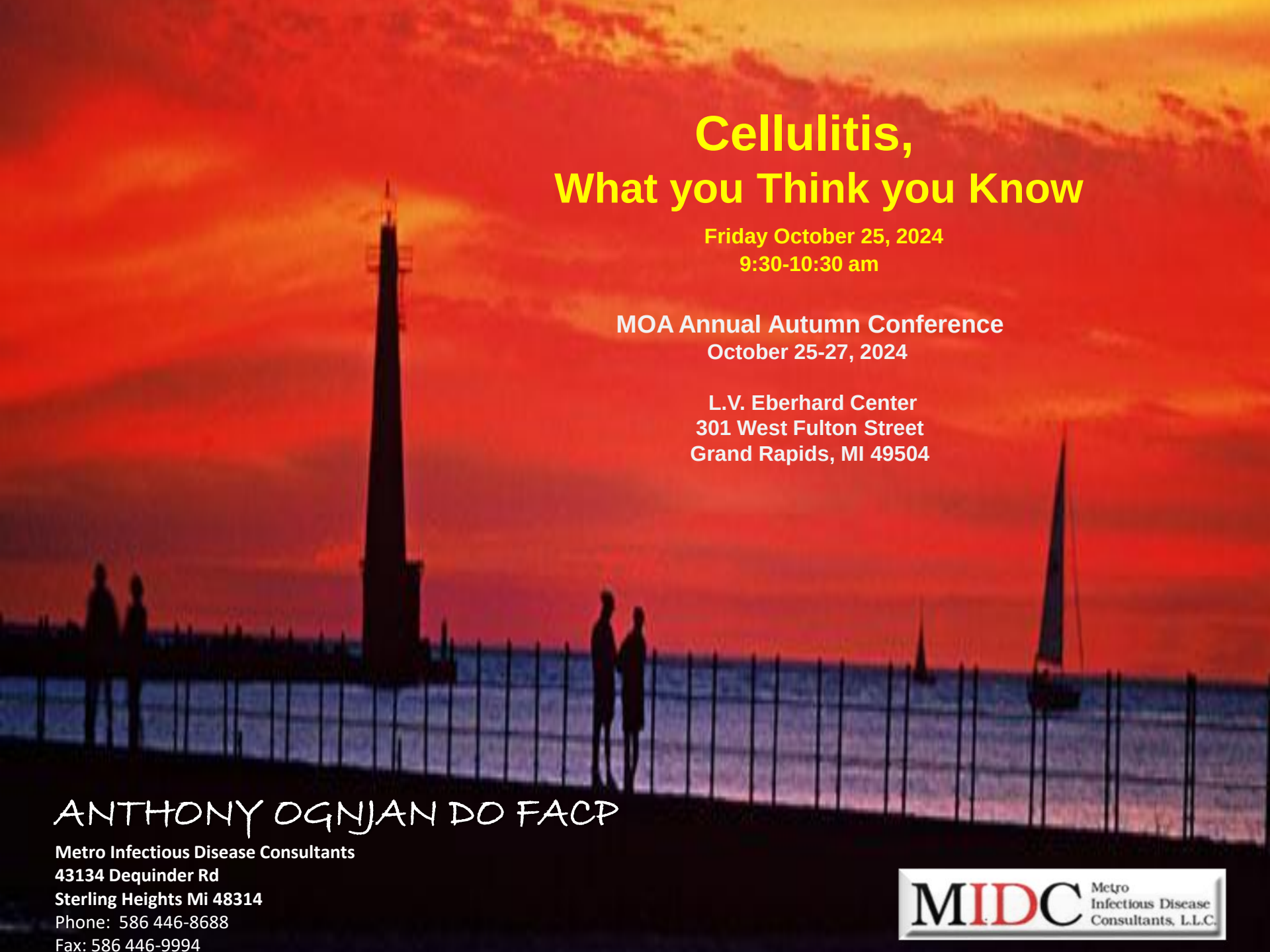
# FINAL
# MOA FALL LECTURE



# Cellulitis,
# What you Think you Know

**Friday October 25, 2024**
**9:30-10:30 am**

**MOA Annual Autumn Conference**
**October 25-27, 2024**

**L.V. Eberhard Center**
**301 West Fulton Street**
**Grand Rapids, MI 49504**


ANTHONY OGNJAN DO FACP

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**43134 Dequinder Rd**
**Sterling Heights Mi 48314**
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Fax: 586 446-9994


MIDC Metro Infectious Disease Consultants, L.L.C.

# Anthony Ognjan, D.O., FACP

*Serbo-Croatian - French Canadian)*


**Diploma. Algonac High School** (Long time ago!)
**B.S. Microbiology & Public Health MSU 1975**
**B.S. Pharmacy, Ferris State College 1978**
**MSU College of Osteopathic Medicine 1983**
**Board Certified IM: 1987 [ABIM]**
**Board Certified Infectious Diseases: 1991 [ABIM]**

**Past President, Macomb County Osteopathic Medical Association**
**Chairman, Michigan Osteopathic Association [MOA] Political Action Committee**
**Member, Counsel of Governmental Affairs (MOA)**
**Vice-Chair MOA House of Delegates (MOA)**
**Associate Professor of Medicine MSU-COM**

**Hospital Orderly:** (Orthopedics), Ingham Medical Center
**Pharmacist:** Children's Hospital of Michigan
**Internship:** Detroit Osteopathic Hospital / BCCH
**Resident: Internal Medicine**, Henry Ford Hospital, Detroit
**Infectious Disease Fellowship:** Henry Ford Hospital, Detroit

Work experience

- Staff Emergency room Physician
  Henry Ford hospital System
- Staff physician HIV/ID Clinic
  Macomb County Jail
- Staff physician Wound Care Center
  Mclaren Macomb hospital

MIDC Metro Infectious Disease Consultants, L.L.C.

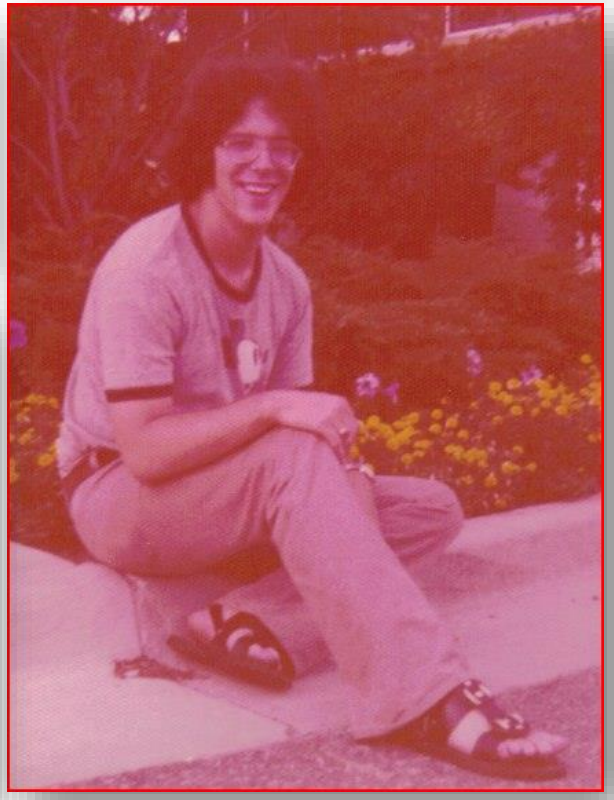
1989 McLaren Macomb Hospital / Ascension Macomb-Oakland

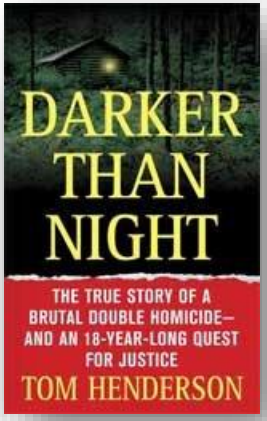
# A few personal observations …

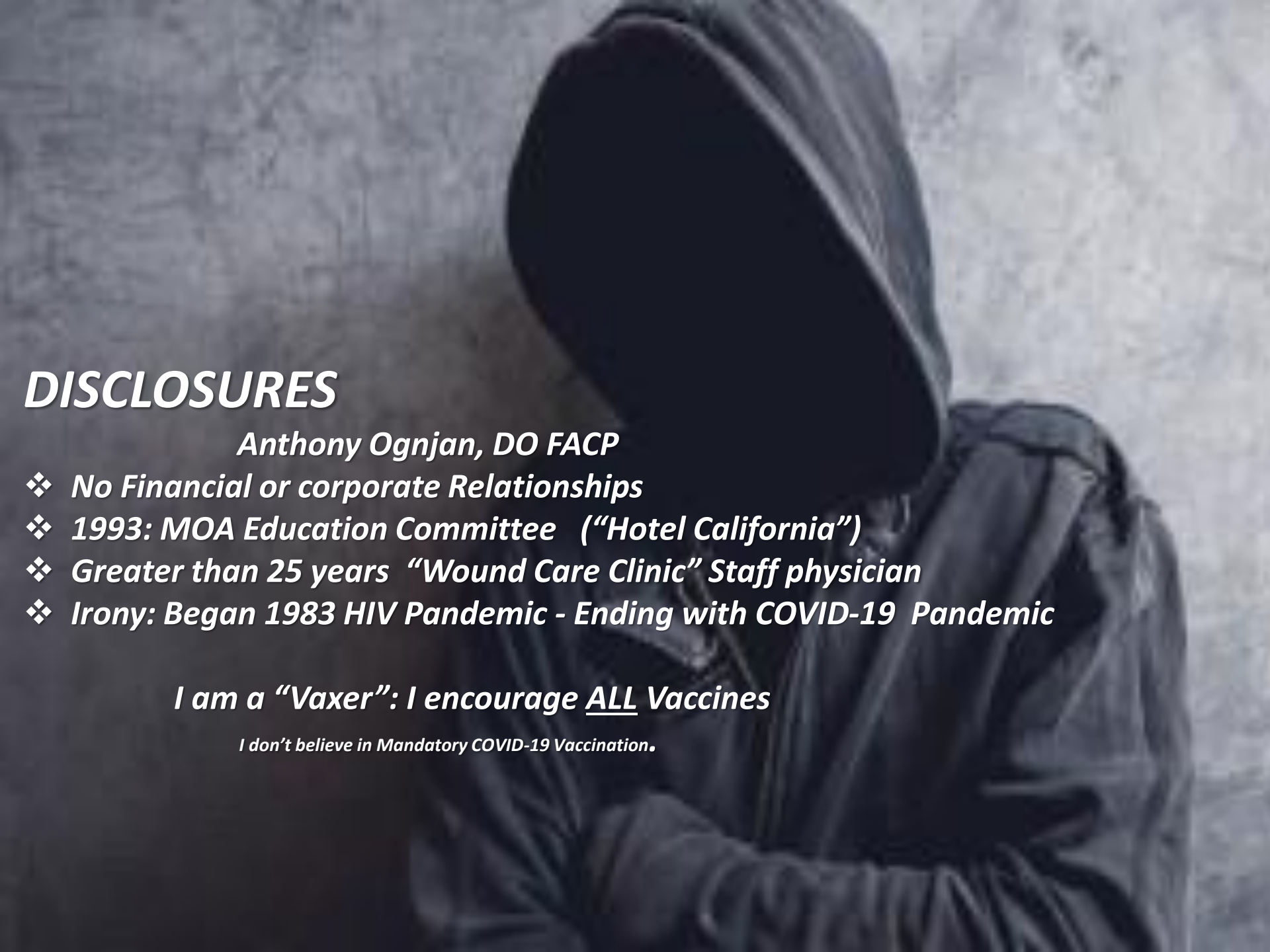


**What is the QAAP tax in Michigan?**
A QAAP is a process authorized by the Legislature that levies an assessment on Physician service to, leverage additional federal dollars into the Medicaid program, theoretically allowing higher reimbursement rates to be paid when providing services to Medicaid recipients

Michigan state capital steps
"Norma Rae" [1979 Sally Fields]





# *DISCLOSURES*

*Anthony Ognjan, DO FACP*

- *No Financial or corporate Relationships*
- *1993: MOA Education Committee ("Hotel California")*
- *Greater than 25 years "Wound Care Clinic" Staff physician*
- *Irony: Began 1983 HIV Pandemic - Ending with COVID-19 Pandemic*

*I am a "Vaxer": I encourage <u>ALL</u> Vaccines*

*I don't believe in Mandatory COVID-19 Vaccination.*

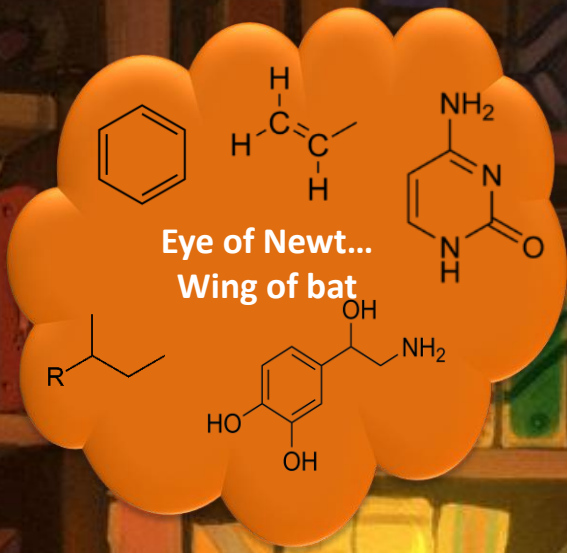
## Major Objectives

I intend Not to be boring ..

Offering a flowing presentation with some useful clinical pearls

**Cellulitis,**

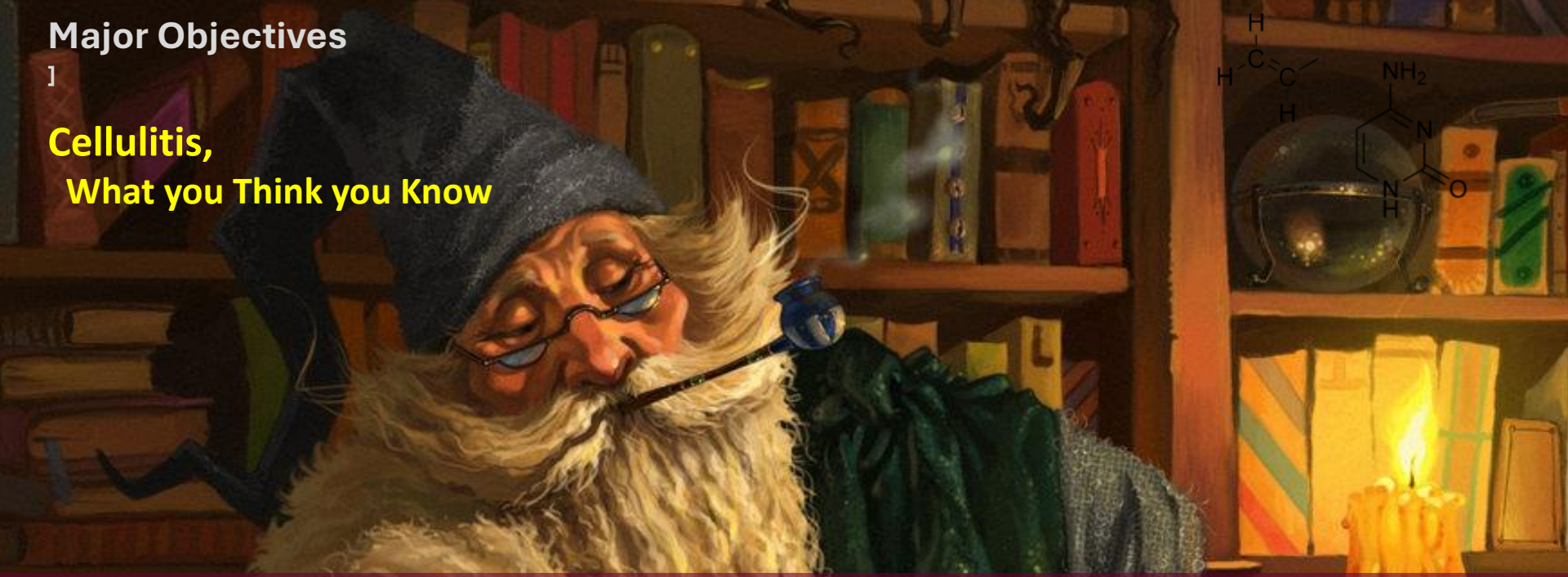
**What you Think you Know**



# Major Objectives

]

## Cellulitis,
## What you Think you Know



1. Increase knowledge and understanding of selected Soft tissue infections and diseases

2. Improving the understanding of applicable skin and soft tissue anatomy, defining and exploring various soft tissue infections and pathology

3. Explore Clinical pathology utilizing slide presentation featuring varies types of soft tissue Syndromes and infection infections

4. Using illustrative case studies and summaries as applicable

5. ***Brief*** **overview** of clinical medical issues associated with cellulitis and soft tissue infections
   - -- Microbiology
   - -- Antibiotics
   - -- Circulation
   - -- Miscellaneous : trauma, inflammatory issues

# CELLULITIS

What you think you know

PEARLS

## Lecture Design

- The lecture can be best appreciated by watching and listening to the overall narrative…
- There will be points along the way, where clinical **“Pearls”** **may** emphasize specific points of interest

# Let the GAMES begin….

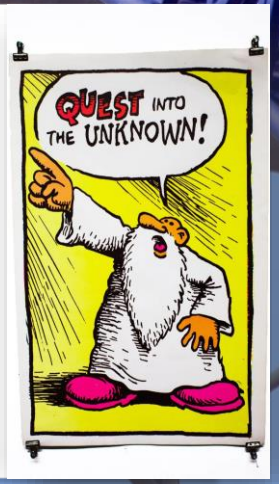
## I know….

**I talk fast…**

**I have too many slides…**

**Respectfully of your attention…..**

**Buckle Up…..Here we go….**



# Cellulitis

"The Ognjan ruler"

1.0 CM [10mm]

2.5 CM "DIP joint"

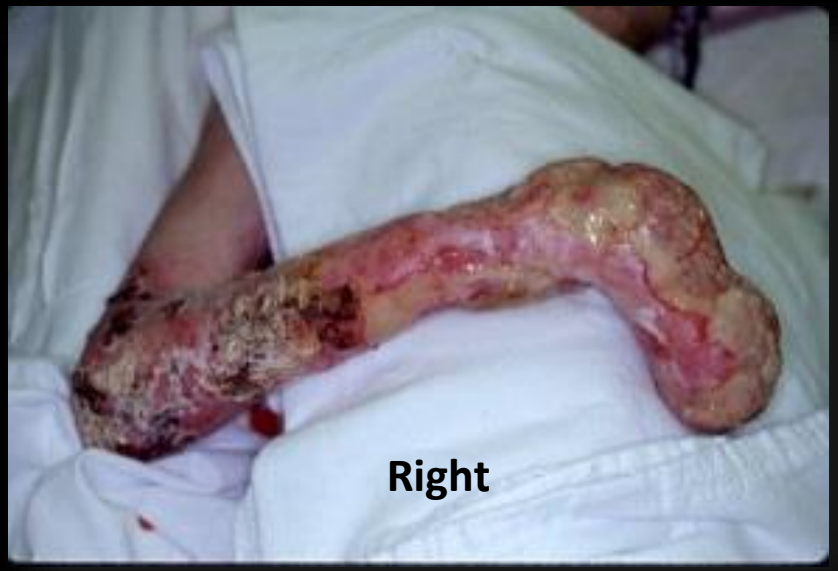
5.0 CM "PIP Joint"

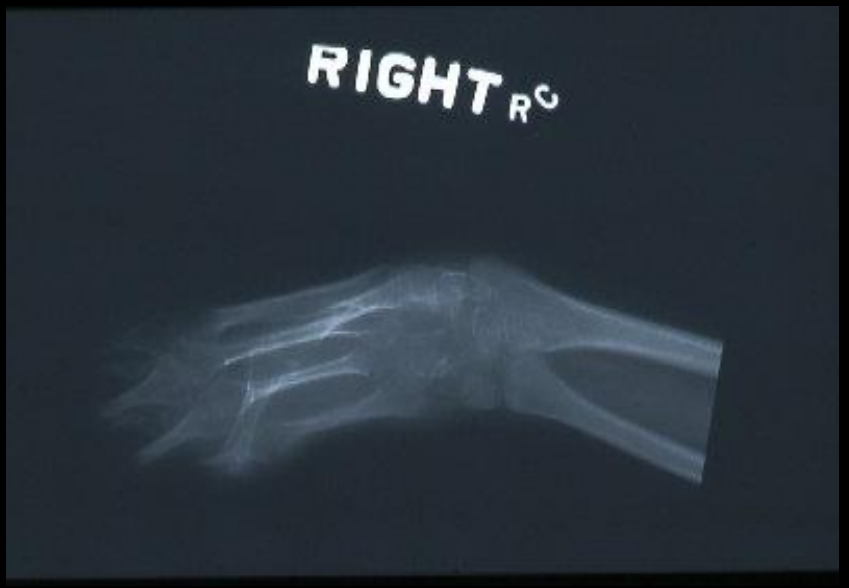
10.0 CM "MCP" joint"



Au Train
Paquette

# Dystrophic Epidermolysis Bullosa



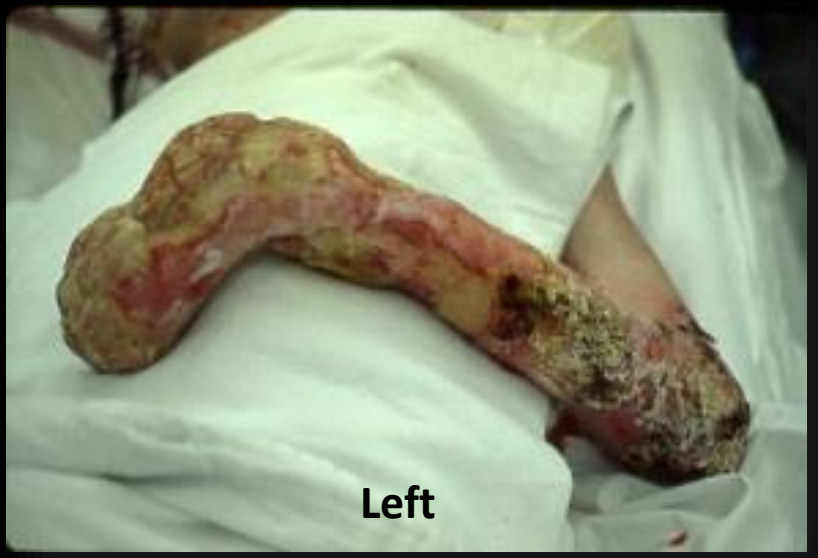

## Epidermolysis Bullosa

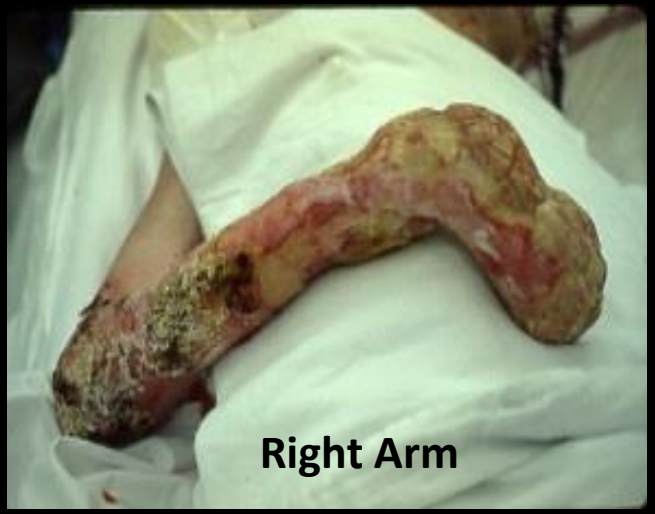
- Inherited connective tissue disease
- Blisters of the skin and mucosal membranes
- Incidence of 1 / 50,000.

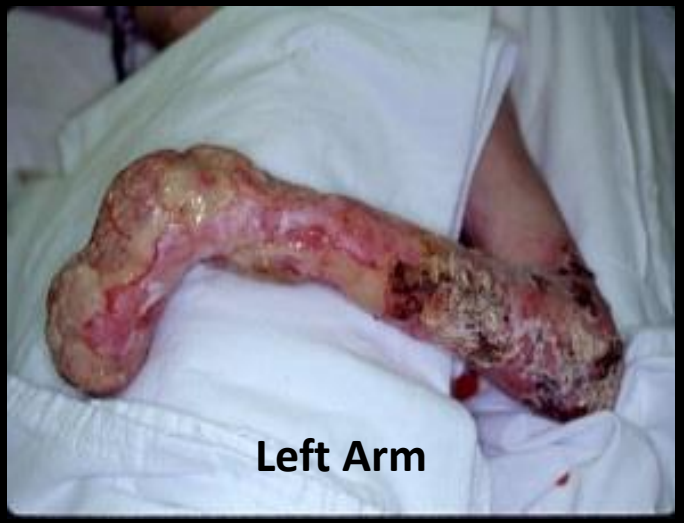
Result of a defect in “anchoring” between the epidermis and dermis

resulting in friction and skin

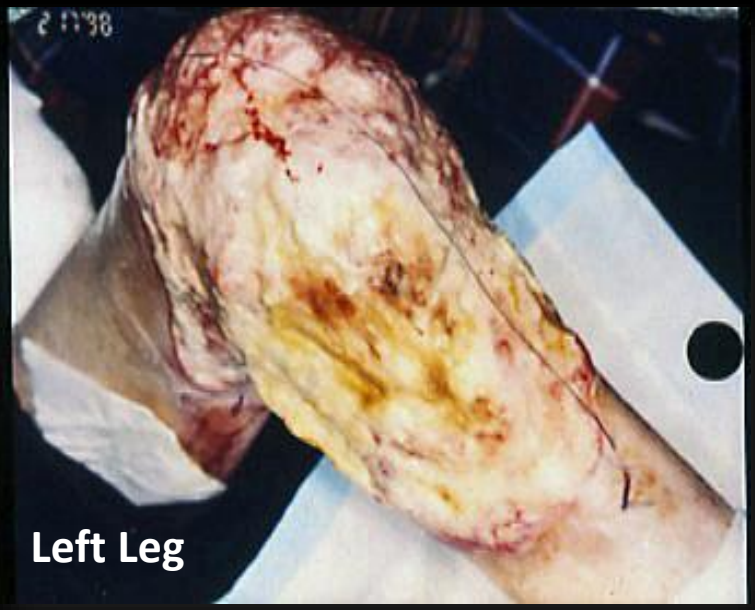
Severity ranges from mild to lethal.

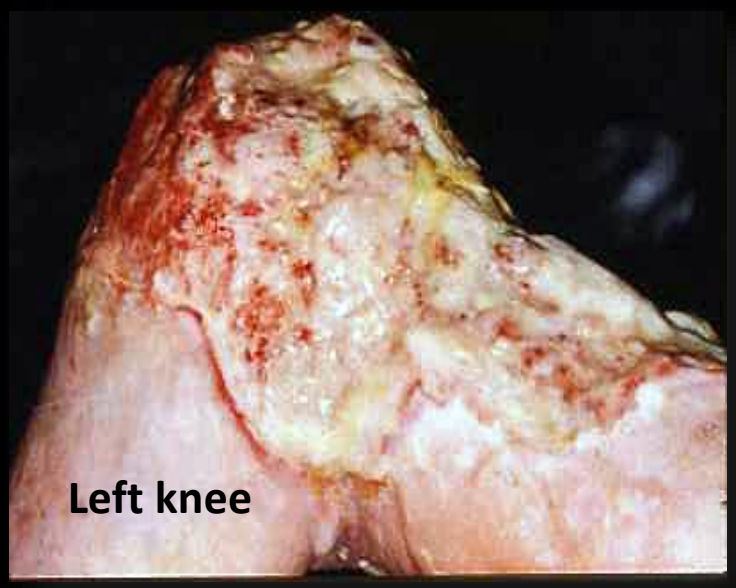





**Mr. Paquette was a talented, proliferative, and very successful watercolor artist, known through out the Great Lakes region for great lake landscapes**



## Jonathan “Jonny” Kennedy

Born Alnwick, United Kingdom, spent most of his life in neighbouring Northumberland.

He had a severe form of dystrophic epidermolysis bullosa and was born with no skin on his left leg. Ultimately died age 36 from complications of skin cancer.

**Jonny Kennedy**

(10/04/1966 – 09/26/2003)

**“The Boy Whose Skin Fell Off”,**

Documented the final months of his life

Dystrophic Epidermolysis Bullosa .

https://www.youtube.com/watch?v=OUWqyQYkZrg

Re-Accessed 10/15/2024

# CELLULITIS

What you think you know

RULES / Observations

# Cellulitis??...Antibiotics??

## RULES?

DO you think so?

DON'T NEED NO

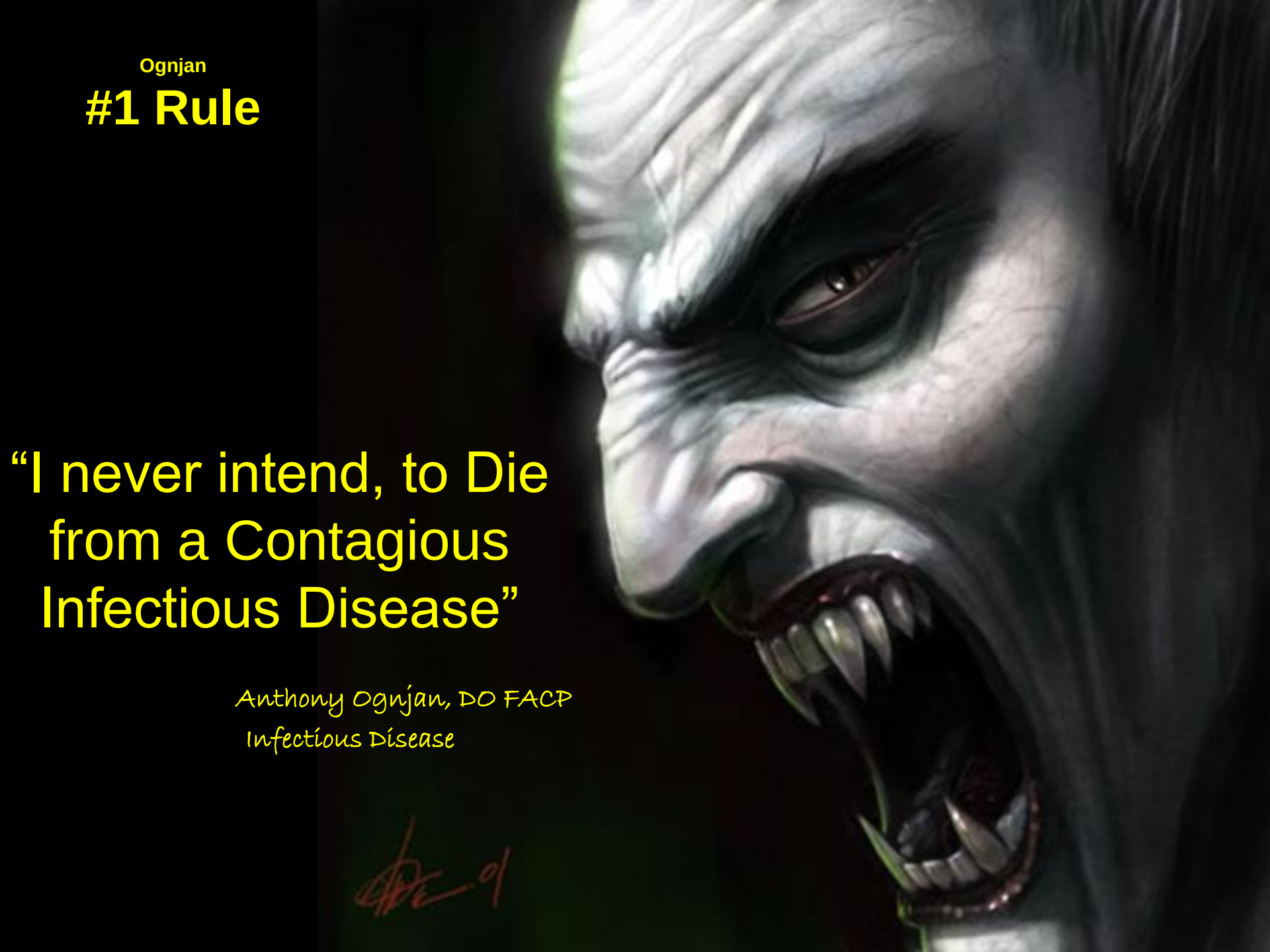
STINKING RULES".....

