Current Dilemma for Residential Sewage System Owners in the TRSD Area

Gila County Wastewater Department

Jake Garrett, Manager

May 6, 2013

(Update January 2019)

Gila County Now Has Responsibility for Your Area

- Delegated Authority by ADEQ
- Issue Permits for New or Replacement Onsite Wastewater Systems
- Provide Clearance to Building Department for All Home Remodels or New Construction
- See that all Sewage and Gray Water Failures are Cleaned Up and Corrected

Current Situation

- My Estimate:
  - Over 1900 Homes in this area now
  - Over 1600 of these Properties are served by either
    - CESSPOOL or
    - VERY OLD SEPTIC SYSTEM

Facts

- Cesspool *USE* has been prohibited by state rule since May 1976 - nearly 37 years
- Plat Dates on Claypool-Central Heights Subdivisions go back to at least 1908 when the best available wastewater system was a cesspool
- Many have been in use for over 100 years

When did septic systems replace cesspools

- Contractors in Globe-Miami area say about 1970 or the late 1960's
- Knowledgeable County Personnel say mid-1970's

When did good septic systems begin being installed?

- Earliest permitting records are 1979.
- We got good at permitting around 1984
- Very few permits issued until 1986 when mine operations picked up again.
- 1989 - 1600 septic systems were installed 1200 in north and 400 in south before significant rule change in late 1989.

- Old Systems - 1950's to early 1980's
  - Installed by hand or with little equipment
  - Poor access to Materials
  - Design was what someone thought
- Unpermitted Systems
  - No Design or thought for useful life
  - Only concern was getting rid of the flush
- 1980's systems
  - Bad perc tests
  - In a hurry construction & leaky tanks

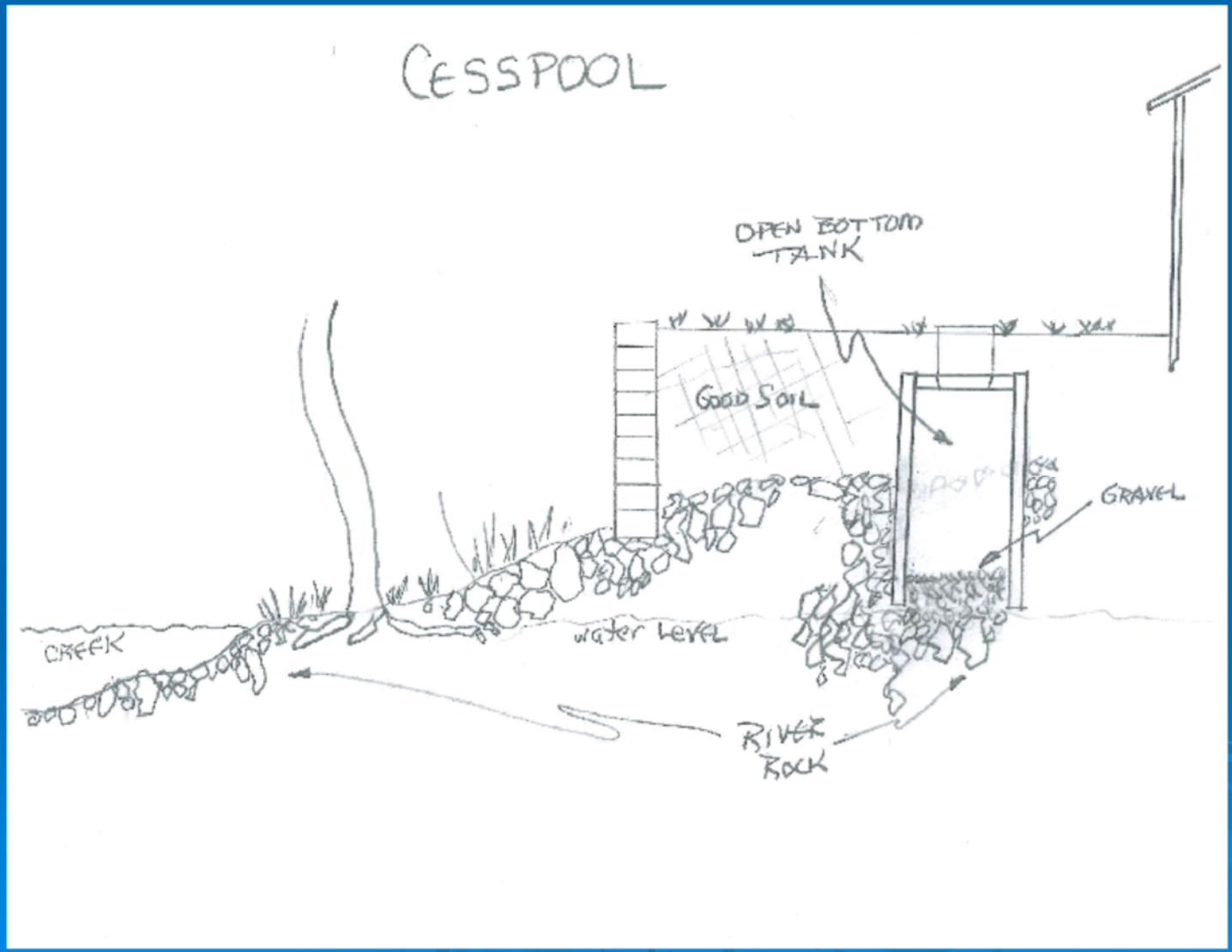
Arizona On-site Rules

- End of 1989 - Major Upgrade of Bulletin 12 … a "Guidance Document"
- January 1, 2001 – Aquifer Protection Permit (APP) Rules Adopted … the First Enforceable Laws Covering Sewage Treatment
- November 12, 2005 - APP revised …. Sewage Treatment Tanks Now ***Required to Hold Water*** Rather than being allowed to ***Leak Raw Sewage for Two People*** into the Environment Every Day

What is a Cesspool?

- An outhouse with running water
- A hole in the ground into which you flush your toilets and run your used water…or…
- A tank that does not hold water

This is Common Along Streams



The Objective of Sewage Systems

- To Remove All Pollutants
  - Pathogens
  - Viruses
  - Bacteria
  - Human Waste
  - Nitrogen
  - Phosphorus
- To Produce Clean Water

Excerpts from Superhumans vs. Superorganisms

Arizona County Directors of Environmental Health Services Association (ACDEHSA)

Southwest Food Safety Seminar
Keynote Presentation
January 28, 2009

Al Brown, R.S., M.P.A.

Wastewater slides
added by

Jake Garrett, P.E.
Gila County Wastewater Department

Clip art edits by Holly Brown

Organisms of the 70's?

- *Salmonella*
- *Shigella*
- *Staphylococcus aureus*
- *Clostridium botulinum*
- *Clostridium perfringens*
- *Enterotoxigenic Escherichia coli*
- *Trichinella spiralis*
- *Taenia solium and saginata*
- Hepatitis A
- Norwalk virus
- ***Infective Dose was 30,000 to 40,000 cfu's/ 100 ml***

Where we are today.

- Organisms have developed immunity to antibiotics
- Organisms have mutated
- New strains have developed

.....resulting in

Resulting in ….

