

# Bacteria and Skin Infections

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*Staphylococcus aureus*

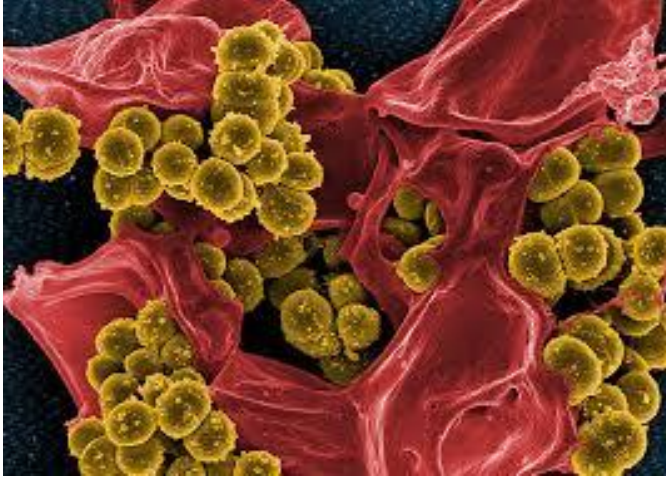
*Mycobacterium ulcerans*

*Pseudomonas aeruginosa*

*Propionibacterium acnes*

Streptococcal Skin Infections

# *Staphylococcus aureus*



<http://www.differencebetween.net/science/health/difference-between-methicillin-resistant-staphylococcus-aureus-and-staphylococcus-aureus/>

“Cluster Spheres golden”

- Gram Positive
- Halophile
- Lives in Nasal passages, and on the skin (loves sweaty skin)
- Divides and forms clusters in cocci shape
- Catalase positive
- Beta-hemolytic
- Alters penicillin binding proteins
- Can be determined easily via MSA agar

<http://www.health.state.mn.us/divs/idepc/diseases/staph/basics.html>



# Diseases of *S. aureus*

MRSA- coagulase released from the bacteria, provides a protective structure around bacteria. Skin to skin

- 1.pimples
- 2.boils

Food Poisoning

1. Due to enterotoxins (super antigen) on food
2. Damages tissue causing cytokine storm → septic shock

(1980s fiasco) Tampons Toxic shock syndrome (TSS)

Exfoliatin

1. Causes dermis to separate from epidermis
2. Notorious in Infants (due to no normal flora)/  
immature immune system Scalded skin syndrome

<http://www.health.state.mn.us/divs/idepc/diseases/staph/basics.html>

Food Poisoning



<http://www.healthline24x7.com/diseases/skin-disorders/staphylococcal-scalded-skin-syndrome-cess/introduction>

Exfoliatin

MRSA

# Diseases of *S. aureus* cont.



## *Necrotizing Fasciitis*

1. Hyaluronidase, breaks down our connective tissue, Enzymatically digest connective tissue
2. Can spread to bone or heart



CDC Features. (2017, July 03). Retrieved November 17, 2017, from <https://www.cdc.gov/features/necrotizingfasciitis/index.html>

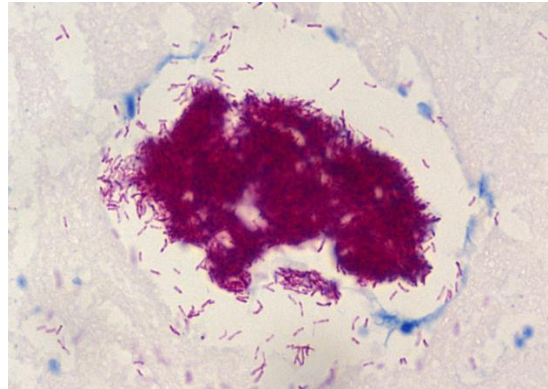
# Treatments

- MRSA- Incision and drainage along with a round of antibiotics
- Food Poisoning- Passes itself through the body
- SSS- Eradication of infection with use of antibiotics, hydration and antipyretics with use of vancomycin