Alfonso Bedoya

"The Treasure of the Sierra Madre"

Ognjan

# #1 Rule



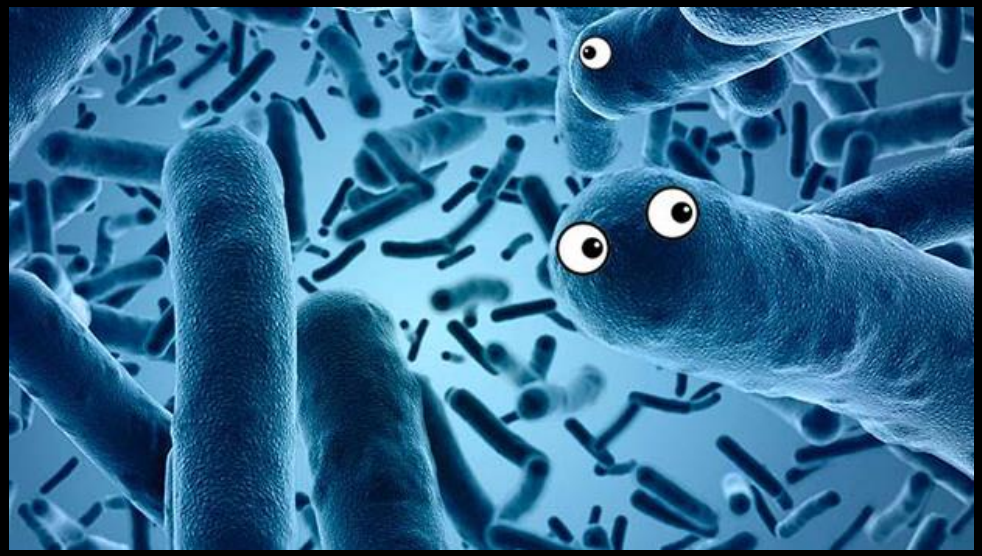
"I never intend, to Die from a Contagious Infectious Disease"

Anthony Ognjan, DO FACP
Infectious Disease

Ognjan

# #2 Rule

## Bacteria Are Not BUGS!!!



## Any Questions?

# Cellulitis

## *Human / Bacterial Ecology*

*Bacteria with EMERGING β-LACTAM RESISTANCE*

### GRAM POSITIVE
(Skin, Mucus Membranes, Soft tissues)

MICROCOCCUS
- S. aureus (MSSA, MRSA, VRSA, CA-MRSA)
- S. epidermidis
- Micrococcus

STREPTOCOCCI
- S. pyogenes (β Streptococci)
- S. agalactae (β Streptococci)
- Pneumococcus
- Enterococcus (GDE, VRE)

α Streptococci
- Viridian streptococcus gr.

Anaerobic Bacteria:
- Coccus, Bacillus, Spirochetes

### GRAM NEGATIVE
(Enterobacteriaceae, GI tract)

FIVE TRIBES


I. E. Coli
II. Salmonella, Shigella
III. Proteus, Morgenella
III. Klebsiella Enterobacter Serratia (KES)*
V. Yersinia

H. influenza
- H. Influenza β ("HIB"

ANAEROBIC
- Bacteroides fragilis (β-lactamase)

### GRAM NEGATIVE
Environmental

- P. aeruginosa
- Aeromonas spp.
- Acinetobacter spp.

### MISCELLANEOUS
[Resistance]

"S.PI.C.E." BACTERIA*
- Serratia
- Pseudomonas
- Indole-positive Proteus
- Citrobacter
- Enterobacter

# *Cellulitis*
# *Bacteriology*
# *GRAM POSITIVE ORGANISMS*

**Micrococcus**

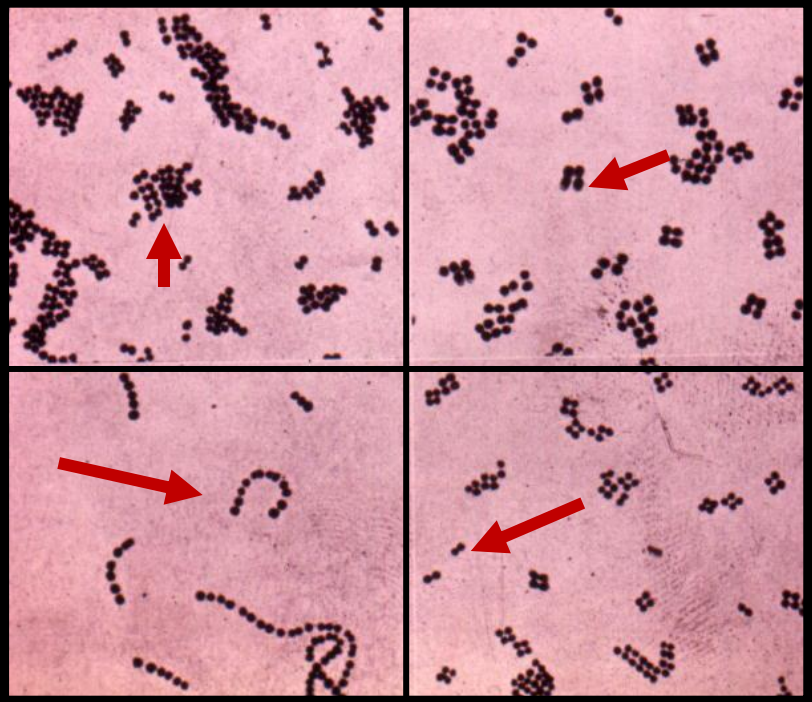
Staphylococcus

**Streptococcus**

α β ɣ

Staphylococcus (Micrococcus) "Clusters"

Staphylococcus (Micrococcus) "Tetrads"



Streptococcus "Chains"

Streptococcus "Diplococcus"

# GRAM POSITIVE CLUSTERS


**MICROCOCCUS**

- **Micrococcus species**
- **Staphylococcus aureus "Gold"** → **COAGULASE "POSITIVE"**
- **Coagulase Negative Staphylococcus (Albus) "White"** → **COAGULASE "NEGATIVE"**

**COAGULASE + / -**
**Slide Test Tube**



# *Streptococcus Taxonomy*

***Lancefield's group classification, introduced in 1933,***

*Based upon the carbohydrate composition of bacterial antigen**


Rebecca Craighill
Lancefield
1895-1981

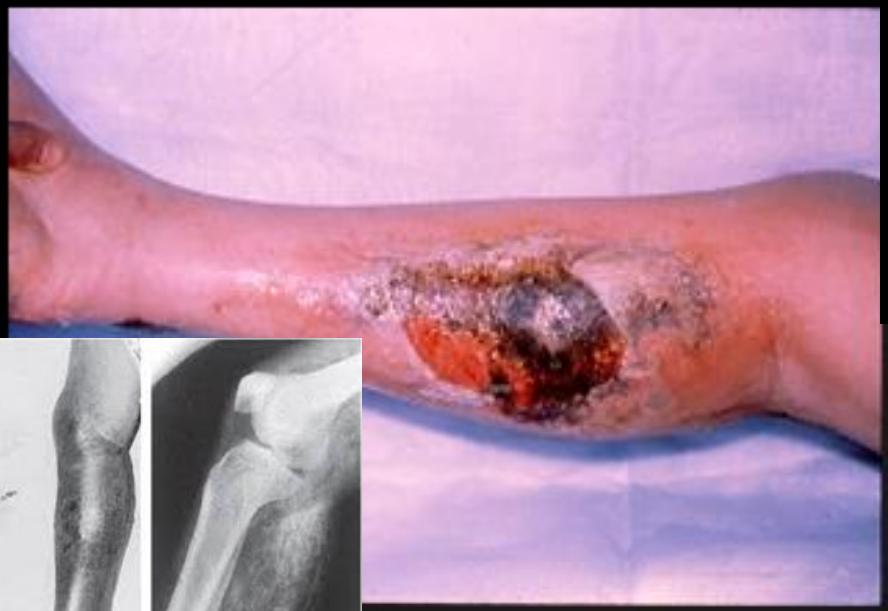
| Beta Hemolysis β | Alpha hemolysis "Viridian Group" α | Gamma Hemolysis (Enterococcus) ɣ |
|---|---|---|
| **S. pyogenes (Group A)* "GAS"**<br><br>**S agalactiae (Group B) "GBS"** | S. millerii<br>S. mitor<br>S. mitus<br>S. mutor<br>S. anginosis (F,G)<br>S. mutans<br>S. sanguis (H)<br>S. salavarius (K) | S. bovis (D)<br>S. equis<br>S. durans<br>S. cannis<br>S. susis<br><br>E. faecalis<br>E. faecium (VRE) |

***Complex sugar molecule "Polysaccharide": C substance, major cell wall component in all streptococci**

- **"Groups"** are designated by the letters **A through O**
- The most common species causing human disease: **Streptococcus pyogenes**: "Group A".
- Among the group A streptococci, Lancefield found another antigen:

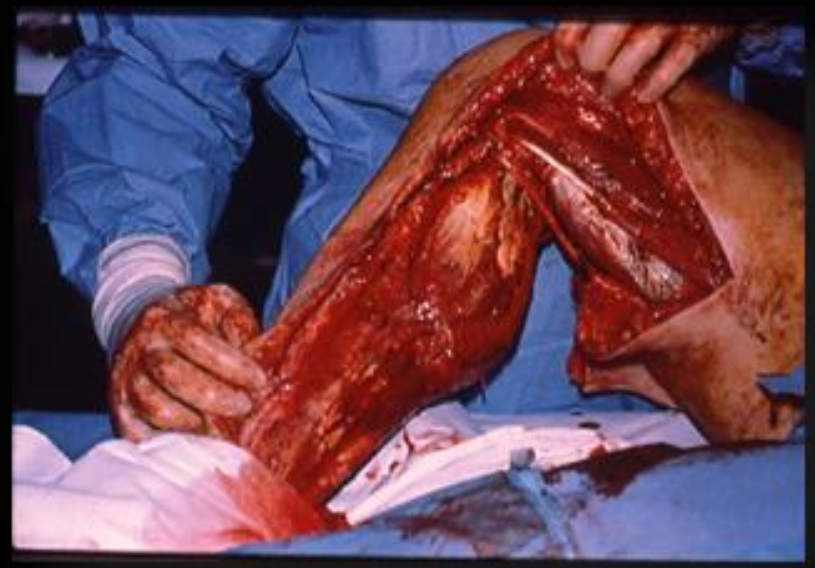
**"M protein" - matt appearance in colony formations.**

# Cellulitis
# Synergistic Gangrene





| GRAM POSITIVE (Skin, Mucus Membranes, Soft tissues) | GRAM NEGATIVE (Enterobacteriaceae, GI tract) | GRAM NEGATIVE Environmental |
|---|---|---|
| MICROCOCCUS<br>❖ S. aureus (MSSA,MRSA,VRSA,CA-MRSA)<br>❖ S. epidermidis<br>❖ Micrococcus | FIVE TRIBES<br>  <br>I. E. Coli<br>II. Salmonella, Shigella<br>III. Proteus, Morgenella<br>III. Klebsiella Enterobacter Serratia (KES)*<br>V. Yersinia | ❖ P. aeruginosa<br>❖ Aeromonas spp.<br>❖ Acinetobacter spp.<br>  <br>  |
| STREPTOCOCCI<br>❖ S. pyogenes (β Streptococci)<br>❖ S. agalactae (β Streptococci)<br>❖ Pneumococcus<br>❖ Enterococcus (GDE, VRE)<br>α Streptococci<br>❖ Viridian streptococcus gr. | H. influenza<br>❖ H. Influenza β ("HIB" | MISCELLANEOUS [Resistance]<br>"S.PI.C.E." BACTERIA*<br>❖ Serratia<br>❖ Pseudomonas<br>❖ Indole-positive Proteus<br>❖ Citrobacter<br>❖ Enterobacter |
| Anaerobic Bacteria:<br>❖ Coccus, Bacillus, Spirochetes | ANAEROBIC<br>❖ Bacteroides fragilis (β-lactamase) | |

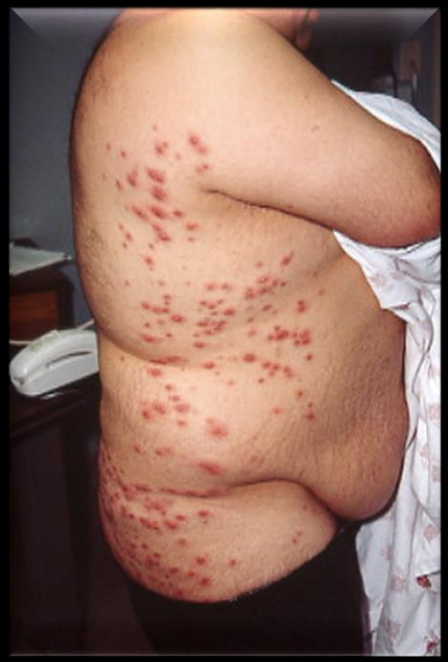


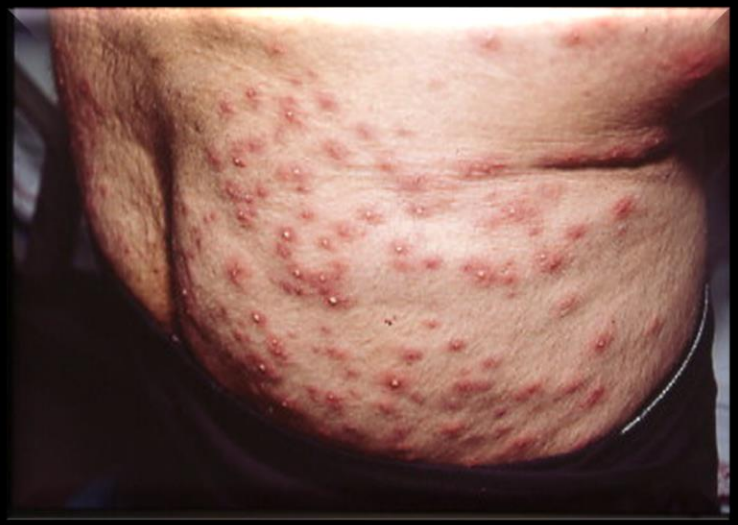
## Synergic gangrene

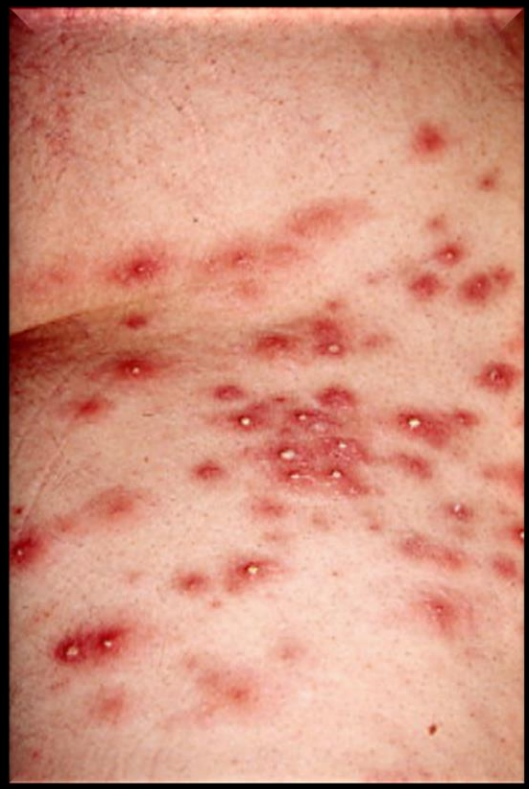
A **Progressive bacterial synergistic** mixed bacterial infection that usually occurs at the site of abdominal or thoracic surgery. It's typically caused by **microaerophilic streptococci, Staphylococcus aureus, and Enterobacteriaceae species**

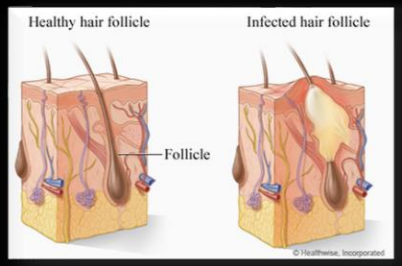
# Cellulitis

## Folliculitis and Furunculosis [Pseudomonas aeruginosa]








**Hot tub Folliculitis**

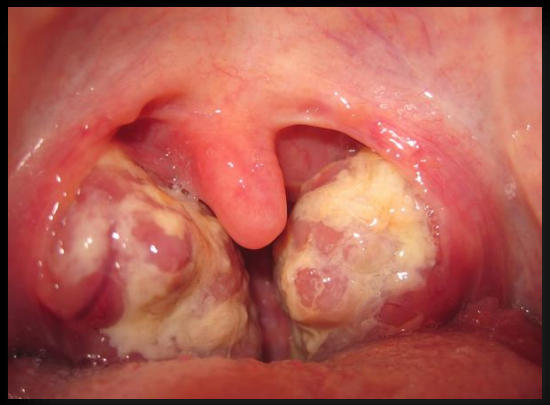
**Pseudomonas Folliculitis**

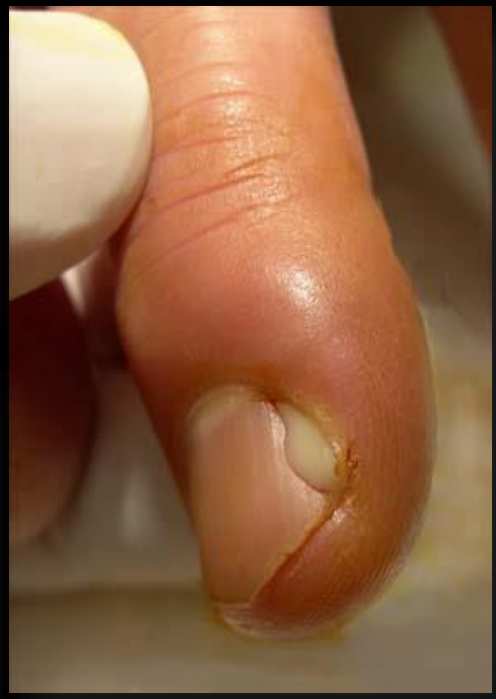
**"Hot tub buns"**

37 year old home builder. With peri-rectal abscess. Hospitalized and underwent I&D.
Recommended sitz bath to the area post discharge…
Instead had one of his building crews build a $12,000 Hot tub at his home.
Shared tub with other family members; Not so good at maintenance of the tub….

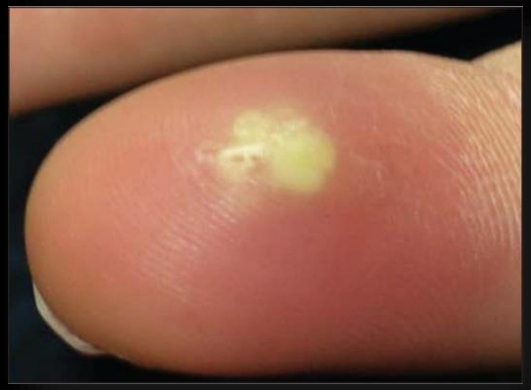
Washburn J, Jacobson JA, Marston E, Thorsen B. Pseudomonas aeruginosa rash associated with a whirlpool. JAMA. 1976 May 17;235(20):2205–2207

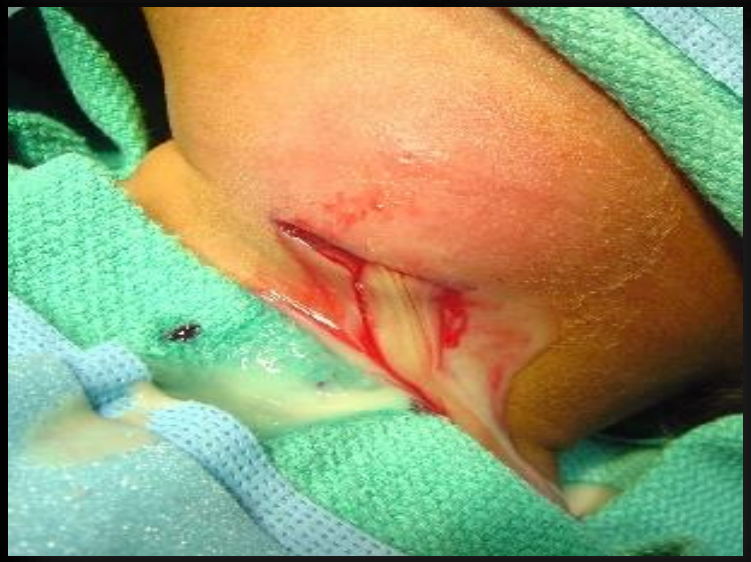

Ognjan
#3 RULE
"If it weren't for Pus....
I wouldn't HAVE a job...





Paronychia





# “Pus”:

- A protein-rich fluid called “Liquor puris”: Whitish-Yellow, Yellow, or Yellow Brown in color.
- Pus consists of a buildup of Dead leukocytes (White Blood Cells) from the body's immune system in response to infection.
- It accumulates at the site of inflammation.

http://www.medicalnewstoday.com/articles/249182.php

Ognjan

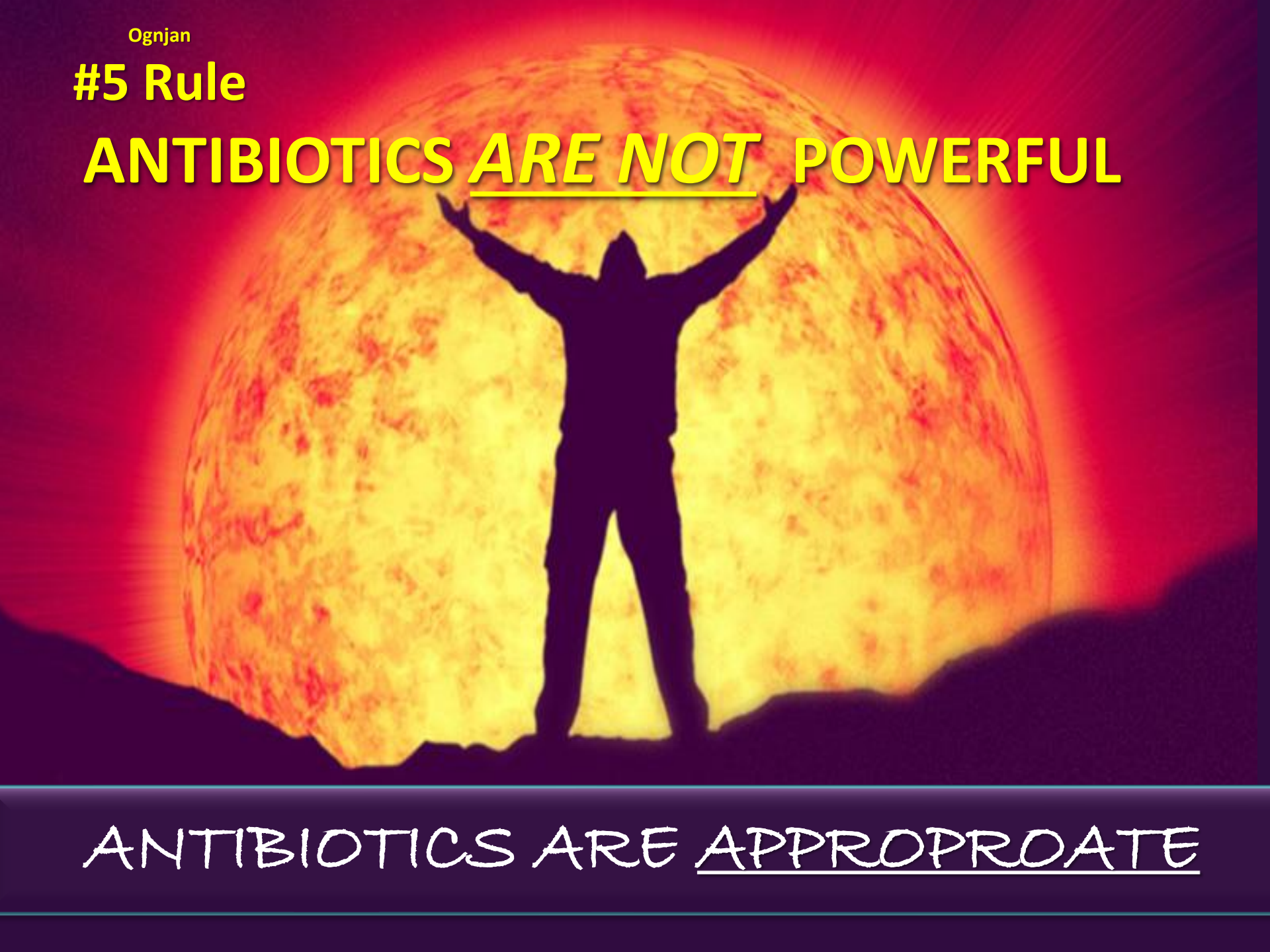
# #4 RULE

"MRSA...Put my Kids through College..."

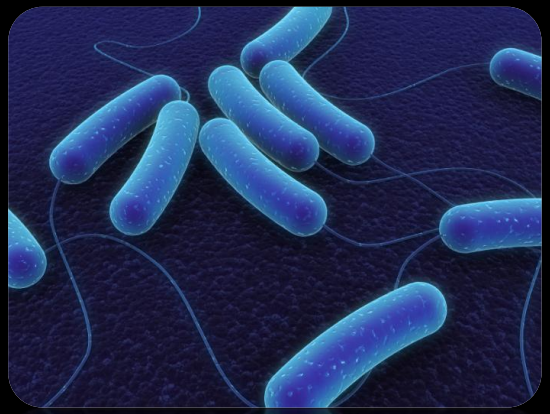
Ognjan

# #5 Rule

# ANTIBIOTICS *ARE NOT* POWERFUL



ANTIBIOTICS ARE APPROPROATE



Bacteria

Fungus

# *ANTIBIOTICS*
# *"Against Life"**

*1889 by Louis Pasteur's pupil **Paul Vuillemin** 1861–1932

- Single "Scoop" of soil, contain Bacteria and Fungi number in the Millions.
- **With Thousands of varieties and survive by "fighting" each other.**
  - **Past century, several newly discovered Antibiotics have been found by isolating them from the Bacteria and Fungi that produce them to defend their own lives.**

*History of Antibiotics http://inventors.about.com/od/pstartinventions/a/Penicillin_2.htm

# *Bacterial Antibiotic targets*

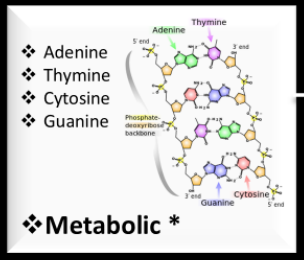
Metabolic *

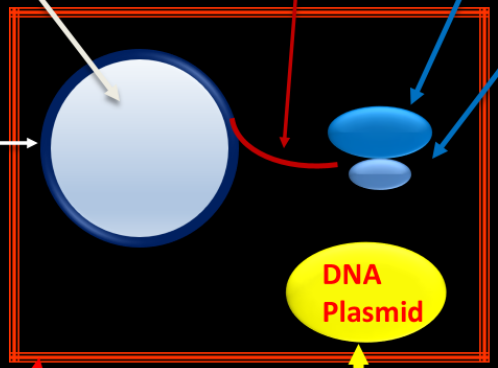
Bacterial DNA
Circular Double Strand

Transfer RNA

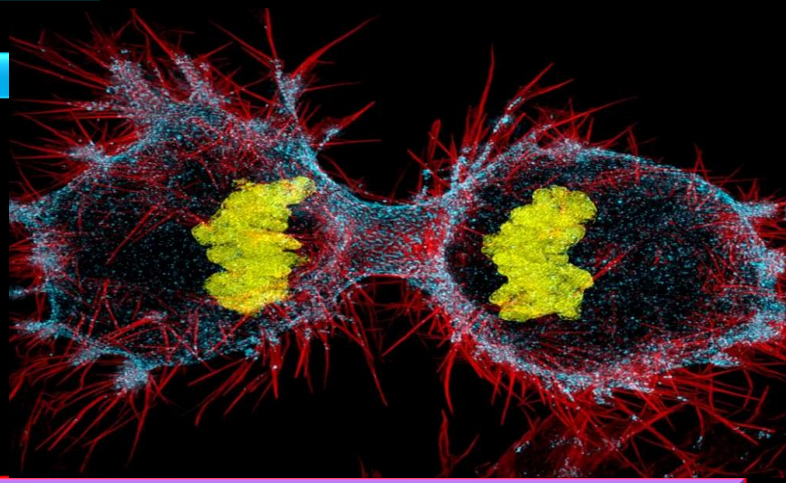
Ribosome 50s

Ribosome 30S



DNA
Plasmid



- Cell Wall:
- Plasma / Lipid Membrane

1940 - 2017

## Daughter cells

Cell division occurs every 20 minutes
Survival depends upon creation of
CELL COMPONENTS for 2 cells

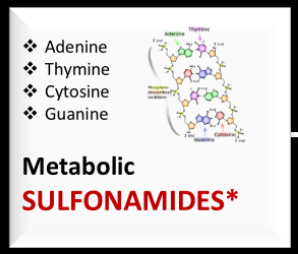
- Metabolic Enzymes
- Structural proteins
- Cell well
- DNA RNA repair / Synthesis

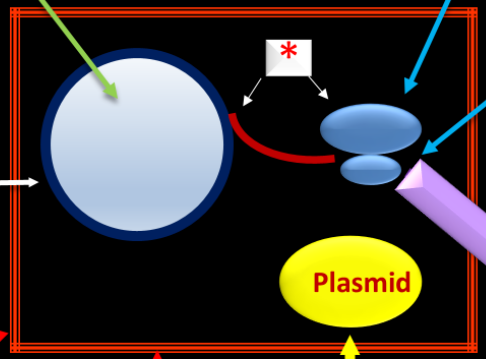
# *Antibiotic targets bacteria*

**DNA target:**
- QUINOLONE
- METRONIDAZOLE
- RIFAMPIN

**Ribosome 50s:**
- CLINDAMYCIN
- TETRACYCLINES
- MACROLIDES
- BIAXIN /ZITHROMAX
- LINEOZOLID (23s)

**Ribosome 30s**
- AMINOGLYCOSIDES




**Membrane Detergents**
- Daptomycin

**Cell Wall:**
- BETA LACTAMASES
- GLYCOPEPTIDES

1940 - 2017


## Disruption:

- Structural and organelle proteins
- Cell wall synthesis and repair
- Damage / depletion Metabolic enzymes
- Disruption DNA/RNA Repair / Synthesis

**Daughter Cell creation**

# CELLULITIS

## Anatomical consideration

# Anatomical consideration

## Normal Skin Flora

- Staphylococcus sp [>14]
- Corynebacteria
- Proteobacteria
- Flavobacteriales
- Proteobacteria
- Cutibacterium

## Introduction

The skin is the largest organ in the body, covering its entire external surface.

