



Exploring the World of Science

2017 MICROBE MISSION(B/C)

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Event Rules – 2017

DISCLAIMER

This presentation was prepared using draft rules. There may be some changes in the final copy of the rules. The rules which will be in your Coaches Manual and Student Manuals will be the official rules.



Event Rules – 2017

- **BE SURE TO CHECK THE 2017
EVENT RULES FOR EVENT
PARAMETERS AND TOPICS
FOR EACH COMPETITION
LEVEL**



TRAINING MATERIALS

- **Training Power Point** – content overview
- **6 Training Handouts** - content area information and
- **Microscope Review** – Review of use light microscope and kinds of microscopes
- **Practice Activities** – sample stations with key
- **2 Sample Tournament** – sample problems with key
- **Event Supervisor Guide** – event prep tips, setup needs and scoring tips
- **Internet Resources & Training Materials** – on the Science Olympiad website at www.soinc.org under Event Information
- **A Biology-Earth Science CD, a Microbe Mission CD and the Division B and Division C Test Packets** are available from SO store at www.soinc.org



MICROBE MISSION(B/C)

- **Event Description** - lab-oriented competition to answer questions, solve problems and analyze data pertaining to various microbes
- **Event** – lab practical in stations
- **Event Parameters** – be sure to check the rules for resources allowed, type of goggles needed.



MICROBES

- The term **microbe** is short for **microorganism** which means small organism – observed with a microscope
- **Over 99% of microbes** contribute to the quality of human life
- A **small minority** cause disease – in humans by sheer numbers or producing powerful toxins
- The **major groups** of microbes are bacteria, Archaea, algae, fungi, protozoa & viruses
- In **terms of numbers**, microbes represent most of the diversity of life on Earth and are found in every environment.



Content Handouts

- **General Overview**
- **Major Groups of Microbes**
- **Microbes and Ecology**
- **Microbes and Industry**
- **Microbes and Food**
- **Microbes and Disease**