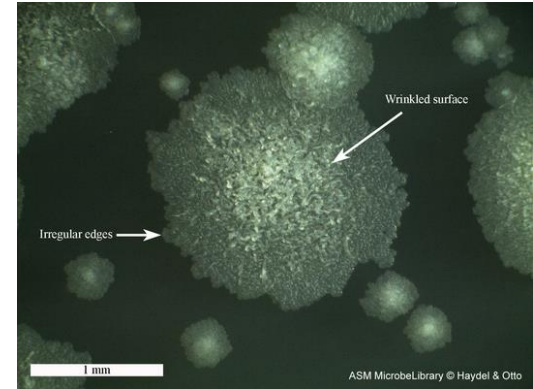
# *Mycobacterium ulcerans*

## The Organism:

- Microaerophilic
- Slow-growing
- Same family that causes tuberculosis and leprosy
- Gram positive
- Grows at 29-33 °C



<http://www.asmscience.org/content/education/imagegallery/image.3359>



<http://www.who.int/features/factfiles/buruli-ulcer/en/>

\*[https://en.wikipedia.org/wiki/Mycobacterium\\_ulcerans](https://en.wikipedia.org/wiki/Mycobacterium_ulcerans)

\*<http://www.who.int/mediacentre/factsheets/fs199/en/>

# *Mycobacterium ulcerans* cont.

## The Disease:

- Buruli ulcer
- Destroys skin, tissue, even bone
- 3 categories
- Mycolactone toxin inhibits immune response

\*<http://www.who.int/mediacentre/factsheets/fs199/en/>



<https://www.enad.eu/tag/buruli-ulcer/>



# *Mycobacterium ulcerans* cont.

## The Transmission:

- Unknown
- Maybe contaminated water
- Maybe vectors like mosquitos

## The Symptoms:

- Initially a painless nodule
- Nodule grows bigger
- Develops into ulcer

\*<http://www.who.int/mediacentre/factsheets/fs199/en/>



<https://www.fic.nih.gov/News/GlobalHealthMatters/january-february-2013/Pages/water-buruli-ulcers.aspx>

# *Mycobacterium ulcerans* cont.

## The Treatment:

- Antibiotics
  - Rifampicin
  - Streptomycin
  - Clarithromycin
- Skin graft

\*<http://www.who.int/mediacentre/factsheets/fs199/en/>



<https://www.webmd.com/drugs/2/drug-11249/streptomycin-intramuscular/details>



<http://medifitbiologicals.com/rifampicin/>



<https://wwwnc.cdc.gov/eid/article/15/11/09-0460-f1?commit=GO>

# *Mycobacterium ulcerans* cont.

## The Occurrence:

- No cases in the U.S.
- 6,000 cases around the world each year
  - Most in Central and West Africa
  - Australia
  - Japan
- Most cases occur in ages 5-15

\*<https://emedicine.medscape.com/article/1104891-overview#a6>

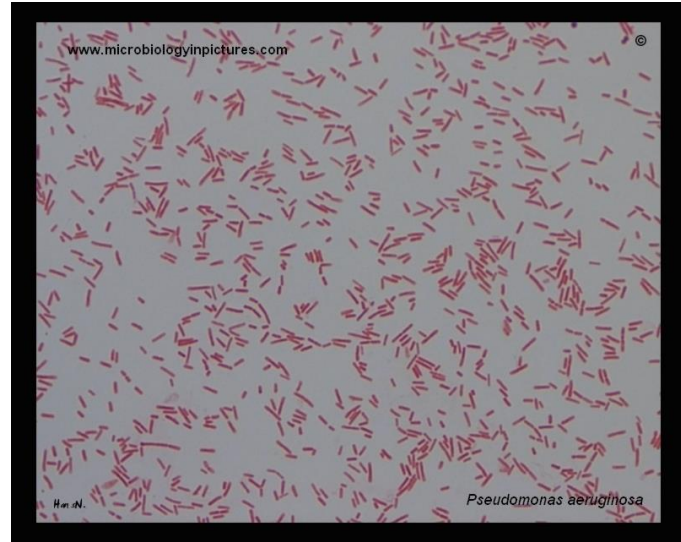


<http://www.worldatlas.com/webimage/countrys/af.htm>

# *Pseudomonas aeruginosa*

## Biological Characteristics

- Gram-Negative
- Bacillus
- Motile with polar flagella
- Found in moist environments
- Facultative anaerobe
- Can grow at 42°C
- Produces Exotoxin A



<https://www.microbiologyinpictures.com/bacteria-photos/pseudomonas-aeruginosa-photos/pseudomonas-aeruginosa-micrograph.html>

\*<https://www.microbiologyinpictures.com/pseudomonas-aeruginosa.html>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2708563/>