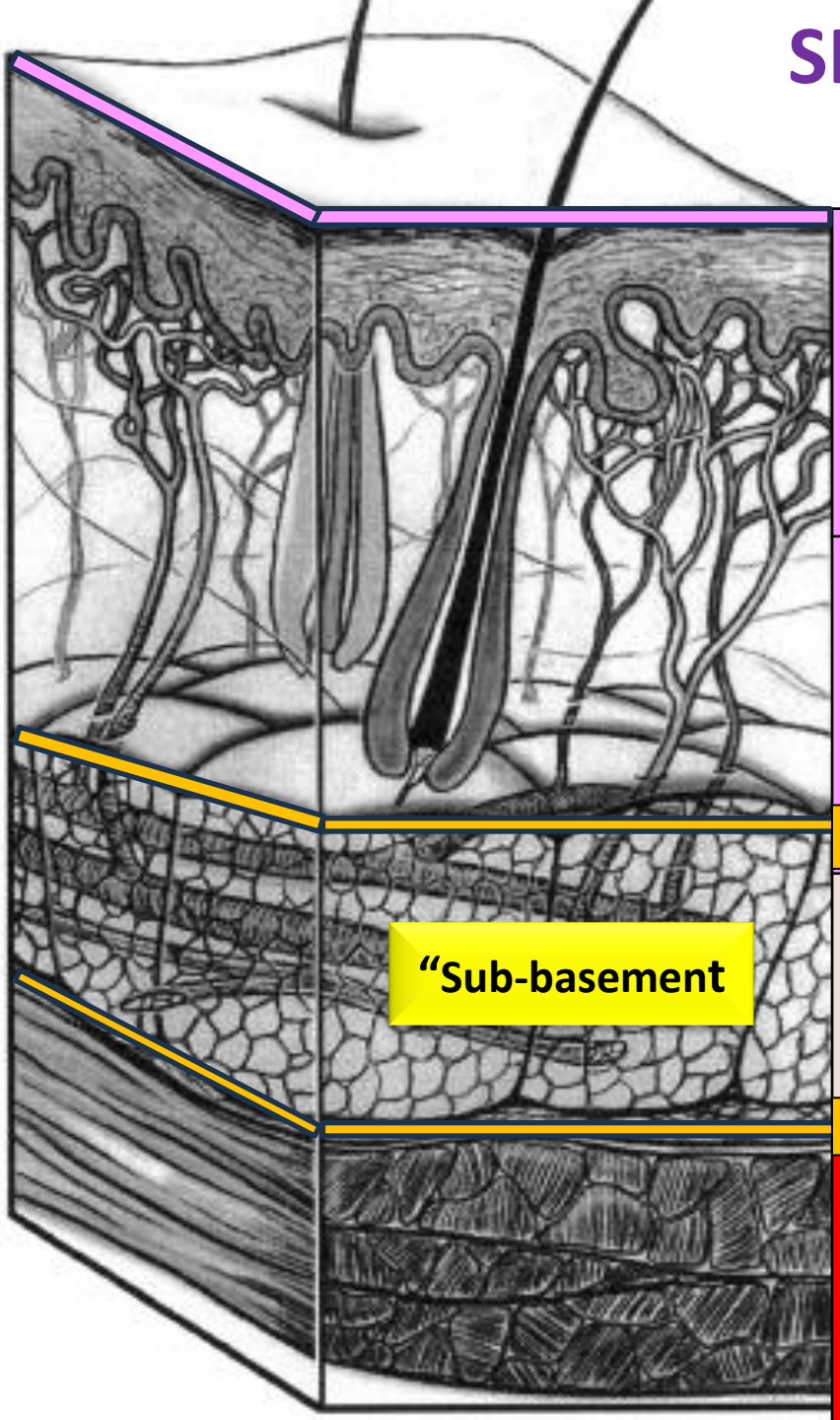
**The skin has 3 layers:**

**Epidermis**

**Dermis**

**Hypodermis**

# SKIN SOFT TISSUE ANATOMY




| ANATOMY | SYNDROME |
|---|---|
| **Epidermis**<br>❖ Hair<br>❖ Stratum Corneum<br>❖ Squamous Layer<br>❖ Basal Cell<br>❖ Merkle cells | ❖ Erysipelas<br>❖ Impetigo<br>❖ Ecthyma |
| **Dermis** "Skin" | |
| **Dermis**<br>❖ Sweat Glands<br>❖ Apocrine glands<br>❖ Hair follicles<br>❖ Connective tissue | ❖ Folliculitis<br>❖ Furunculosis<br>❖ Carbuncles<br>❖ Hydranitis Suppurative |
| **Superficial Facia** | |
| **Subcutaneous Tissues**<br>❖ Subcutaneous adipose<br>❖ Nerves, Arteries<br>❖ Veins, Lymphatic | ❖ Panniculitis<br>❖ Lymphangitis<br>❖ Arteritis<br>❖ "Necrotizing Fasciitis"<br>❖ Gangrene |
| **Hypodermis** | |
| **Deep Facia** | |
| ❖ **Muscle** | ❖ Myonecrosis<br>❖ "Gangrene"<br>❖ Osteomyelitis |

# CELLULITIS

What you think you know

## DEFINITIONS

# Cellulitis

what you think you know

cel·lu·li·tis

*Noun* Medicine

A localized or diffuse inflammation of connective tissue with severe inflammation of dermal and subcutaneous layers of the skin

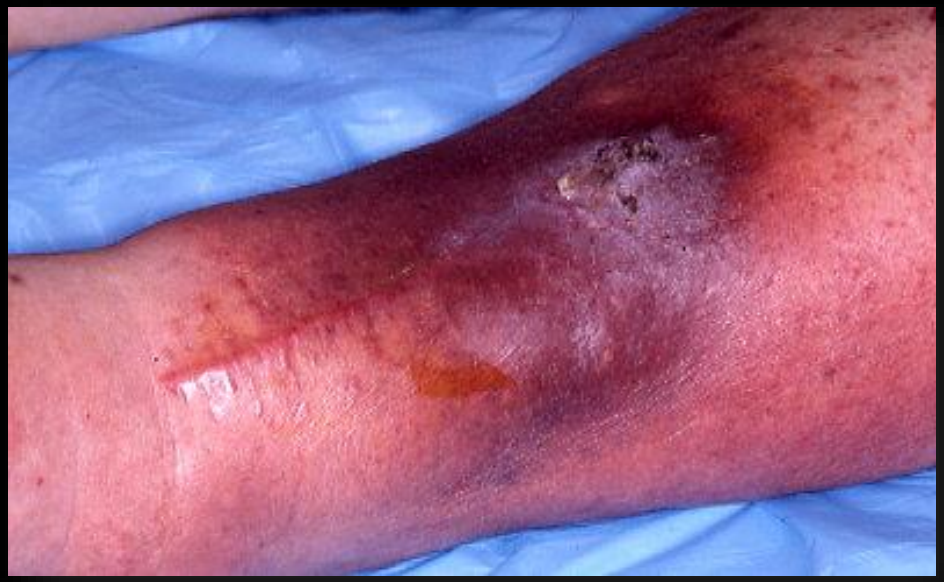
**Cellulitis classically presents with erythema, swelling, warmth, and tenderness over the affected area.**

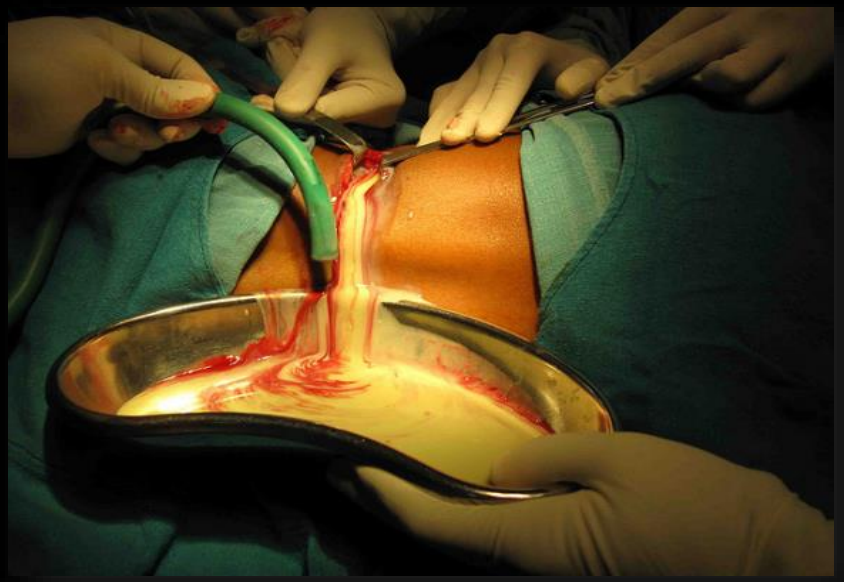
AND

## Cellulitis:

An infection involving the deep dermis and subcutaneous tissue

# *ABSCESS or CELLULITIS*





***CELLULITIS*** : Erythema, Indurated, Spreading lymphangitis, Bullous Weeping.....

"Streptococcus"

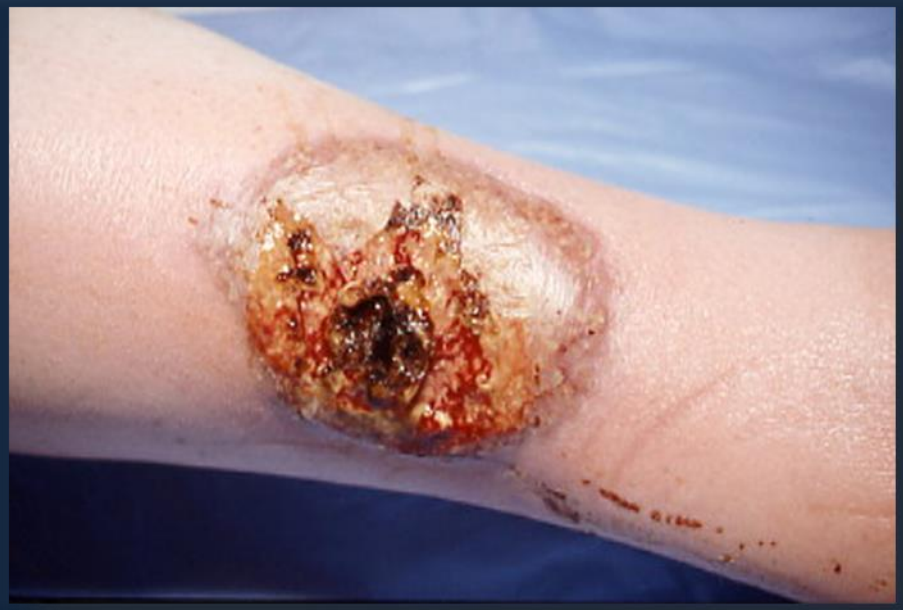
***ABSCESS*** : Localized, Sinus tract, Indurated flocculent, Painful

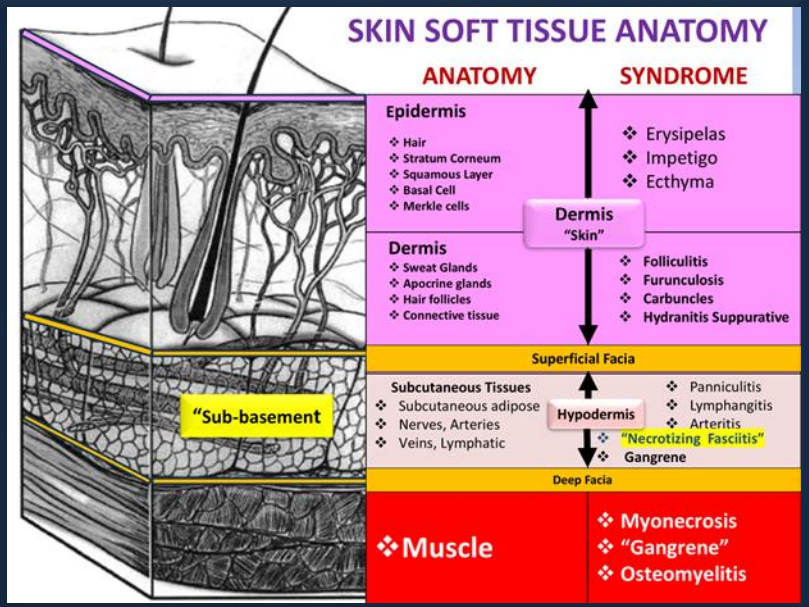
"Staphylococcus aureus

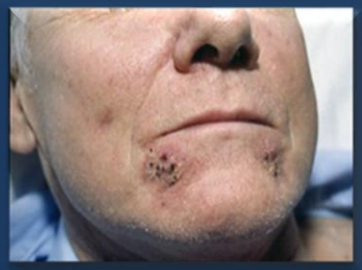
# Cellulitis

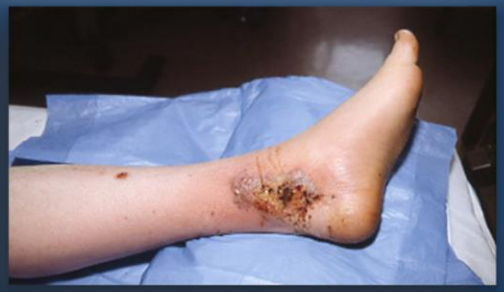
## Pyoderma Gangrenosum multiple sites

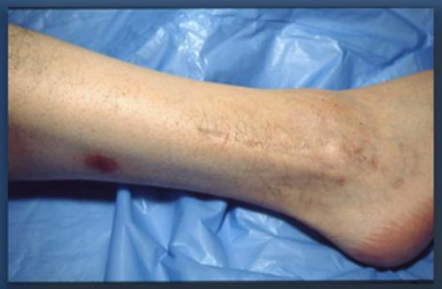
**Cutaneous ulcerations with mucopurulent or hemorrhagic exudate. Painful ulcers present with undermined bluish borders with surrounding erythema.**









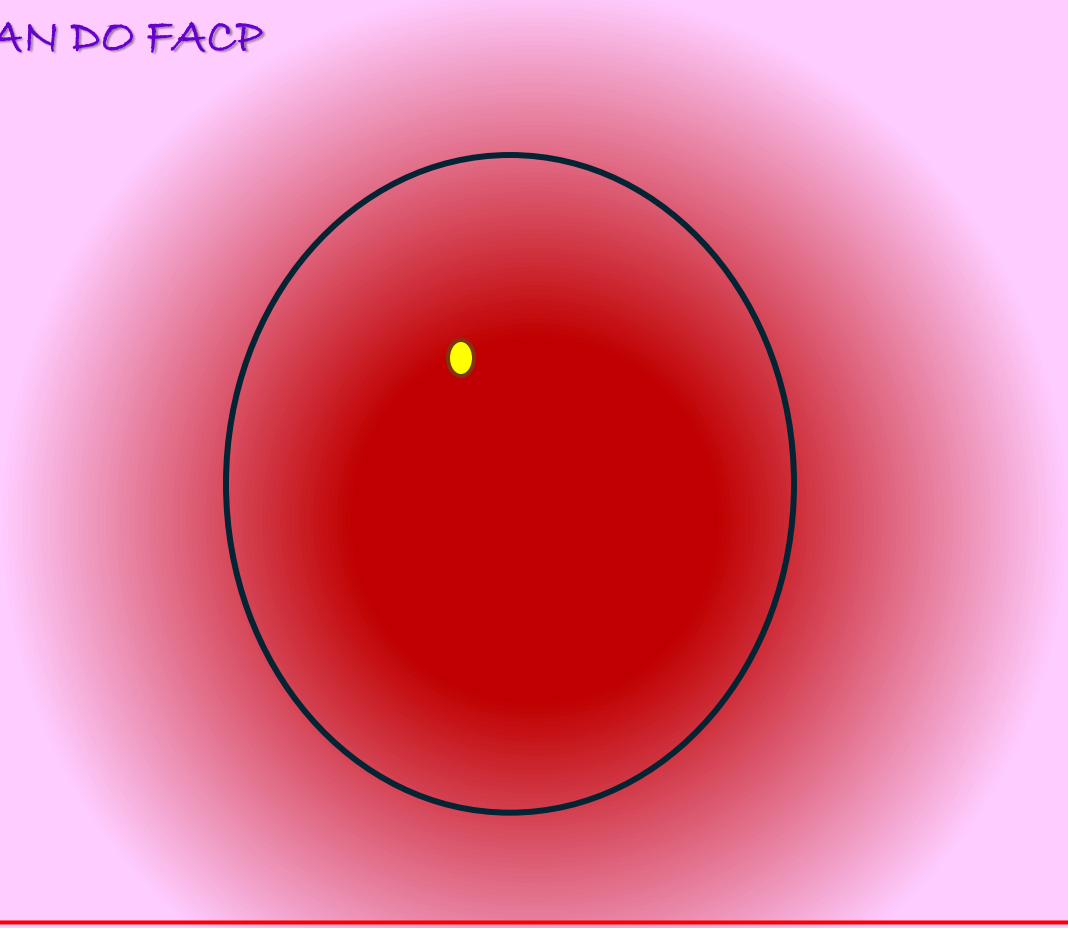
# CELLULITIS

What you think you know

"Can get redder before it gets better"

# “Cellulitis can get redder, before it gets better”*

ANTHONY OGNJAN DO FACP



**Pathogen concerns**

- **Streptococcus: S pyogenes [GAS]; S agalactia [“GBS”]**
- **Staphylococcus aureus**
- **“Synergistic infection” [ Mixed: GPC, Anerobic, GNB]**

# Cellulitis

## Chronic Ulcers

***NORMAL* ulcer "SLIME FLORA"**

- Staphylococcus epidermidis Sp
- Anerobic bacteria
- Enterobacteriaceae sp
- Enterococcus Species
- Pseudomonas sp [?]

Ulcer "Slime"

**Potential Pathogen concerns**

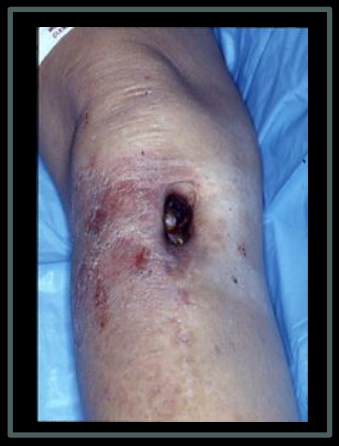
- Streptococcus: S pyogenes [GAS]; S agalactia ["GBS"]
- Staphylococcus aureus
- "Synergistic infection" [ GPC, Anerobic, GNB]

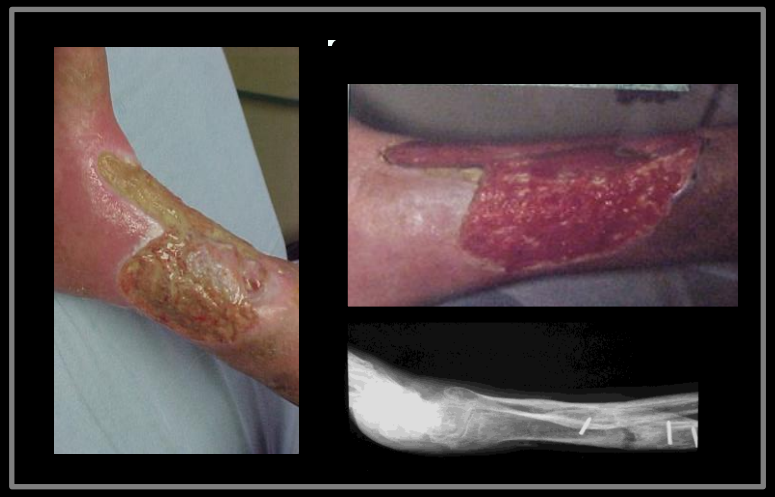
# CELLULITIS

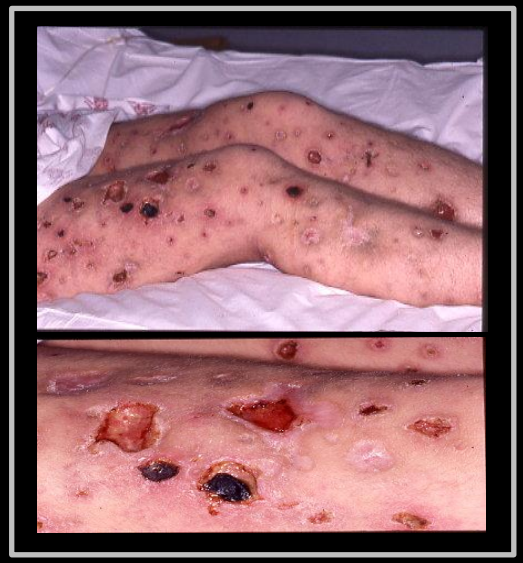
## A word about Cultures

- Sterile Bone Culture NO FORMILIN)
- Sterile operative Culture (Tissue, Exudate)
- “Prepped” tissue aspirate
- Post Debridement Ulcer surface
- “Cleaned” Ulcer surface
- Ulcer wound “slime” Layer
- Osteomyelitis “Sinus” tract drainage

Reliability of culture results:
Pathogen recovery
Limited Contamination



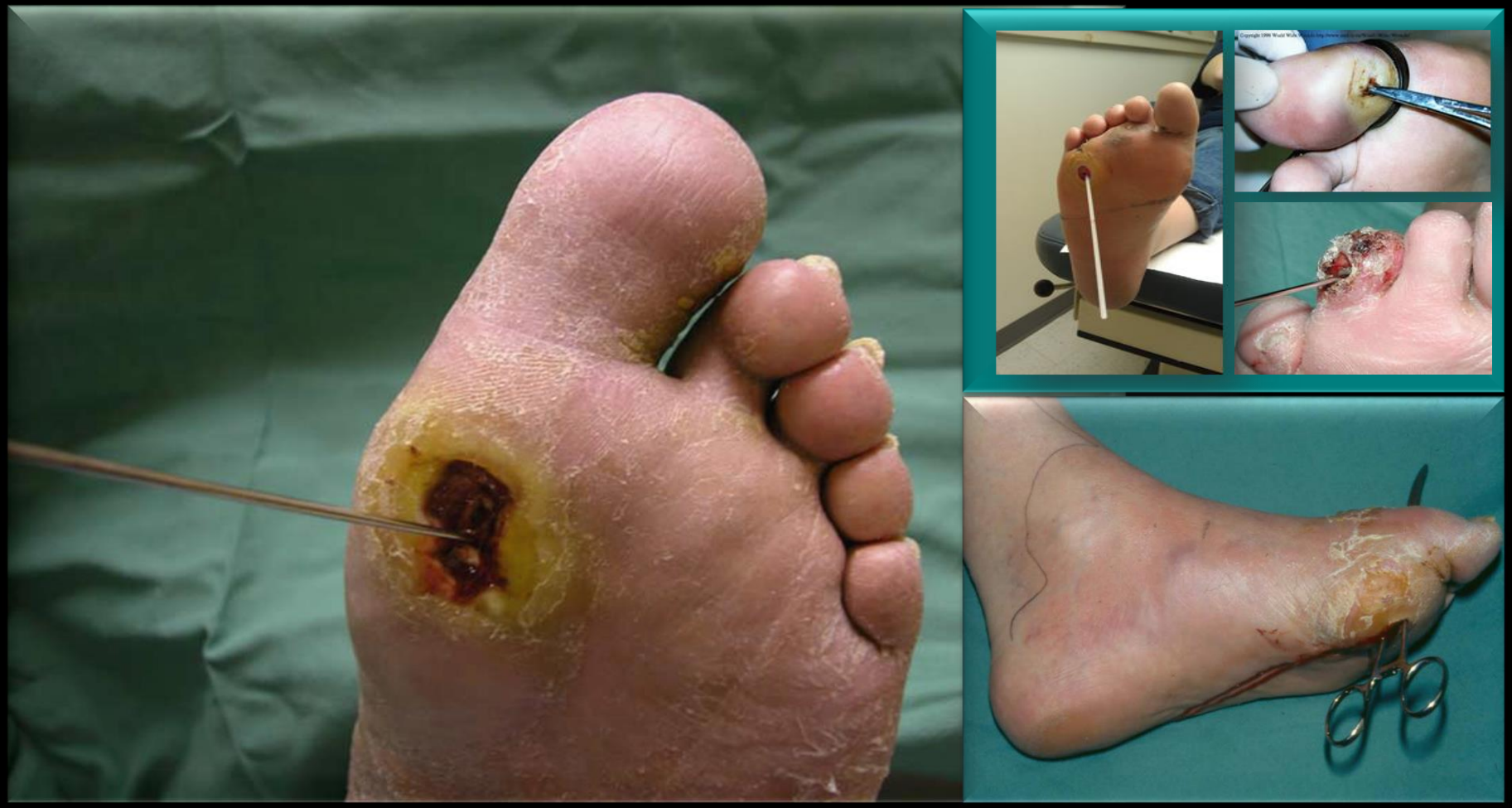




# Cellulitis

## Probe to Bone test :  Underlying Osteomyelitis

| Signs / Predictive | Sensitivity | Specify | |
|---|---|---|---|
| **Probe to bone** | **66%** | **86%** | Negative Predictive 56% |



# Cellulitis
## Contributing Clinical factors

Clinical, Anatomic, vascular, issues

Hydrostatic pressure - Lymphedema

Vascular Ischemia

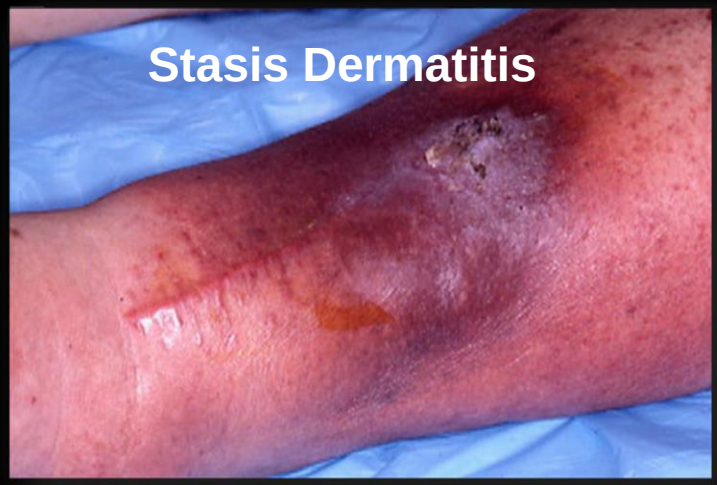
Topical Irritants

Trauma

Infectious (“typical Vs. atypical”)

# Cellulitis

## Comorbid Circulation Pathology
Vascular Circulation
Impacting Tissue Perfusion and Circulation




- Major vessel compromise
- Small and Medium vessel disease
- Extensive vessel scarring
- Inflammatory Arteritis
- Post Radiation fibrosis trauma
- Chronic Lymph Edema
- Tobacco abuse (>2 packs per day)
- Neuropathy (Central, Peripheral, “Mobility”)
- Venous stasis

**Increased cellulitis risk**

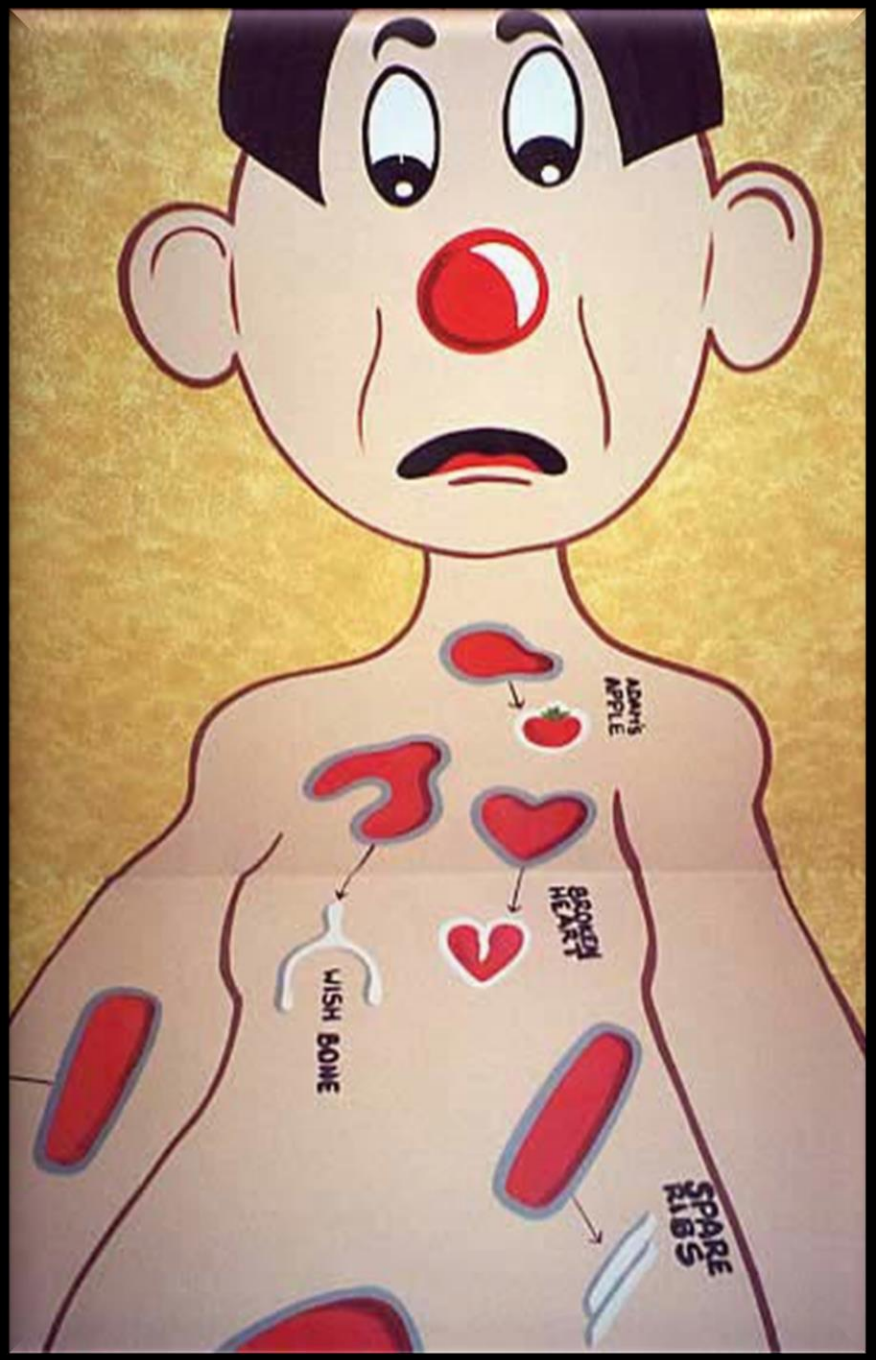
- **Trauma history**
- **Fracture repair**
- **Arterial damage**
- **Vein damage**
- **Lymphatic trauma**
- **Soft tissue scaring**

- **Recurrent cellulitis**

# Cellulitis
## Pathophysiology

**“The Human Condition”:**

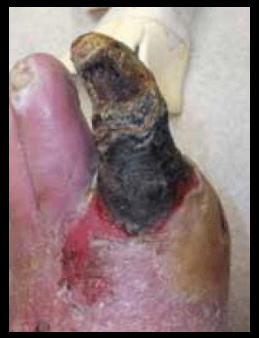
- Diabetes Mellitus
- Renal, Hepatic failure
- Malnutrition
- Chronic Hypoxia / Smoking
- Immunosuppression
- Immunodeficiency
- Malignancies
- Autoimmune disease
- Extremes of age

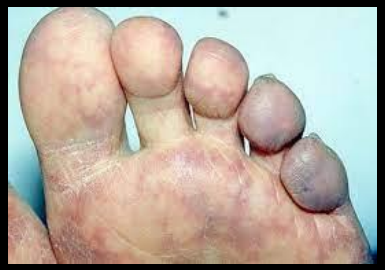


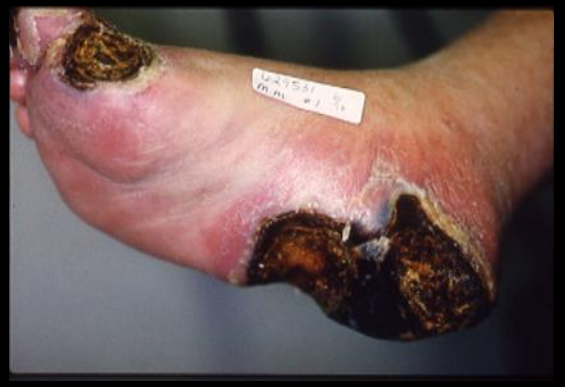
# CELLULITIS

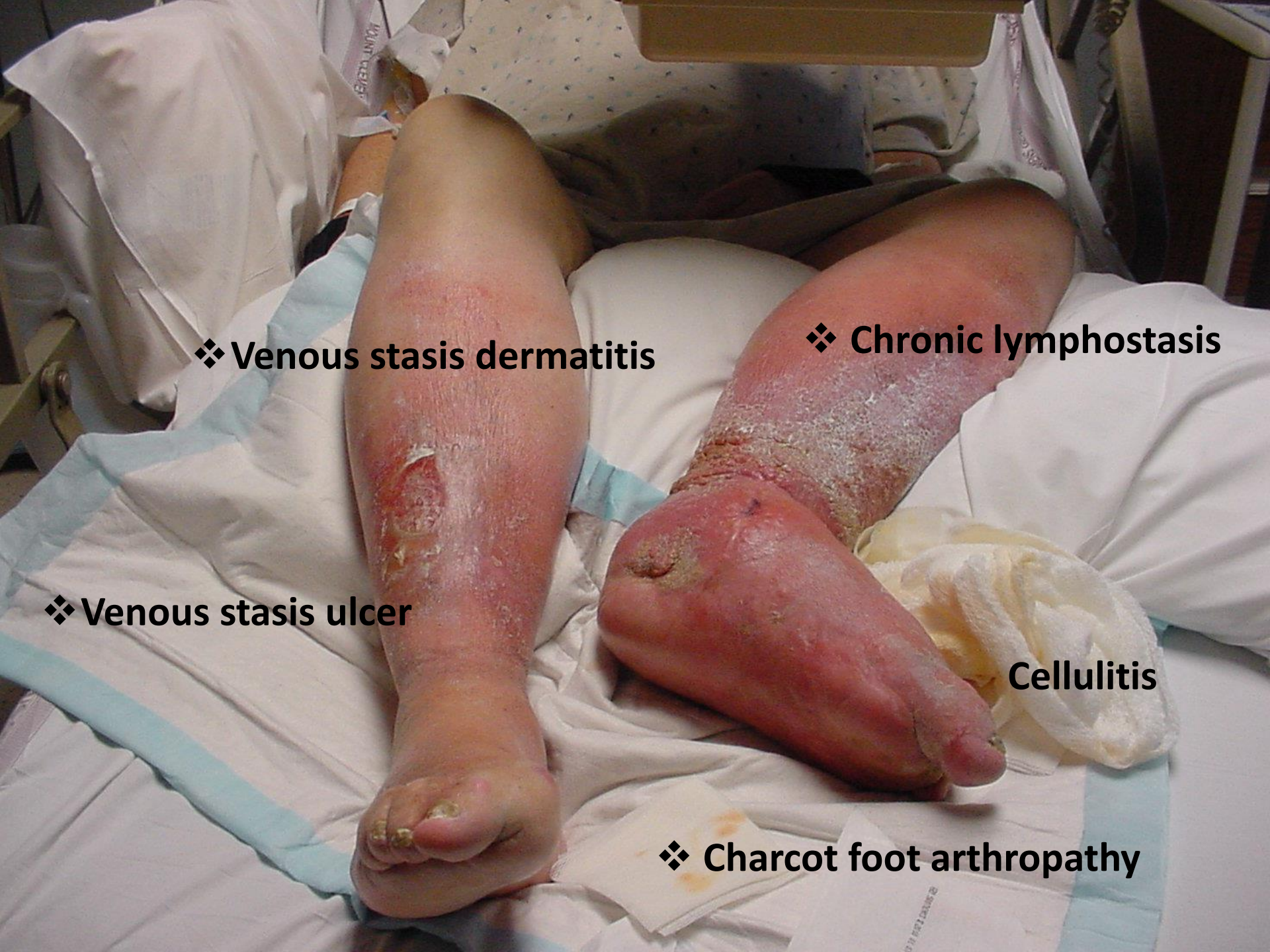
General Foot  Arterial Perfusion

“TRIPOD”



