas putida*

*Saccharomyces cerevisiae*

*R. basilensis* R25C6

*E. coli*

*P. putida*

*S. cerevisiae*

# Bacterial morphology

Shape

Size

Arrangement

Colony

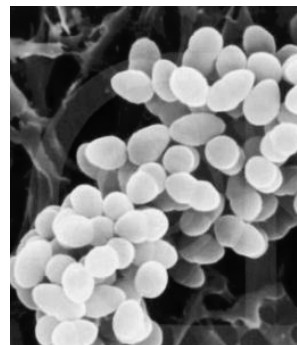
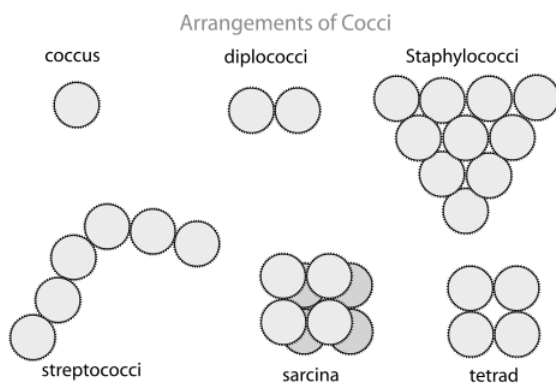
structure



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# Bacterial morphology

Shape, size, arrangement

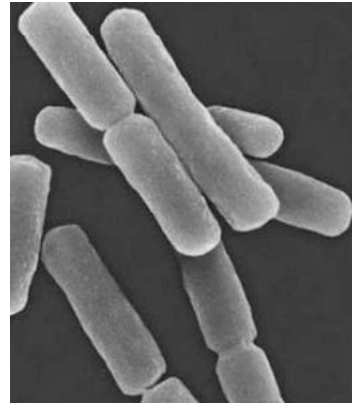
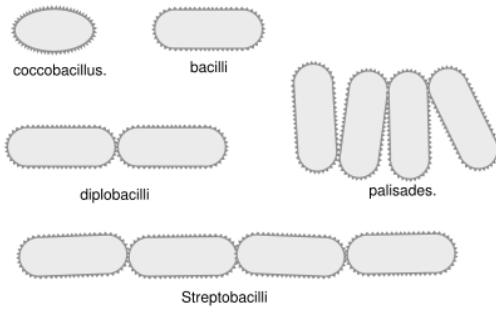


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# Bacterial morphology

Shape, size, arrangement

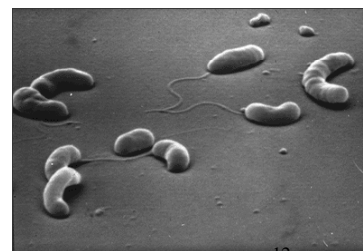
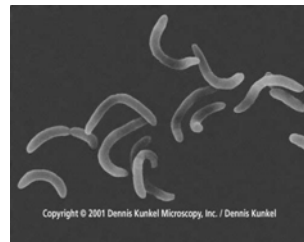
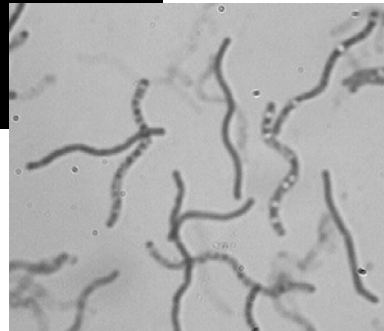
Arrangements of Bacilli