# *Pseudomonas aeruginosa*

## Transmission

- Nosocomial
- Spread patient to patient or through reservoirs
  - Reservoirs include food, sinks, and respiratory equipment
  - Can be introduced through fruits and vegetables
- Normally found on skin



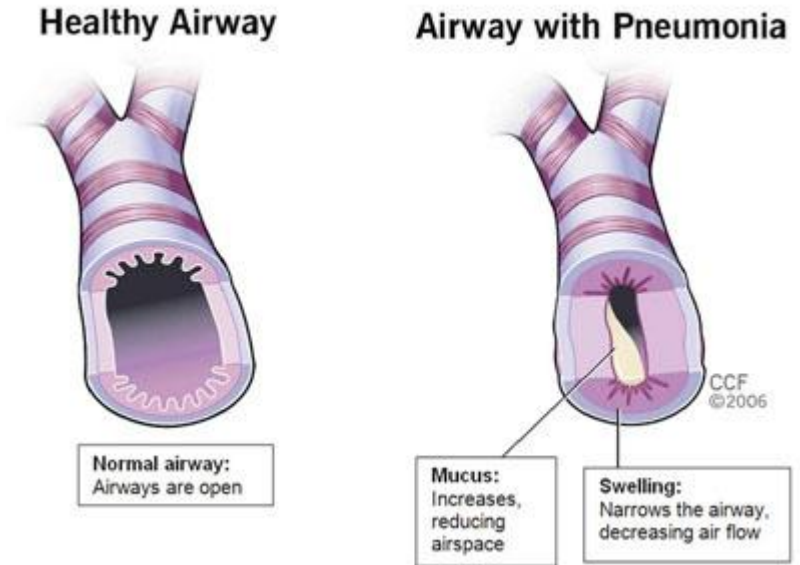
<http://www.medicaexpo.com/prod/hamilton-medical/product-75118-474512.html>

\*<http://www.ehagroup.com/resources/pathogens/pseudomonas-aeruginosa/>

# *Pseudomonas aeruginosa*

## Infection Sites and Symptoms

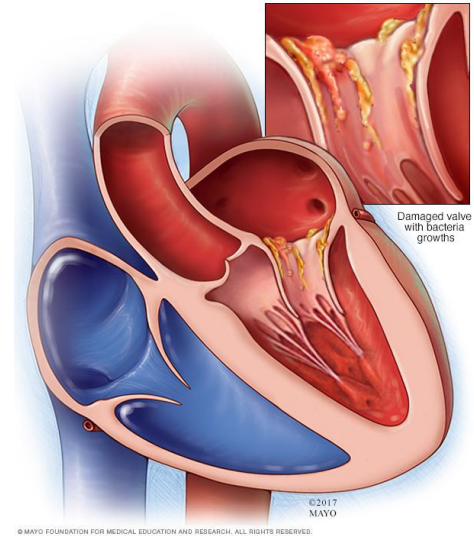
- Opportunistic pathogen
- Can affect any part of the body
- Respiratory tract
  - Pneumonia
  - Common in patients with ventilation tube or neutropenia
  - Fever, chills, cough, and cyanosis



# *Pseudomonas aeruginosa*

## Infection Sites and Symptoms

- Endocarditis
  - Infects native and prosthetic heart valves
  - Symptoms differ depending on side infected
    - Fever and malaise
    - Left side: symptoms of congestive heart failure



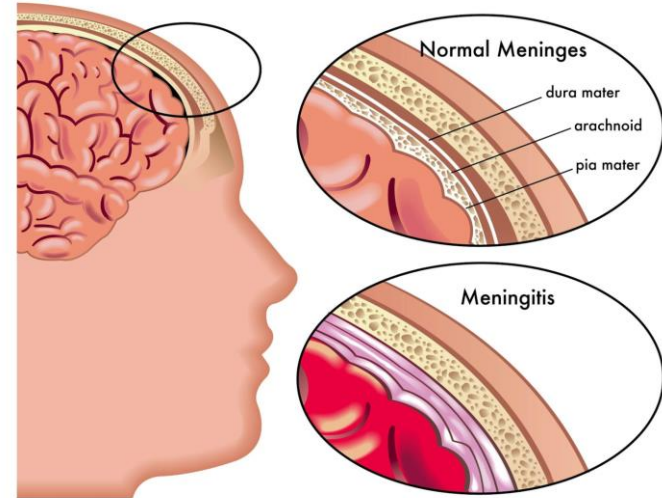
<https://www.mayoclinic.org/diseases-conditions/endocarditis/symptoms-causes/syc-20352576>