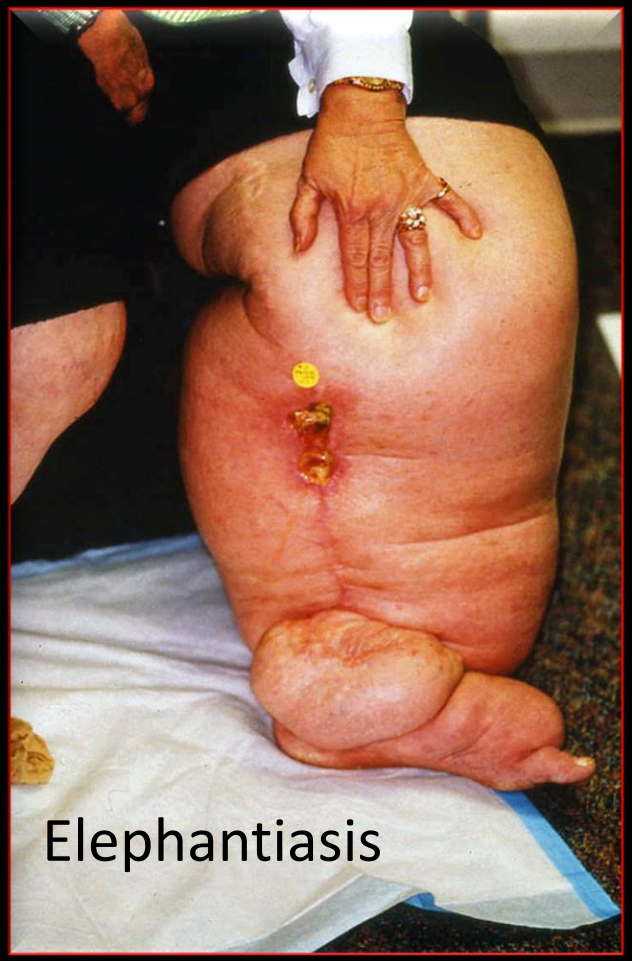





❖ Venous stasis dermatitis
❖ Chronic lymphostasis
❖ Venous stasis ulcer
Cellulitis
❖ Charcot foot arthropathy

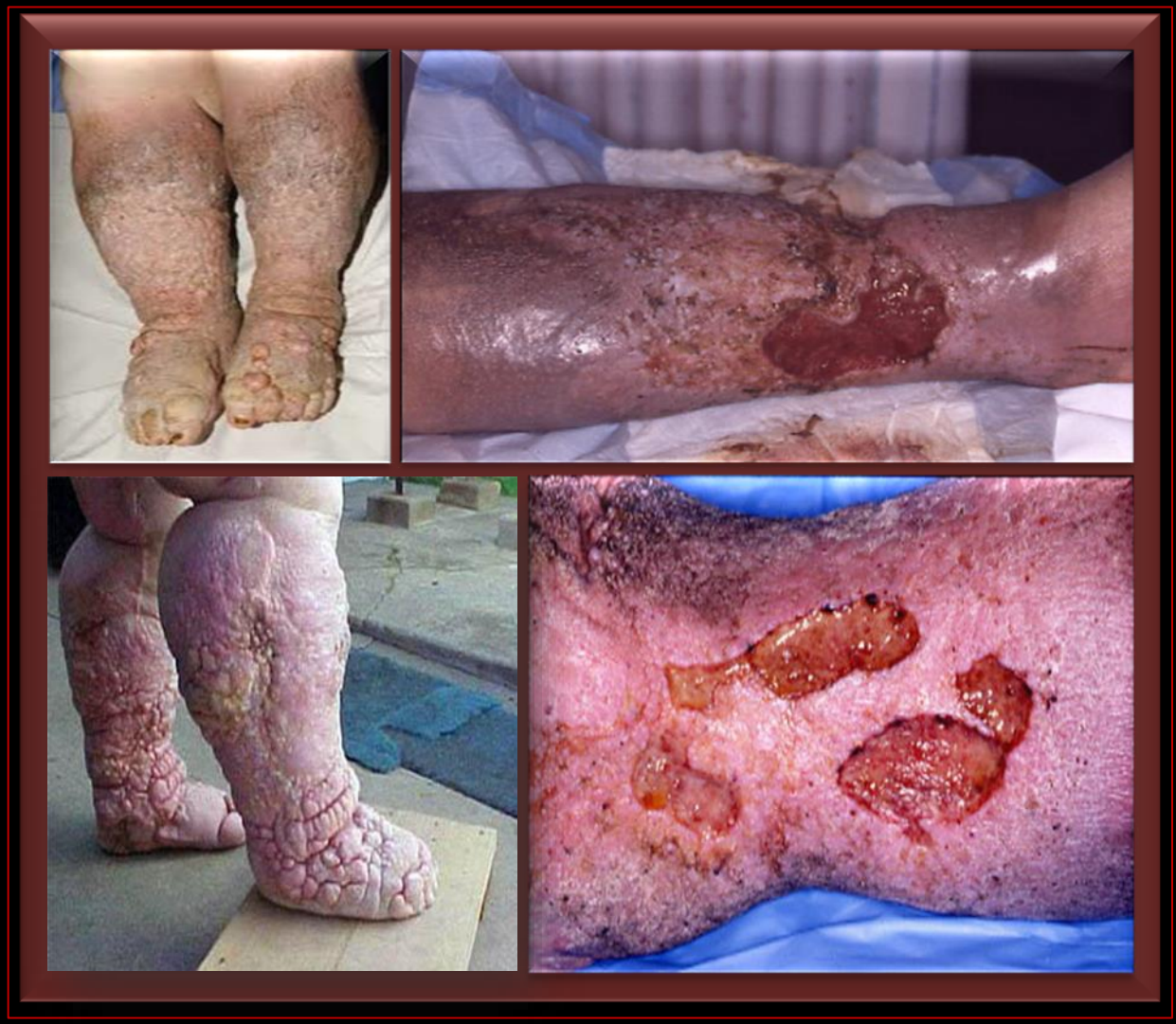
# Cellulitis

Anatomical Vascular consideration
Lymphedema




## Elephantiasis nostras verrucosa

Congestive Heart Failure,
Diabetic Nephropathy, and Obesity



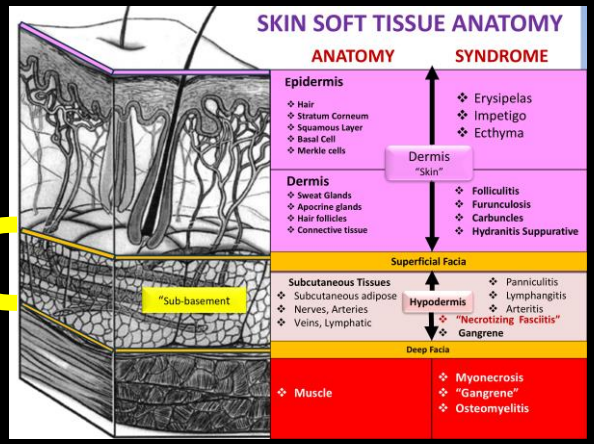
# Cellulitis

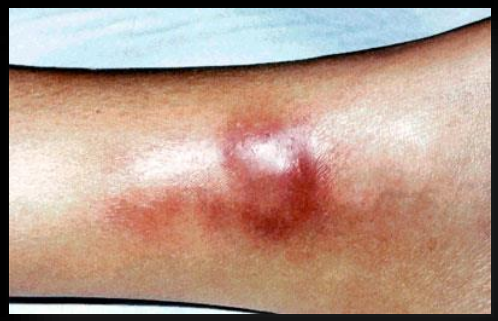
## Diseases Masquerade as infectious Cellulitis

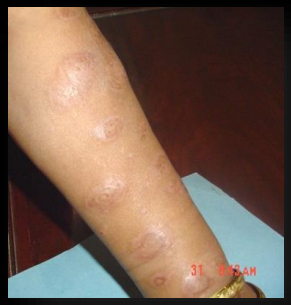
**Panniculitis** :

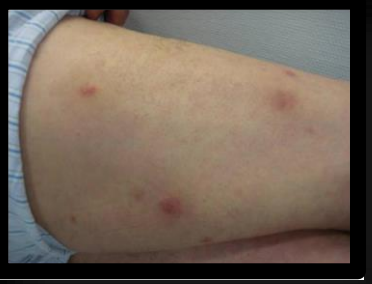
Group of diseases

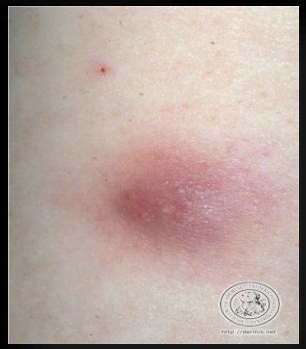
- Hypodermas Pathology
- Neurovascular adipose







## Panniculitis

### Septal

- Erythema nodosum
- Lipodermatosclerosis
- Morphea
- Eosinophilic fasciitis
- Eosinophilia myalgia syndrome

### Lobular

- Physical panniculitis
- Cold-induced
- Traumatic
- Chemical
- Factitious
- Post irradiation

### Panniculitis associated with systemic disease

- Pancreatic panniculitis
- Lupus panniculitis
- 1-Antitrypsin deficiency
- Weber–Christian disease
- Cytophagic histiocytic panniculitis
- Post-steroid panniculitis
- Nodular vasculitis

### Malignant disorders

- Lymphoma
- Leukemia
- Paget disease of the breast
- Extramammary Paget disease
- Glucagonoma

### Other

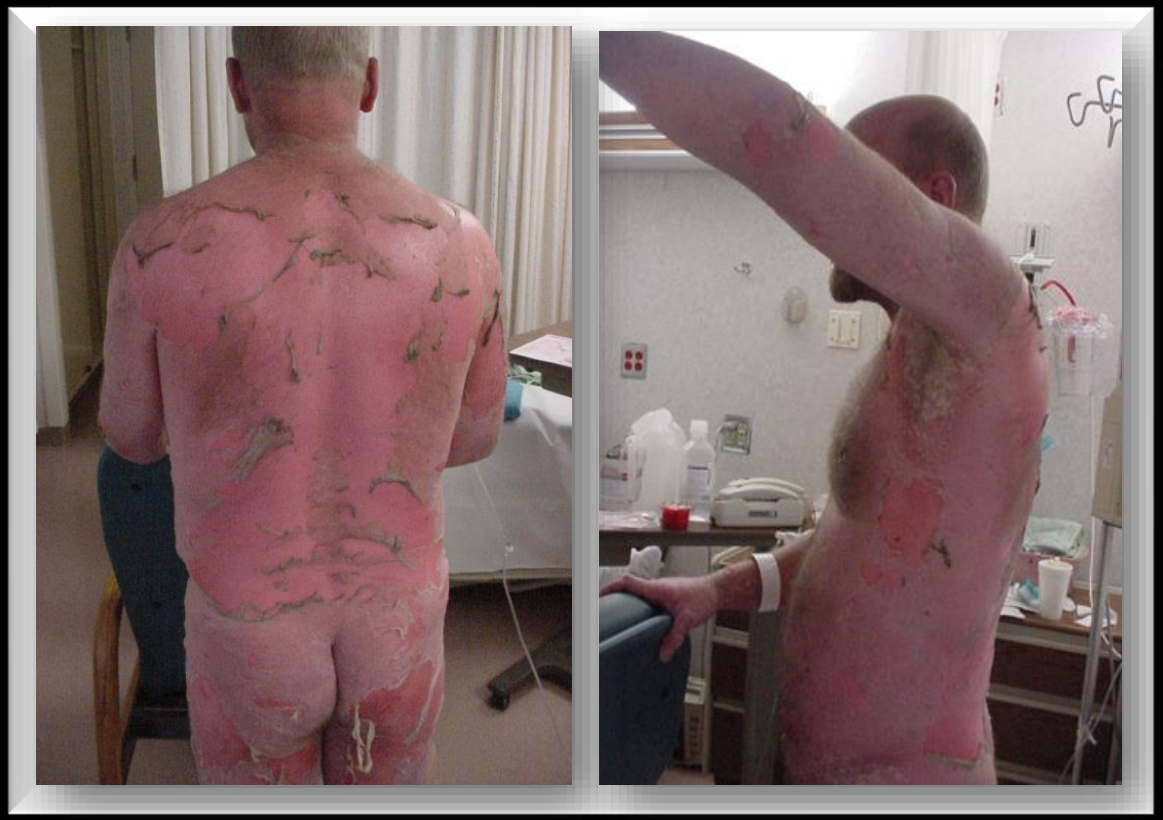
- Calciphylaxis
- Compartment syndrome

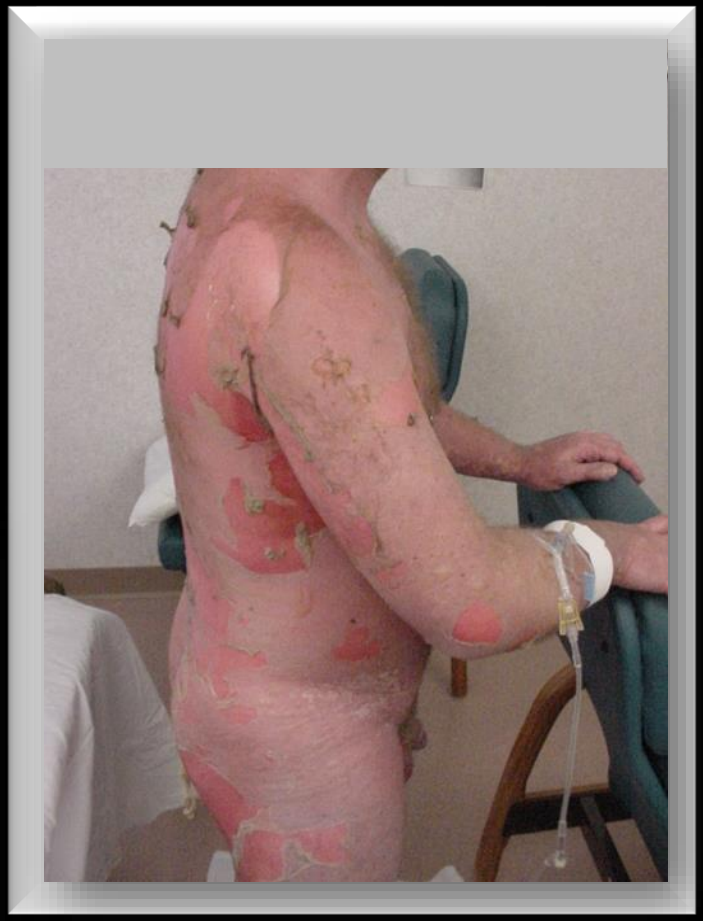
Falagas ME. ***Narrative review: diseases that masquerade as infectious cellulitis***. Ann Intern Med. 2005 Jan 4;142(1):47-55.

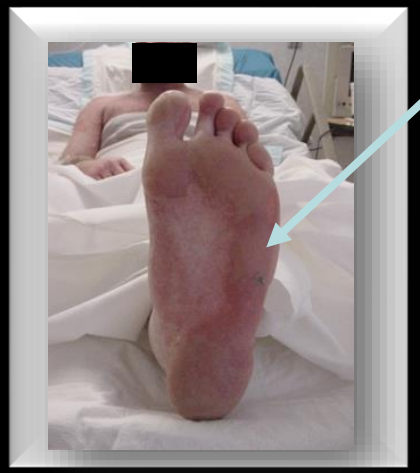
# Cellulitis

**Sulfa Allergy**
**Toxic epidermal necrolysis**
**“Stevens Johnson syndrome:**

keratinocyte necrosis with separation of the epidermis from the underlying dermis.







# CELLULITIS

## What you think you know

"It's a mystery to me"


Gee, I wonder why this "*Uncultured*" Infection won't heal...


I've tried every antibiotic I know... for the past six weeks.... Not any better...


...I will just have
to try my
"New"
Antibiotic...

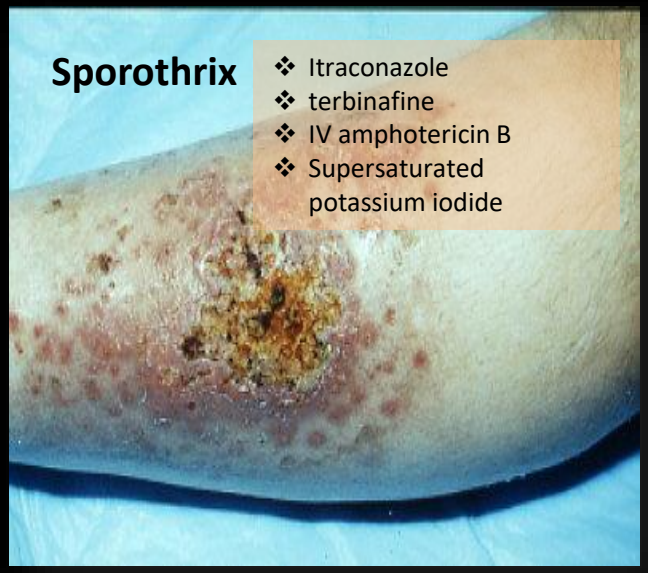

NAPALMICiIN

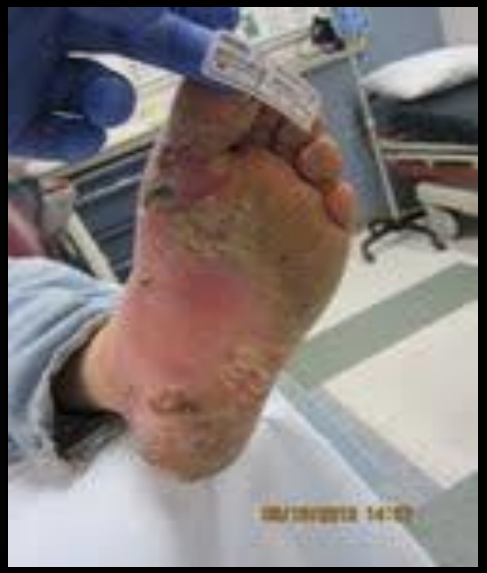
OR…

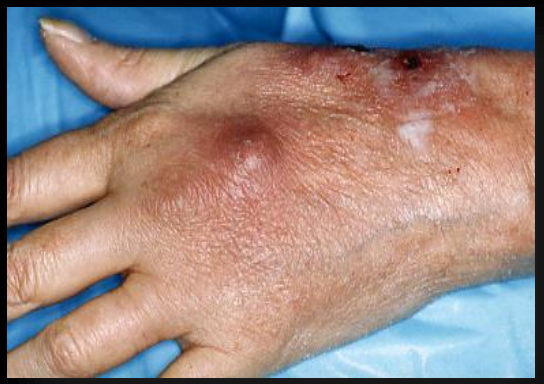
Biopsy…

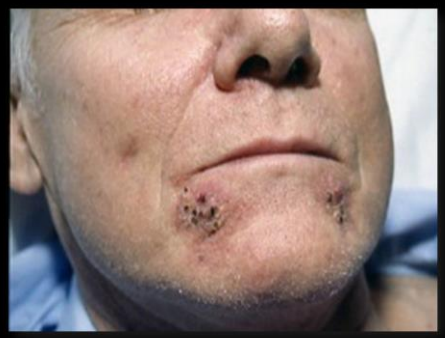
# Culture…

- Typical Bacteria
- Atypical Bacteria
- Fungi

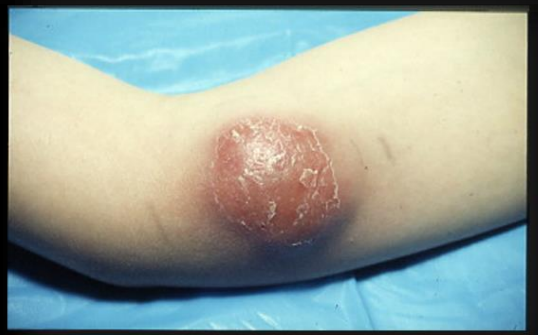


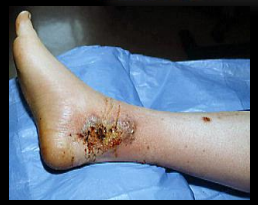



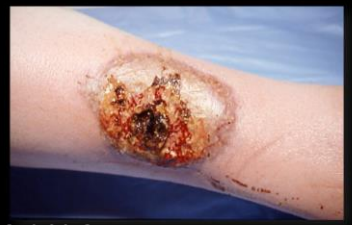


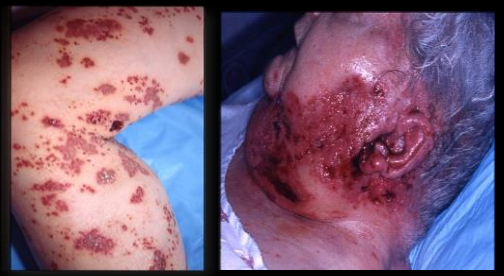
Sézary disease
Cutaneous T-Cell Lymphoma





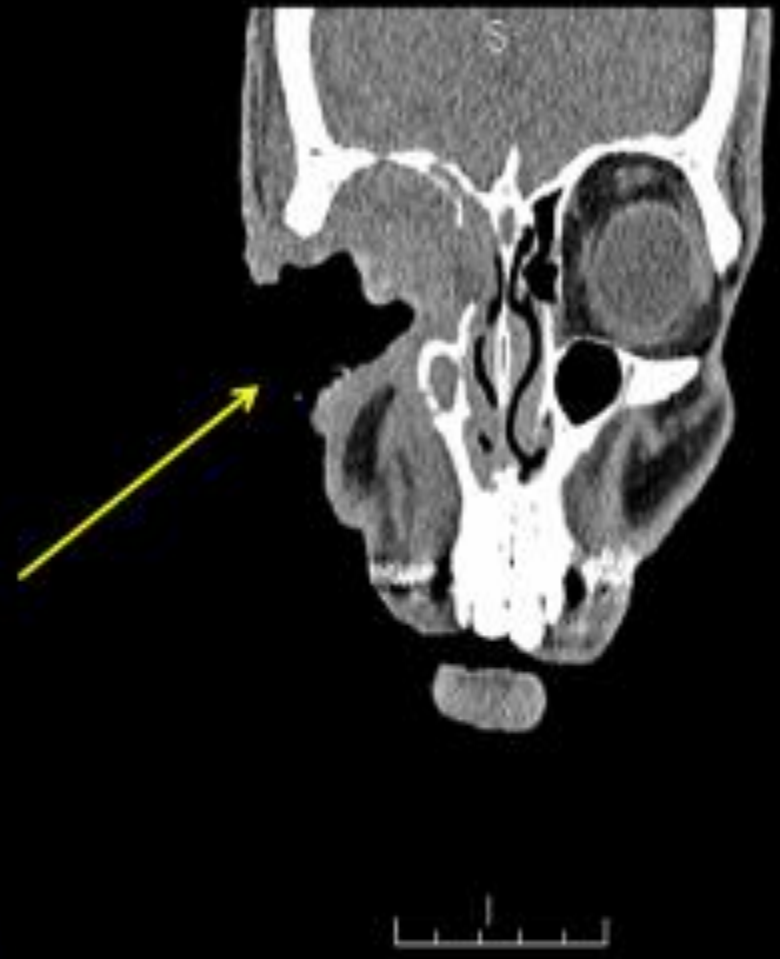


Pyoderma Gangrenosum



Herpes Zoster
"Shingles"

"Cat Scratch" Bartonella
Suppurative Epitrochlear Lymphangitis

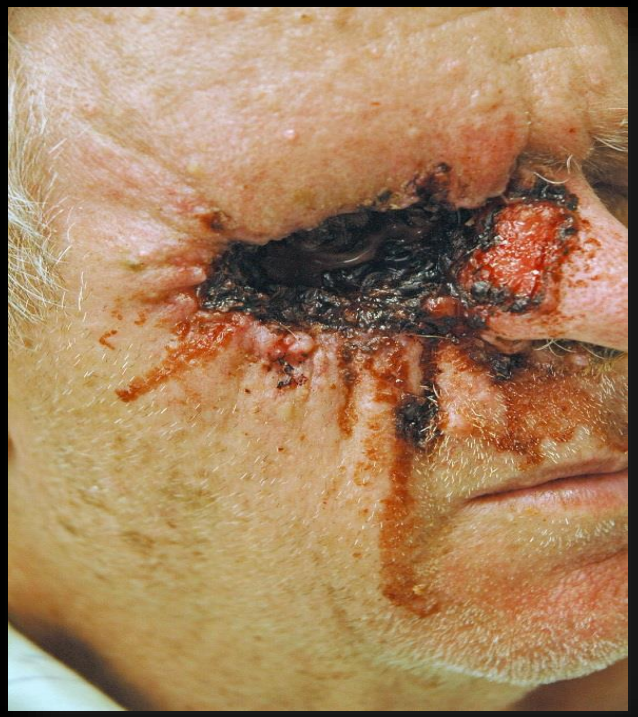


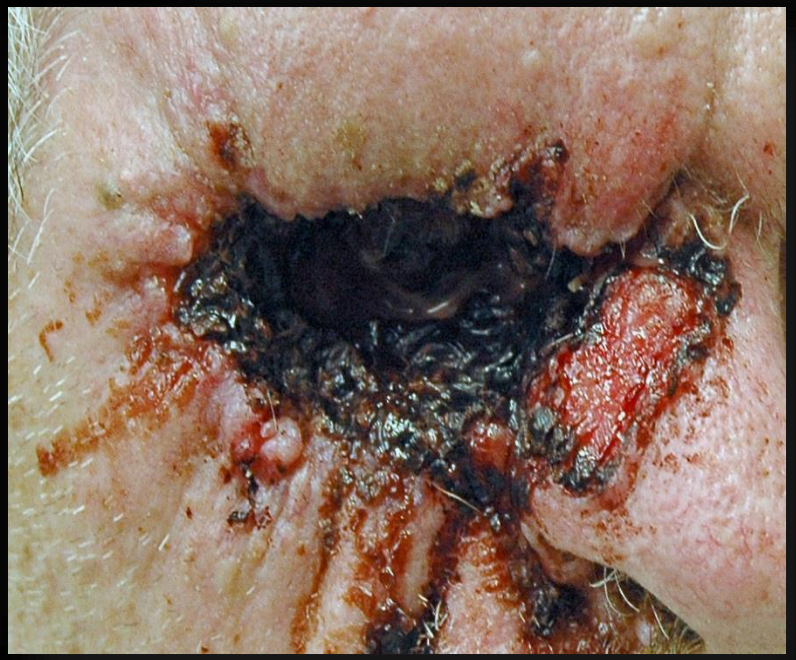

INST:McLaren Macomb
IMG_D:2012.06.20
IMG_T:18:18.33
IMG#:55
SL:108.0 mm
ST:0.9 mm

L

KVP:120
XRAYTUBE:224
GANTRYTILT:0.0

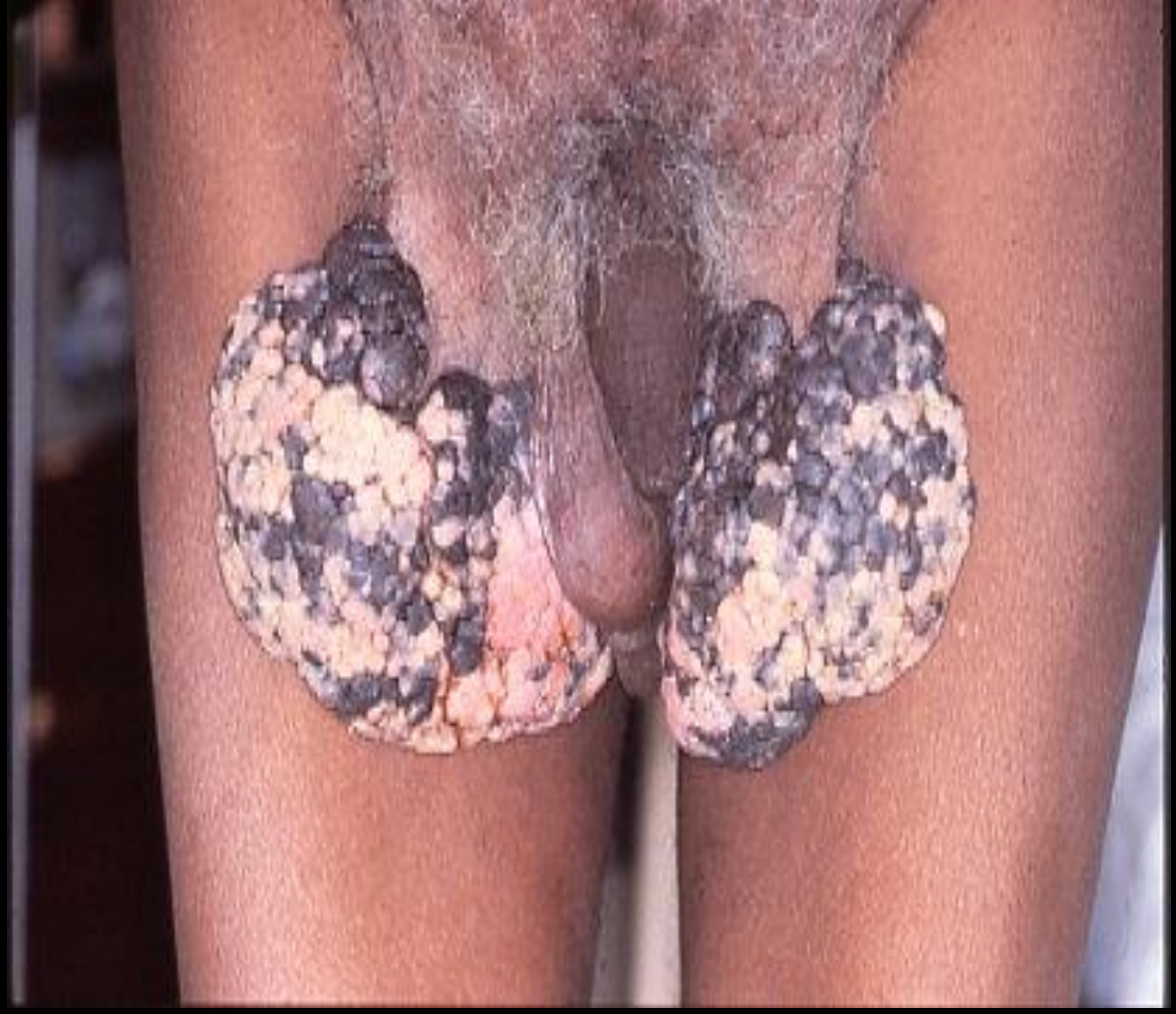
**20 year history**
**Neglected Basal cell cancer**
**(Secondary MSSA)**





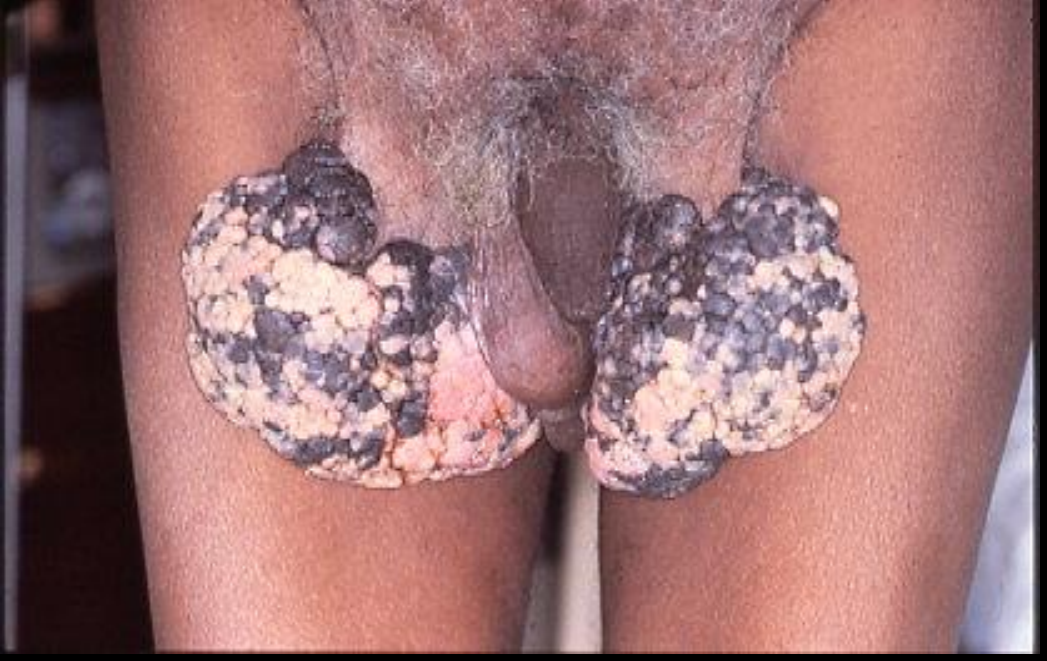
An “anxious” third year medical student assigned to an History and physical, notices a “peculiar” physical finding .....