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# Bacterial morphology

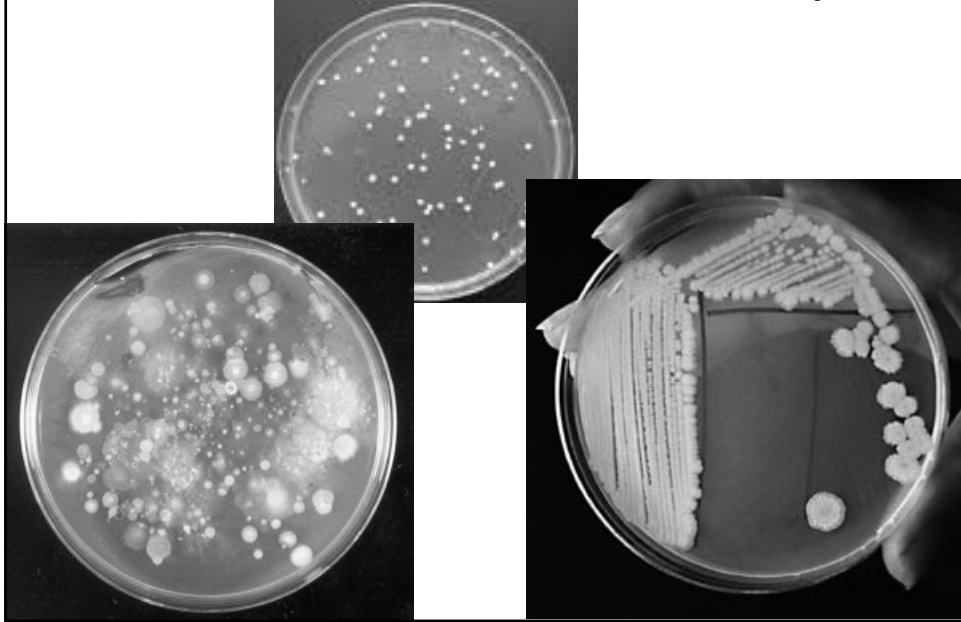
Shape, size, arrangement



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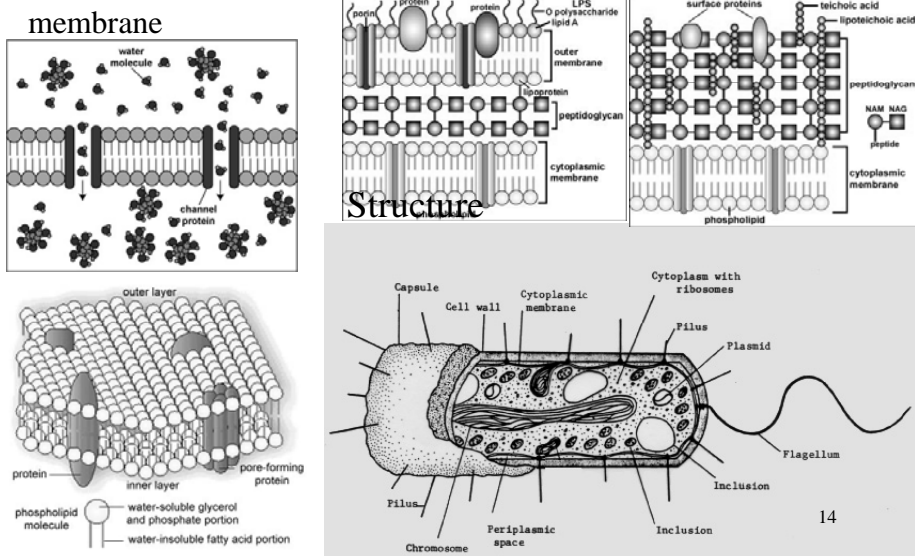
# Bacterial morphology

# Colony



# Bacterial morphology Structure

## Bacterial cell wall



# Bacteria

## Chemical composition

water	75%
Dry matter	25%
<hr/>	
organic	90%
C	45-55
H	5-7
O	22-28
N	8-13
inorganic	10%
P, K, Na, Mg, Ca, S, ... metals	