- Strains that are very hard or impossible to kill
  - Heat or Cold resistant
  - Chlorine resistant
  - Anti-Bacterial Immune
- Variant strains we have never seen
- Very few organisms to infect vs. tens-of-thousands to hundreds-of-thousands

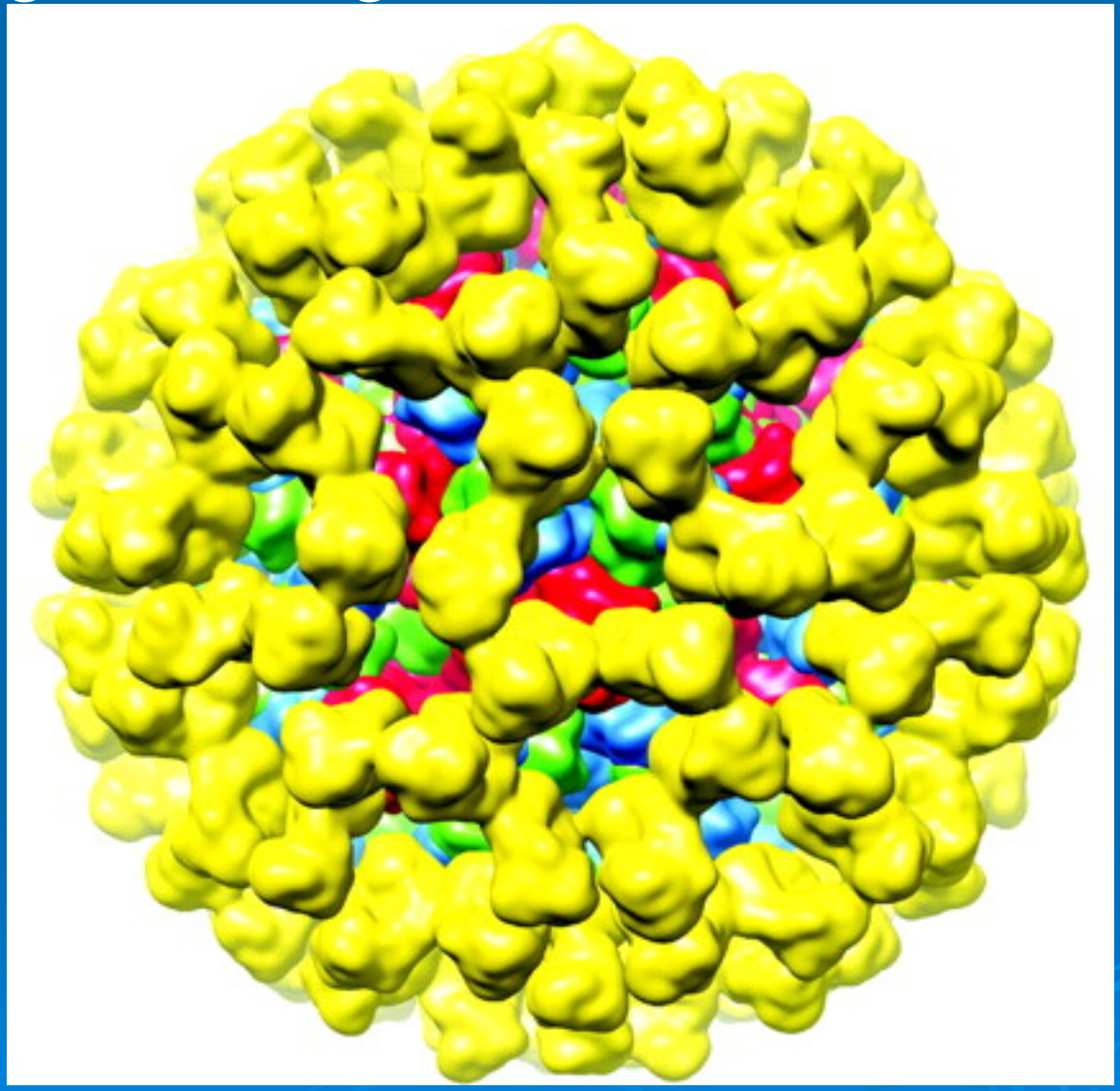
Newer foodborne illnesses In your Sewage

- *Escherichia coli 0157:H7*
- *Campylobacter jejuni*
- *Listeria monocytogenes*
- *Cryptosporidium parvum*
- *Methicillin resistant Staphylococcus aureus (MRSA)*
- Prions
- And Old Ones Like
  - HIV
  - Hepatitis B & C

Norovirus

- From the *Caliciviridae* family of viruses
- 1968 was first recognized outbreak in Norwalk, OH
- **Many strains exist** making vaccinations impractical
- Infective dose **less than 100** organisms
- Vomitus **droplets** spread the disease
- Period of **contagion up to 2 weeks**
- Golf course outbreak: drinking water not subject to sewage contamination