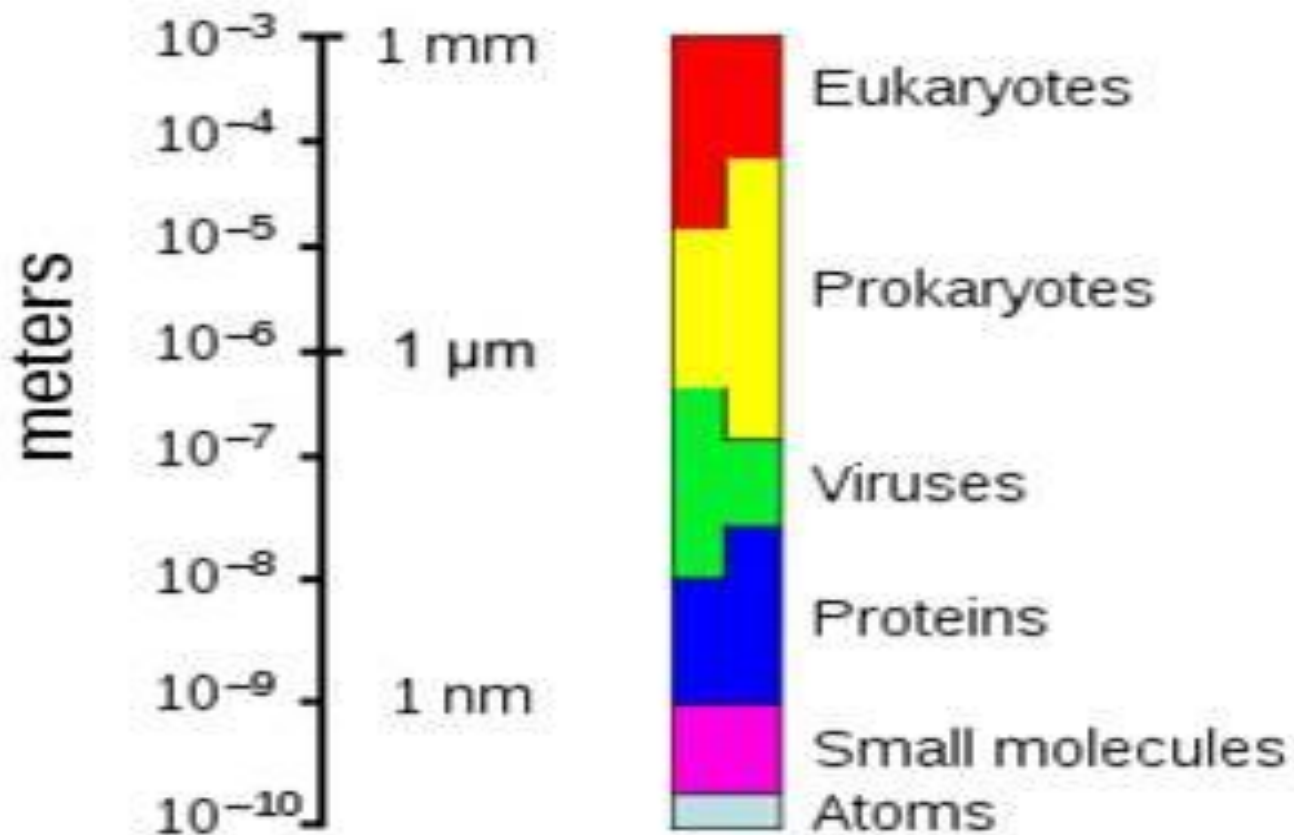


2017 Microscope Review

A special training handout covering

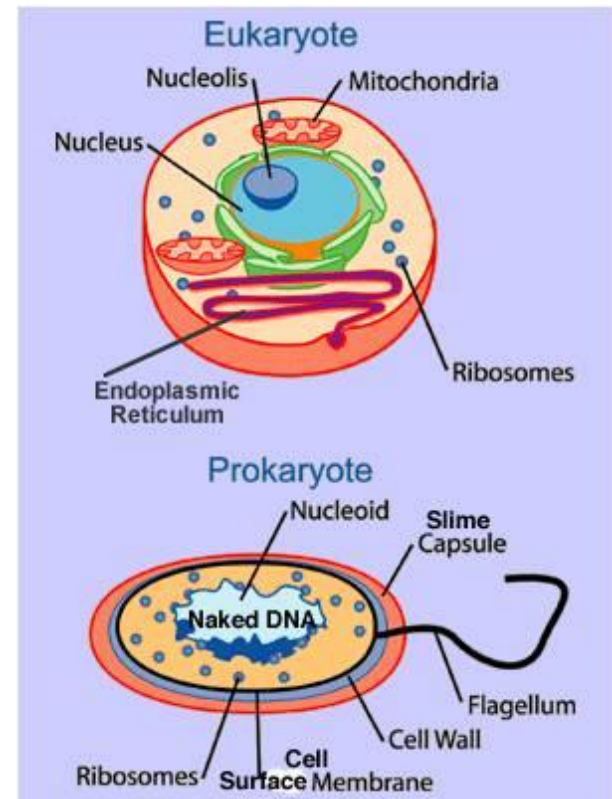
- **Relative Size of Microbes**
- **Types of Microscopes – their uses, advantages and disadvantages**
- **Parts of a Light Microscope and their function**
- **Principles of Microscopy**

RELATIVE SIZE OF MICROBES



Prokaryotic vs. Eukaryotic

- **Prokaryotic – single cell with nuclear material but no nuclear membrane or membrane bound organelles**
- **Eukaryotic – most cells – with organized nucleus and membrane bound organelles**