Curiously, not mentioned in the DEM admit note

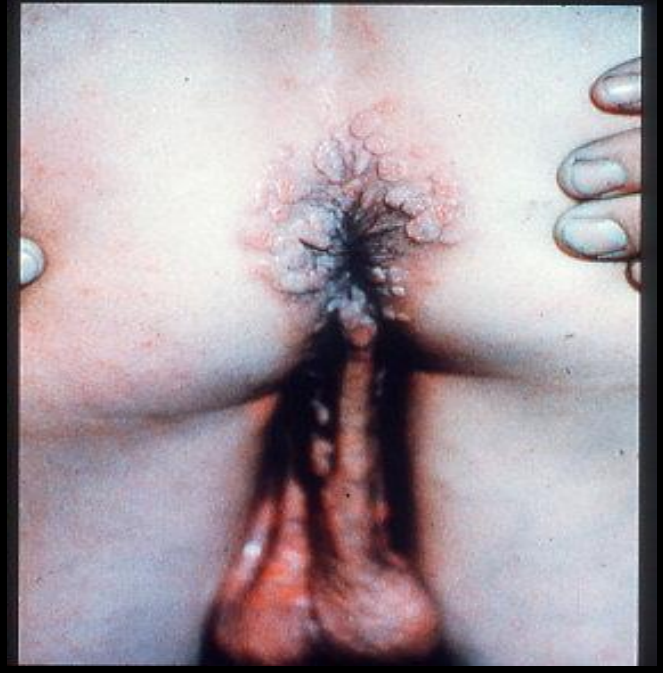


What the heck?

- What do you see?
- Differential?
- Treatment options?



**Condyloma acuminata**



**Condyloma lata**

- Twenty year growth of “venereal warts”
- Both are contagious
- Condyloma lata  “Lotta syphilis organisms”

Each weighed 1.5 lbs

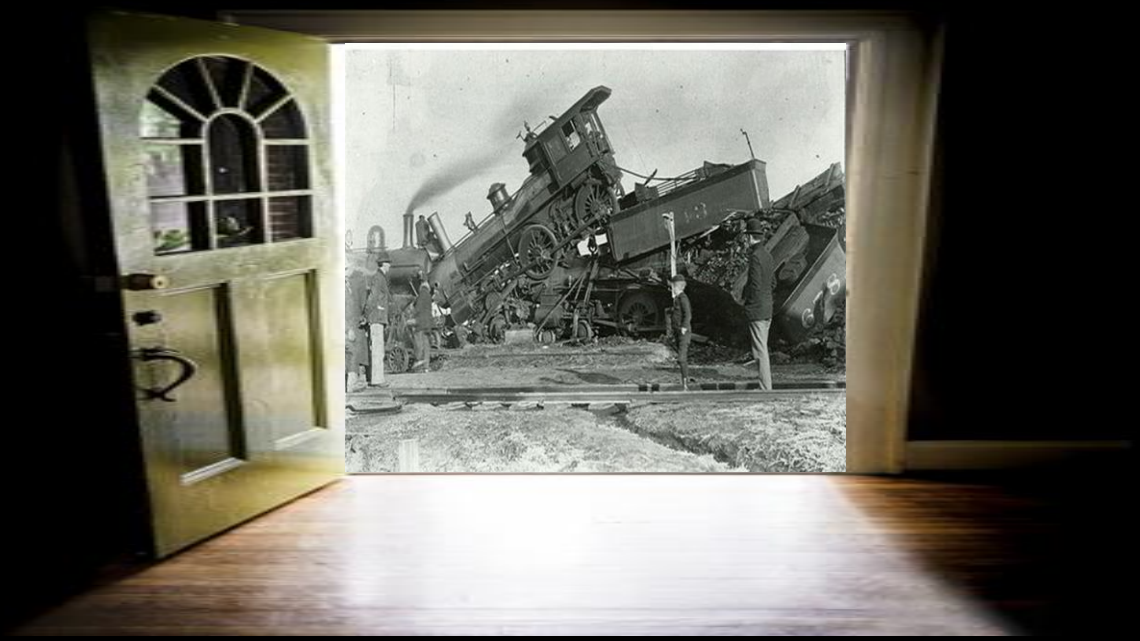
**Giant condylomata of Buschke-Loenstein**

**(HPV-6)**

# CELLULITIS

What you think you know

## Foreign Bodies // Trauma

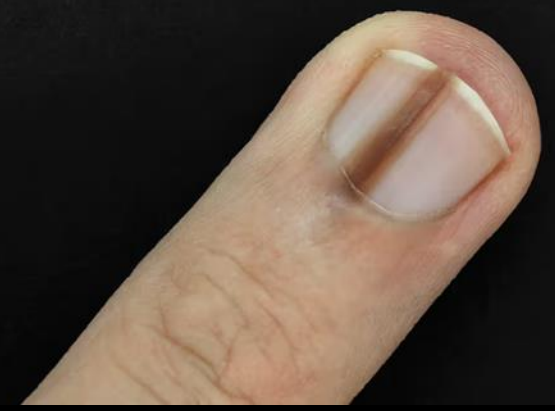


# CELLULITIS

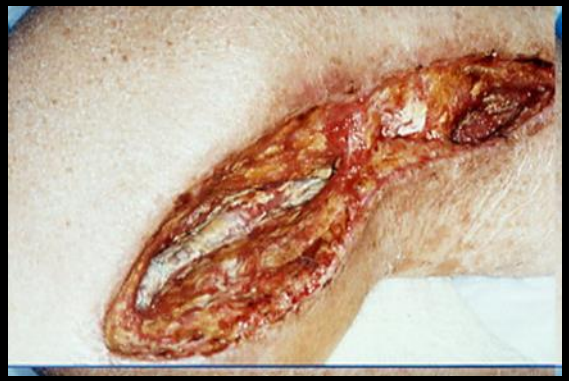
What you think you know

## Foreign Bodies /Trauma

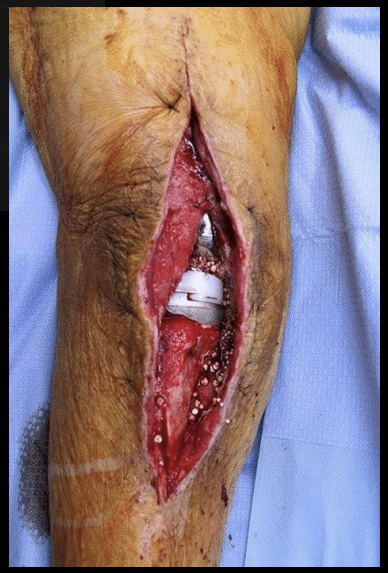
**Wooden splinter**



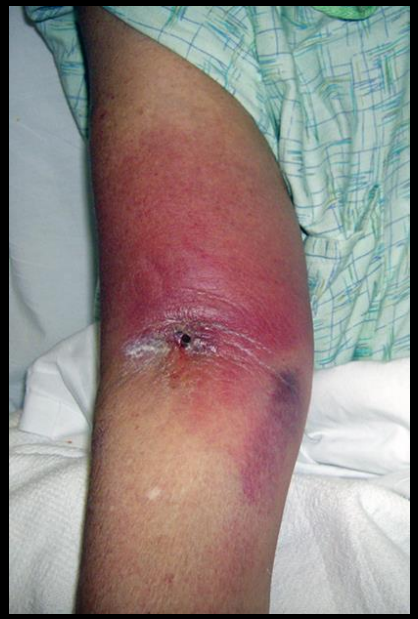
**Remove Foreign body if possible**



**Infected arterial graft**



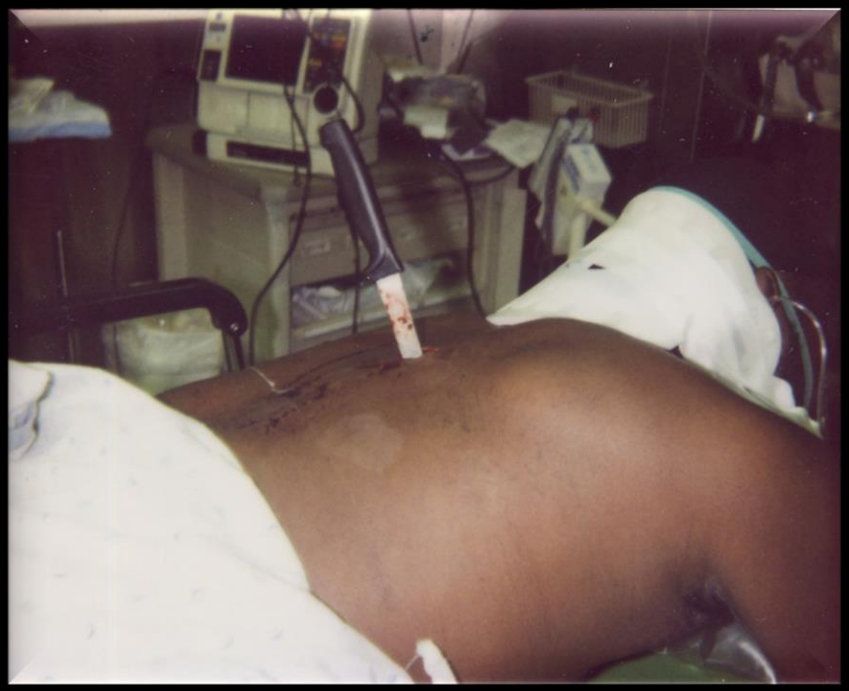
Infected knee arthroplasty

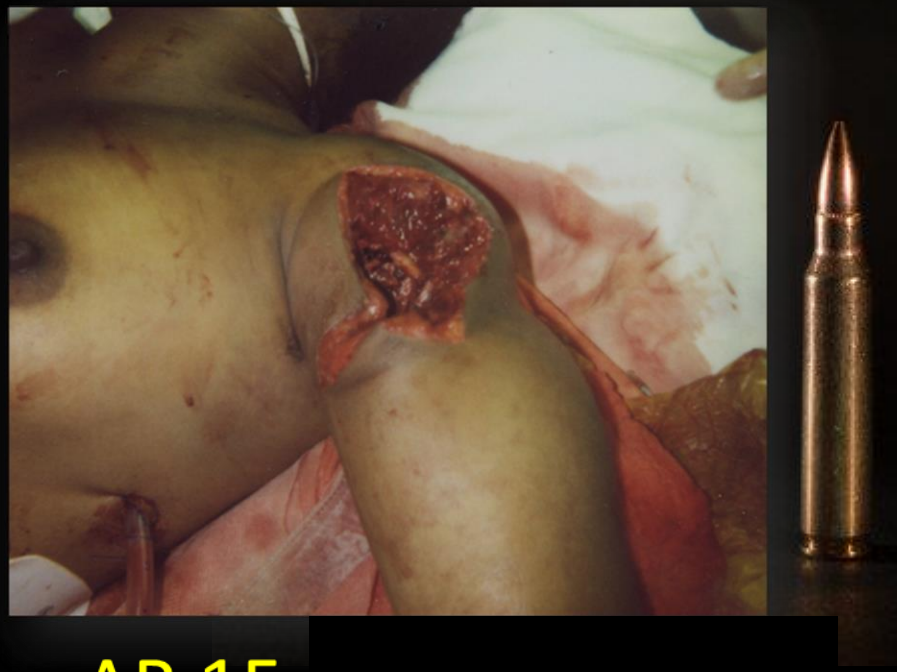


**Infected Venous IV catheter**

# Trauma

## Penetrating/Lacerating

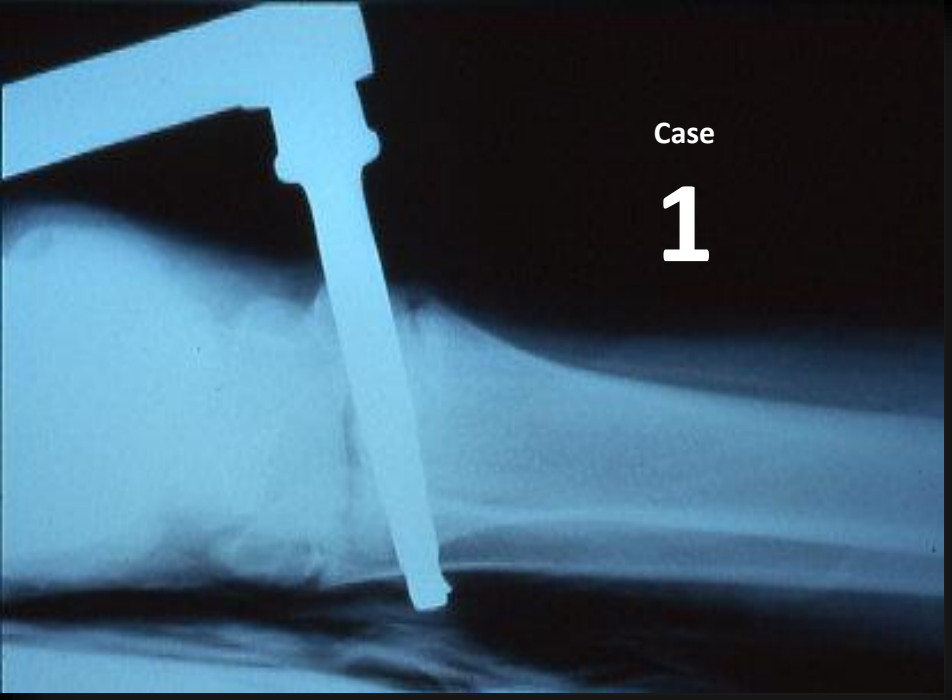


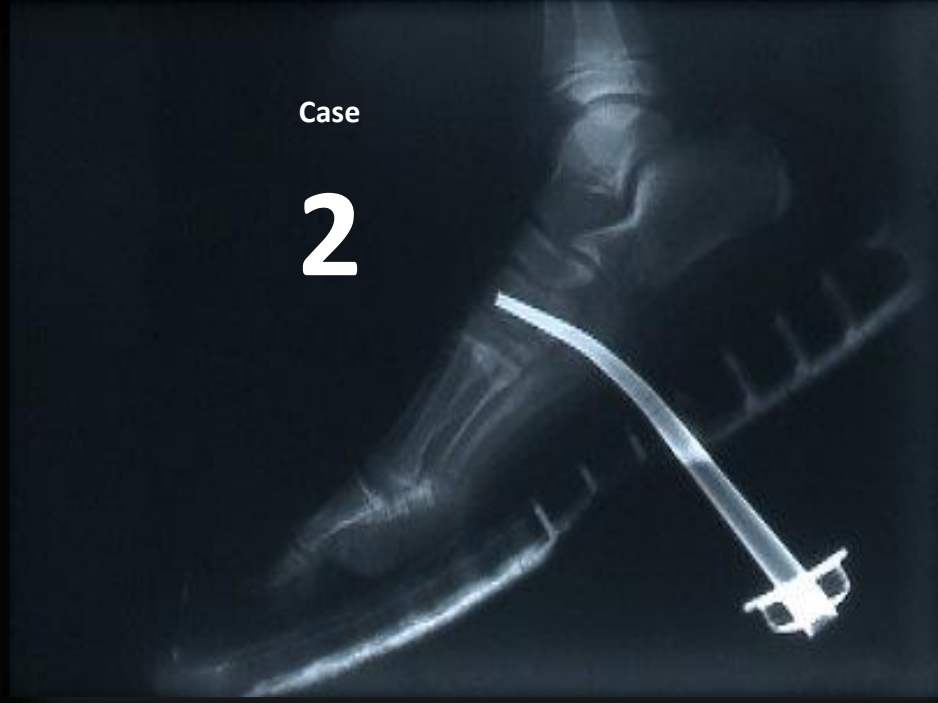


AR 15

**Both AR-15; AR-16**
**Use**
**Remington .223 or**
**Military 5.56 mm rounds**

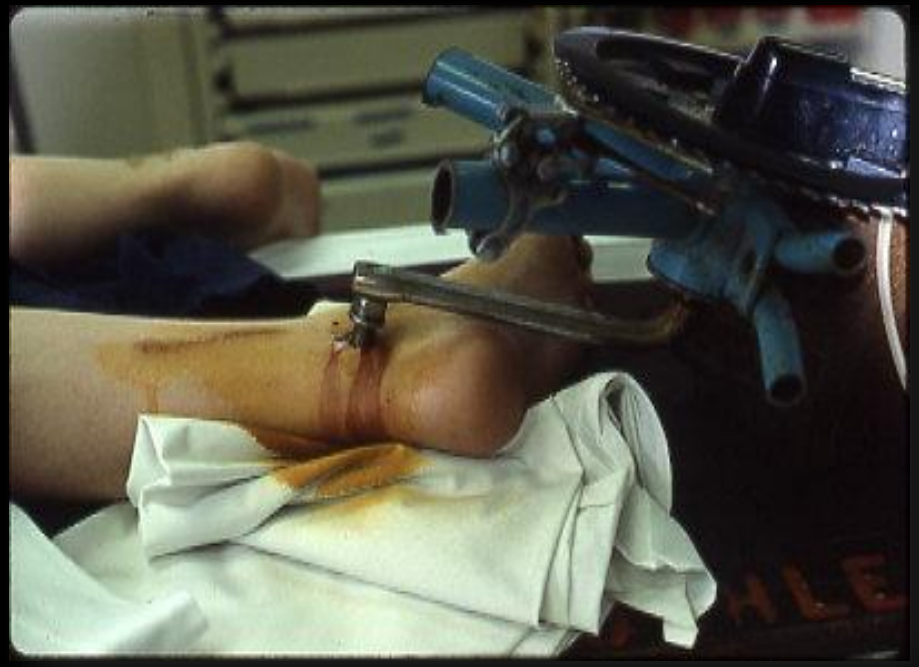
Lawn mower

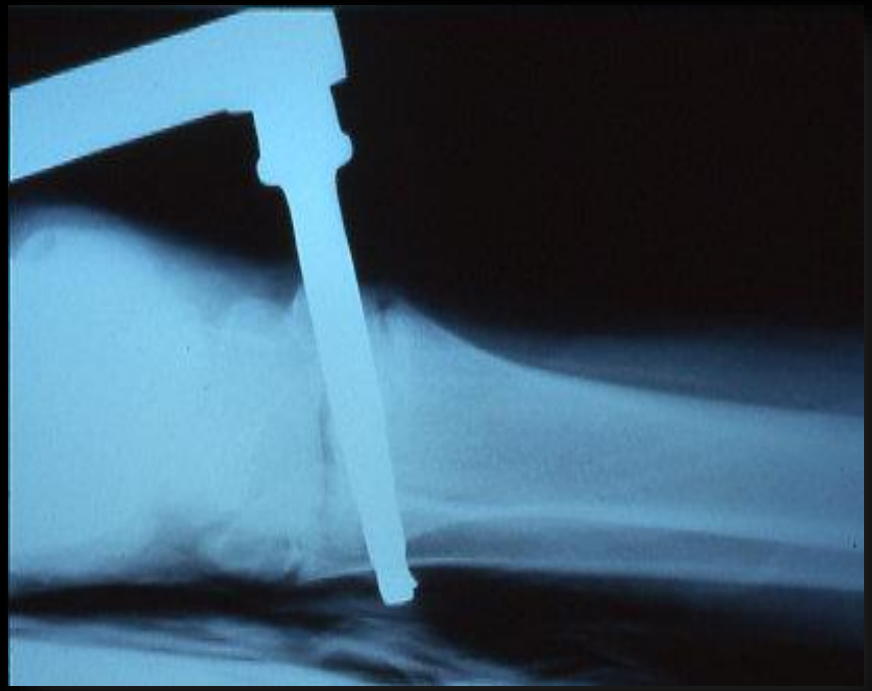


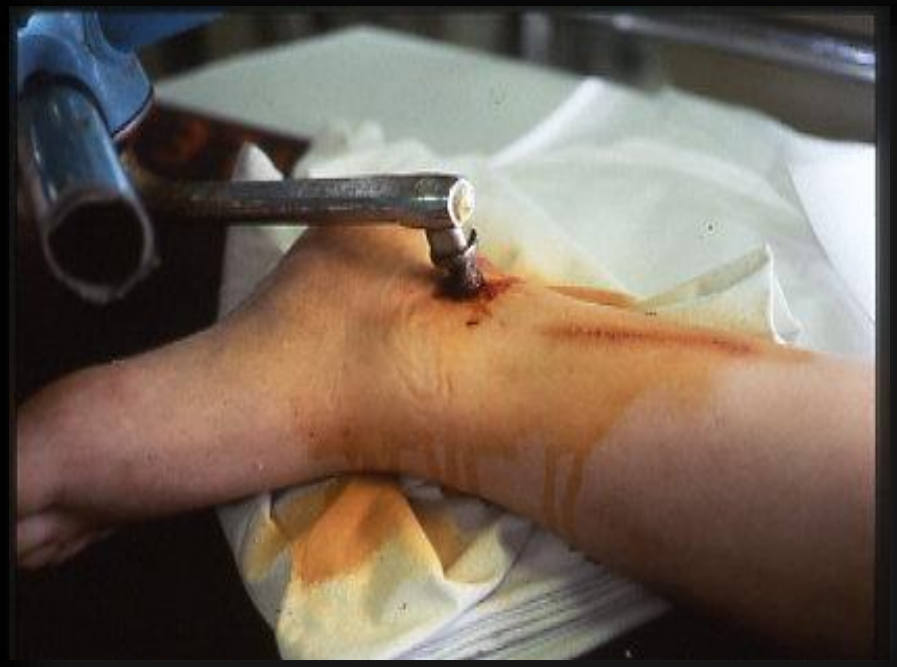




# What's this X-ray??....

New orthopedic fixation "devices"?.....

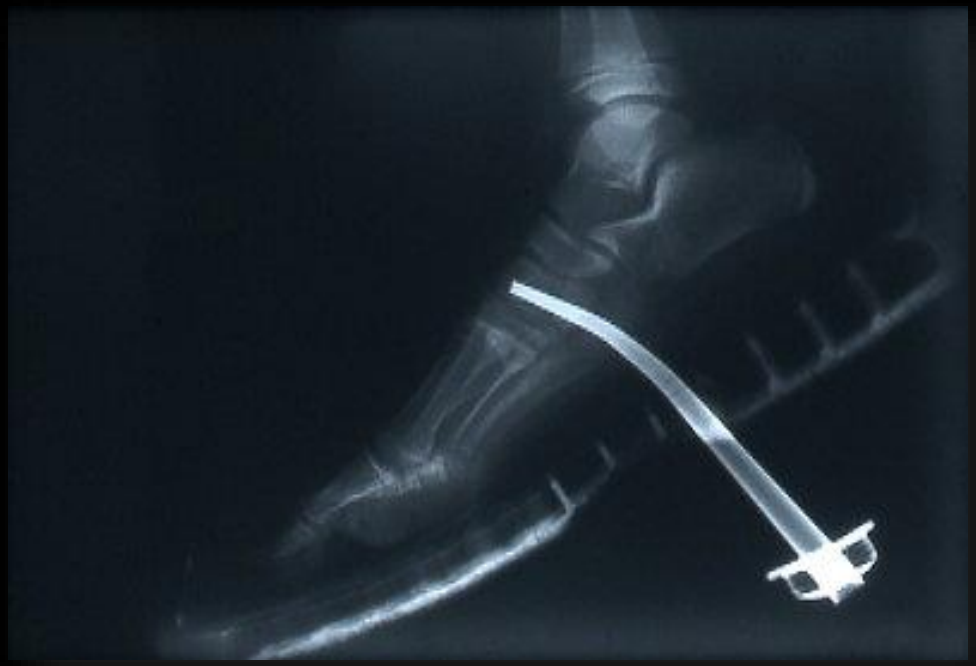


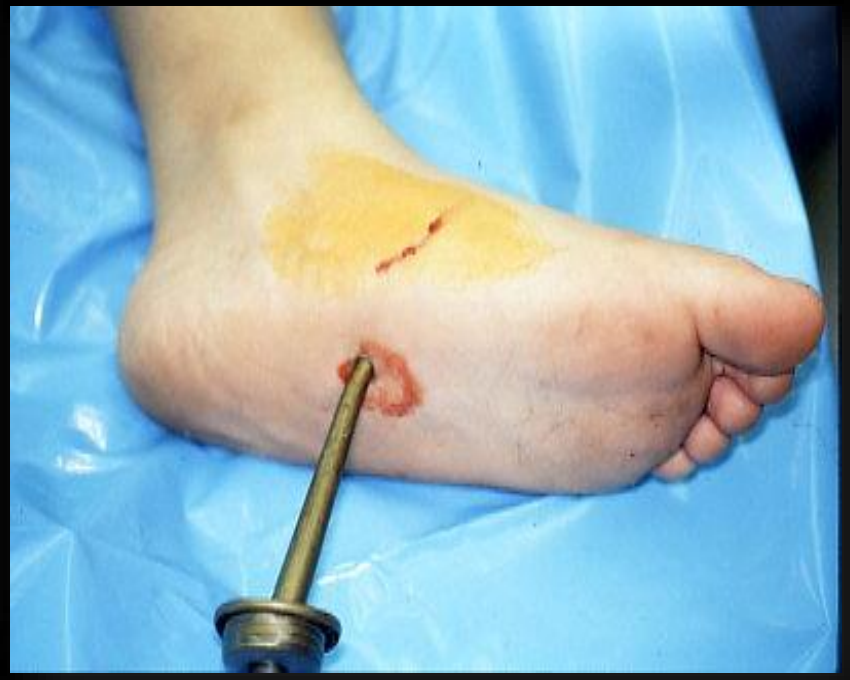




**No, Motorcycle pedal…….**

**24 year old lost control of his motorcycle hitting the back of a parked car.**

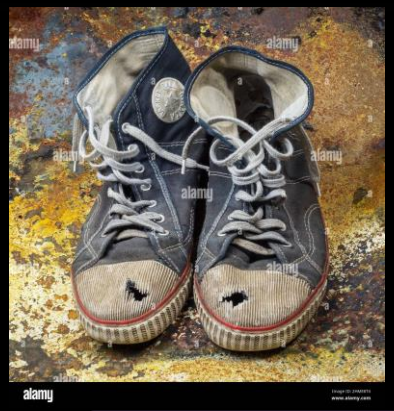




# AND

Oil can funnel through tennis shoe.

13 year old, “hyperactive” male, “playing” at a construction site, jumped down from the construction on to a oil can…..

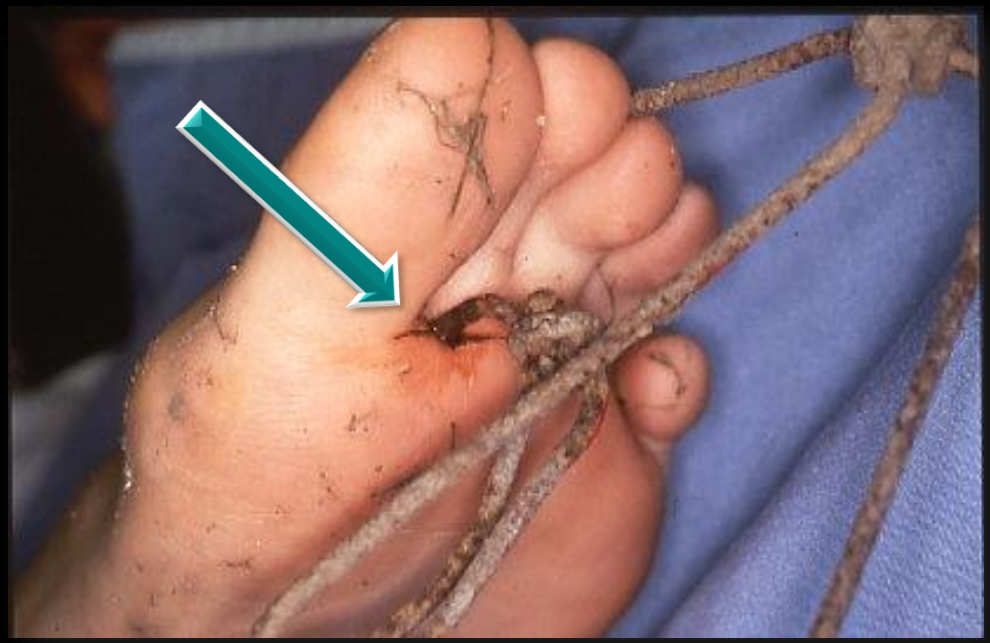


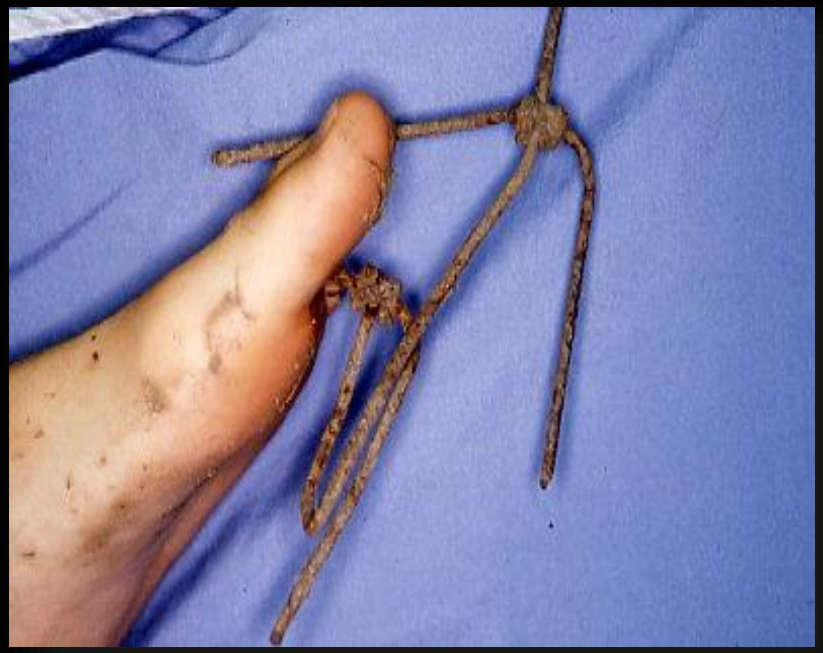
- Piperacillin / Tazobactam
- Cefepime / Metronidazole
- ?Quinolone / Clindamycin

# Question:

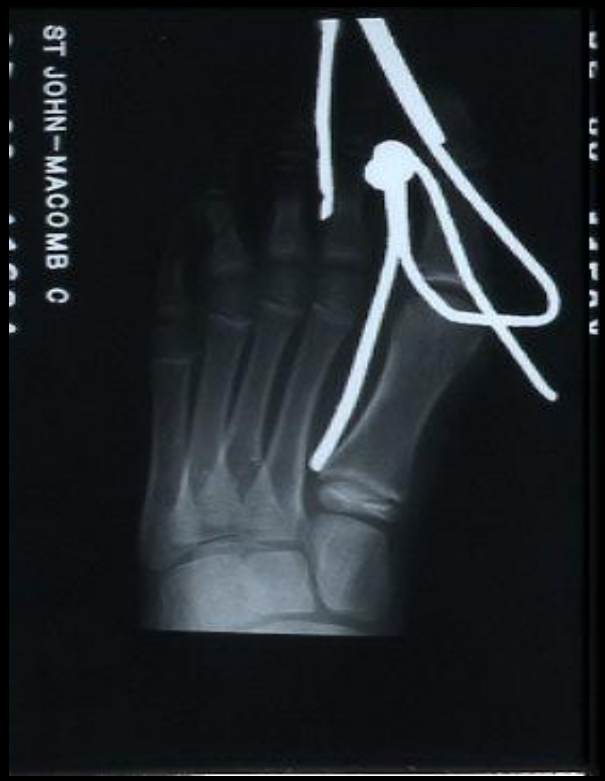
True False

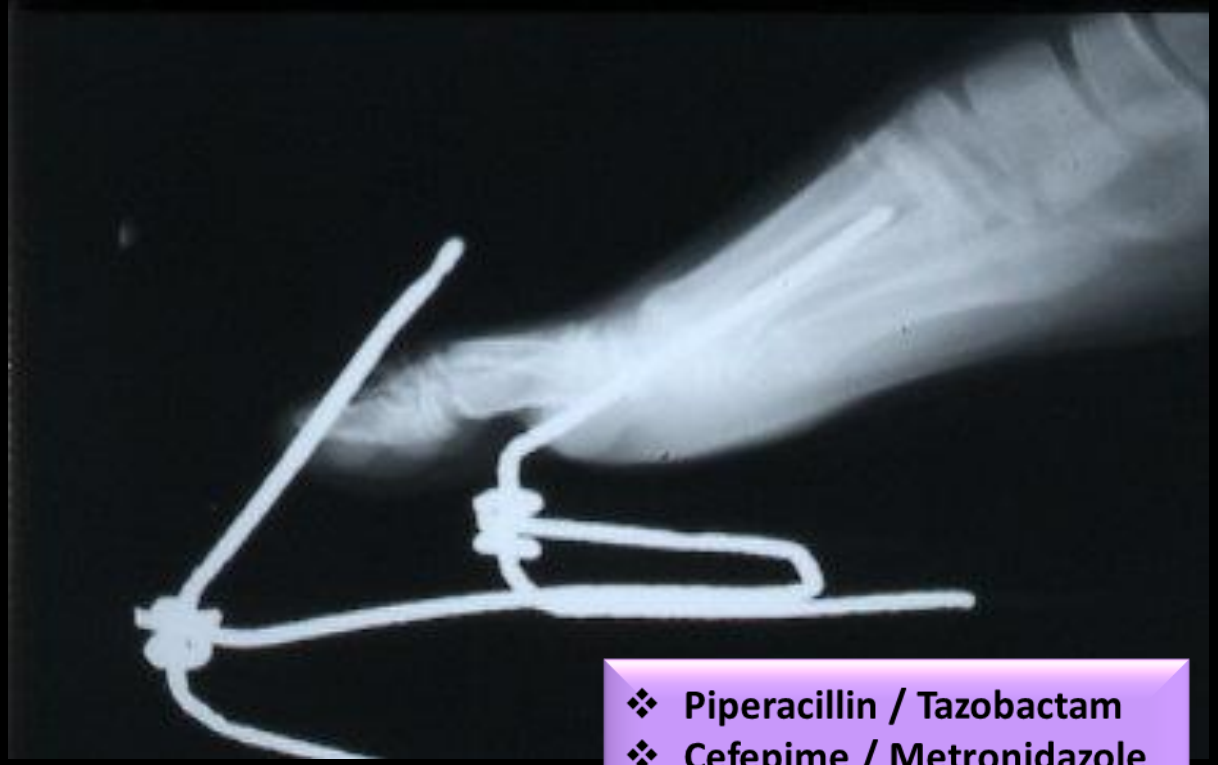
White milk comes from White cows…..
Chocolate milk comes from Brown cows……





- 13 year old running barefoot through a farm pasture with several friends, sustaining a foreign body (FB) to his bare foot.
- Brought into the DEM by his family, not particularly painful, bleeding controlled.



