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# Preventing Disease Transmission

# Disease Transmission

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Pool water can be a carrier of disease organisms

- Conjunctivitis (eyelid membrane inflammation)
- Sinusitis (inflammation of the sinuses)
- Strep throat (respiratory infection)
- Otitis (ear infections)
- Enteritis (inflammation of the intestines)
- Eczema (skin rash or dermatitis)
- Athlete's foot (fungal infection)
- Folliculitis (hair follicle inflammation)
- Viral infections (gastroenteritis, hepatitis)
- Vaginal infections
- Urinary tract infections

# Pathogens

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- Bacteria
  - Pseudomonas aeruginosa
    - Folliculitis: red, bumpy itchy skin rash
    - Otitis externa: outer ear infection
  - Staphylococcus
    - Boils: soft tissue infection
  - Shigella
    - Shigellosis: fever, dysentery, diarrhea, bloody stool

# Pathogens

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- Bacteria
  - Legionella
    - Pontiac fever: milder form of Legionnaires' disease
    - Legionnaires' disease: pneumonia -- fatal in 15% of population
  - Salmonella
    - Para typhoid fever: fever, headache, constipation, nausea, loss of appetite, vomiting, abdominal rash

# Pathogens

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- Viruses
  - Enterovirus
    - Hepatitis A: jaundice
  - Norwalk
    - Gastroenteritis: abdominal discomfort, fever, vomiting, diarrhea, headache

# Pathogens

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- Protozoa
  - Giardia
    - Severe and prolonged diarrhea
  - Cryptosporidium
    - Diarrhea and severe abdominal discomfort
  - Entamoeba histolytica
    - Amebiasis: abdominal discomfort, fatigue, flatulence, diarrhea, weight loss

# Waterborne Disease - Pathways of Infection

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Contaminated pool water can make you sick

- Ingestion of contaminated water
- Inhalation of water vapor
- Body contact with pathogens and absorption during bathing

# Disinfectant Efficacy

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- Residual disinfectant levels
- Contact time ORP
- Uniform circulation and absence of dead spots
- Physical characteristics of the water (TDS, suspended solids)
- Removal of settled materials
- Perimeter overflow
- Filtration
- Pathogens embedded in higher organisms (algae...)
- Water temperature
- Number of organisms present (density)
- pH levels
- Maintenance procedures
- Bather load to water volume ratio
- Microbe strength (virulence)

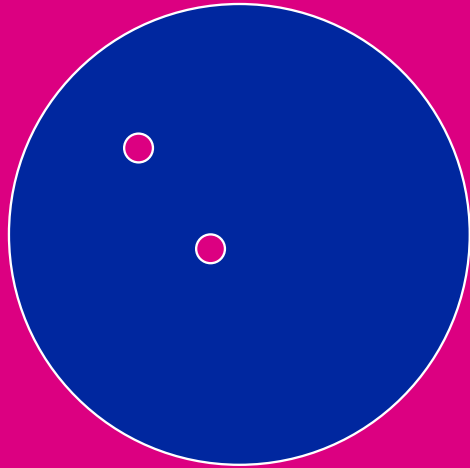


# Bacteriological Water Quality Analysis

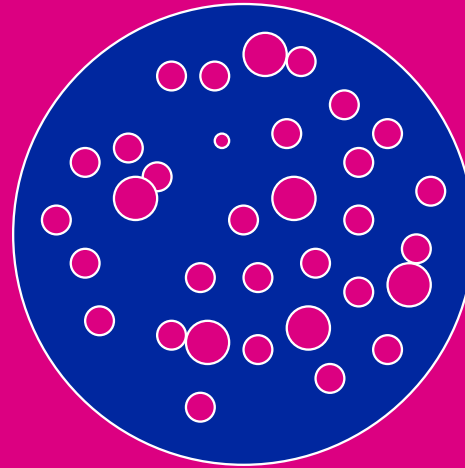
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- Some state and local health codes require that bacteriological quality analysis tests be performed on a regular weekly or monthly basis
- May require tests be performed by an independent laboratory
- Simple tests are now available for on-deck testing by pool operators
- If a pool operator only tests for chemical levels in the water, and does not monitor bacterial growth, he will probably be unaware of a bacterial contamination problem until bathers start complaining of infection

# Bacteriological Water Quality Analysis



Acceptable



Unacceptable TNTC

# Standard Plate Count

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- AKA heterotrophic plate
  - Indicator test for pathogens that obtain food from organic material only
  - Consistently acceptable
  - The number of Colony Forming Units (CFU) must not exceed 200 colonies per milliliter