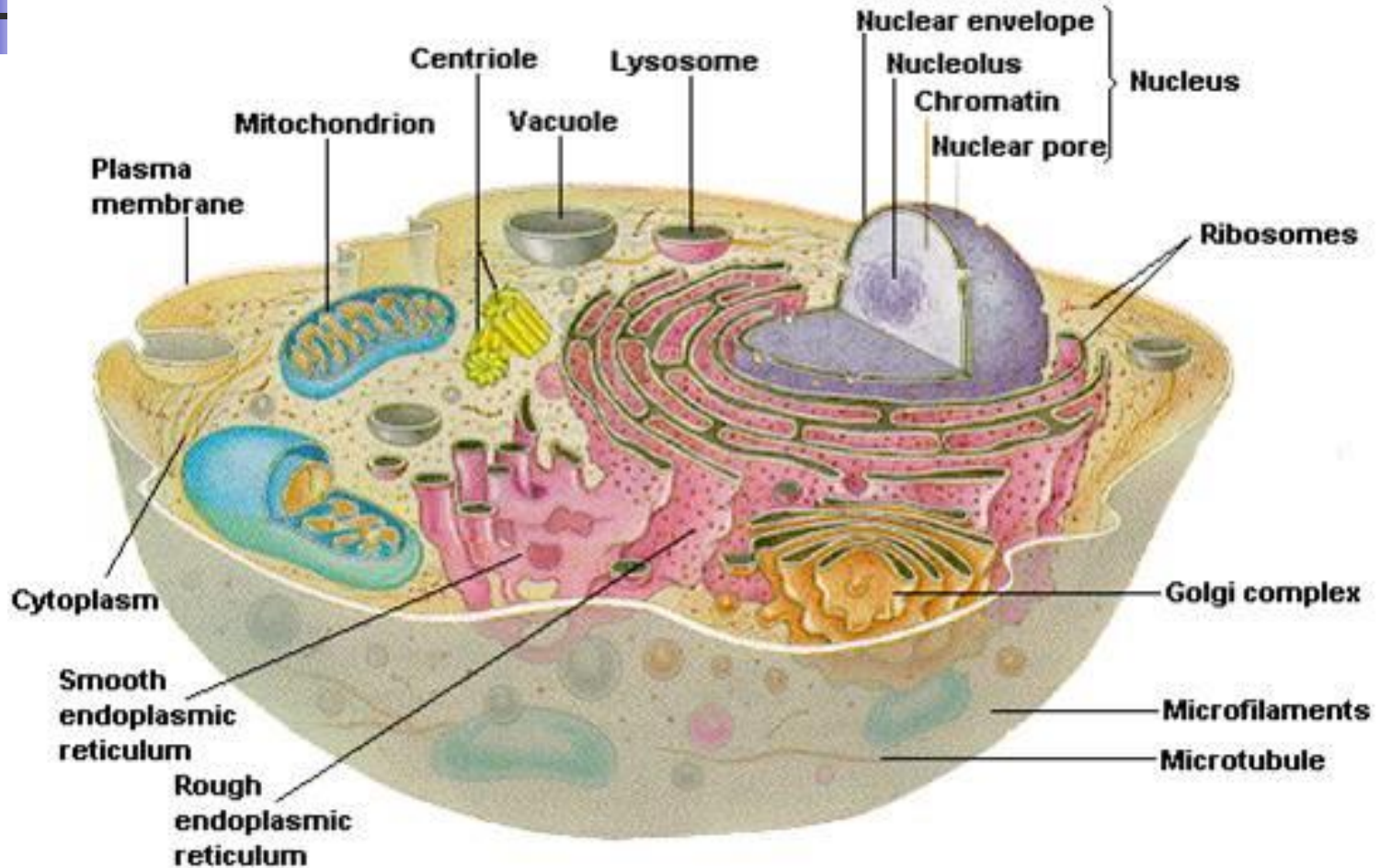




Cellular vs. Acellular

- **Acellular – Viruses** do not have cellular components, nor do they grow or metabolize organic materials. They generally consist of a piece of nucleic acid encased in protein which must use the cellular components of a living cell to reproduce.
Prions (**pr**oteinaceous **i**nfectious particles) are infectious agents composed primarily of protein which induce the existing polypeptides in host cells to take on its form.
- **Cellular – bacteria** and **Archaea** are **prokaryotic cells** while **algae, fungi,** and **protozoa** have **eukaryotic cells.**