- ❖ Piperacillin / Tazobactam
- ❖ Cefepime / Metronidazole
- ❖ ?Quinolone / Clindamycin

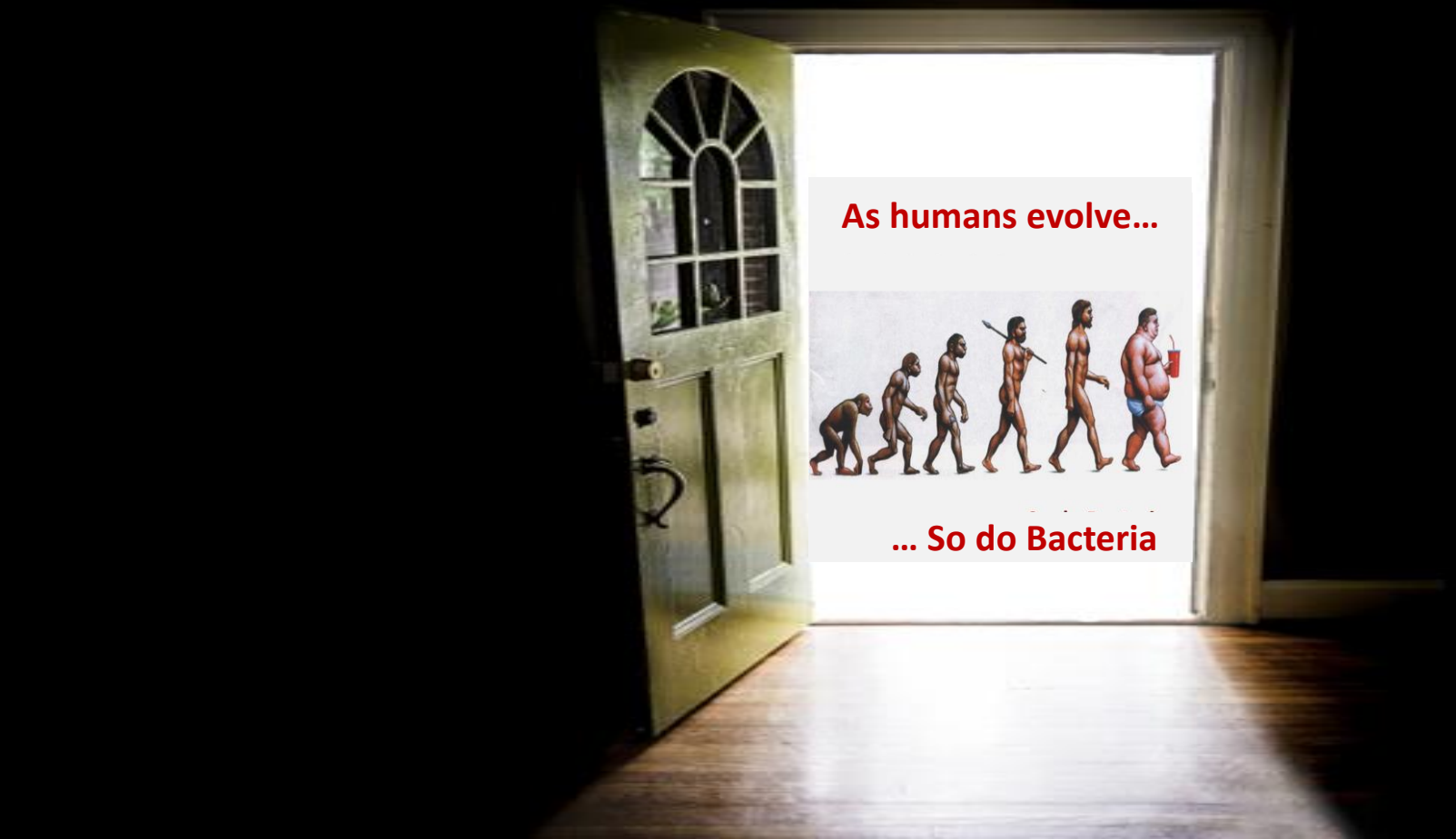
- Note the proximity of the barbed wire to the bone (traumatic osteomyelitis)
- Antibiotics are appropriate, as well as tetanus.
- Be sure removal of a foreign body does not cause further damage.

- Appropriately, vaccinated people need tetanus vaccinations:
  during "mid decade" 15 yr, 25 yr, 35 yr, 45 yr, etc.

# CELLULITIS

What you think you know

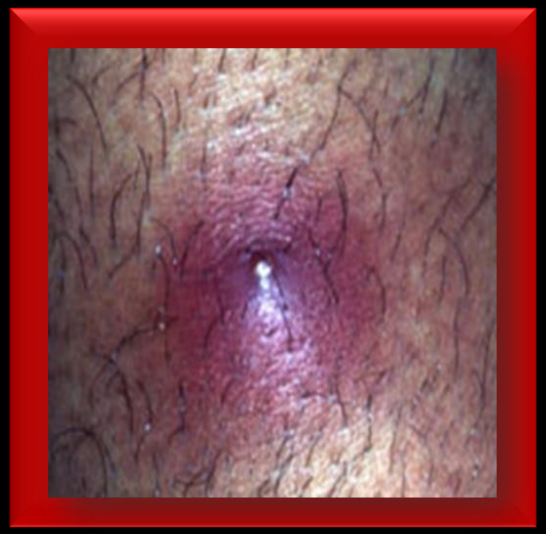
## Community acquired MRSA



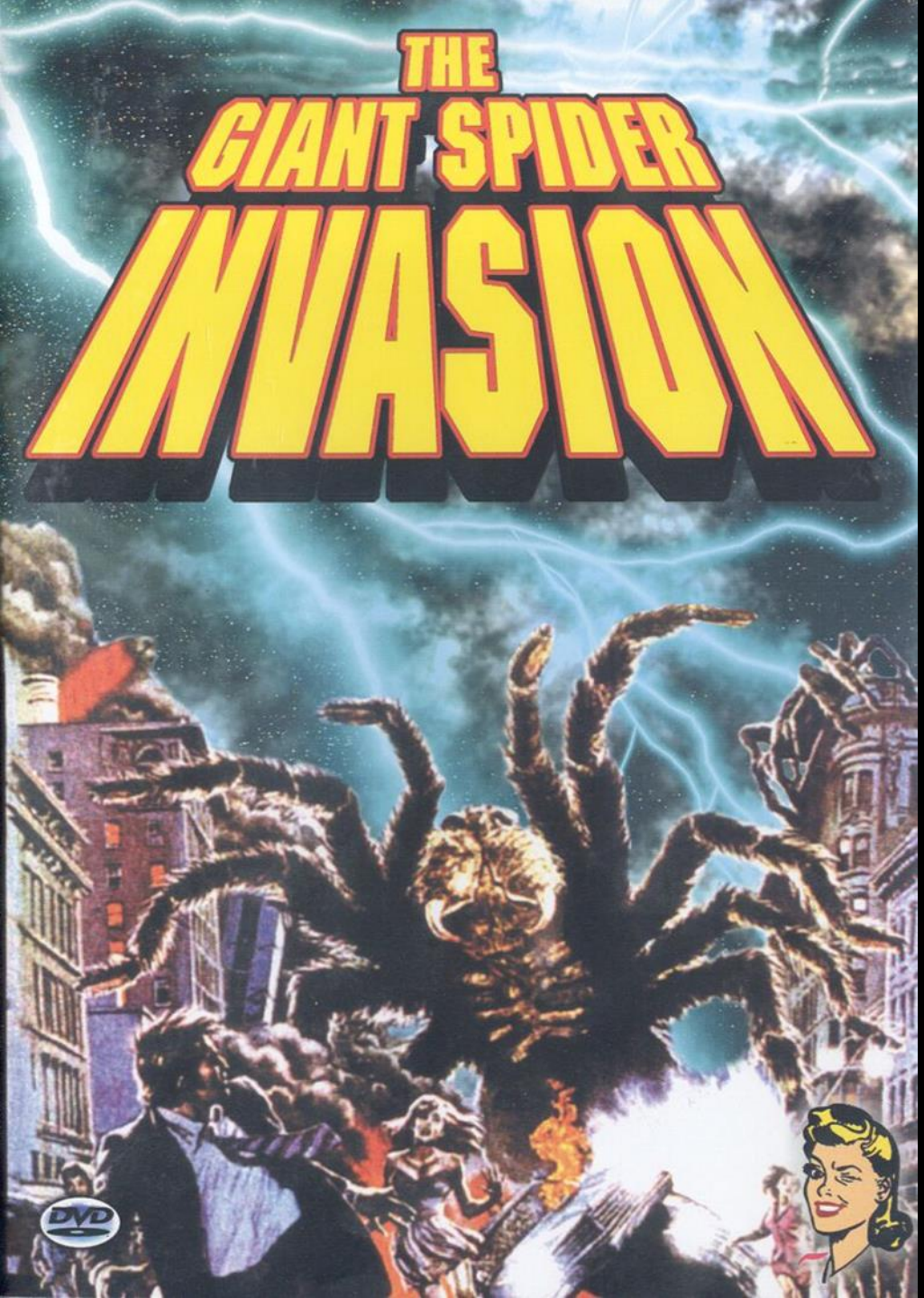
# CELLULITIS

What you think you know

"Has to be a spider  bite Doc….
What else could it Be?"




2002




2002

*It must be a "Spider bite"….*

*…..What else could it be?*

Loxosceles Reclusa

# CELLULITIS

What you think you know

Only one thing in Michigan….

**2002**

# U.S. Geographic Distribution of Verified Widespread Populations of Six Native Loxosceles Species. ("Brown Recluse Spider")



**Michigan's *biting* spider**
**Northern Black Widow Spider**
**(Latrodectus variolus)**
Underside view, displaying red hourglass marking

Loxosceles spiders "purportedly" are transported beyond the areas where they are endemic in household goods and warehouse cargo…

...But uncorroborated…actual epidemiology essentially ***does not*** occur beyond the spiders' usual habitat.

**Brown recluse spiders are *VERY* rare.**

- **The brown recluse is not indigenous to Michigan and cannot live in temperatures colder than 40°F, so they are extremely rare in the state*.**

***Preventative Treatments for Michigan's Spiders***
Creature Control Insect Pests. Spiders
https://www.creaturecontrol.net/insect-pest-control/spiders/

# CELLULITIS

What you think you know

## Staphylococcus aureus

# *MRSA*
Genome

Survival

**One drop MSSA Pus…**
**Contains 250,000 organisms….**
**1 of these bacteria have a chromosomal mutation**

***mecA 2a***

**This Mutation confers Antibiotic Resistance to all BETA LACTAM ANTIBIOTCS…**


**The mutation can be transmitted “Daughter” Bacteria Cells**

# MRSA

**1964** Likely original MRSA infections developed in Immunocompromised; hospitalized patients with initial **Methicillin sensitive** (MSSA ) infections. Antibiotics eliminated the Penicillin / MSSA "sensitive" Bacteria….

HOWEVER

The patients in their "weaken" immune state could not clear the residual **Methicillin resistant** ("MRSA") bacteria leading to **"super" infections with MRSA**

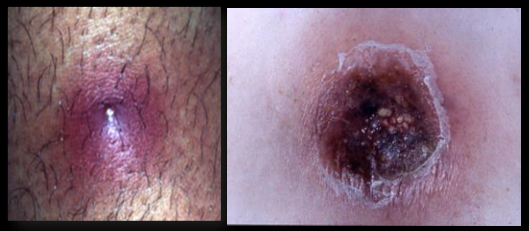
**1970's** the MRSA organisms "escaped" the hospital … and began infecting and colonization the General Population……

# 2002

## Where Did all this Community Acquired CA-MRSA Come from?

| MRSA Hospital 1960-1970s | "Community MSSA" |
|---|---|

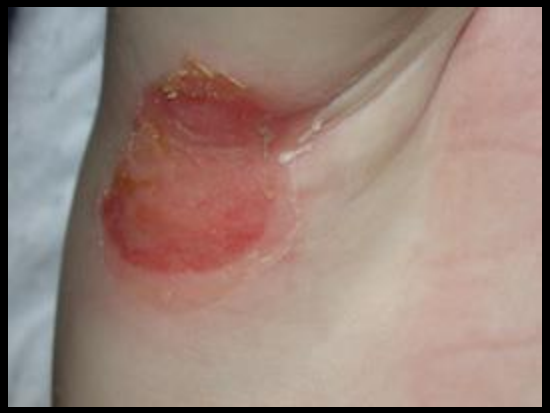
Community MRSA (USA 300) 2000



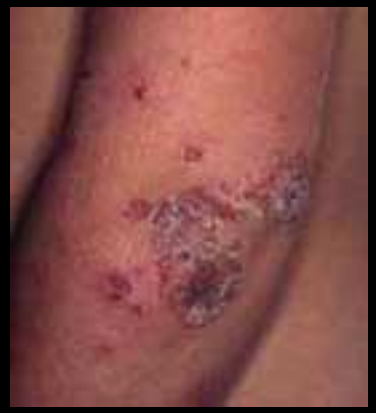
"Spider Bites"
Furuncle / Carbubcle
"Boils"

**Increased Virulence**

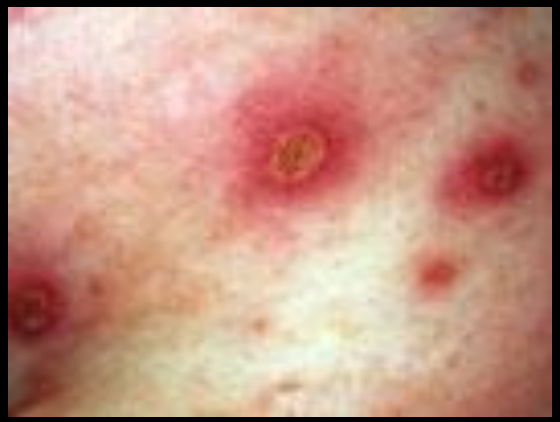
- Panton-Valentine leucocidin genes
- Expression of core genome-encoded toxins



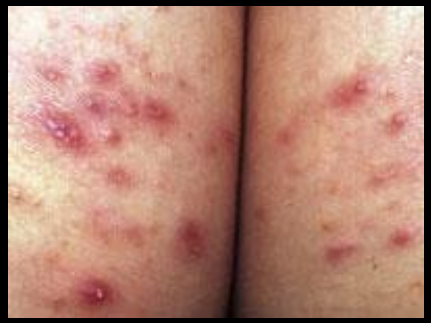
Bullous impetigo



Ecthyma

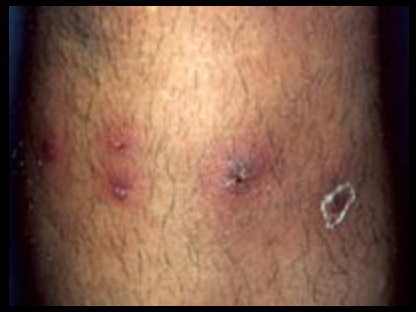


Ecthyma



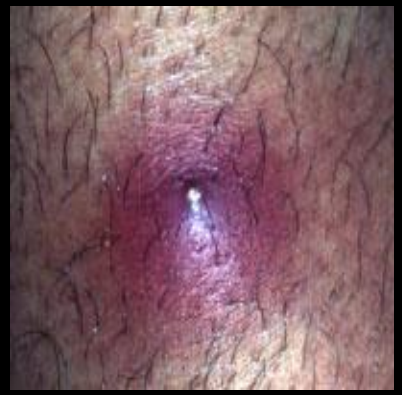
Folliculitis

*S. aureus*
*Skin lesions*

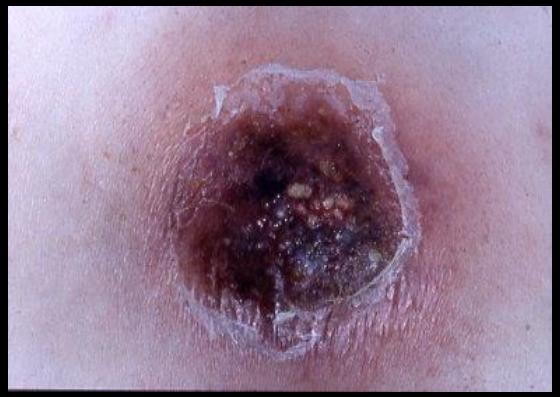


Ecthyma”

Folliculitis



“Boil” Furuncle



Carbuncle

# Representative Antimicrobial Susceptibilities (%) Of CA-MRSA and Health Care-Associated MRSA

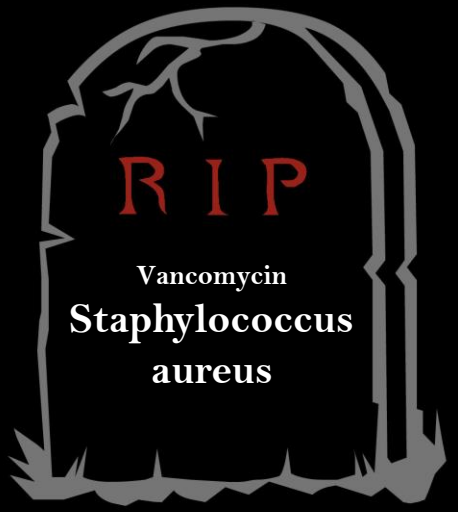
(Kowalski et.al Mayo Clinic Proceedings)

| Antimicrobial | CA-MRSA | Hospital MRSA |
|---|---|---|
| **Agent** | **% Sensitive** | |
| Oxacillin (Cephalosporins) | 0 | 0 |
| ❖ Ciprofloxacin | 79 | 16 |
| ❖ Clindamycin * | 83 | 21 |
| Erythromycin | 44 | 9 |
| Gentamycin | 94 | 80 |
| Rifampin | 96 | 94 |
| ❖ Tetracycline | 92 | 92 |
| ❖ Sulfa-Trimethoprim | 95 | 90 |
| ❖ Vancomycin | 100 | 100 |

Greater then 50% sensitive

Less than 50% sensitive

Vancomycin
Ace in the hole




**HOWEVER:**

**S. aureus (MSSA or MRSA)**

***WILL ALWAYS***

**Remains Sensitive to Vancomycin:**

**ANY De-novo MUTATIONAL attempt**
**for S. aureus to become resistant to Vancomycin**
**is a**
**Lethal Chromosomal mutational event**
**for the Bacteria….**

**For the present:**
**IV VANCOMYCIN : Remains "Ace in the Hole" for MRSA and MSSA infections**

# Cellulitis

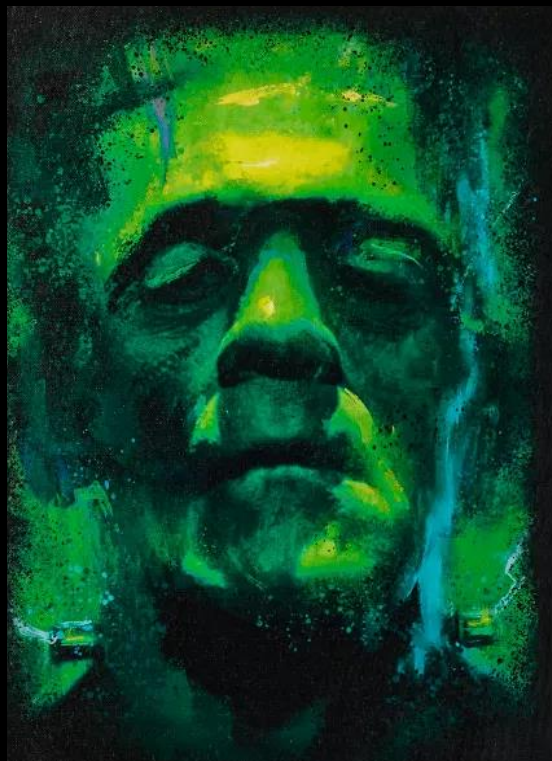
## Vancomycin resistant staphylococcus aureus "VRSA" 2002

Vancomycin-resistant Staphylococcus aureus (VRSA)
A rare but difficult-to-treat bacterial infection caused by a strain of
Staphylococcus aureus that has become resistant to the antibiotic vancomycin

Transmission of the VanA gene,
one off the vancomycin resistance genes,
found among
**"VRE" Vancomycin Resistant Enterococcus**

**Summer 2002 Metro Detroit Michigan**
40 year old Michigan woman became the first person worldwide known to have been infected with a strain of Staphylococcus aureus that was resistant to the antibacterial vancomycin

**Since the initial report**
**total 52 worldwide cases have been reported**



Chang S, Sievert DM, Hageman JC et al. ***Infection with Vancomycin-Resistant Staphylococcus aureus Containing the vanA Resistance Gene.*** N Engl J Med 2003;348:1342-1347 DOI: 10.1056/NEJMoa025025 VOL. 348 NO. 14

# CELLULITIS

## S aureus

### Epidemiology: Human Carriers

## Transmission:

**Close personal contact**

Infected secretions

- ("Pus") / Objects

Skin Contact:

- Athletic competition
- Draining lesions
- Shared Personal items
- Towels, Razors, Medical Equipment etc.

| | | |
|---|---|---|
| 30 - 40% | Healthy human carriers | At any given time |
| 1% | Humans are MRSA carriers | |

***335 Million Americans:***
***100 Million MSSA carriers***
***1 million MRSA Carrier***

Coagulase Negative Staphylococcus

# Provides

"Protective Suit of Armor"

- **ALL** Skin, Mucus Membranes
  - Not the GI tract
- **Humans can't survive without colonization**
- Very **LOW** Pathogenic Potential:
  - Increased with "Prosthetic" materials
- **Often Methicillin Resistant**
  - Humans take too many antibiotics

# So… if it NOT….S. Aureus…..

## What is it?.....

### "Coagulase Negative Staphylococcus"

**S lugdunensis**
**S schlieferi**

**S intermedius**
**S pseudintermedius**

**S. epidermadis species group**

- S epidermadis
- S haemolyticus
- S hominis
- S saccharolyticus
- S warneri
- S capitis
- S auricularis

**S. saphrophyticus group**

- S saphrophyticus
- S cohni
- S xylosus
- S arelettae
- S equorum
- S gallainarum
- S kloosii

**S. sciuri species group**

- S Sciuri
- S lentus

**S. simulans Species group**

- S simulans
- S carnosus

**Unspecified Group**

- S caseolyticus
- S hyicus

Becker K, Heilmann C, Peters G. ***Coagulase-negative staphylococci***. Clin Microbiol Rev. 2014 Oct;27(4):870-926. doi: 10.1128/CMR.00109-13. PMID: 25278577; PMCID: PMC4187637

*“Cluster” Gram Postiive Cocci*

# *Are Either S. aureus or are not !!!!!*

**Any questions?**

**Staph?**
**“I don’t give a sh—t-a-cus”**

# CELLULITIS

What you think you know

**Streptococcus  Bacteria**

*S. pyogenes*

*Clinical disease*

## Non-invasive Disease

- Strep throat (“Scarlet fever” )
- Cellulitis
- Impetigo
- Erysipelas

## Invasive Disease

- Necrotizing fasciitis
- Myositis, Endocarditis
- Streptococcal toxic shock
- Pneumonia, Osteomyelitis

## IMMUNE MEDIATED DISEASE

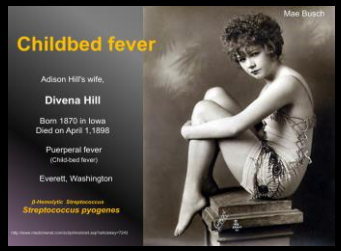
- Rheumatic fever
- Glomerulonephritis

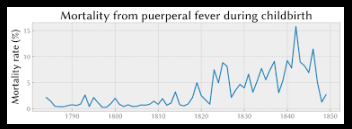
## Bacterial Toxic Shock Syndrome “GAS”

| Factoid | Streptococcus | Staphylococcus |
|---|---|---|
| Identifiable Infectious source | +++++ | + |
| Prodrome 2-3 days | Yes | Yes |
| Fevers, chills | Yes | Yes |
| Nausea, Vomiting | Yes | Yes |
| Watery Diarrhea /abdominal Pain | Yes | Yes |
| Myalgias Arthalgias | Yes | Yes |
| Pharyangitis / Headaches | Yes | Yes |
| Confusion | ? | More Common |
| Bacteremia | More common | Rare |
| Pain at site of infection | More common | ? |

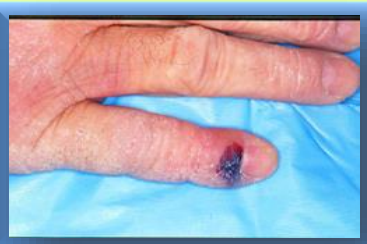
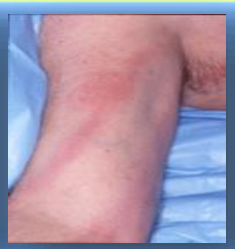
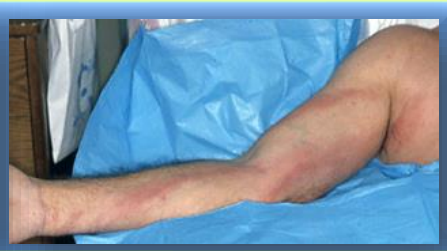
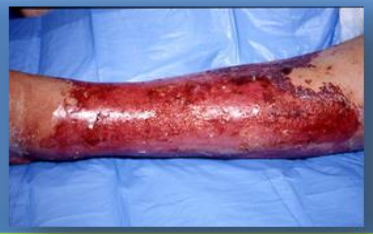
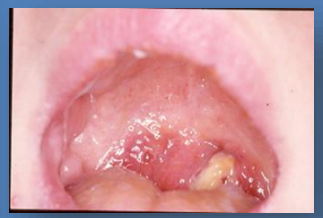
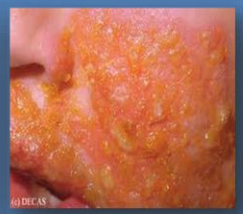
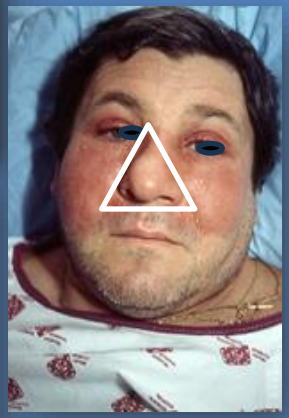
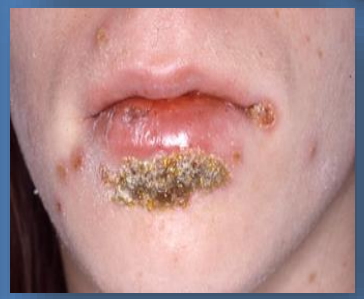
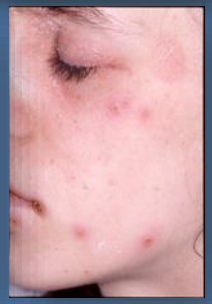
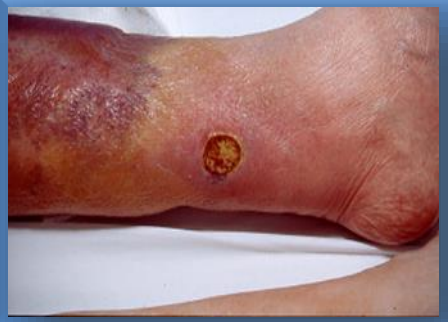
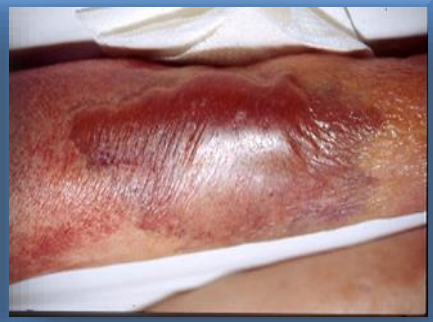
**Jean Harlow**
March 3, 1911 - June 7, 1937
(Age 26 years)

**James Maury *Henson***
September 24, 1936 – May 16, 1990
(Age 53)



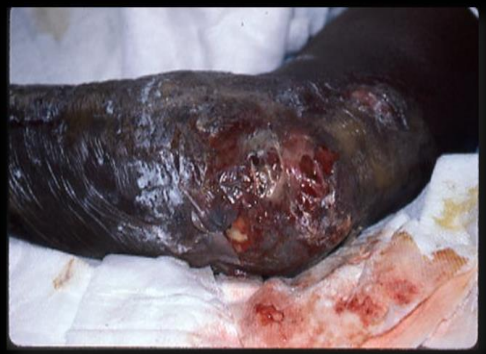

**Ignaz Phillip Semmelweis**
1818- 1865
“Wash your Hands” -1846
Maternity Vienna General Hospital

*Streptococcal Necrotizing cellulitis*

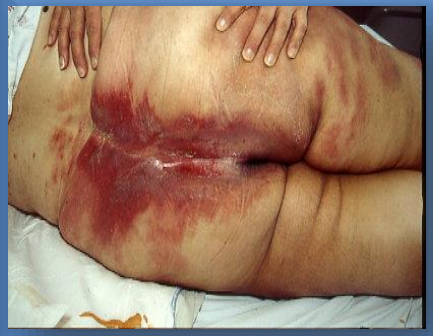
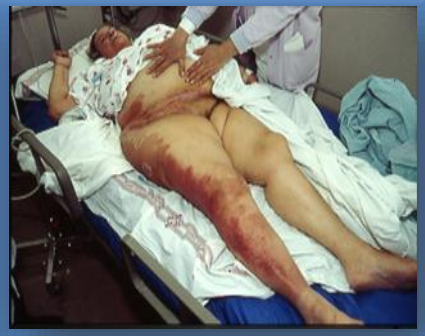
## *"Flesh Eating Bacteria"*

| NORMAL 48 HOURS AGO... |
| --- |
| "FLESH EATING" bacteria<br>Evil "M" TYPE: rare (type 1,3) |
| ❖ **Ampicillin / Sulbactam** to kill<br>❖ Clindamycin : "Stop" ribosome protein/toxin production |
| ❖ AMPUTATION |



- ❖ Necrotizing fasciitis caused by Streptococcus pyogenes infection can be rapidly fatal
- ❖ This is probably the result of a toxic shock syndrome [1]

1 P M Donaldson, B Naylor, J W Lowe, ***Rapidly fatal necrotising fasciitis caused by Streptococcus pyogenes.*** J Clin Pathol. Jul 1993; 46(7): 617–620.