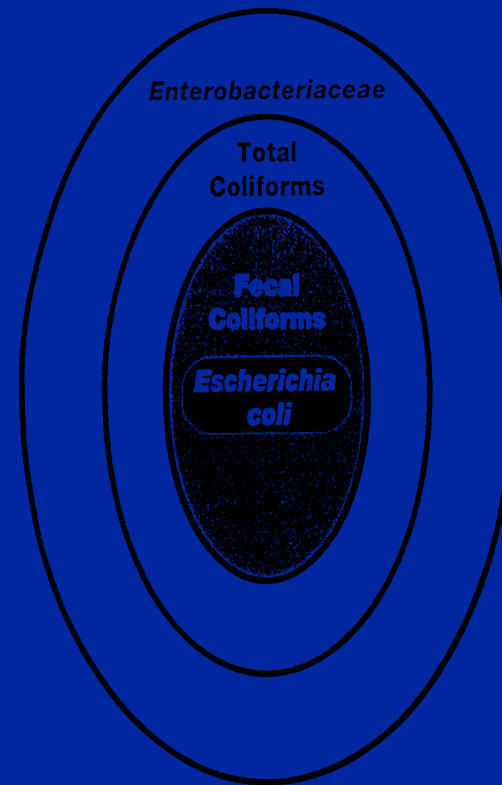
# Coliform Testing

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- Total coliforms can be any of several bacilli found in the large intestine of warm blooded animals
- Multiple tube fermentation method
  - None of the five (5) standard ten milliliter portions should show the presence of organisms of the coliform group at any time.
  - None of the confirmed five portions should show the presence of the coliform group.
- Membrane filtration technique
  - The number of coliform organisms must be less than one colony per 100 milliliters.

# Coliform Testing

- Coliform presence in test samples indicates fecal contamination of the pool
- If total coliforms are present, test for fecal coliforms and *E. coli*

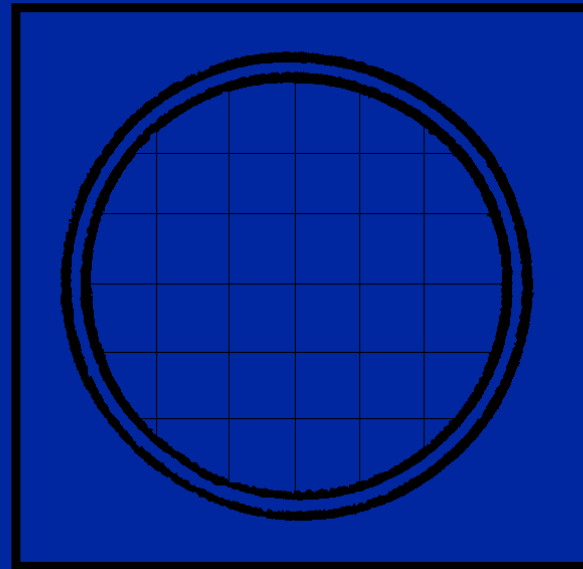


# Bacteria Testing Methods

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## Membrane filter technique

- Quantitative
- Water sample is filtered through a membrane filter to retain organisms
- The membrane is placed in a petri dish with a media & incubated
- Colonies are identified and counted

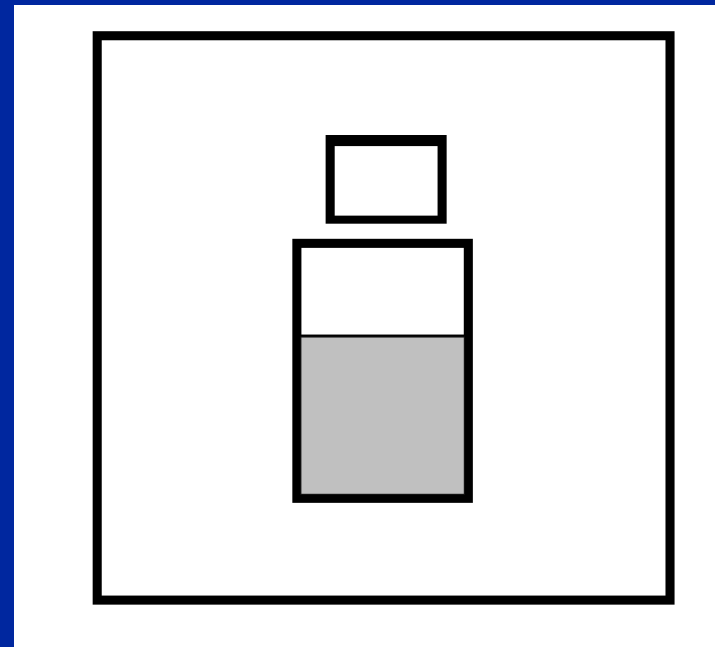


# Bacteria Testing Methods

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## Presence - absence tests

- Qualitative
- Method of determining the presence or absence of an organism in the water, but not the number of organisms



# Bacteria Testing Methods

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## Multiple tube fermentation

- Quantitative
- MPN (most probable number) testing uses a specified number of test tubes to statistically predict the number of organisms present