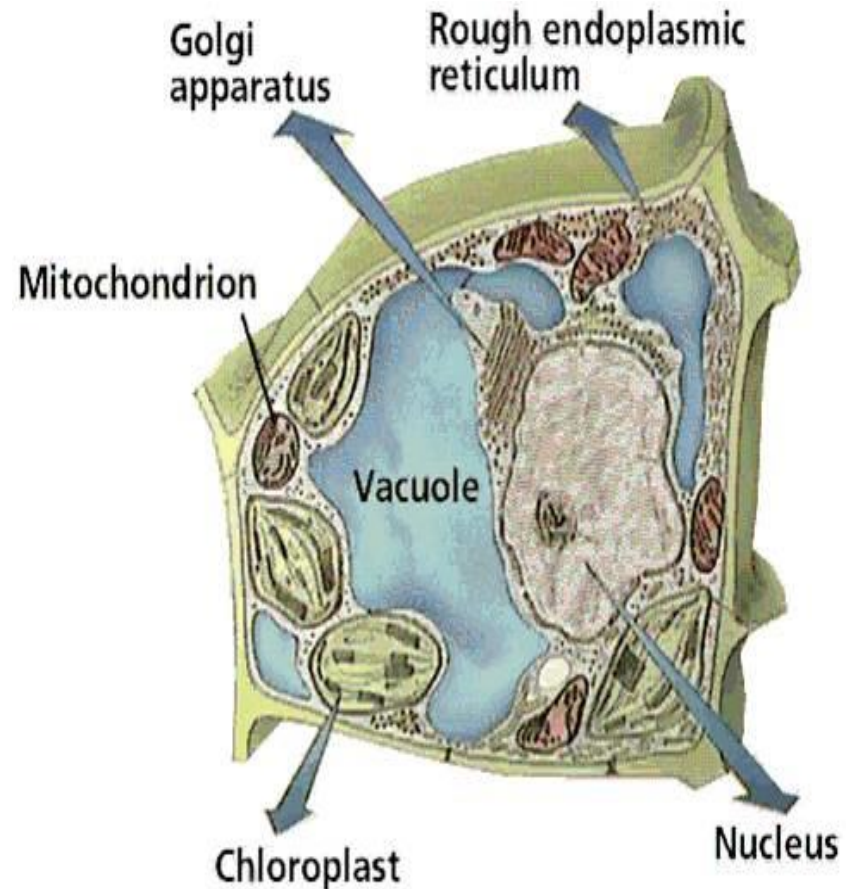
Animal Cell



Plant Cell

Special Features

- **Cell wall – protection and support**
- **Chloroplast - for photosynthesis**
- **Large central vacuole- for storage and increase surface area**