## Macromolecular composition

Proteins	50-60
Carbohydrates	10-15
Lipids	6-8
DNA	3
RNA	15-20

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# Growth requirement

**Nutrients**

**Oxygen**

**Moisture**

**Optimal temperature and pH**

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# Growth requirement

## Energy source

Phototrophs

Chemotrophs

Chemoorganotrophs

Chemolithotrophs

## Carbon source

Autotrophs

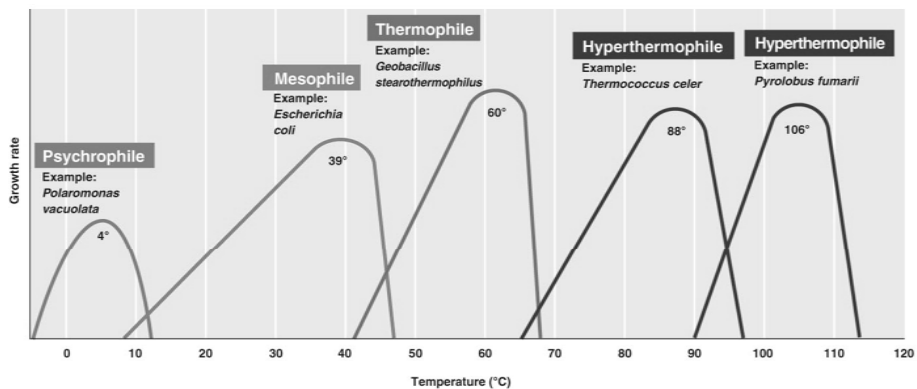
Heterotrophs

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# Bacteria

## Environmental conditions

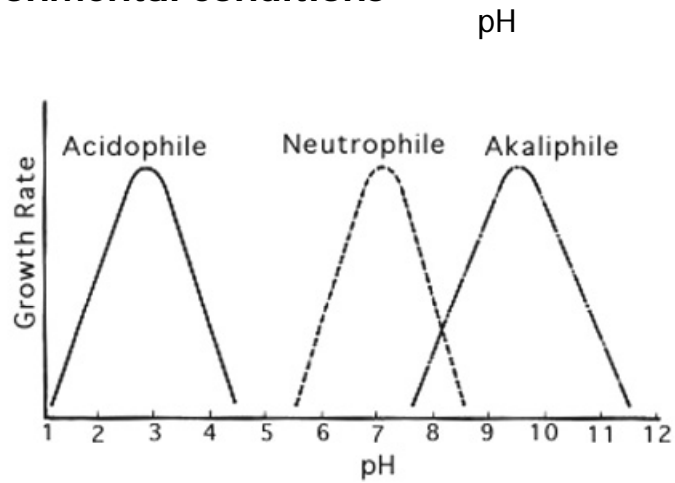
Temperature



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# Bacteria

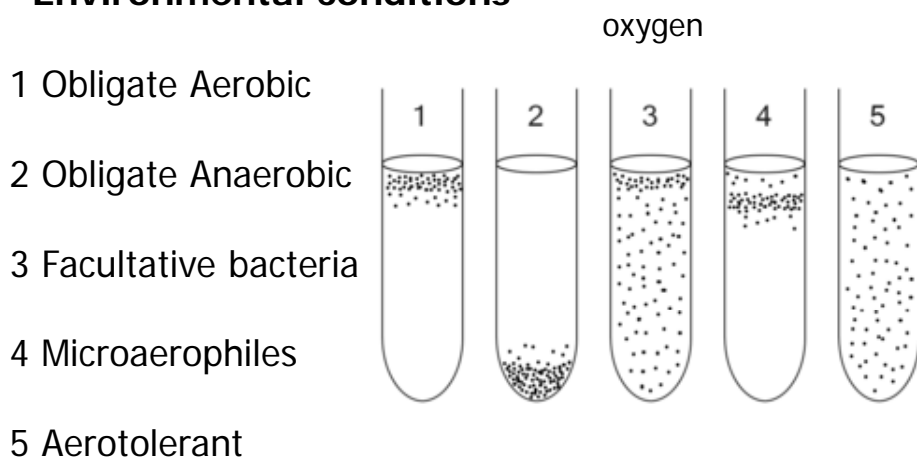
## Environmental conditions



19