<https://emedicine.medscape.com/article/226748-clinical>

# *Pseudomonas aeruginosa*

## Infection Sites and Symptoms

- Central Nervous system
  - Meningitis
  - Results from surgical procedures or other infections through bacteremia
  - Fever, headache and confusion



[http://www.neurology-asia.org/articles/20092\\_095.pdf](http://www.neurology-asia.org/articles/20092_095.pdf)

<https://emedicine.medscape.com/article/226748-clinical>

<https://www.tes.com/lessons/HxJ3YZKLmbMPUQ/meningitis>



# *Pseudomonas aeruginosa*

## Infection Sites and Symptoms

- Skin
  - Paronychia
  - Sepsis in burn wounds
  - Secondary infection in individuals decubiti, eczema, and athlete's foot



<https://emedicine.medscape.com/article/226748-clinical>

[http://www.regionalderm.com/Regional\\_Derm/files/qr\\_nail.html](http://www.regionalderm.com/Regional_Derm/files/qr_nail.html)

# *Pseudomonas aeruginosa*

## Infection Sites and Symptoms

- Bacteremia
  - Mortality greater than 10%
- Ear
  - Chronic swimmer's ear
- Eye
- Bones and Joints
- Gastrointestinal

<https://emedicine.medscape.com/article/226748-clinical>

# *Pseudomonas aeruginosa*

## Diagnosis

- Grows on most agar
- Isolated on eosin-methylthionine blue agar or blood agar
- Identified by
  - Gram morphology
  - Inability to ferment lactose
  - Positive oxidase reaction



<https://www.microbiologyinpictures.com/bacteria-photos/pseudomonas-aeruginosa-photos/growth-of-pseudomonas-on-blood-agar.html>

<http://www.ehagroup.com/resources/pathogens/pseudomonas-aeruginosa/>

# *Pseudomonas aeruginosa*

## Treatment

- Resistant to many antibiotics
  - Increasing resistance
- A specimen from the patient is often needed for proper treatment
- gentamicin and carbenicillin combination

<http://www.ehagroup.com/resources/pathogens/pseudomonas-aeruginosa/>

<https://www.cdc.gov/hai/organisms/pseudomonas.html>

# *Pseudomonas aeruginosa*

## Occurrences

- 0.04% of all hospital discharges
- 10% of all hospital infections
- 51,000 healthcare-associated incidences per year
- 13% are multi-drug resistant
- Cause 400 deaths per year

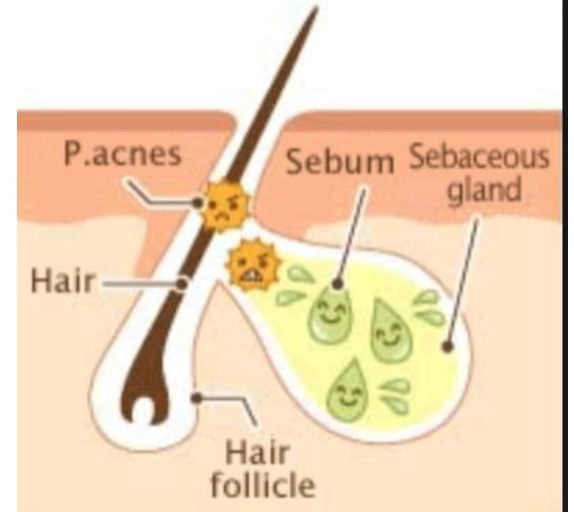
\*<http://www.ehagroup.com/resources/pathogens/pseudomonas-aeruginosa/>

<https://www.cdc.gov/hai/organisms/pseudomonas.html>

# *Propionibacterium acnes*

## The Organism:

- Gram-positive
- Rod-shaped
- Aero-tolerant: prefers low oxygen environments
  - Deep within clogged hair follicle
- Found deep in pores and feeds on sebum
  - Sebum is produced by sebaceous (sweat) glands
- Create biofilms- contributes to persistence



\*<http://thescienceofacne.com/what-is-propionibacterium-acnes/>

\*[https://www.otsuka.co.jp/en/health\\_illness/nikibi/kisochishiki.html](https://www.otsuka.co.jp/en/health_illness/nikibi/kisochishiki.html)