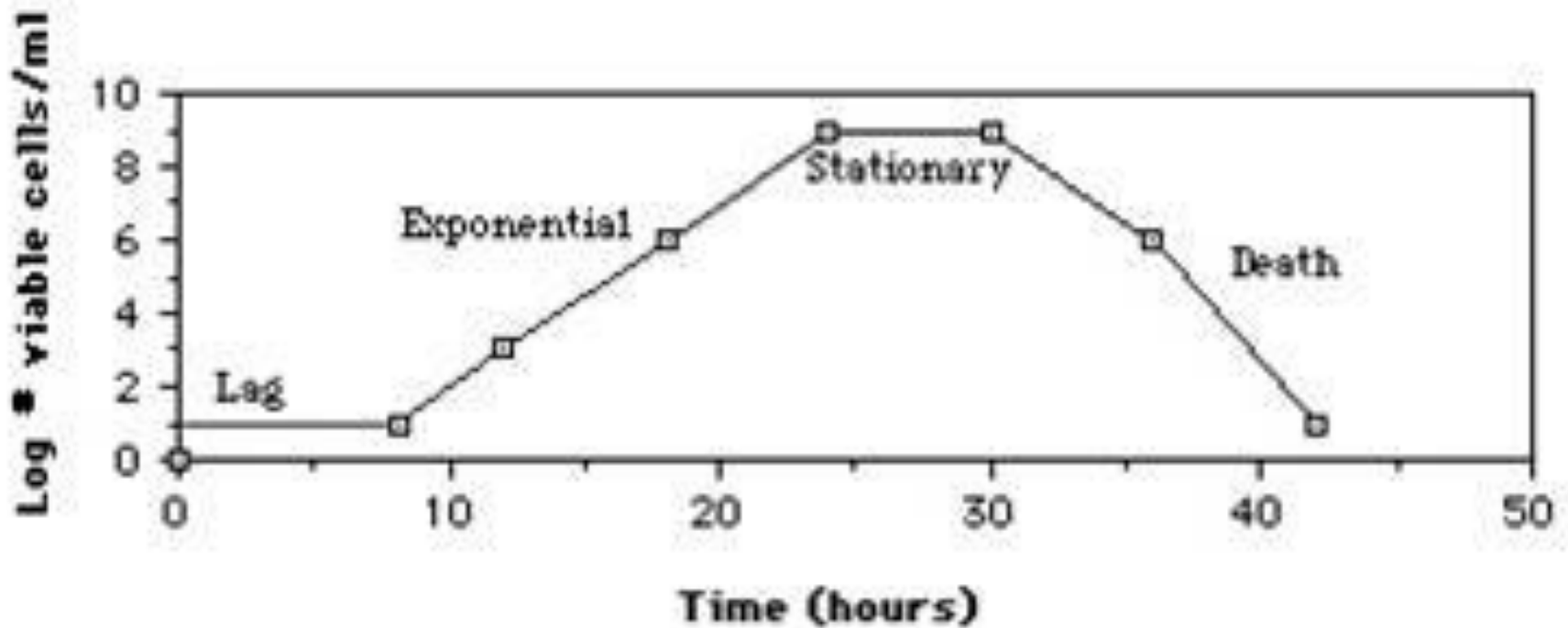




Organelles of Microbial Origin

- **Mitochondria** – have DNA similar to that of a Prokaryotic cell and can reproduce independent of the rest of the Eukaryotic cell.
- **Chloroplasts** – also have DNA similar to that of a Prokaryotic cell and can reproduce independent of the rest of the Eukaryotic cell.
- It is believed that both chloroplasts and mitochondria were one independent Prokaryotes who took up residence in the Eukaryotic cell and have developed a special symbiotic relationship

MICROBIAL GROWTH CURVE



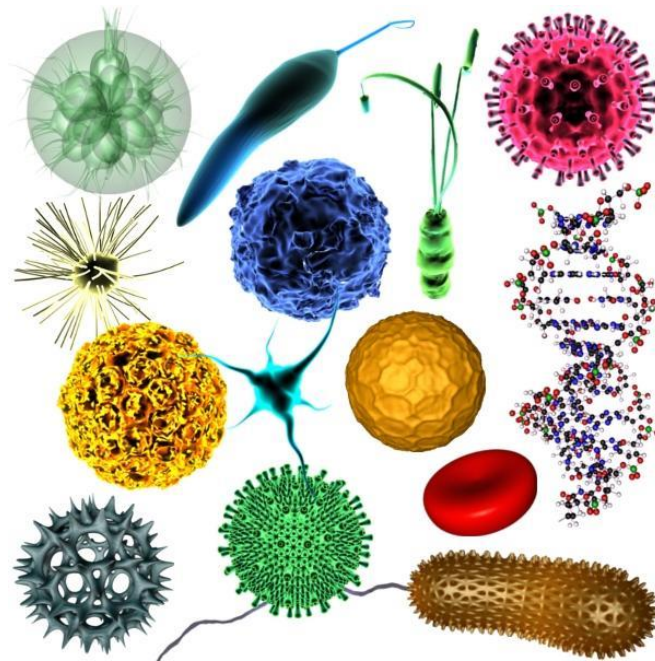
BENEFICIAL VS HARMFUL MICROBES



- **Over 99%** contribute to the quality of human life
- **Live in every environment on earth**
- **Important in ecological systems**
- **Important in biogeochemical cycles**
- **Human digestion depends upon them**
- **Important to the food industry and the productions of many products**
- **Help with wastewater and oil spill cleanup**
- **Small minority cause disease**

MAJOR GROUPS OF MICROBES

- **Prions**
- **Viruses**
- **Archaea**
- **Bacteria**
- **Algae**
- **Protozoa**
- **Fungi**

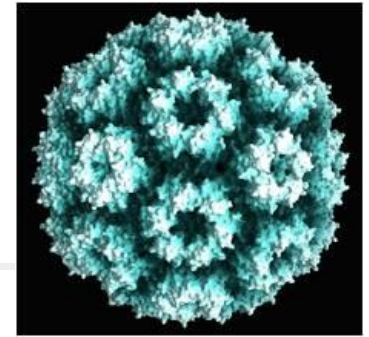




PRIONS

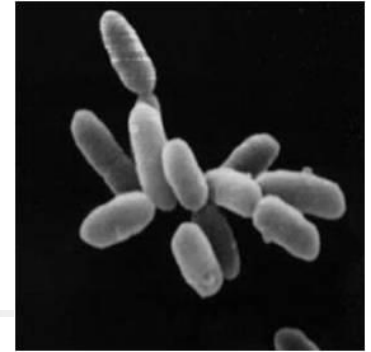
- **proteinaceous infectious particles, associated with a number of diseases**
- **characterized by loss of motor control, dementia, paralysis, wasting and eventually death**
- **Mad Cow Disease in cattle**
- **Creutzfeldt-Jacob disease (CJD) in humans**