Drawing of a Single Norovirus Particle

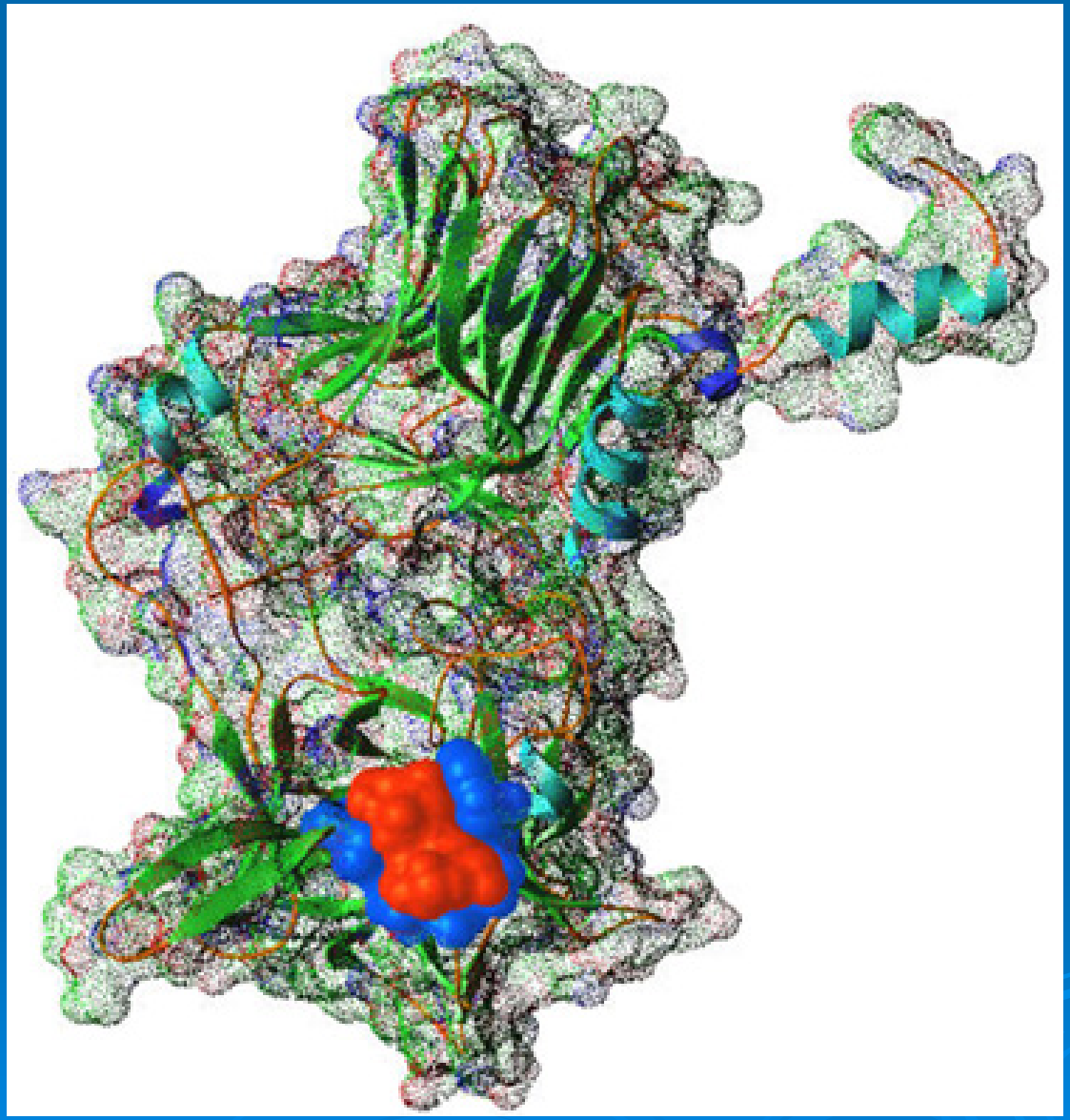


http://images.google.com/imgres?imgurl=http://www.iayork.com/Images/2008/2-21-08/NorovirusKatpally08.png&imgrefurl=http://www.iayork.com/MysteryRays/2008/02/20/evolution-of-noroviruses/&usg=__k4T13cdnl-eL3DSOs6w_VHu3Vmk=&h=423&w=433&sz=260&hl=en&start=53&um=1&tbnid=dLP00kg43ckUkM:&tbnh=123&tbnw=126&prev=/images%3Fq%3Dnorovirus%2Binfection%26start%3D40%26ndsp%3D20%26um%3D1%26hl%3Den%26rlz%3D1T4GGLR_enUS243US249%26sa%3DN

Clostridium botulinum

- Spores are **resistant to heat**
- Toxin is **extremely toxic** – down to the **nanogram level** of dosage
- Not always found in canned foods: baked potatoes can be a hazard

Drawing of *Clostridium botulinum* toxin



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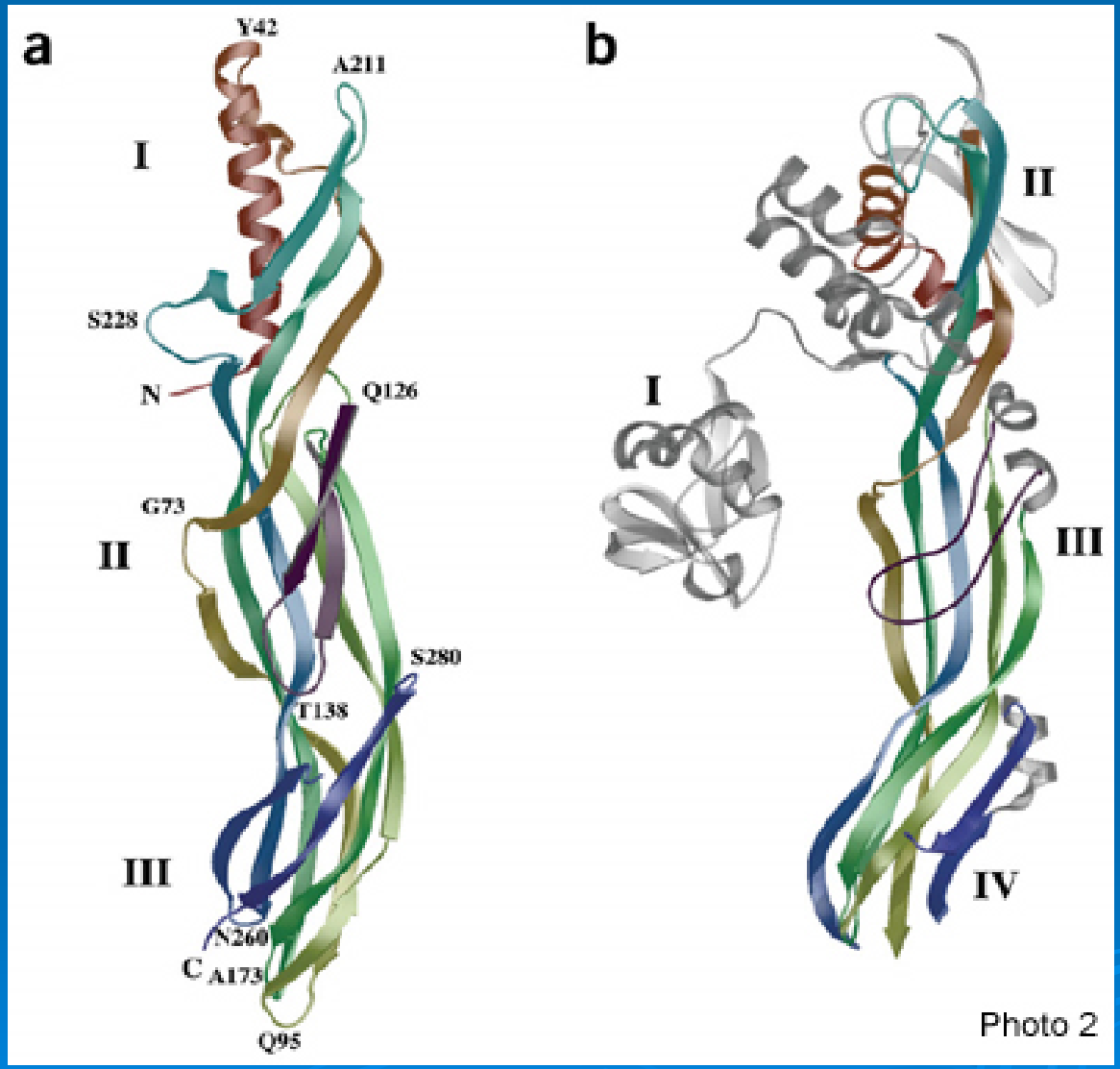
Clostridium perfringens

- Spores are resistant to heat
- Small numbers may survive cooking
- Subsequent temperature abuse results in rapid growth due to no competing organisms in the food