# *Propionibacterium acnes*

## Diseases:

- Acne
- Post-Surgical Infections
- Brain Abscesses
- Subdural empyema
- Parotid and Dental Infections
- Conjunctivitis (Contacts)
- Pulmonary Infections
- Peritonitis
- Osteomyelitis



[\\*http://www.antimicrobe.org/b225.asp](http://www.antimicrobe.org/b225.asp) [\\*https://moonhaven.com.au/blogs/news/the-5-simple-but-vital-rules-for-treating-adult-acne-or-acne-at-any-age-1](https://moonhaven.com.au/blogs/news/the-5-simple-but-vital-rules-for-treating-adult-acne-or-acne-at-any-age-1)

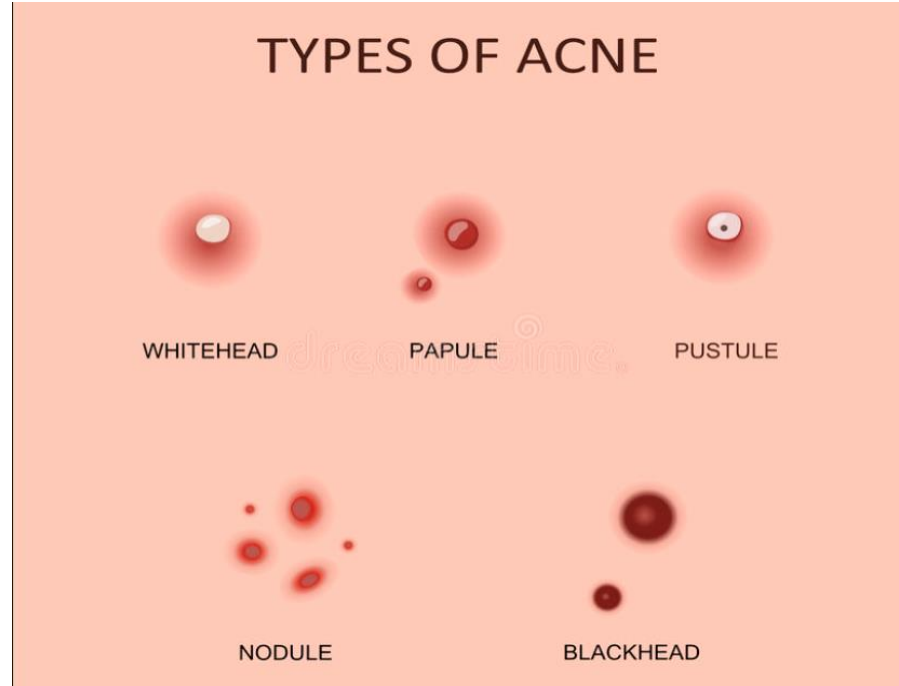
# *Propionibacterium acnes*

## Symptoms:

- Redness
- Swelling
- Tenderness
- Bumps

## Common Types of Acne Bumps:

- Whitehead
- Pustule
- Blackhead



\*<https://www.ncbi.nlm.nih.gov/books/NBK83685/>



# *Propionibacterium acnes*

## Treatments:

- Antibiotics (Penicillin G)
- Topical Treatments (benzoyl or triclosan)
  - Difficulty penetrating to follicle
- Hormonal Treatments and Retinoids
  - Limit sebum production
- Light and Laser Therapies
  - Kill bacteria and limit sebum production
- Essential Oils (Tea Tree and Thyme)