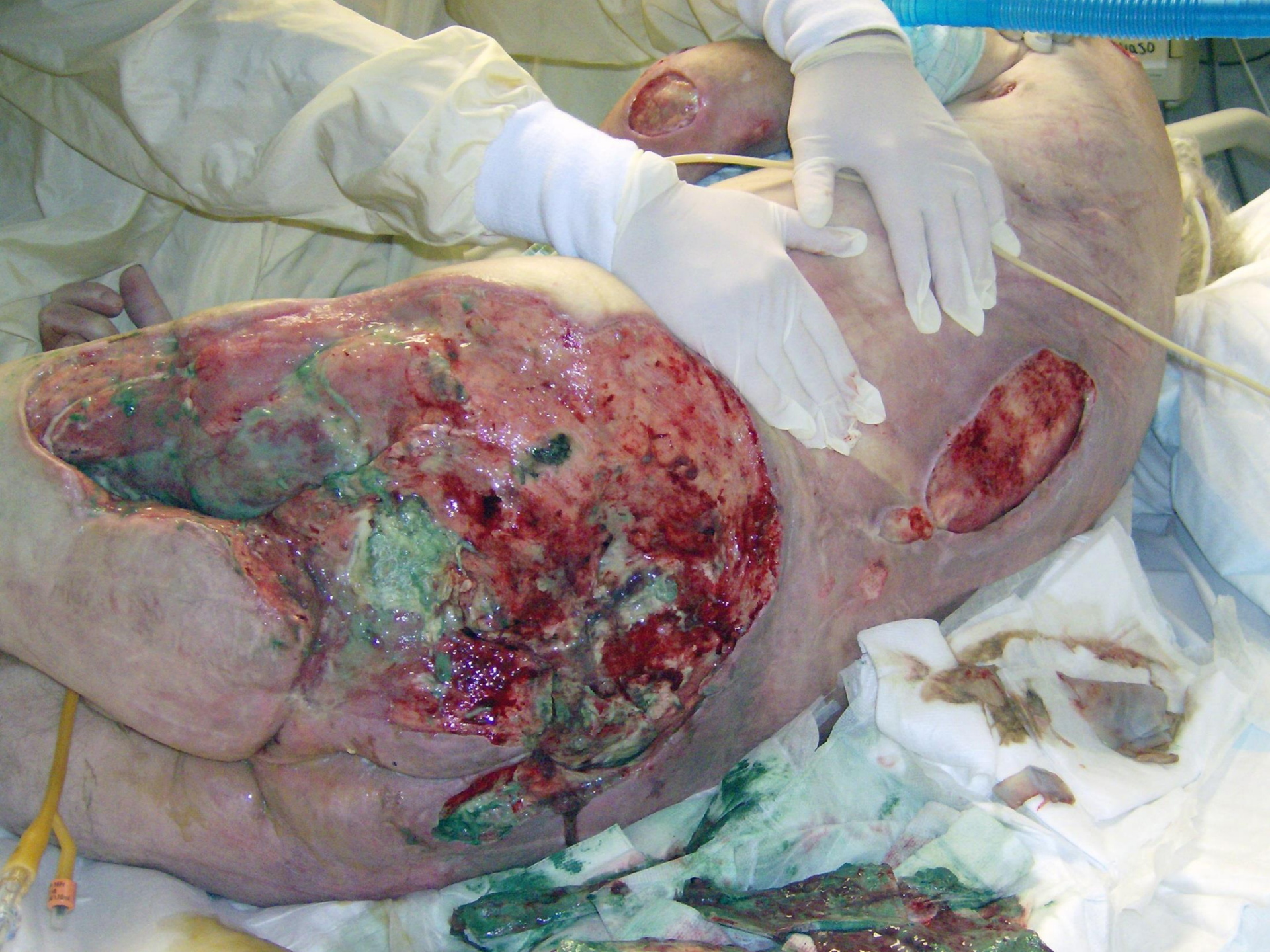



"Millions" Non-invasive (Pharyngitis) / 10-15,000 invasive/year

# CELLULITIS

What you think you know

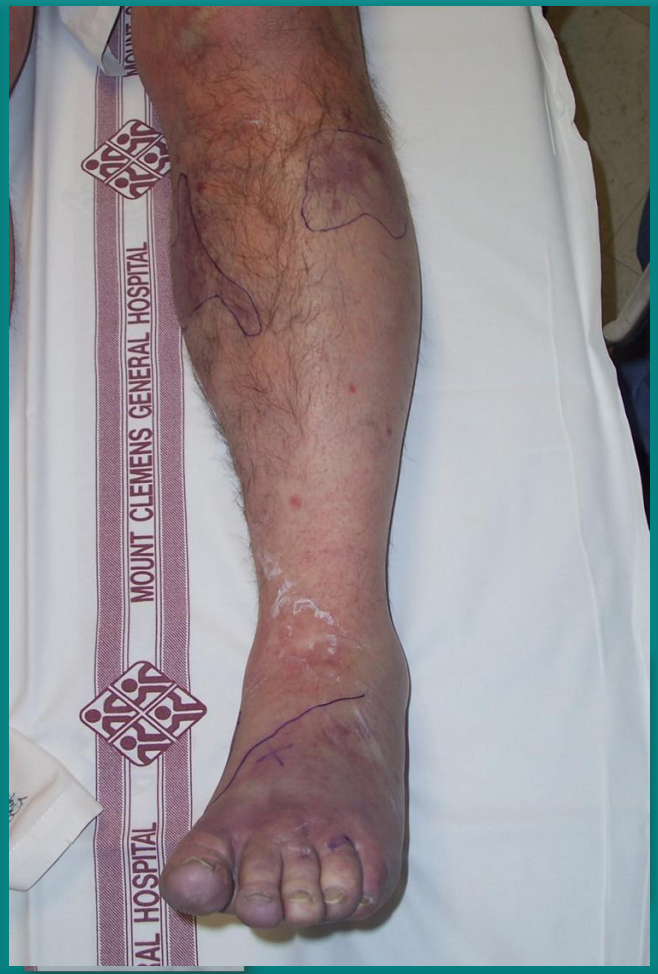
Necrotizing facilities

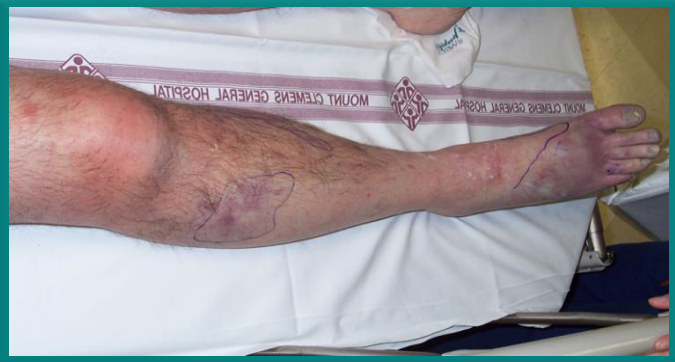


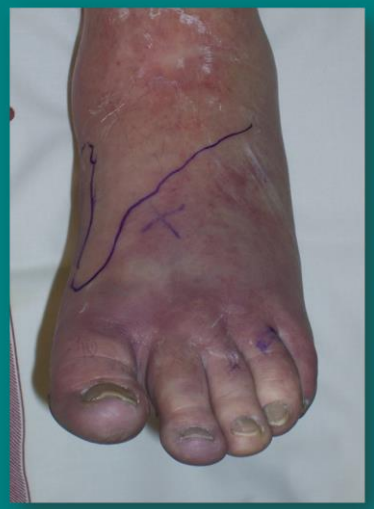
# Cellulitis

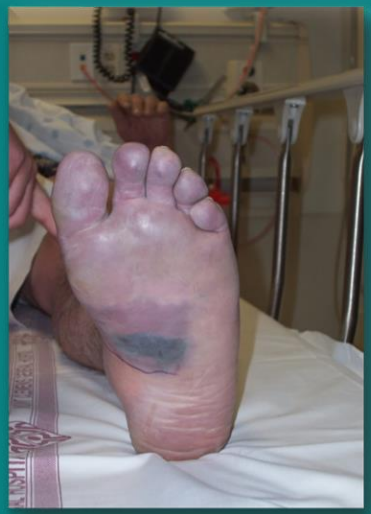
## Streptococcus pyogenes

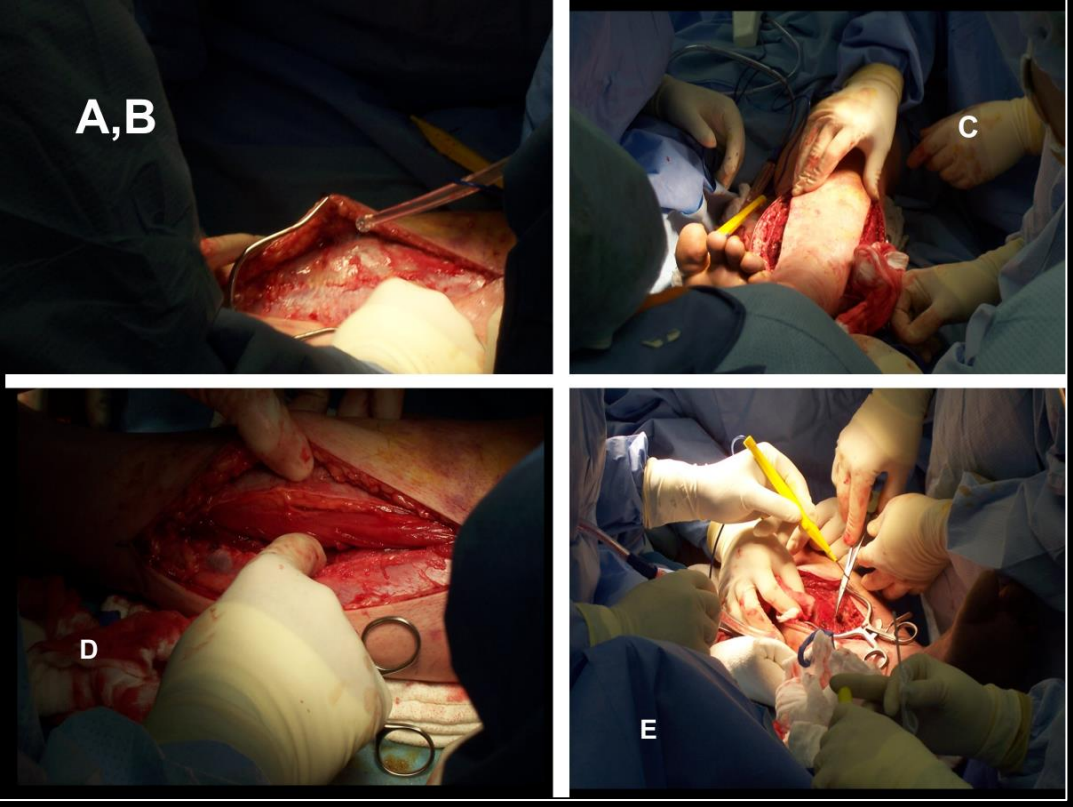
**Streptococcal pyogenes**
**Necrotizing fasciitis and**
**Toxic shock**





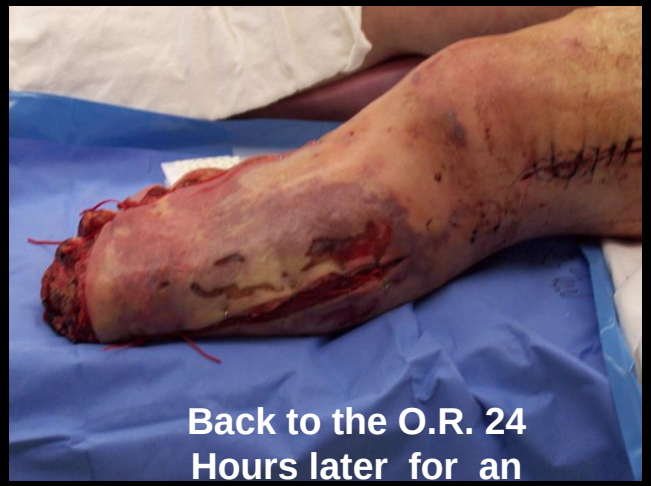




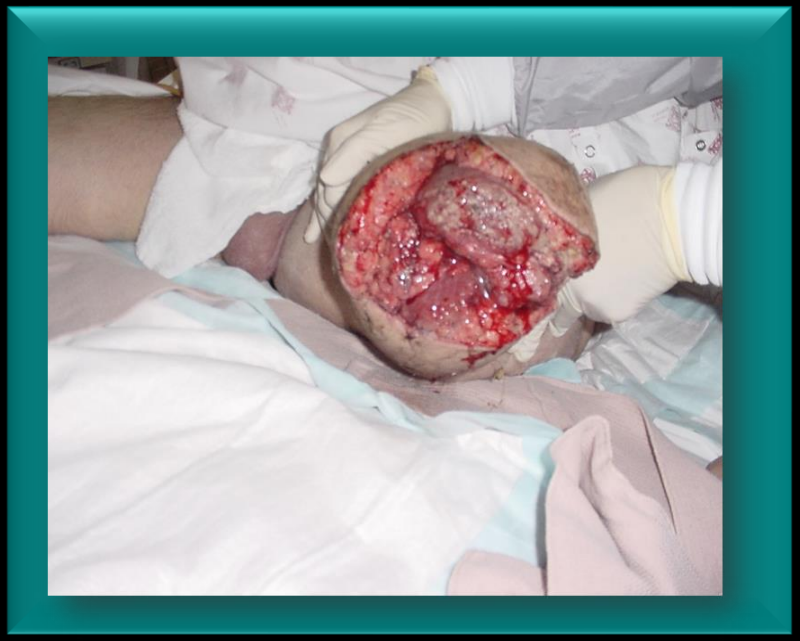
## Necrotizing Fasciitis surgical findings

**Surgical exploration and debridement:**

A- Gray Necrotic Tissue
B- “Dishwater Pus”
C- Lack of Bleeding
D- Lack of resistance to finger dissection
E- Non-contractile muscle



**Back to the O.R. 24 Hours later for an Above the knee Amputation**



# DAY 5
# Last revision

- Wound was monitored closely. Ceftriaxone / clindamycin maintained for 3 weeks past the last Debridement.
- ICU 5 days Post Op, extubated. (Remarkably no Nosocomial complications) .
- Patient was discharged to rehabilitation after three weeks of hospital confinement.....

# CELLULITIS

What you think you know

CASE STUDIES

*Osteomyelitis*

# History Neuropathic Foot

In 1703, William Musgrave

first described a
"Neuropathic joint"

as an "anthelia" * caused by venereal disease**.

Syphilis**

William Musgrave
(1665-1721)
British physician and antiquary.

**Anthelia : faint halo sometimes seen in polar or high altitude regions around the shadow of an object cast onto a thick cloud bank or fog.*

# Jean-Martin Charcot
## Neuropathic Joints
### "Charcot Joint"

Jean-Martin Charcot
1825-1893

Born in Paris France, a professor at the University of Paris for 33 years. In 1862 he began a life-long association with Salpetriere hospital.

- An excellent teacher, he attracted students from all over Europe.
- Among his students were **Alfred Binet** and **Sigmund Freud.**
- In 1882 his focus turned to neurology establishing a clinic at his hospital
- He has been called the "father" of modern neurology

n

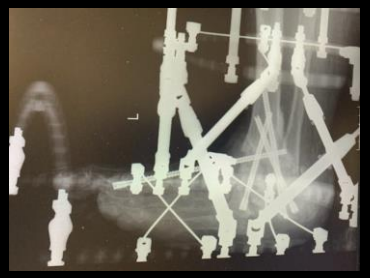
1883, Charcot described the '**pied tabétique' or 'tabetic foot,'** as tabes dorsalis; As Neurosyphilis was the most common cause of neuroarthropathy at the time

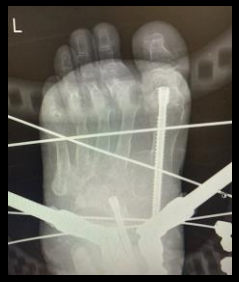
Tabes dorsalis is a slow degeneration of the nerve cells and nerve fibers that carry sensory information to the brain. The degenerating nerves are in the dorsal columns of the spinal cord (the portion closest to the back of the body) and carry information that help maintain a person's sense of position

**Jean-Martin Charcot**

Neuropathic Joint

# Charcot Joint ’Rocker Bottom foot’

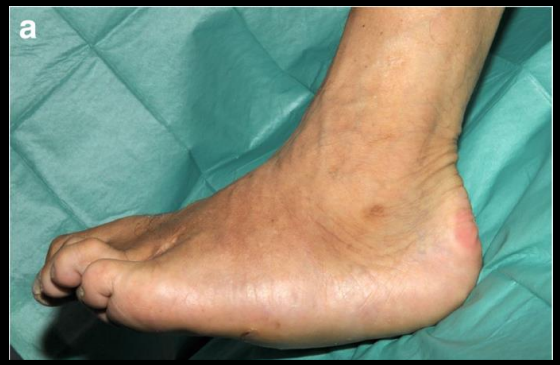


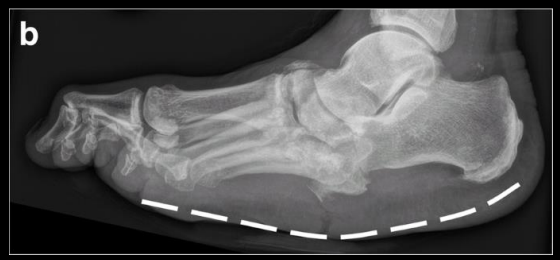


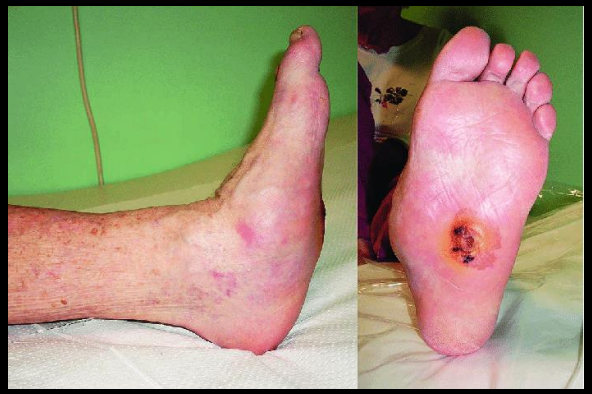
## Diabetes Mellitus:

**In US has long surpassed syphilis as the leading cause of Charcot Neuropathy**

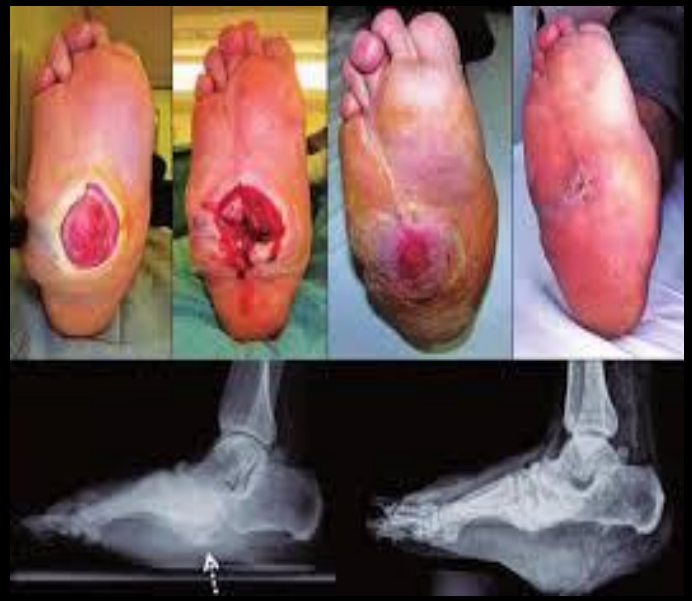
- Prevalence among DM patients : 0.08%–7.5%
- Although rare, Charcot Neuropathy one of the most destructive complications of diabetes
- Subluxation, Dislocation, Deformity, Ulceration of the foot and ankle joints



**Rocker bottom foot deformity**



SA, Burns PR. ***The pathogenesis of Charcot neuroarthropathy: current concepts***. Diabetic Foot Ankle. 2012;3. doi: 10.3402/dfa.v3i0.12236. Epub 2012 Jan 10. PMID: 22396834; PMCID: PMC3284308ntagonize the pathologic mechanisms.

# Broken foot?

What broken foot…

# Charcot foot

## Neuropathic joint disease

**Wound Care Center**

36-year-old obese (350 lb) 15-year DM-II male

Now with several years IDDM

Undergoing treatment for a *"Neuropathic Left"* foot, associated osteomyelitis and digital gangrene

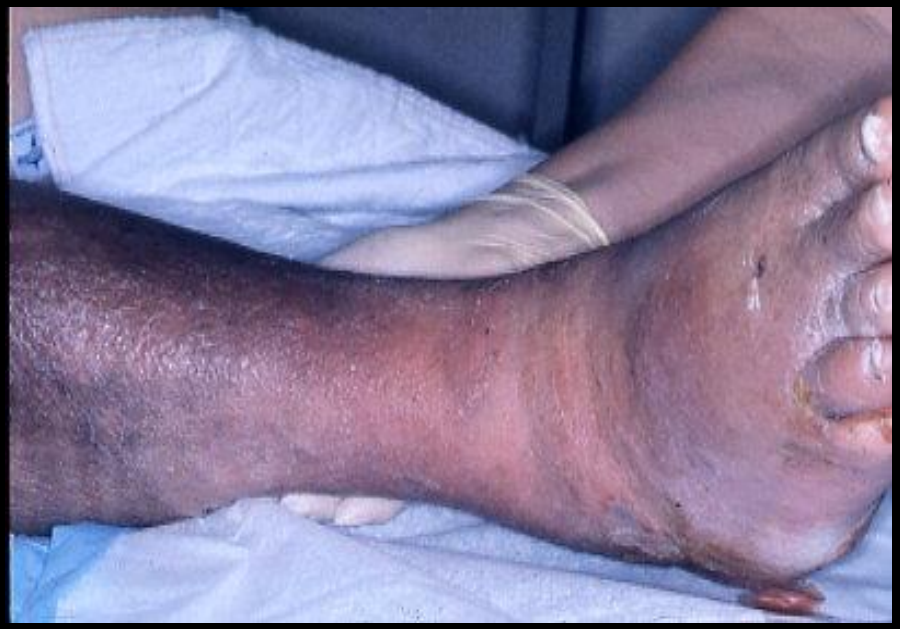
Patient Has been ambulating with Orthotic shoes and crutches…

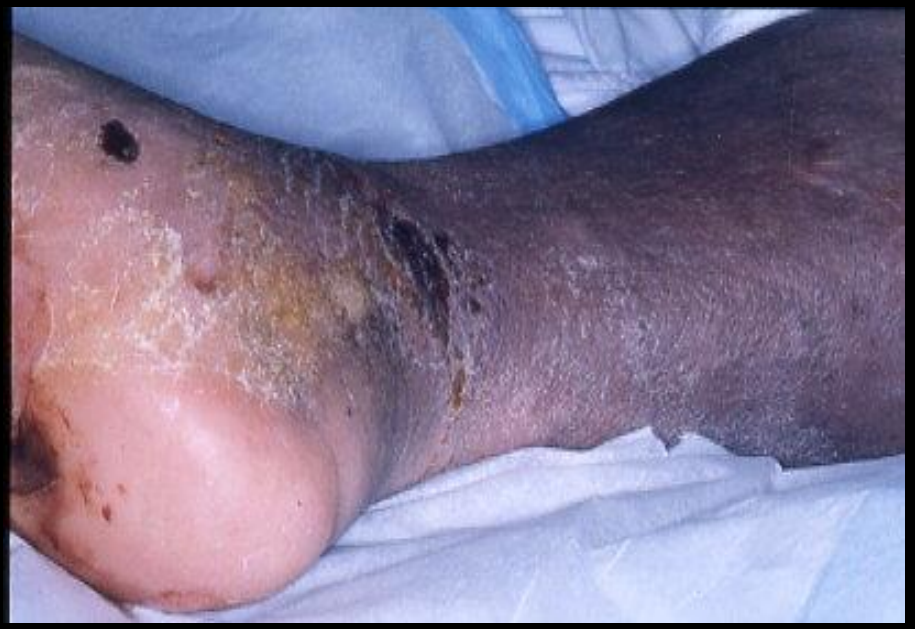
Occasional oral antibiotics ... Local wound therapy…..

At a Wound Care Center


Missing two weeks of clinic appointments:
Now reports
He had tripped and fallen while climbing stairs, destroying his crutches and damaging his left foot orthotic devise……

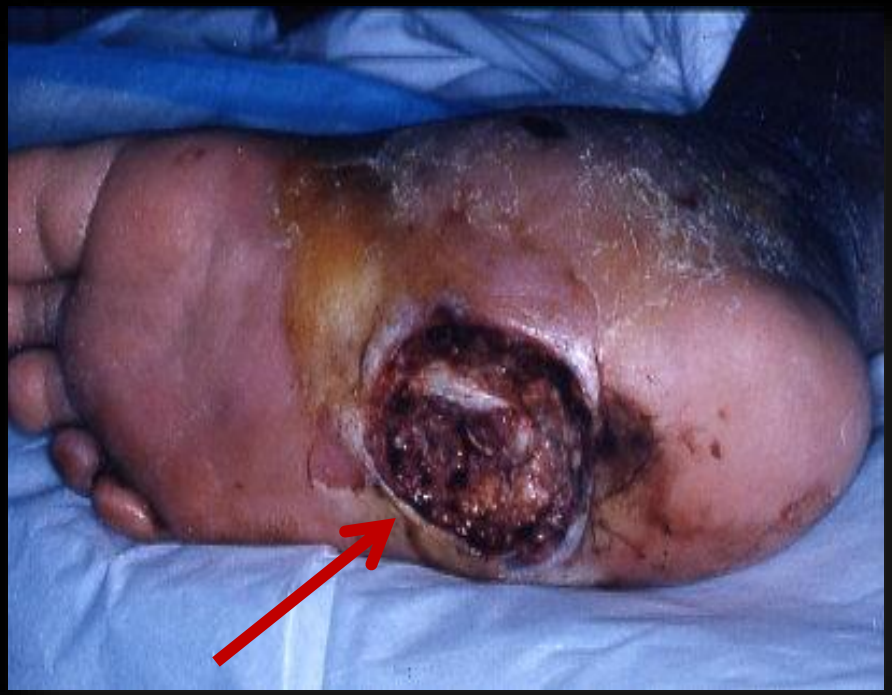
He rescheduled his clinic visit when he noticed his right foot was swollen, he could no longer wear his right shoe…

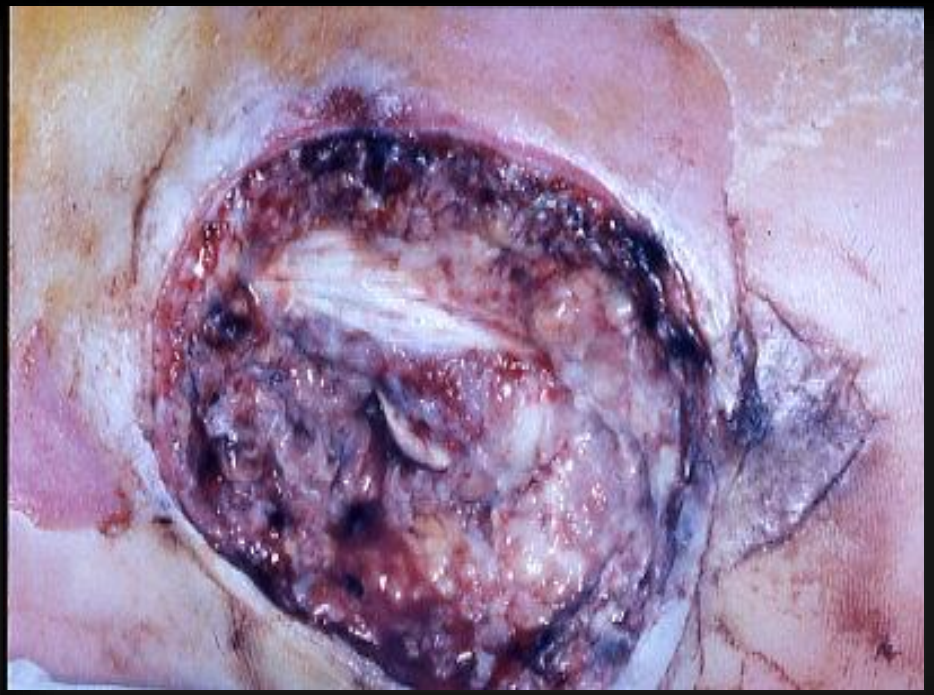




His socks were soaked with  a pungent watery fluid, and it was becoming difficult to “hobble around” without his crutches…….