Drawings of structures of *C. perfringens* toxin



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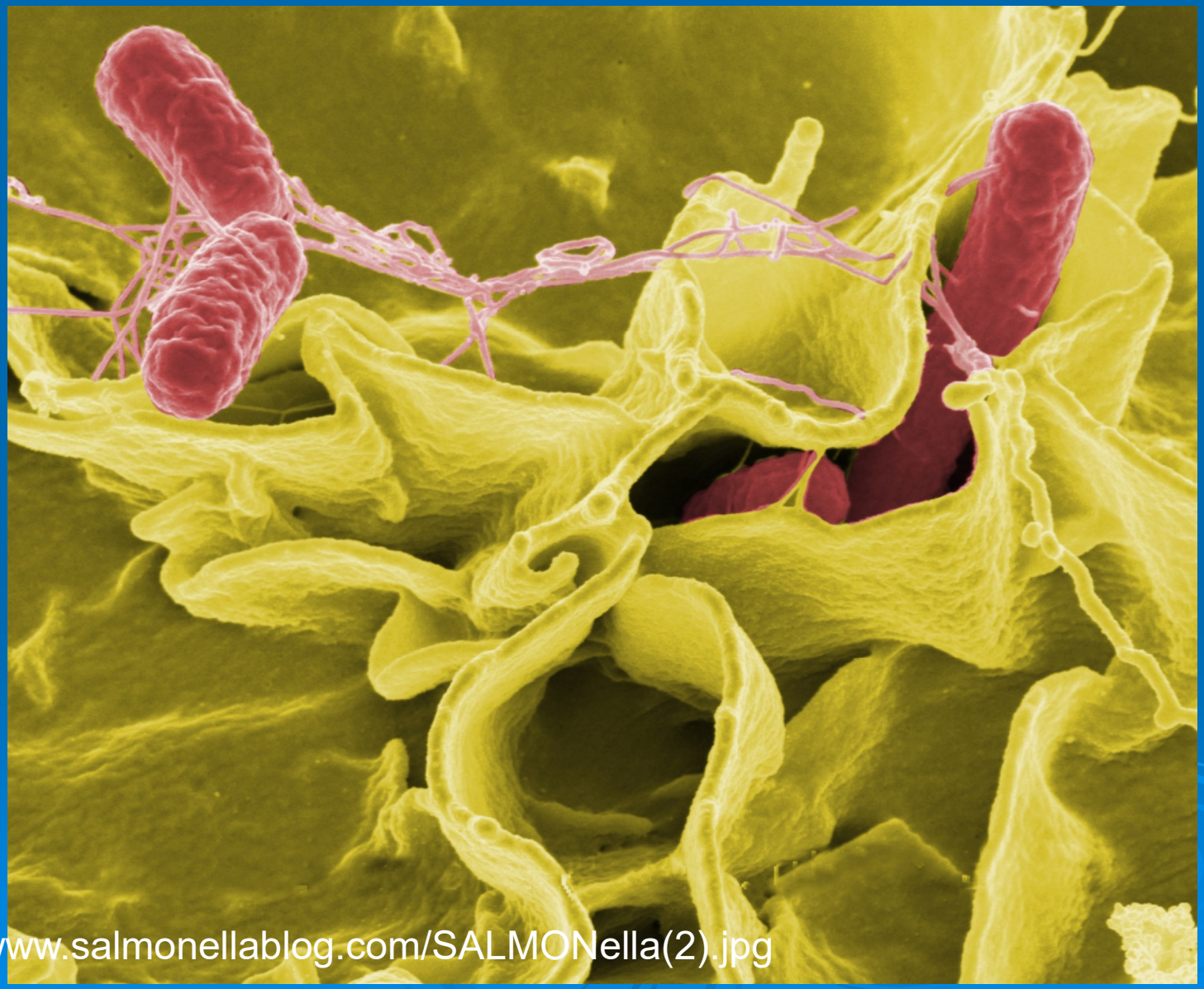
Salmonella

- **2000 Serotypes** can cause human illness
- **50,000 reported cases** in U.S. in 2005
- **15 – 20 cells** as infectious dose
- Diversity of associated foods: meats, eggs, dairy, fish, yeast, coconut, peanut butter, chocolate, cantaloupe, orange juice, alfalfa sprouts, oat cereal
- **Antibiotic resistant strains**, i.e. *S. Newport*

Friis, R.H., 2007. Essentials of Environmental Health, Sudbury: Joes and Bartlett

Salmonella enteritidis



http://www.salmonellablog.com/SALMONella(2).jpg

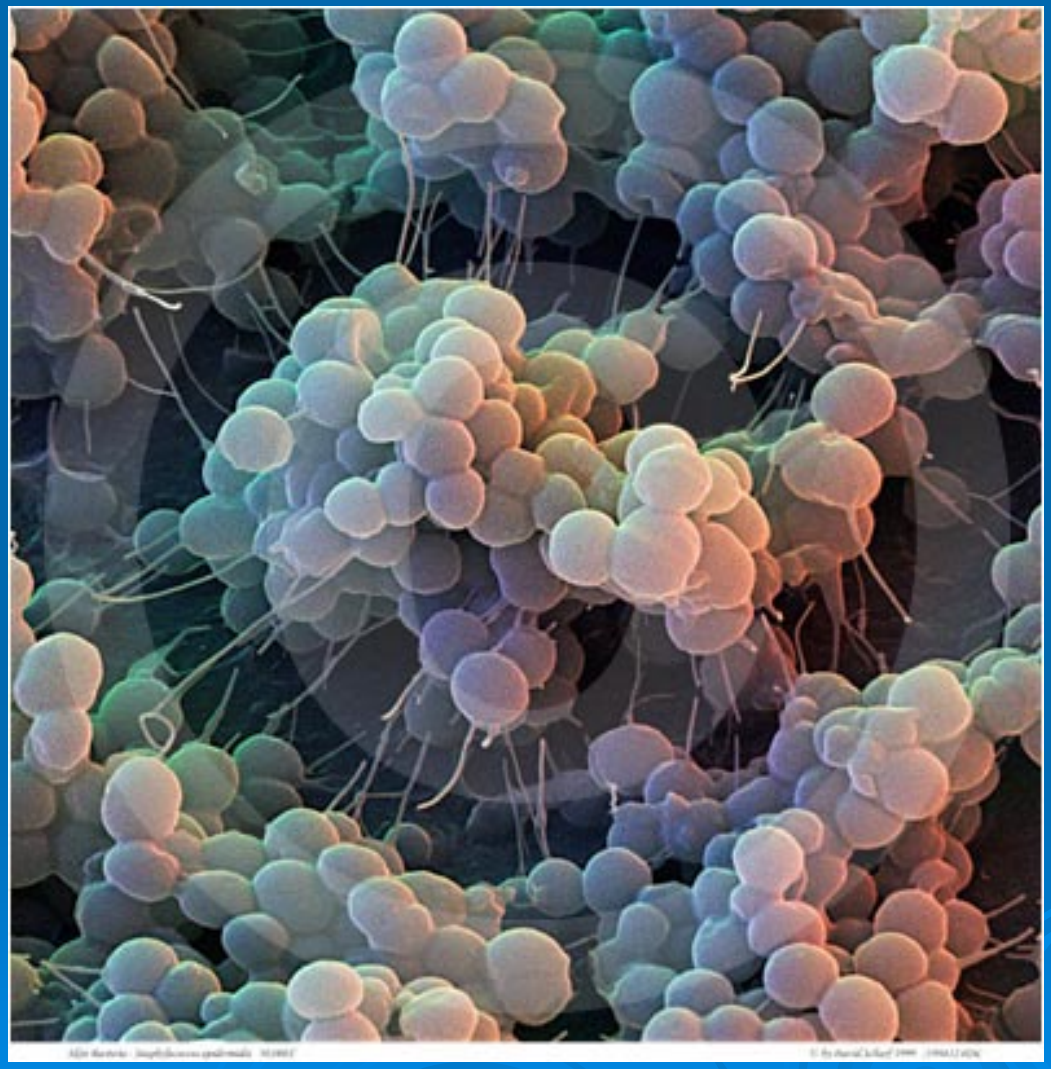
Staphylococcus aureus

- Can grow in saline or high sugar foods
- Produces a **highly heat stable** enterotoxin
- Antibiotic resistance: **MRSA**