\*<http://thescienceofacne.com/what-is-propionibacterium-acnes/>

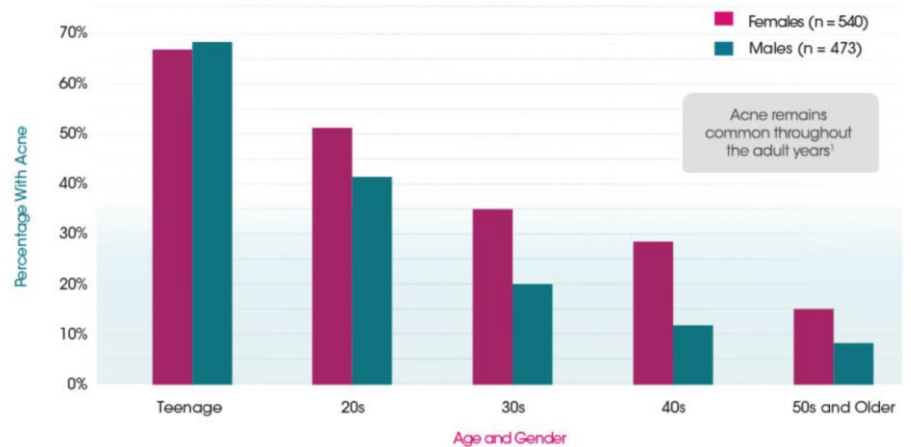
# *Propionibacterium acnes*

## Prevalence:

- >45 million individuals in the US affected
- ~20% of all visits to the dermatologist are for acne
- More prevalent in teenagers
  - Decreases with age
- More common in females >20 years

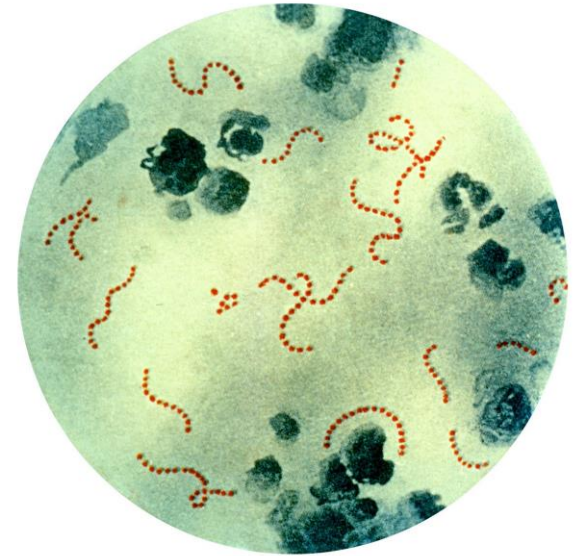
\*<https://www.ncbi.nlm.nih.gov/books/NBK83685/>

\*<https://www.aczonehcp.com/patient-experience>



# Streptococcal Skin Infections

- *Caused by Streptococcus pyogenes*
- These infections fall under Group A streptococcus
- Gram Positive
- Some skin infections these bacteria can cause are:
  - Impetigo
    - Ecthyma
  - Cellulitis:
    - Erysipelas
    - Necrotizing fasciitis
- Some strains of these bacteria also account for diseases such as strep throat and scarlet fever



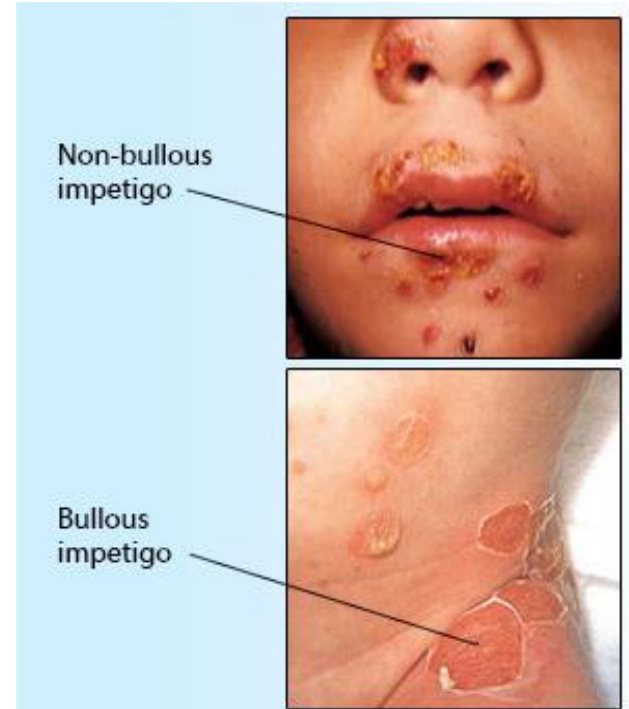
\*<https://www.medicinenet.com/script/main/art.asp?articlekey=143954>

<https://www.wired.com/2014/04/how-flesh-eating-strep-bacteria-evolved/>

# Impetigo: Signs and Symptoms

- There are two forms: Nonbullous and Bullous
- Nonbullous form caused by *S. pyogenes* bacteria
- Causes red sores to form on the skin, usually around the mouth and nose
- Sores break open and secrete fluid, causing a yellowish brown crust to form around the infected area
- Usually occurs in young children