# Bacteria

## Environmental conditions



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# Bacteria

## Environmental conditions

Salinity , osmosis pressure

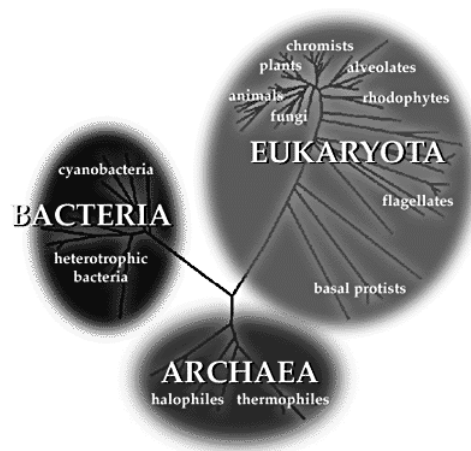
Halophiles

Extreme Halophiles

21

# Archaea

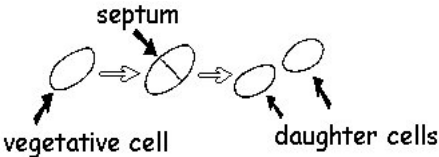
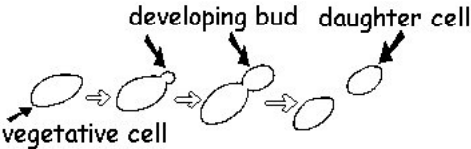
- adapted to heat , salt , acid , pH, pressure
- Methane producers
- Hyperthermophiles
- Extreme halophiles
- Sulfur reducers



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# Fungal morphology

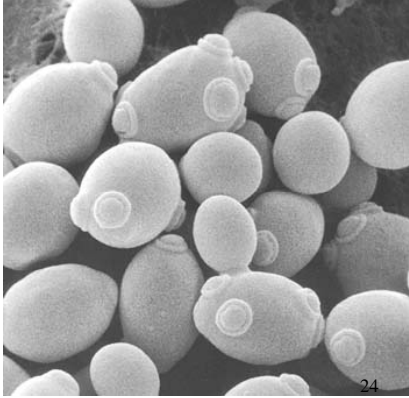
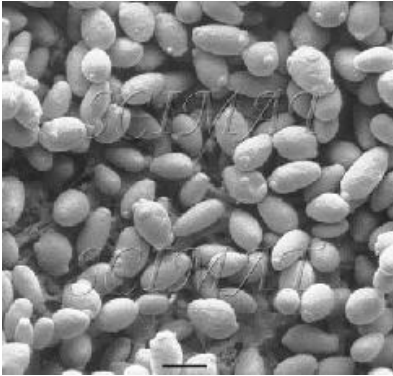
yeast



# Fungal morphology

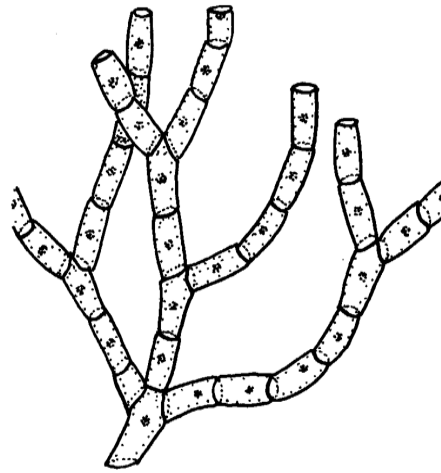
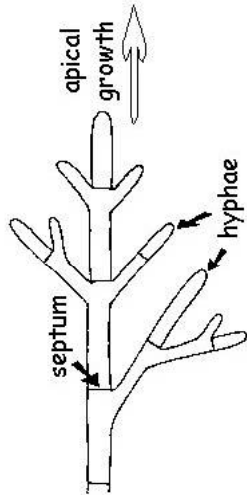
yeast