VIRUSES



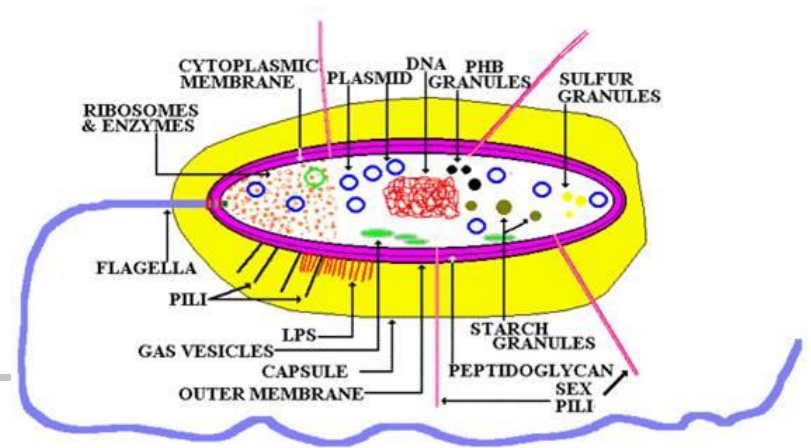
- **Are acellular**
- **Consists of a piece of nucleic acid (DNA or RNA) encased in protein and in some cases a membrane-like envelope**
- **They come in many shapes**
- **Found anywhere there are cells to infest**
- **Exist to reproduce – must take over a suitable host cell**
- **Uses the cell machinery of the host cell to reproduce**

Archaea



- **Similar to bacteria – prokaryotic**
- **Cell walls lack peptidoglycan + other differences**
- **Origin very old - during formation of the earth**
- **Extremely tolerant to heat, acid, and toxic gases**
- **Found in extreme habitats in anaerobic environments to produce methane, high salt concentrations or hot acid environments**
- **Involved in carbon & nitrogen cycles, assist in digestion, & can be used in sewage treatment**

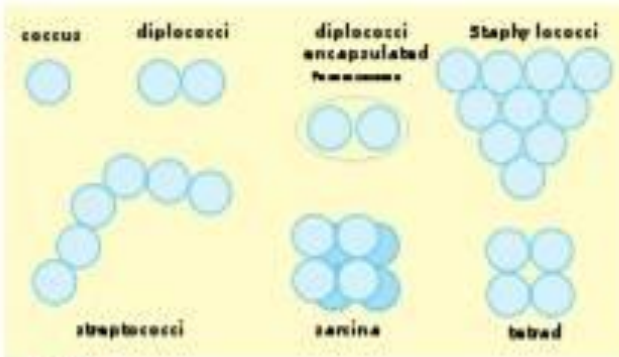
Bacteria



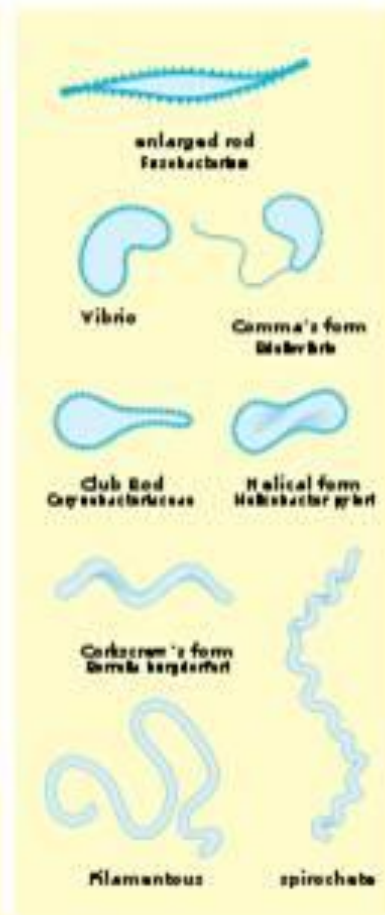
- Only one cell – a prokaryotic cell
- Live in all environments – even above boiling point and below freezing point
- Basically three shapes – spherical , rod , and spiral or helical (spirillum) Exist as individuals or cluster together to form pairs, chains, squares, or other groupings
- Some form spores
- Some are photoautotrophic - make their own food as plants and give off oxygen – **Cyanobacteria** are also aerobic **Purple and green bacteria** are anaerobic
- Some are chemoautotrophic - synthesize their own food using energy from chemical reactions – important for recycling in nitrogen and sulfur cycles
- Some have flagella - rotates like a tiny outboard motor, others secrete a slime layer and move over surfaces like slugs