\*<https://www.medicinenet.com/impetigo/article.htm>

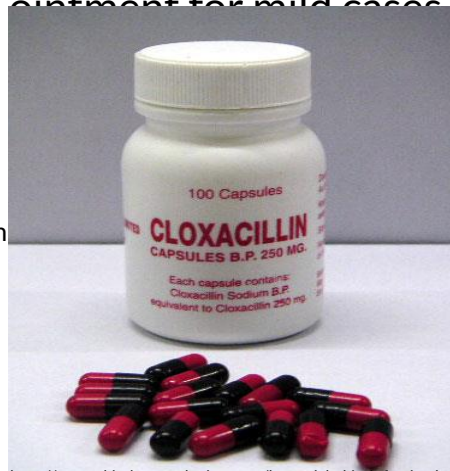


<https://www.medicinenet.com/impetigo/article.htm>

# Transmission and Treatment of Impetigo

- Spreads through close contact or sharing of items such as clothes, towels, sheets, etc.
- Bacteria usually enter through skin that has been previously cut or injured
- Number of sores will increase and sores will get bigger
- Doctors prescribe antibiotic ointment for mild cases and antibiotic pills for more severe cases
- Usually heals within a week

\*<https://www.medicinenet.com/impetigo/article.htm>



# Ecthyma Signs and Symptoms

- Deep tissue form of Impetigo
- Crusty red sores
- Start as small blisters
- Ulcers form below sores
- Can occur in all people, but children, elderly, and immunosuppressed people are usually more susceptible



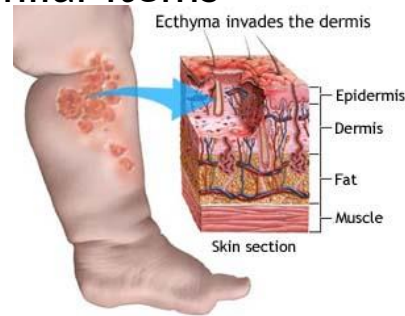
\*<https://www.dermnetnz.org/topics/ecthyma/>

# Transmission and Treatment of Ecthyma

- Close contact
- Sharing of clothes, towels, and other similar items
- Soak crusted areas
- Ointment antibiotic
- Oral antibiotic

\*<https://www.dermnetnz.org/topics/ecthyma/>

\*<https://www.webmd.com/skin-problems-and-treatments/understanding-impetigo-basics>



ADAM



# Cellulitis: Signs and Symptoms

- *S. pyogenes*
- Infection of the skin and the tissues beneath it
- Can occur anywhere on the body
- Patches of red skin that are painful and tender
- Patches are also warm to the touch
- People can also have:
  - Fever
  - Chills and sweats
  - Pain and swollen lymph nodes
- Occurs in people of all ages, but most prevalent in middle aged and elderly people





# Erysipelas: Signs and Symptoms

- A form of cellulitis
- Affects deeper tissue
- Symptoms include:
  - Spreading areas of heat
  - Bright red circumscribed areas
  - Sharp raised borders around areas
- Usually occurs in younger children



CDC/Dr. Thomas F. Sellers/Emory University

\*Stöppler, MD Melissa Conrad. "Cellulitis Pictures, Symptoms, Treatment & Complications." *MedicineNet*, [www.medicinenet.com/cellulitis/article.htm](http://www.medicinenet.com/cellulitis/article.htm).

# Necrotizing fasciitis: Signs and Symptoms

- Another form of cellulitis
  - Also known as “flesh eating disease”
  - Affects deep lining tissue
  - Results in dead or damaged tissue
- \*[https://www.medicinenet.com/necrotizing\\_fasciitis/article.htm](https://www.medicinenet.com/necrotizing_fasciitis/article.htm)



[https://www.medicinenet.com/necrotizing\\_fasciitis/article.htm](https://www.medicinenet.com/necrotizing_fasciitis/article.htm)

# Transmission and Treatment of Cellulitis

- Not contagious, can only get it by becoming infected
- Can spread to deeper tissues and cause fasciitis
  - Fasciitis is the inflammation of deep lining tissue
- The strep bacteria can get into your bloodstream and infect other tissues
- Oral antibiotic usually containing penicillin
- Surgery may be needed depending on severity