  not necessarily food associated

  potential for MRSA related to food exists

Colony of *Staphylococcus aureus*



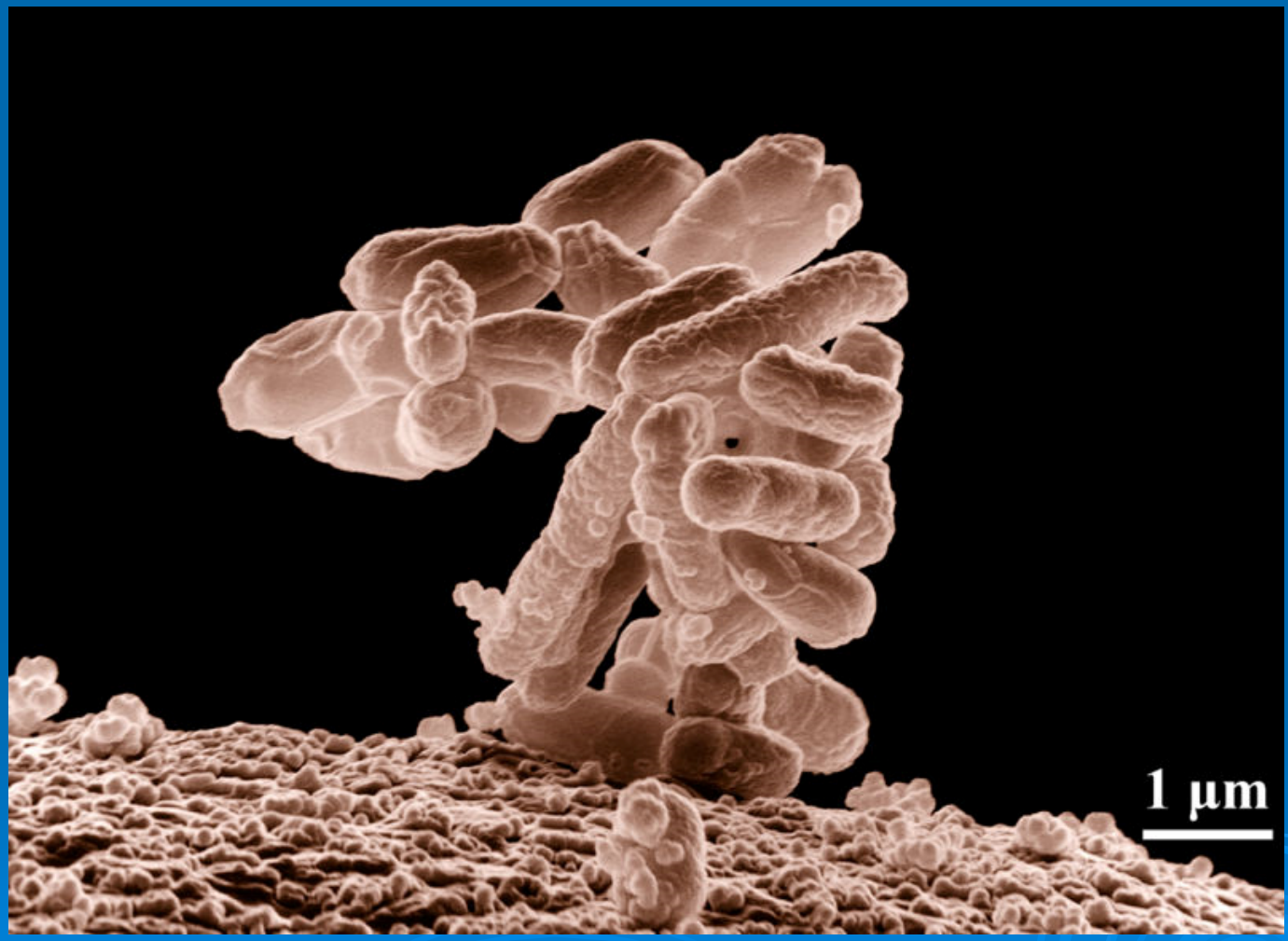
http://www.scharfphoto.com/fine_art_prints/archives/199812-026-Staph-Bacteria.jpg

E. coli 0157:H7

- **73,000** estimated cases per year
- Produces Shiga toxin
- Sometimes causes hemolytic uremic syndrome leading to **acute kidney failure** and end-stage renal disease
- Infective dose as few as **10** organisms
- Diverse food associations: hamburger, spinach, alfalfa sprouts, fruit juice

FDA Bad Bug Book, 2007, http://www.cfsan.fda.gov/~mow/chap15.html
MMWR, 2006, http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5723a2.htm

Colony of *E. coli 0157:H7*



http://upload.wikimedia.org/wikipedia/commons/thumb/b/bc/E_coli_at_10000x,_original.jpg/800px-E_coli_at_10000x,_original.jpg

Campylobacter jejuni

- Most common bacterial cause of foodborne infections – up to **4.0 mil/yr**.
- Up to **100% of raw chicken** tested in some surveys was positive for *C. jejuni*
- **400 – 500** bacteria for infective dose

FDA Bad Bug Book, 2007, http://www.cfsan.fda.gov/~mow/chap4.html

Colony of *C. jejuni*

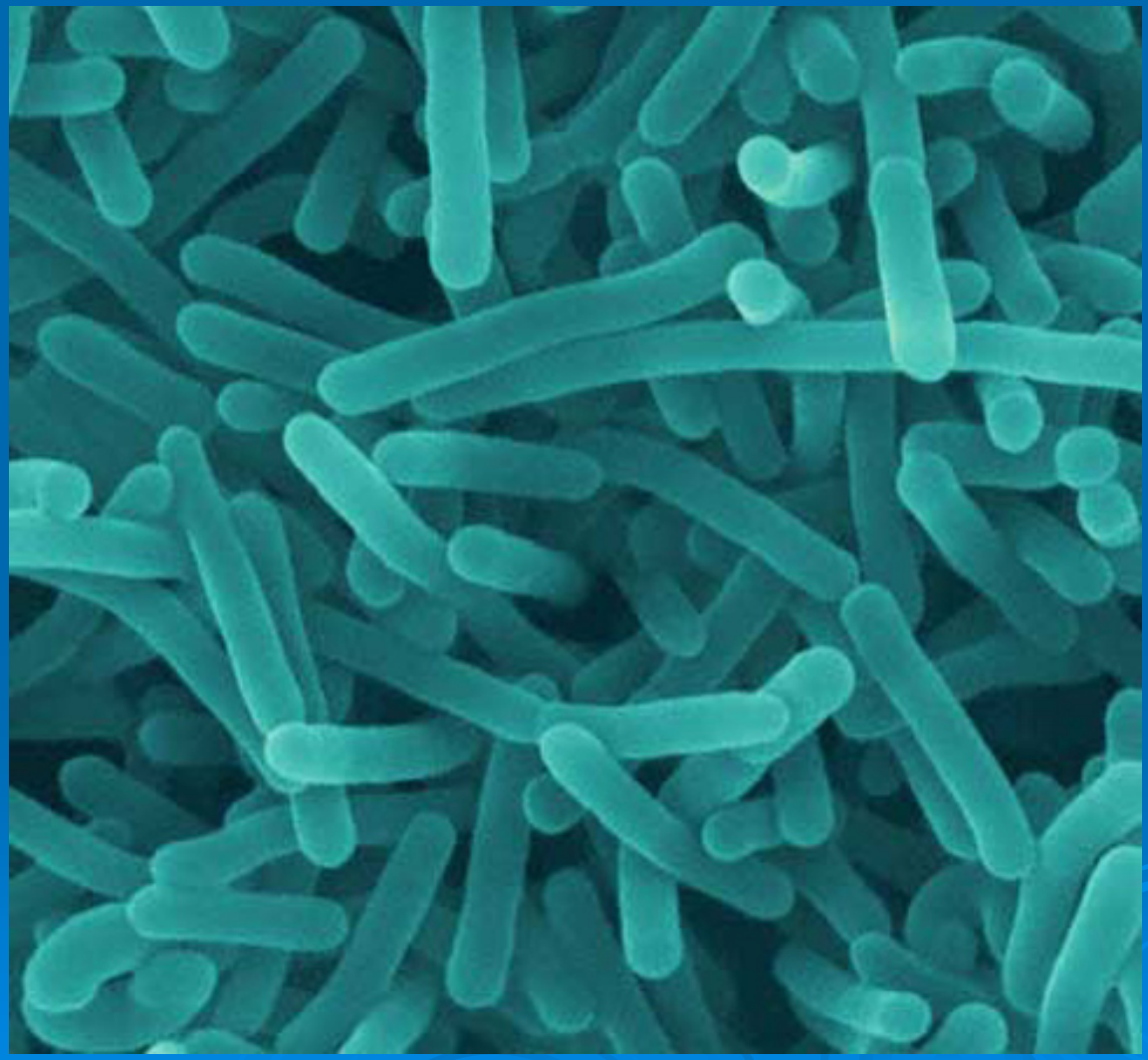
http://upload.wikimedia.org/wikipedia/commons/thumb/d/df/ARS_Campylobacter_jejuni.jpg/300px-ARS_Campylobacter_jejuni.jpg