BACTERIAL SHAPES

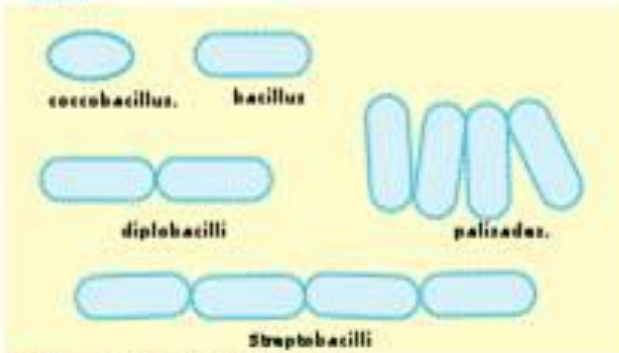
Cocci



Others



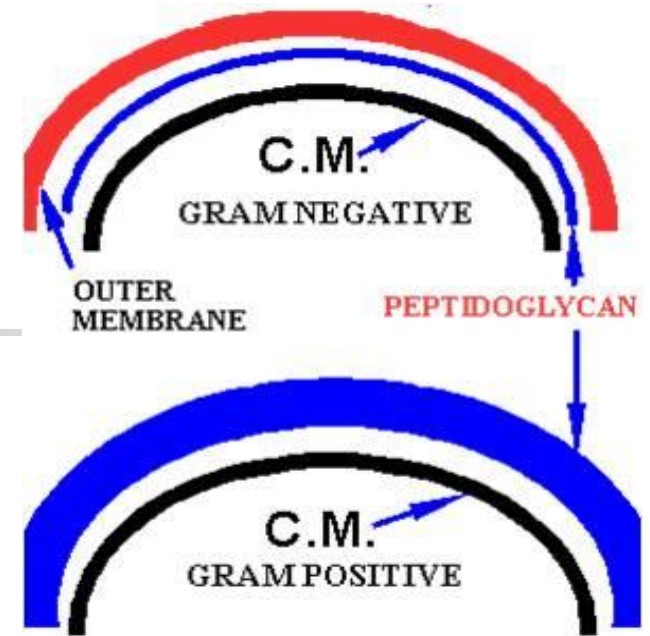
Bacilli



Budding and appendaged bacteria



GRAM + VS. GRAM – BACTERIA



Gram positive bacteria

- stain purple under Gram stain
- have a thick bilayer wall of the polymer peptidoglycan.

Gram negative bacteria

- stain red
- have a thin layer of this polymer and an additional lipopolysaccharide outer layer, LPS,
- often endotoxic - capable of initiating inflammation and cell-mediated immune responses
- e.g., *Salmonella*, *Shigella*, and *Escherichia*.

Algal Protists (ALGAE)



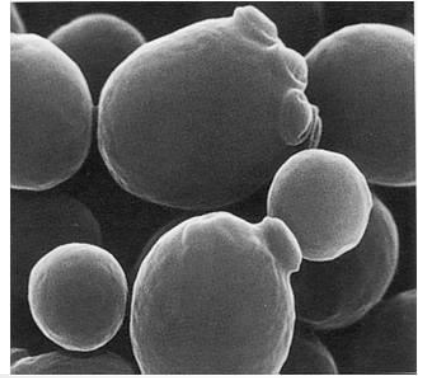
- **Are Eukaryotic**
- **Found in fresh and salt water environments**
- **Can live on rocks, trees, and in soils with enough moisture**
- **Can carry on photosynthesis – produce large amount of oxygen**
- ***Diatoms, Chlamydomonas, Volvox, Spirogyra***

Animal-like Protists (PROTOZOA)



- Protozoa means “little animal” – act like tiny animals – Eukaryotic
- Hunt other microbes for food
- Mainly feed on bacteria, also other protozoa and some algae
- Digest food in digestive organelles
- Ciliates, Amoebae, Flagellates - *Paramecium*, *Amoeba*, *Euglena*
- Most are not harmful – a few are harmful
- Certain protozoa can cause **dysentery** and **malaria**