- Full-thickness plantar skin and soft tissue injury.
- Necrotic tissues and bone fragments at the wound base
- The ankle and foot clearly swollen and discolored…

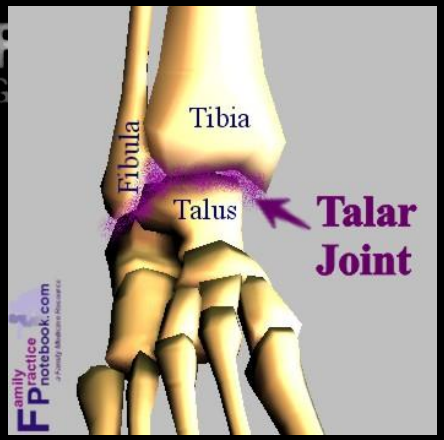




With Diabetic Foot neuroarthropathy…

**"Charcot foot"**

**Not unexpected the patient feels "No pain"**




ANKLE MORTISE *

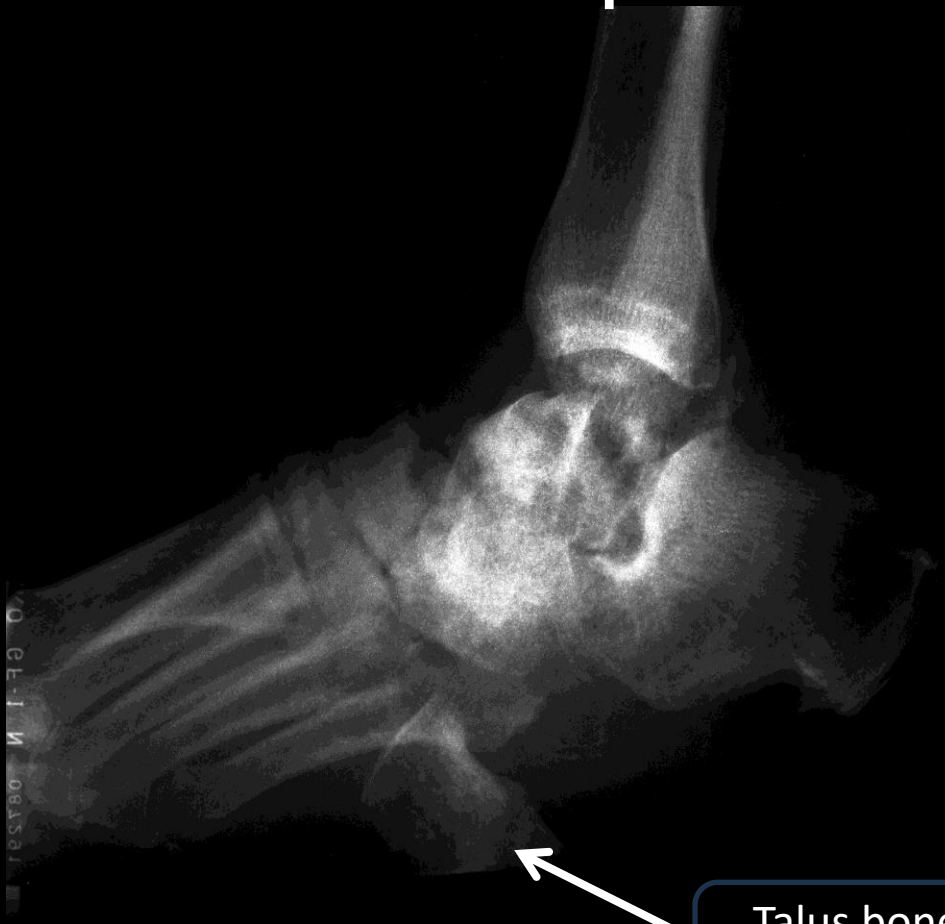
**Normal**

**Patient**

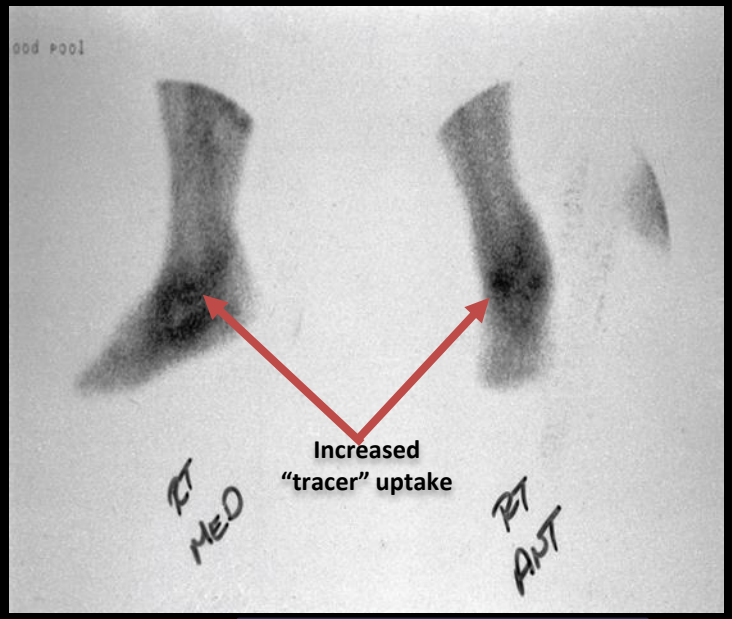
X-RAY: Ankle mortise* is disrupted; bone fragments can be seen a “piece of the talus has broken off” and migrated toward the plantar foot surface

* The ankle mortise is **the "hinge" that connects the ends of the tibia and fibula to the talus**

**Radiographic the  bone fragment can clearly be seen**
**As a “moot" point the bone scan is “Positive”.**



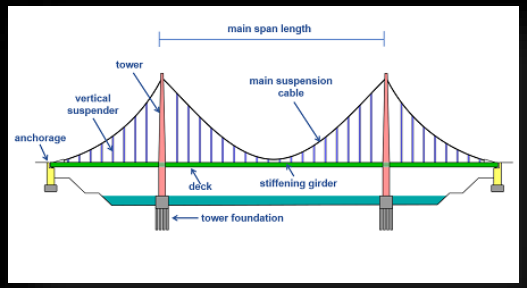
Talus bone fragment




in 2024
National cost $1,255

The patient refused amputation… but later consented.

# Power of “Peripheral neuropathy”

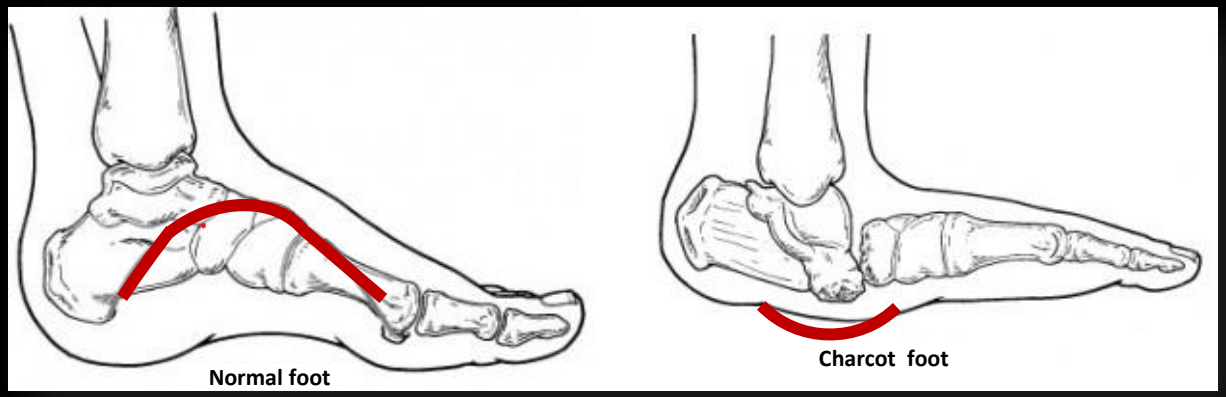



**Our 350 lb patient… feeling No Pain**

**For 3 weeks: ~900 pounds pressure* each step…**

**On a Trimalleolar ankle fracture…**

**No LESS!**




- Supporting foot tendons and ligaments support the foot arch
- Healthy foot arching provides reflexive spring and balance.
- Weight, trauma-injury weakens the tendons - ligaments making up foot / ankle architecture
- **Over time, the arches will collapse, causing flat feet and/or abnormal plantar bone pressure points**

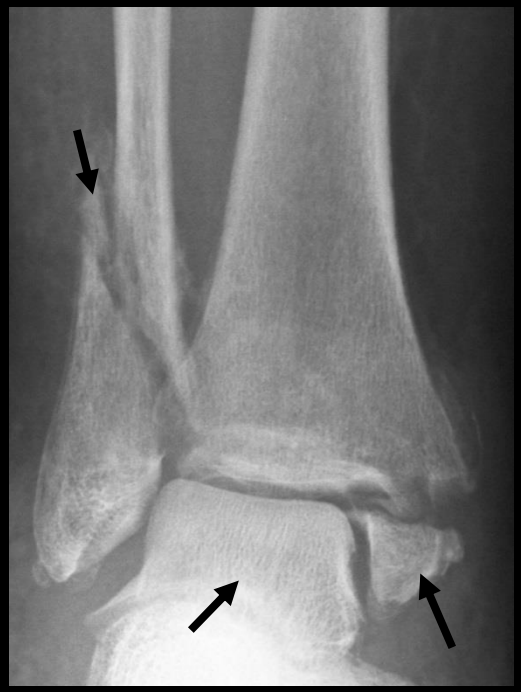
NORMALLY significant pain when standing and walking patients persons will off load

**Feeling No pain….No offloading….Continuing his foot injury**

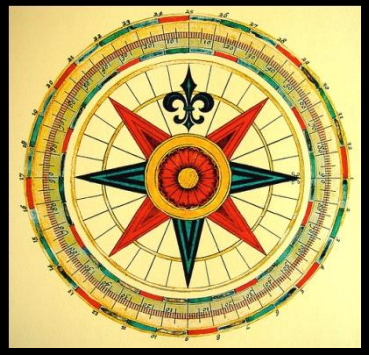
*Estimated that every pound of body weight causes three pounds of force that your feet have to absorb when you're walking, and seven pounds when running. That means a 200 pound person's feet would be subject to 600 pounds of force with every step, and 1,400 pounds of force when running.

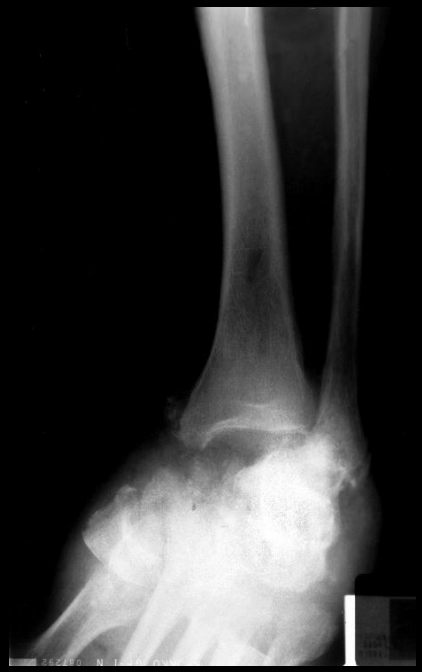
# Tri-malleolar Ankle Fracture

Medial malleolus [Tibia]
Lateral malleolus [Fíbula]
Posterior malleolus [Tibia]



*Trimalleolar ankle fracture*





*Patient*

**Under anesthesia**
**the foot could be “rotated’**
**almost 360º around the Tibiotalar joint**
**of the ankle mortise**

# Question:

**Which are true regarding Animal Bites? (Except)**

**A) Pasturella multocida is common with cat bites.**

**B) S. aureus and Streptococcus are common.**

**C) Keflex® (Cephalexin) is appropriate first line antibiotic.**

**D) Augmentin® (Amoxil/Clavulanate) is an acceptable first line antibiotic**

# Question:

***ALL*** **are true regarding Animal Bites? [EXCEPT]**

A) Pasturella multocida is common with cat bites.

B) S. aureus and Streptococcus are common.

C) Keflex® (Cephalexin) is appropriate first line antibiotic.

**D) Augmentin® (Amoxil/Clavulanate) is an acceptable first line antibiotic**

**Alternate**

- **Tetracycline or Doxycycline plus Metronidazole**
- **IV Ceftriaxone / Clindamycin**
- **Fluoroquinolone / Clindamycin**

# Cellulitis

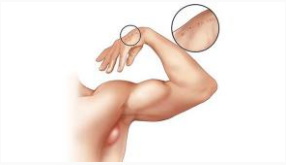
## Miscellaneous

- Staphylococcus species
- Streptococcus species
- Eikenella species
- Pasteurella species
- Proteus species
- Klebsiella species
- Haemophilus species
- Enterobacter species

### DOG BITES

**Amoxil Clavulanate**
**Quinolone / Clindamycin**

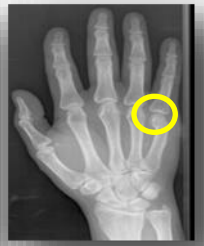

- **Pasteurella multocida**
- Streptococcus
- Staphylococcus
- Fusobacterium
- Porphyromonas
- Bacteroides

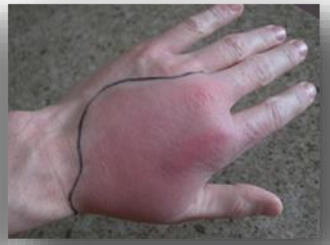


Cat scratch disease
Bartonella

### CAT BITES

**Amoxil Clavulanate**
**Quinolone / Clindamycin**

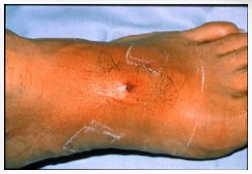




- Eikenella corrodens
- Staphylococcus
- Streptococcus

### HUMAN BITES

**Amoxil Clavulanate**
**Quinolone / Clindamycin**

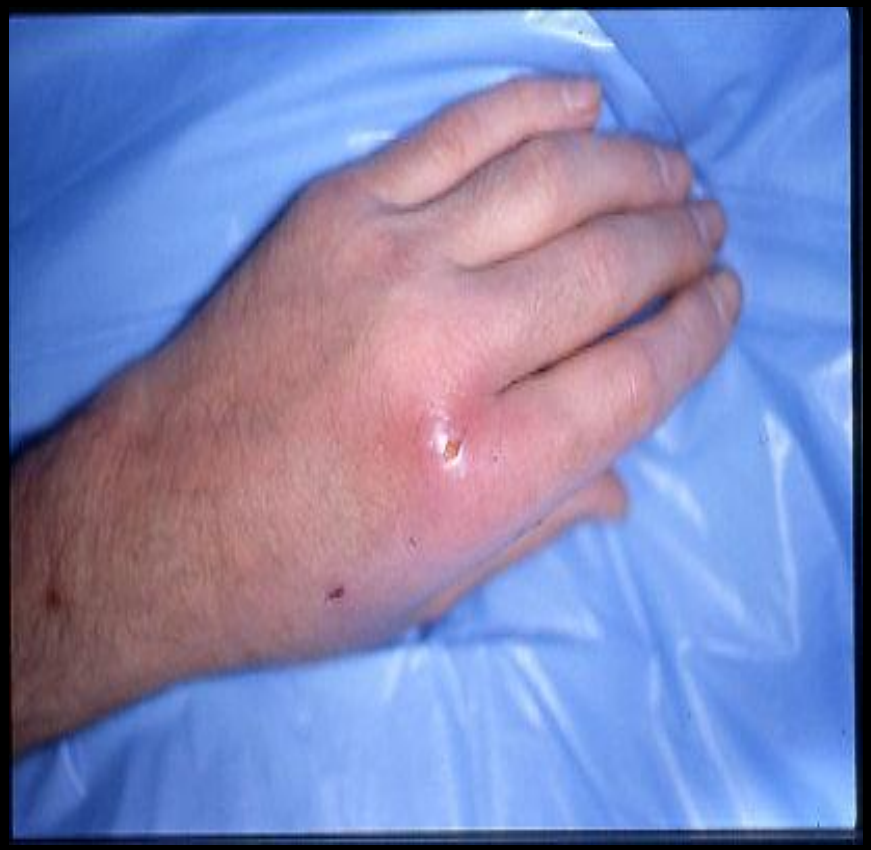


### Aeromonas hydrophila

**Lacerations or puncture wounds sustained in freshwater environments are susceptible to contamination by Aeromonas hydrophila.**

**tetracyclines, sulfonamides, trimethoprim + SMX/MP or ciprofloxacin**


Here kitty, kitty…….

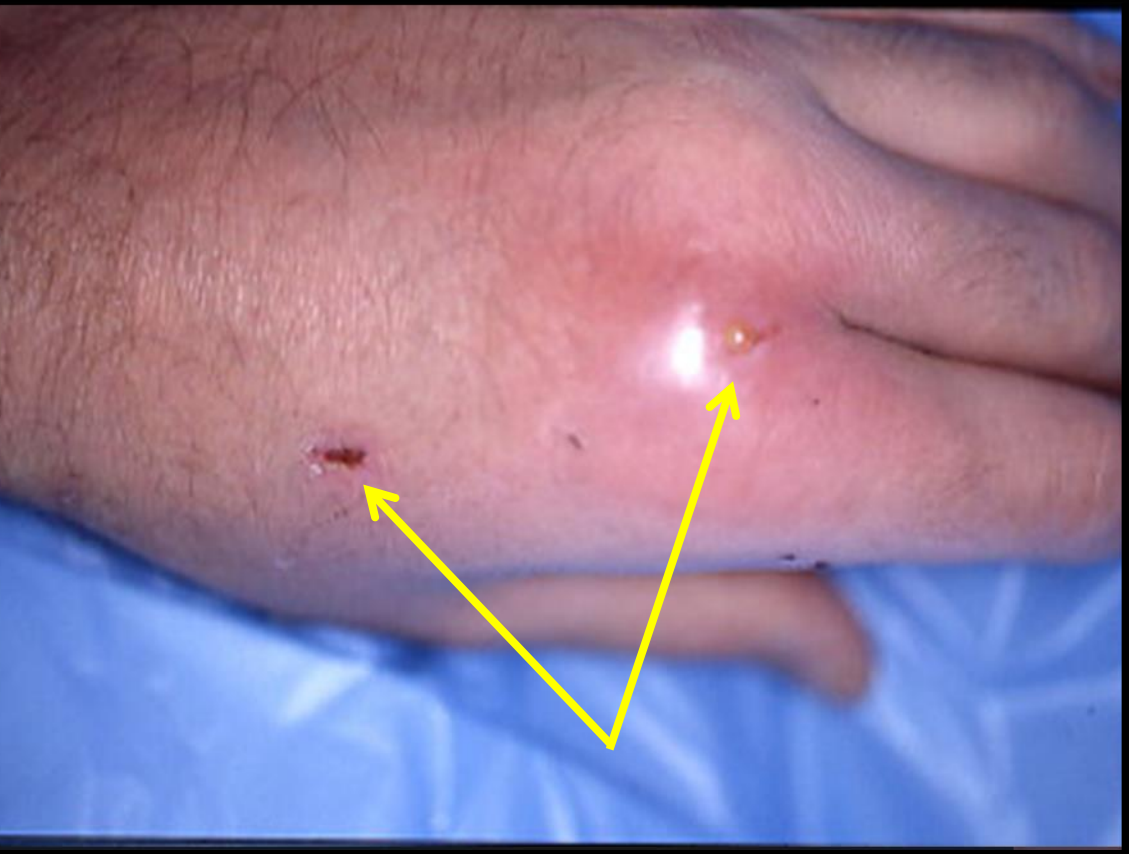


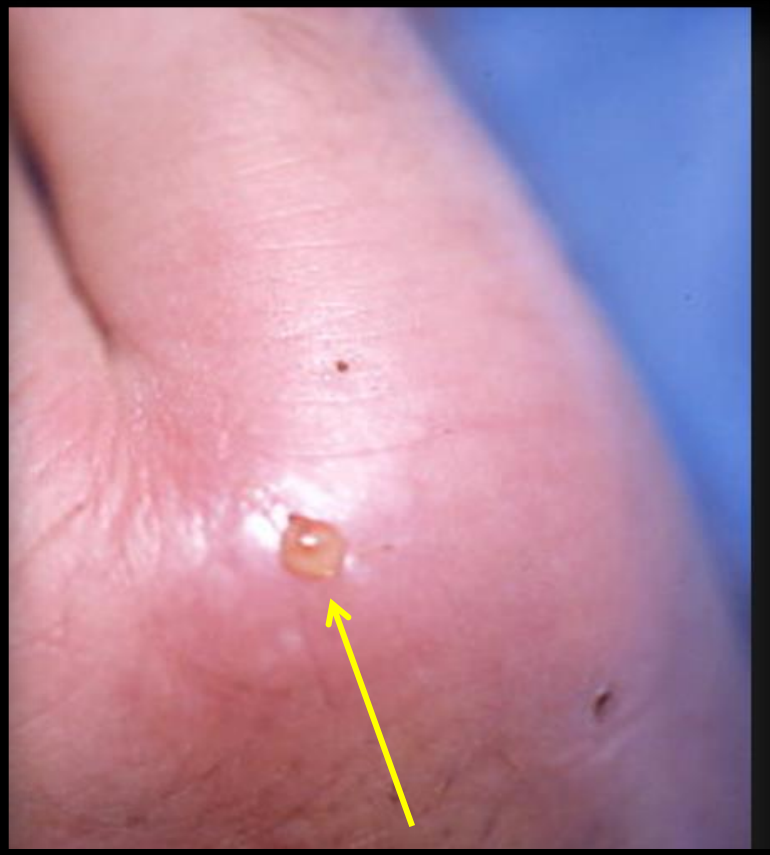
36 year old male

- Puncture wounds to right hand
- Injury occurred 12 hours ago….

**Sister is at the bed side**


According to his sister
Patient Has a history of alcohol abuse
and telling “tall tales”.





## Physical examination

- Significant erythema, edema an induration
- Seemingly : “Puncture” wounds over the first MPC and thenar region
- Significant mucopurulent discharge freely expressed
- Pain seems to be limiting  range of motion of the digit

# “Panther bite”

## Patient story:


The patient lives in the Metro Detroit area…

(11 mile and Schoenherr –Warren Michigan)

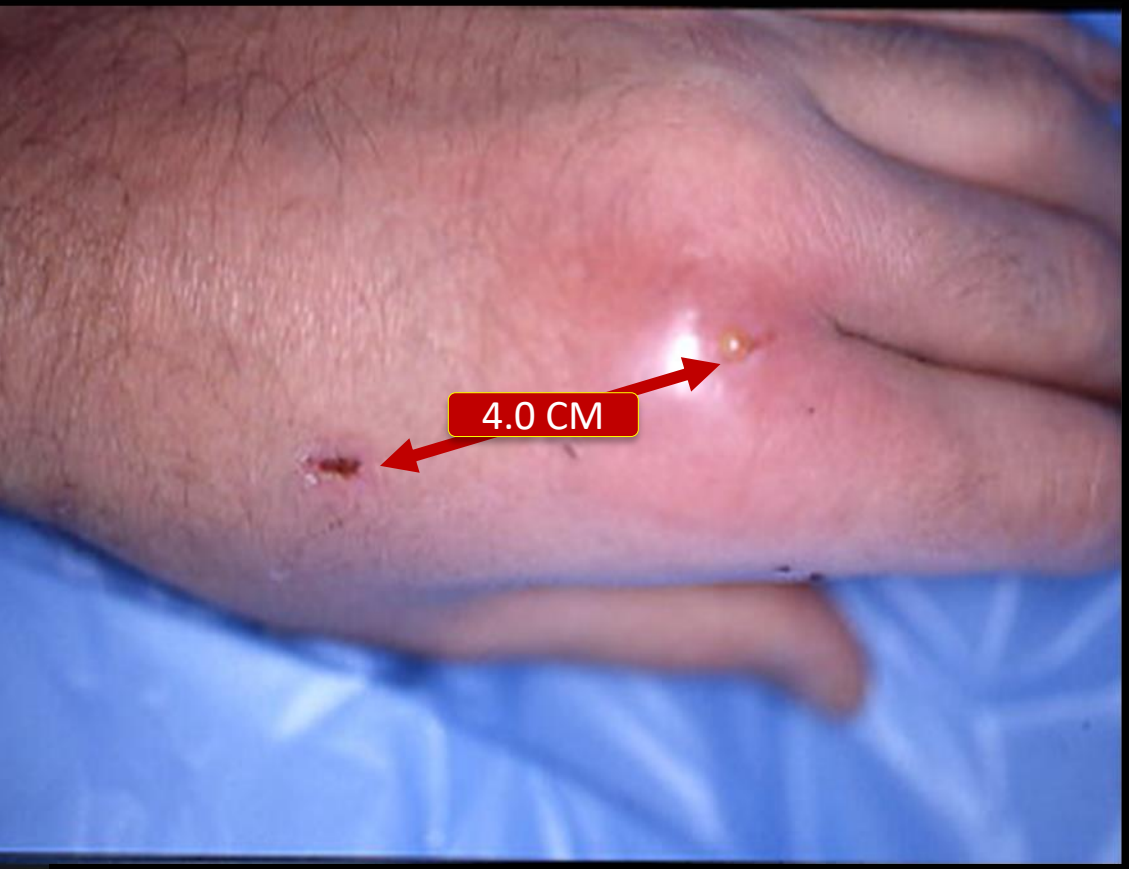
- Has a “pet panther” that lives in his “basement”…

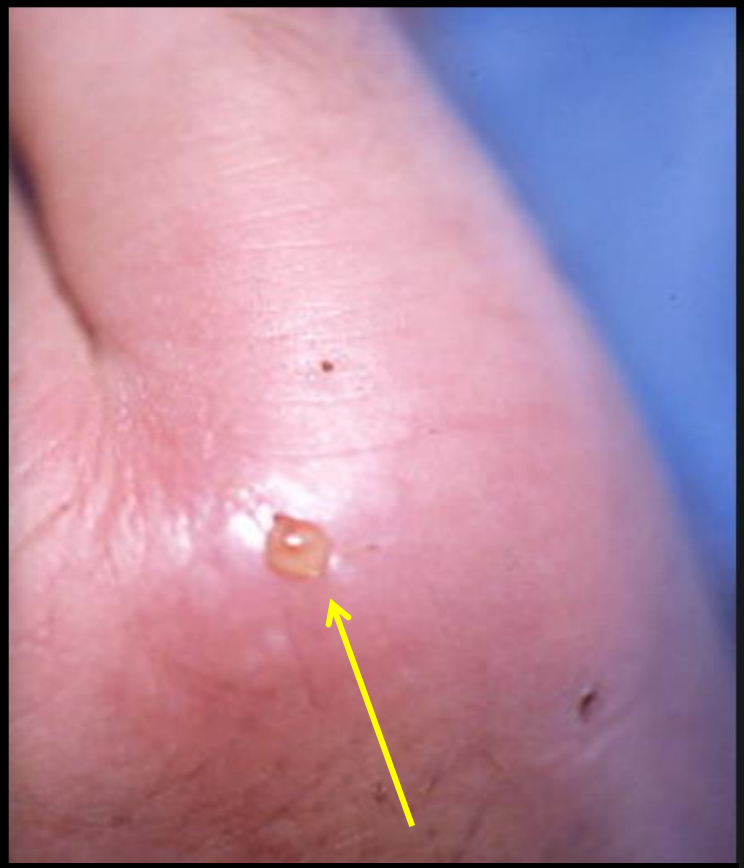
(His sister denies he has a “pet panther”)

“The cat needed to pee….So I let him out in the back yard

He wouldn’t come back inside, so, when I picked him up to bring him into the house, he bit me on the hand”……

**Provoked Vs. non-provoked bite?**



- Note the  space between the puncture wounds (4.0 cm)
- Identical “spaced” marks on palmar surface
- Purulent material was a “Gram negative bacteria”
- Organism identified **Pasturella Multocida……**

# Can you Name 6 pathogens that cause infections after a cat bite?

- *Pasteurella species*
- Anaerobic bacteria: e.g., *Fusobacteria*
- *Bartonella henselae*
- Rabies virus
- *S. aureus*
- *Streptococcal species*

- Ampicillin / Sulbactam
- Amoxil / Clavulanate
- Quinolone / Clindamycin

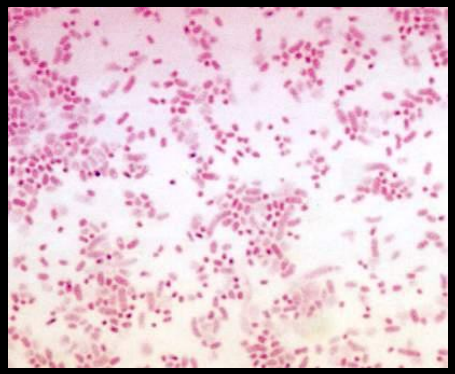
# *P. multocida*

- *P. multocida* is the most common cause of infection from animal injuries.
- Clinically a relatively high WBC
- Generally, a diffuse localized Cellulitis and **purulence** develops rapidly
- Bacteremia-Sepsis can result
- Cellulitis  Osteomyelitis, Endocarditis

Kingdom: Bacteria
Phylum: Proteobacteria
Class: Gamma Proteobacteria
Order : Pasteurellales
Family: Pasteurellaceae
Genus: ***Pasteurella***

**Species**

- ***Pasteurella multocida***

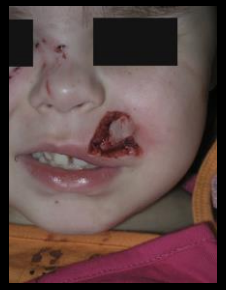


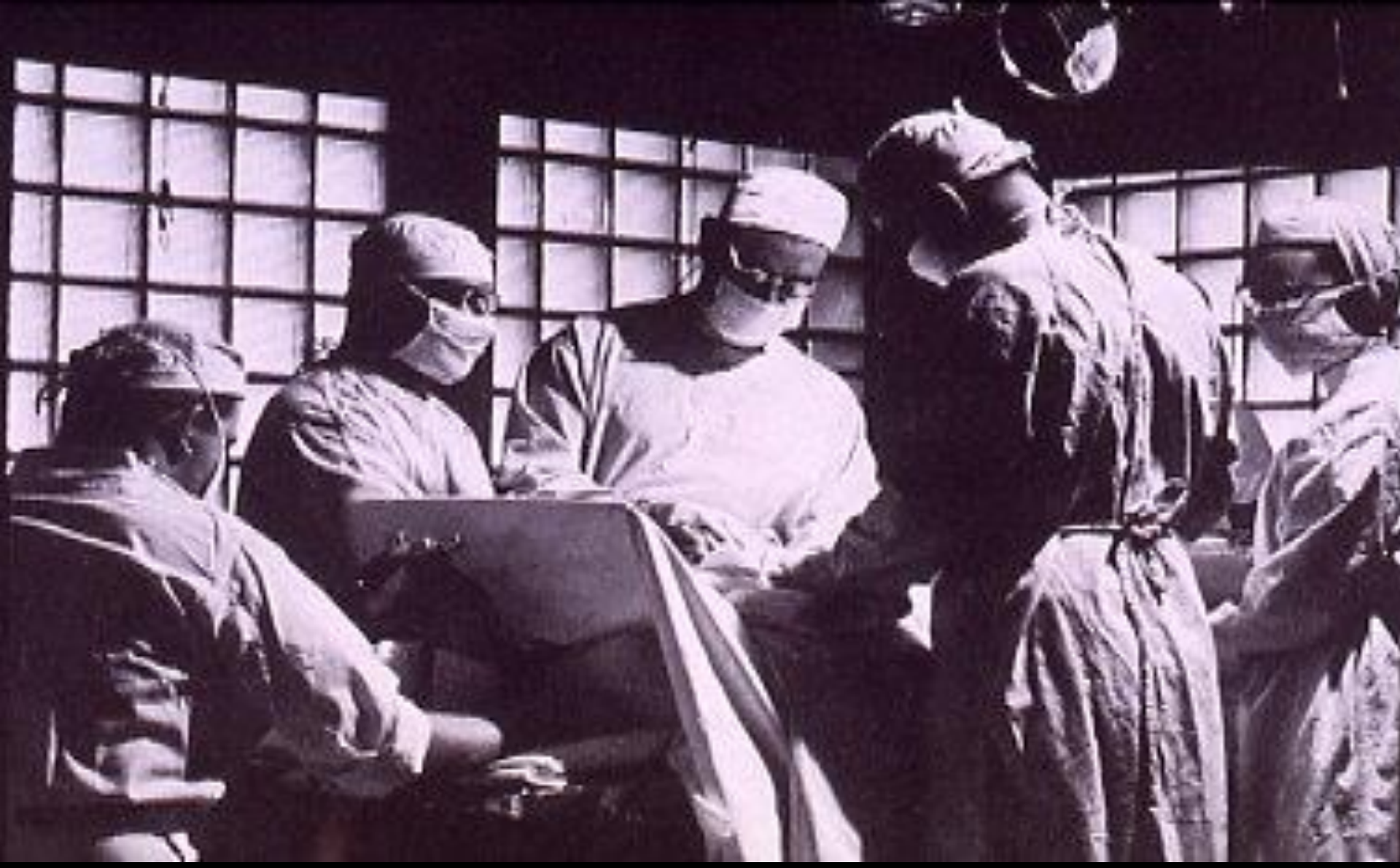
# *Pasteurella* Multocida

## Cat and Dog saliva :

- **CATS: > 90% of Cats (Over 80% of wounds get infected)**
- **DOGS: ~50% of Dogs (Different species), *Pasteurella canis***
  **(Only 2-10% get infected)**

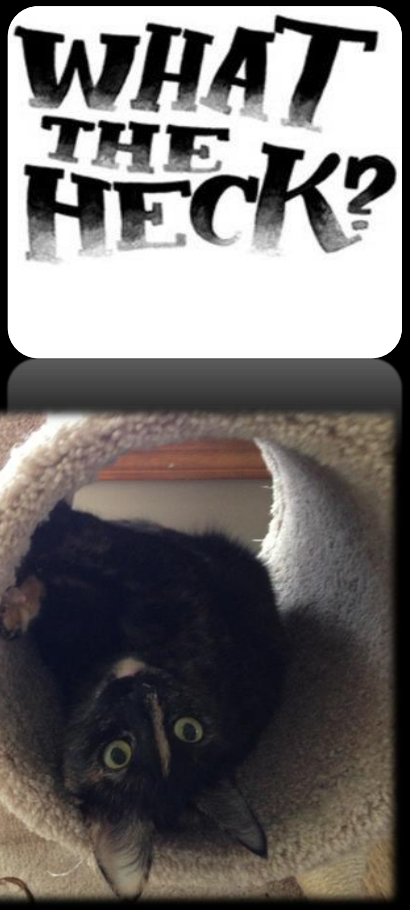
- **Small aerobic Gram-Negative bacillus**
- **Hard to remember antibiotic susceptibility profile,**
  **but amoxicillin sensitive**





- Treated with surgical decompression of the Index finger tendon sheath
- I.V. Unasyn ® (Ampicillin/Silbactam) then P.O Augmentin® (Amoxil/Clavulnate)

# SO……??????




**Is going on here??**

**Local police (Warren)**
**Came to the hospital**

**Looking for the man with a pet "Panther"……**


# THANK YOU!!!!


Thank you!
Baby