Listeria monocytogenes

- High mortality for foodborne disease – 500 deaths per year out of 2500 cases
- Tolerates **low** temperature–grows at 3°C or 31° F
- Forms **disinfectant resistant** biofilm
- Causes listeric meningitis and septicemia in some cases
- Can **invade immune system** cells monocytes, macrophages and leukocytes
- Causes **stillbirths or spontaneous abortion**

FDA Bad Bug Book, 2007, http://www.cfsan.fda.gov/~mow/chap6.html
Friis, R.H., 2007, *Essentials of Environmental Health, Sudbury: Jones & Bartlett*
CDC, 2008, http://www.cdc.gov/nczved/dfbmd/disease_listing/listeriosis_gi.html

Colony of *L. monocytogenes*



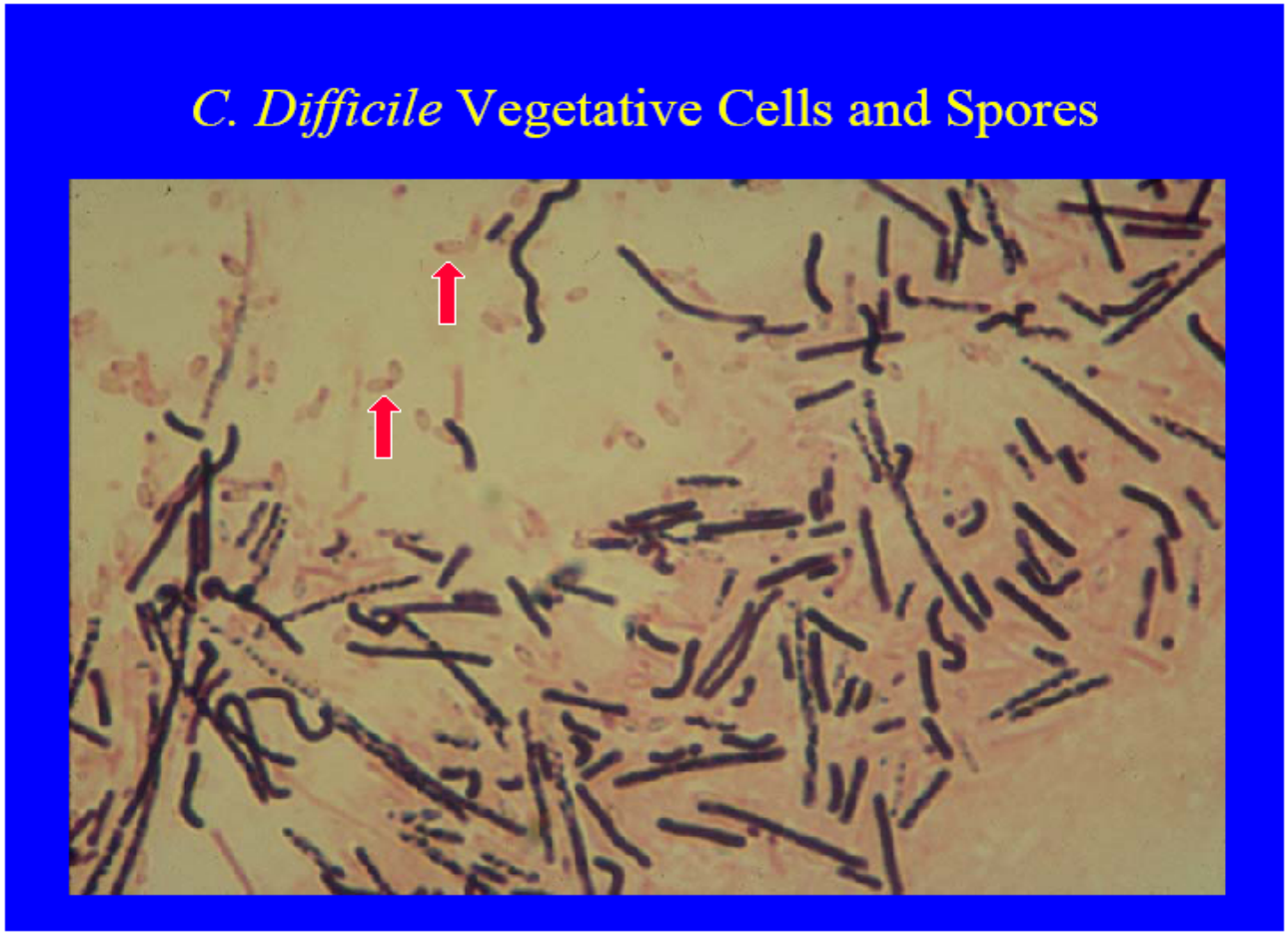
http://www.popsci.com/files/imagecache/article_image_large/files/articles/listeria_485.jpg

Clostridium difficile

- Not currently a foodborne disease for the general population
- Persons on **extended antibiotic** therapy and **elderly** are most susceptible
- Fomites are the **current known** environmental source
- An **argument** for enhanced food safety in hospitals, clinics, senior housing facilities

CDC, 2007, http://www.cdc.gov/ncidod/dhqp/id_CdiffFAQ_general.html#5

Clostridium difficile



FDA, 2006, http://www.fda.gov/cder/meeting/clostridial/gerding.pdf

Cryptosporidium parvum

- Resistant **to chlorine**
- Infective dose as low as **1** organism
- Vegetables and unpasteurized fruit juices are the most commonly reported food associations
- Water is the primary source of infection
- **No effective treatment exists**

FDA, 2007, Bad Bug Book, http://www.cfsan.fda.gov/~mow/chap24.html
CDC, 2008, http://www.cdc.gov/crypto/bwa/commercial.html#cook