Fungi



- Cellular level, more like animals than plants – Eukaryotic
- Can't synthesize their own food
- Single celled as **yeast** or multicellular clusters as **molds & mushrooms**
- Multicellular ones form filament like strands – **hyphae**
- Grow best in slightly acidic environment – can grow in low moisture
- Live in soil, on plants & animals, in fresh & salt water
- One teaspoon of topsoil has about 120,000 fungi
- **Baker's yeast** for bread and brewing, some are used for antibiotics, others serve as decomposers
- Some cause disease in humans, animals and plants – ruin 1/4 to 1/2 of fruits & vegetables per year



MICROBES AND ECOLOGY

- **Major producers** in aquatic environments
- **Decomposers** – bacteria and fungi – in many ecosystems
- Key role in **Biogeochemical cycles** to recycle carbon, nitrogen, carbon, water
- **Natural pest killers** in gardens and on crops
- **Breakdown oil** from oil spills
- **Serve as natural water treatment**
- **Can cause some ecological problems** as red tide and algal blooms



Wastewater Microbiology

- **Microbes play a key role in water and waste treatment facilities**
- **Are involved in natural waterways**
- **Involved in maintaining septic tanks**
- **Coliform bacteria as E. coli can contaminate water making it unsafe**



MICROBES AND FOOD

- **Milk** into yogurt, buttermilk, sour cream, cheese
- **Aid in production** of chocolate, bread products, wine, beer, tea
- **Pickling process** to make pickles from cucumbers and sauerkraut from cabbage



Fermentation Products and their Uses

- **Carbon dioxide** – bread making using baker's yeast
- **Alcohol** – wine making and brewing using yeast
- **Lactic Acid** – lactic acid bacteria ferment milk into products as yogurt



Food Spoilage and Food Decomposition

- **Microbes play a key role – bacteria and fungi – in food spoilage and decomposition**
- **Many types can live at low temperatures as mold on food in the refrigerator**
- **Food preservation techniques as salt and high acid affect microbes**



MICROBES AND INDUSTRY

- **Microbes (fungi and bacteria) are used to make antibiotics**
- **Algae are being used to make petroleum**
- **Yeast and bacteria are used in producing medicines**



Microbes and Diseases

- **There are many agents of infectious diseases**
- **Microbes acting as agents are prions, viruses, bacteria, fungi, protozoa, parasitic worms**
- **Examples of common diseases for each to follow**



List of Microbial Diseases

**Be sure to check the
SO National website
for the final 2017 List
of Diseases.**



VIRAL DISEASES

- **AIDS**
- **Chicken Pox & Shingles**
- **Common Cold**
- **Dengue Fever**
- **Ebola Hemorrhagic Fever**
- **Hepatitis**
- **Influenza**
- **Measles**
- **Mumps**
- **Mononucleosis**
- **Polio**
- **Rabies**
- **Rubella**
- **Small pox**
- **West Nile Fever**
- **Yellow Fever**

BACTERIAL DISEASES

- **Anthrax**
- **Botulism**
- **Chlamydia**
- **Cholera**
- **Dental Caries (tooth decay)**
- **Legionnaire's Disease**
- **Lyme Disease**
- **MRSA**
- **Peptic Ulcer Disease**
- **Pertussis (whooping cough)**
- **Rocky Mountain Spotted Fever**
- **Strep throat**
- **Syphilis**
- **Tetanus**
- **Tuberculosis**



FUNGAL DISEASES

- **Athlete's foot**
- **Dutch Elm Disease**
- **Ergotism**
- **Histoplasmosis**
- **Potato Blight**
- **Ringworm**
- **Thrush**

PROTOZOAN/ALGAL DISEASES



- **Malaria**
- **Paralytic Shellfish Poisoning**
- **Estuary Associated Syndrome**
- **Girardiasis**
- **Cryptosporidiosis**



PRION DISEASE

- **Scrapie**
- **Kuru**



PARASITIC WORMS

- **Hookworm**
- **Pinworm**
- **Schistosomiasis**
- **Tapeworm**
- **Trichinosis**



National Tournament

Added Diseases Topics:

Important Genera Related to Disease



IMPORTANT GENERA

- *Wolbachia*

- *Batrachochytrium*