*Saccharomyces cerevisiae*



# Fungal morphology

Mold

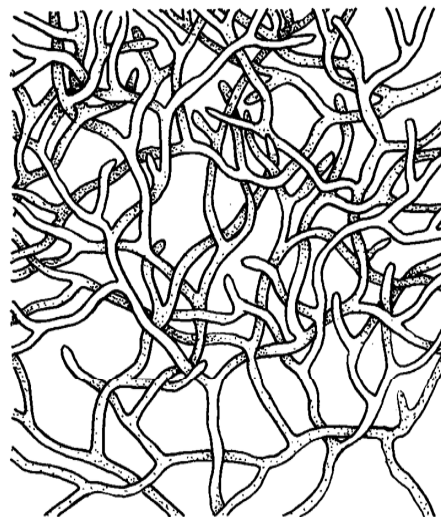
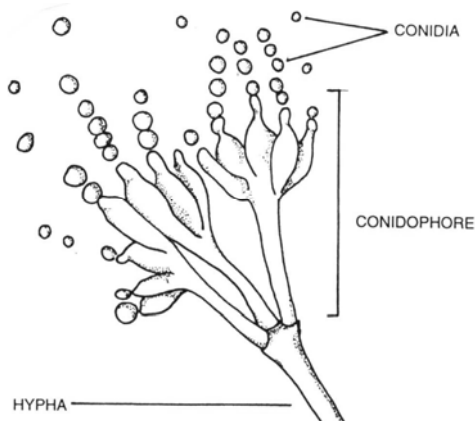


Mycelium

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# Fungal morphology

Mold



Mycelium

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**phenotype approach**

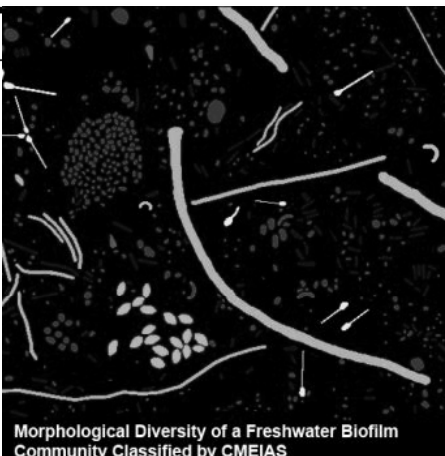
**Table 19.4** Some Physiological and Metabolic Characteristics Used in Classification and Identification

Carbon and nitrogen sources	Classification
Cell wall constituents	
Energy sources	
Fermentation products	
General nutritional type	
Growth temperature optimum and range	Taxonomy
Luminescence	
Mechanisms of energy conversion	
Motility	Phenotype
Osmotic tolerance	
Oxygen relationships	Genotype
pH optimum and growth range	
Photosynthetic pigments	
Salt requirements and tolerance	
Secondary metabolites formed	
Sensitivity to metabolic inhibitors and antibiotics	
Storage inclusions	

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**phenotype approach**

**Table 19.3** Some Morphological Features Used in Classification and Identification

Feature	
Cell shape	
Cell size	
Colonial morphology	
Ultrastructural characteristics	
Staining behavior	
Cilia and flagella	
Mechanism of motility	
Endospore shape and location	
Spore morphology and location	
Cellular inclusions	
Color	

Morphological Diversity of a Freshwater Biofilm Community Classified by CMEIAS

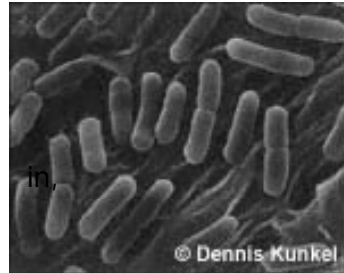
<sup>a</sup>Used in classifying and identifying at least some bacteria, algae, fungi, and protozoa.

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## Microorganisms

Good or Bad ?

*E. coli*



intestinal bacterium

killed 7 people and made 1,000 others ill  
Ontario, in 2000.

Contamination of the town's well water  
when heavy rains washed manure into the wells  
at a time when the disinfection system was broken.



*Cryptosporidium*

the best known and most deadly case  
of contamination in the U.S.

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## Microorganisms

Good or Bad ?

### The main source of pathogens

- Domestic waste
- Effluent from WWTP
- Agricultural runoff (animal feedlots)
- Stormwater runoff (carries animal and bird droppings)
- Industrial waste

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