Excysting Sporozoites of *C. parvum*

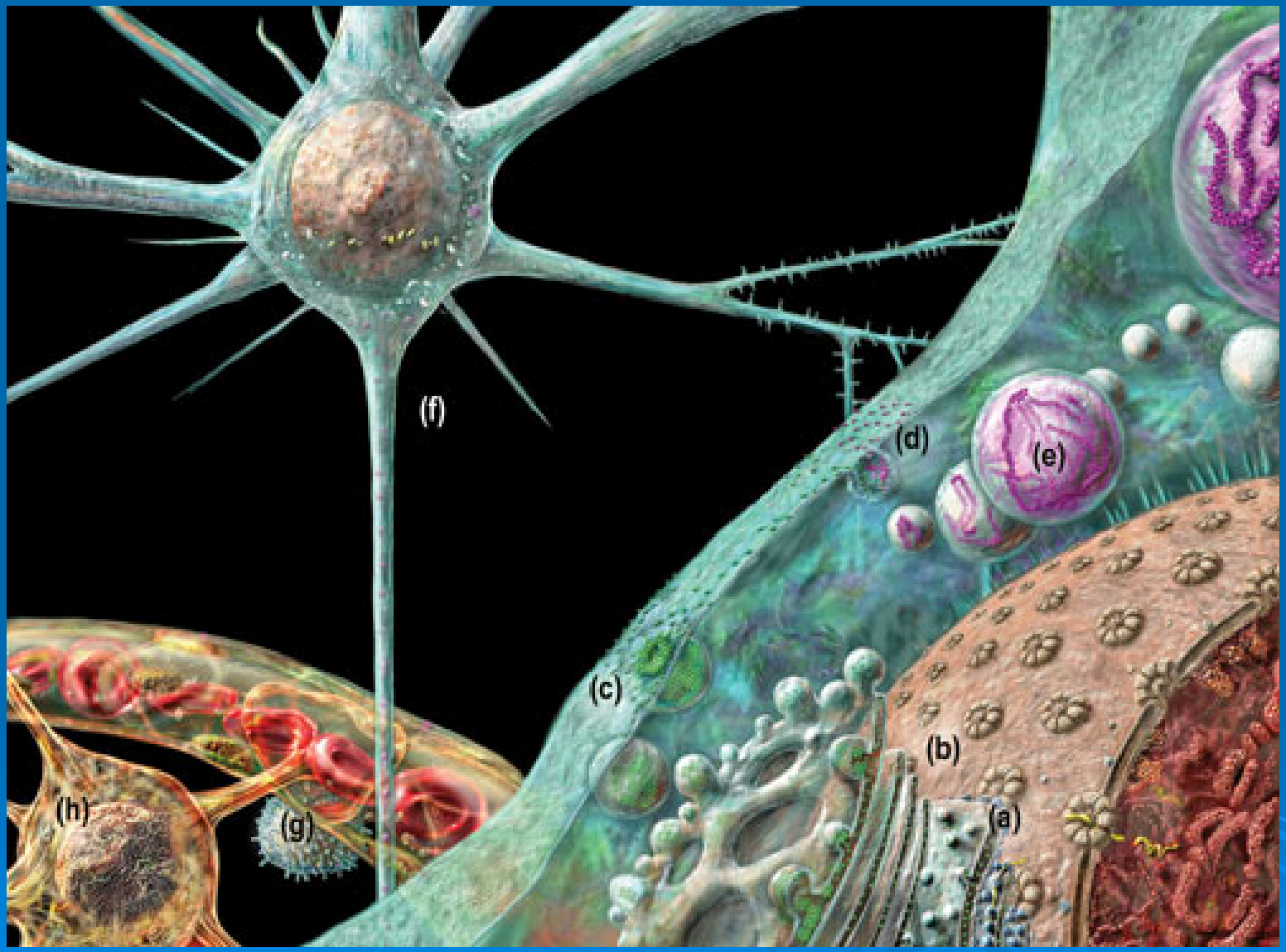
http://www.stanford.edu/class/humbio103/ParaSites2001/crypto/cryptoscape.jpg

Prions

- Not live organisms – they are proteins
- Causes **fatal encephalitis**
- Extremely rare
- From **consumption of nervous system tissues** and animals fed these tissues
- Hunters beware: Scrapie or Chronic Wasting Disease has been found in U.S. deer and elk
- Human influence: vegetarian animals have been fed animal tissues
- This is an unintended consequence
- Are we creating other unintended consequences with genetically modified foods, irradiation, pesticides, food additives and nanomaterials?

FDA, 2007, Bad Bug Book,http://www.cfsan.fda.gov/~mow/prion.html

Neuron absorbing a Scrapie prion



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Relation to Wastewater Complaints

- 100% of 1970's and Super organisms present in a home or contracted by residents are present in their raw sewage
  - Sewage spills, sewer line breaks, septic system backups are highly contaminated and carry a high likelihood of infection ability.
- Most of the 1970's and Super organisms pass through the septic tank to the leach field and are present in infectious quantities in surfacing effluent

and as if that's not enough …

- Gray Water may have many of these same organiosms

The “Short of It”

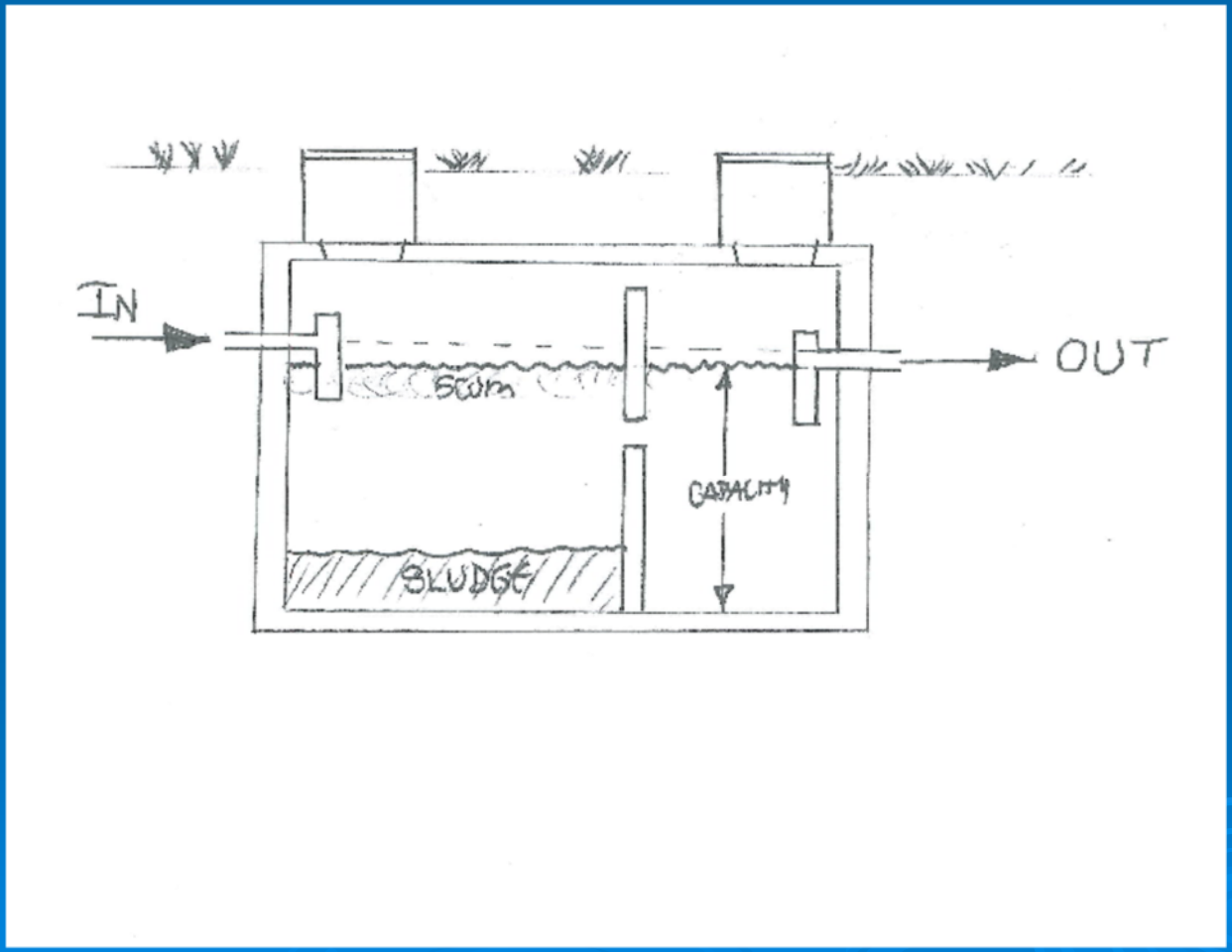
- Sewage spills, surfacing effluent and gray water complaints are

SERIOUS BUSINESS

Septic System 101

- Tanks
  - by definition hold water … or …
  - Do Not Leak
  - Has only been required since 2005
  - Perform the tasks of
    - Settling
    - Retention time for digestion of sewage
- Provide only part of the treatment for the sewage generated in your home

A Tank Is Always Full



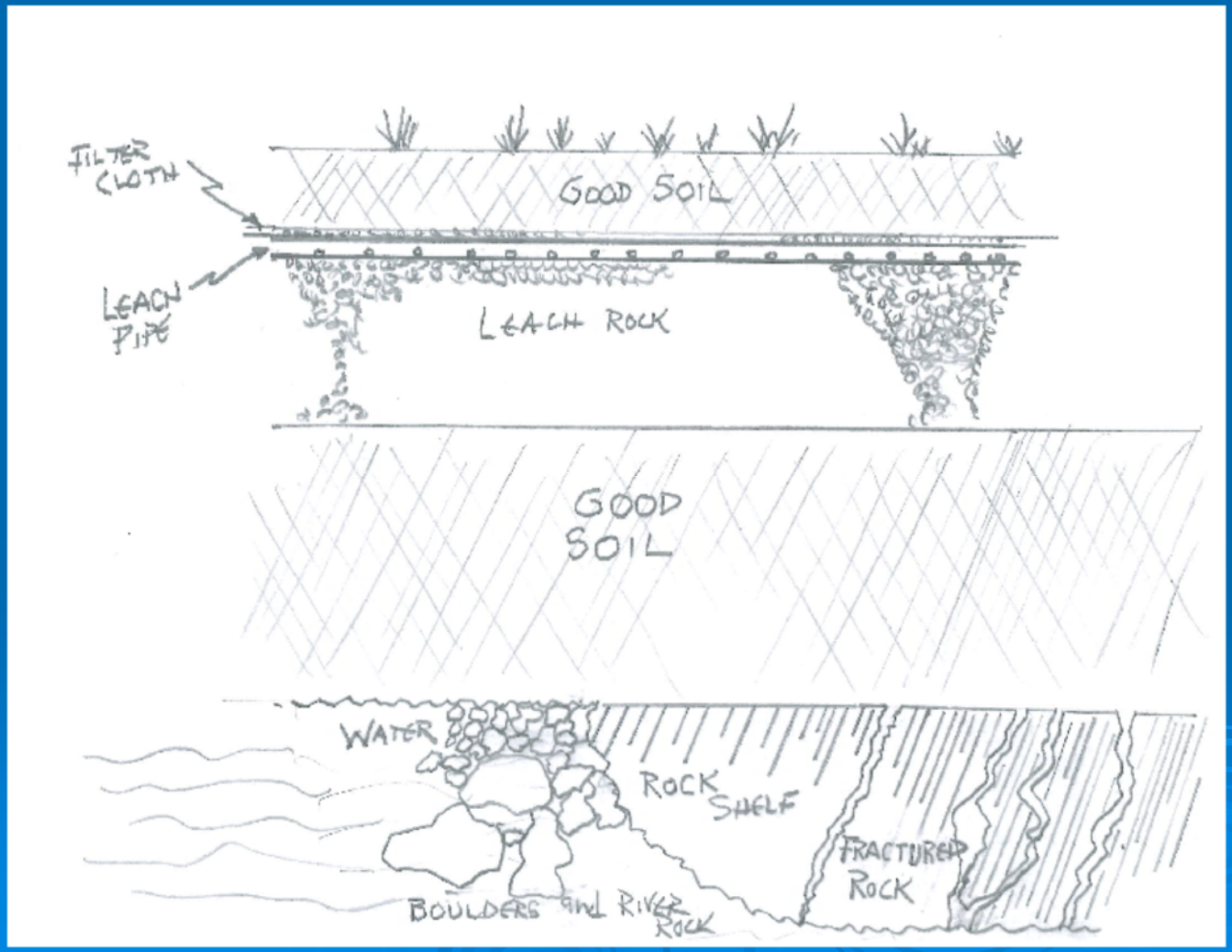
Out of the Tank

- 10,000,000 Colony Forming Units per Liter of total Coliform remain to be treated by the soil.
  - Suspended Solids are75 mg/L (down from Raw Sewage of 430 mg/L)
  - BOD are 150 mg/L (down from Raw Sewage of 380 mg/L)
- Pathogens (Viruses, Bacteria, Protozoa) remain to be treated

The Other Parts

- Leach Lines
  - Adequate Length
  - Shallow is Good - Oxygen
- Soil Treatment
  - Unsaturated Soil – Not Hard
    - (you can dig with a hand shovel)
  - Vertical Separation
  - Setbacks from Slopes, Homes, Water Lines. Driveways and Parking
  - Outside Floodway

The Other Players in the Removal of Sewage



Properly Functioning Septic Tanks and Leach fields

- Remove (BOD and TSS)
  - Bacteria
  - Pathogens
  - Viruses
  - Organic and inorganic Matter
- DO NOT Remove
  - Nitrogen
  - Phosphorus (not currently measured for on-site systems)
- Produce Clean Water (not Drinking Quality) after exiting enough "Good Soil"

How Do You Know It Is Not Working Right?

Dog's Bathing Area

Kid's New Pool

A New Riparian Area in the Forest

Bathing for the Birds

Charmin Yard Art

Extra Septic Capacity Under the House

A New “Compost” Pile

Fresh Grass for the Critters

Underground Failures are Not so Obvious

Orange-berg Pipe

Facts to Consider

- Today's Sewage Systems are Designed for a 20 Year Life
- Acceptable Nitrogen Content for Drinking Water is 10 Parts Per Million (PPM)
- Acceptable Nitrogen Content for Salt River Water is 0.5 Parts Per Million (PPM)
- 1/20th of Drinking Water
- Nitrogen Doesn't Go Away, It Accumulates and Kills

Magnitudes

- Human Waste (Household Sewage) Contains 53 PPM of Nitrogen … or… 106 times the level allowed in the Salt River Basin Creeks.
- Drinking Water can contain 10 PPM of Nitrogen .. or … 20 times the allowed Creek Levels.
- Properly Functioning Septic Systems remove NO Nitrogen

Remember This?
Out of the Tank

- 10,000,000 Colony Forming Units per Liter of total Coliform remain to be treated by the soil.
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E-Coli & Biologic Oxygen Demand (BOD) Facts

- Cesspools introduce Raw Sewage to the Environment which for the most part enters the waterways untreated
- Old “Septic Systems” Act Just Like Cesspools

Your Choices
If you Elect to Stay With Oversight by the Gila County Wastewater Department

One of These …

- If you have a Cesspool
  - Cannot Repair Your Cesspool
- If It Fails
  - Soil Test
  - Either
    - Standard System if your Ground Qualifies
    - Composting Toilet and Gray Water Leach Lines
    - Alternative System
  - Will Likely Use Up All of Your Lot

This Set of Choices Are What You Have Now
I'm Happy to Continue With My Oversight … however

The Tri-City Regional Sanitary District Has Researched some Other Choices You Might Want To Consider