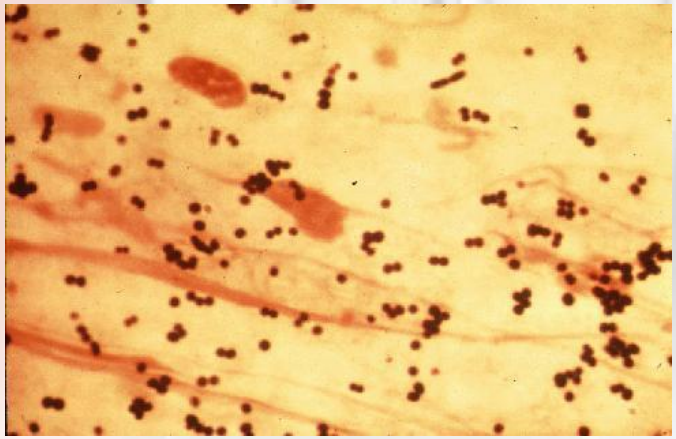
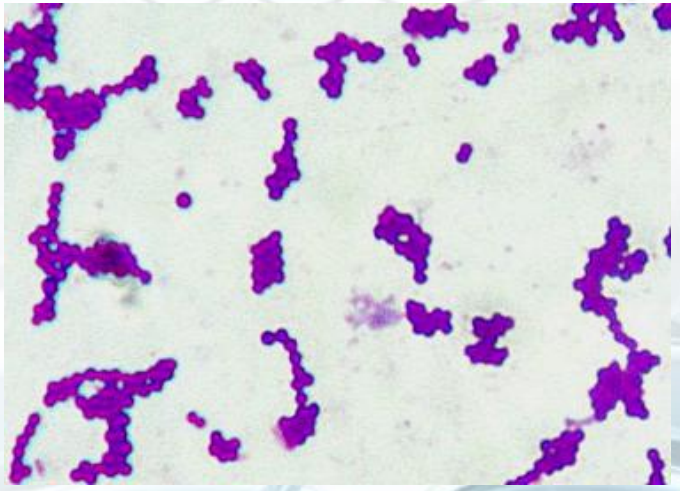
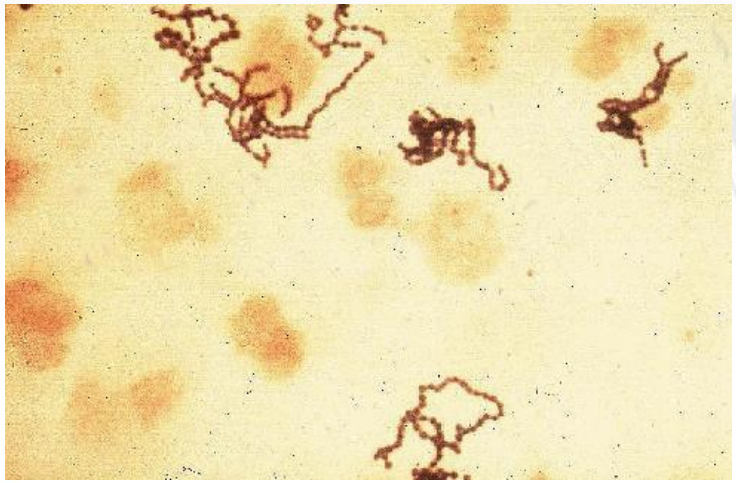
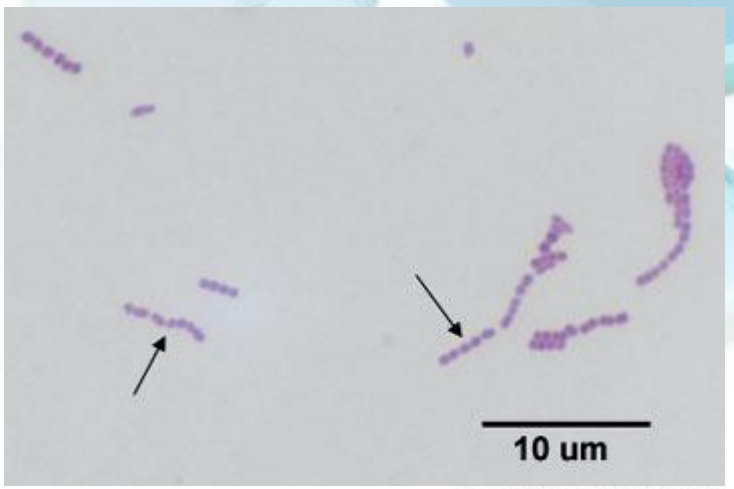
Gram Positive Cocci









Staphylococcus aureus

- *"Staphule"* means grape in Greek
- Toxins are quite the problem:

These are all exotoxins (because its a gram positive so it could not be endotoxin)

  - ✓ Cytotoxins
  - ✓ Haemolysins
  - ✓ Enterotoxin (A-E, G-I)
  - ✓ Exfoliative toxins (ETA, ETB)
  - ✓ Toxic shock syndrome toxin 1 (used to be exotoxin C and enterotoxin F)

Staphylococcus aureus

- Enzymes:

Coagulase is very useful in differentiating between the bad staph and the good one (on skin/breath)

  - ✓ Coagulase (coagulation of fibrin)
    - ✓ made by almost all pathogenic staphylococci
    - ✓ used in laboratory test to differentiate from *S. epidermidis, S. capitis and S. saprophyticus*

  - ✓ Beta-lactamase (penicillinase)
    - ✓ destroys penicillin

Staphylococcus aureus

- Many *S. aureus* strains are found in normal population (~15%)
- Carried in anterior nares, axilla, perineum and hands
- Problem:
  - ✓ 85-90% of strains isolated in hospital are penicillin resistant!!!
  - ✓ Localized purulent infections (pustules, boils, styes, conjunctivitis, otitis, etc.)
  - ✓ Pneumonia, osteomyelitis, septicaemia, endocarditis and impetigo
  - ✓ Food poisoning, toxic shock syndrome, scalded skin syndrome

Staphylococcus aureus

- Important cause of hospital acquired (nosocomial) infections from stitch abcesses, infected wounds, or generalized infections

- Preventative measures include
  - ✓ Aseptic technique in ER and OR, wound precaution
  - ✓ Education of health personnel
  - ✓ Handwashing! Major problem in hospitals

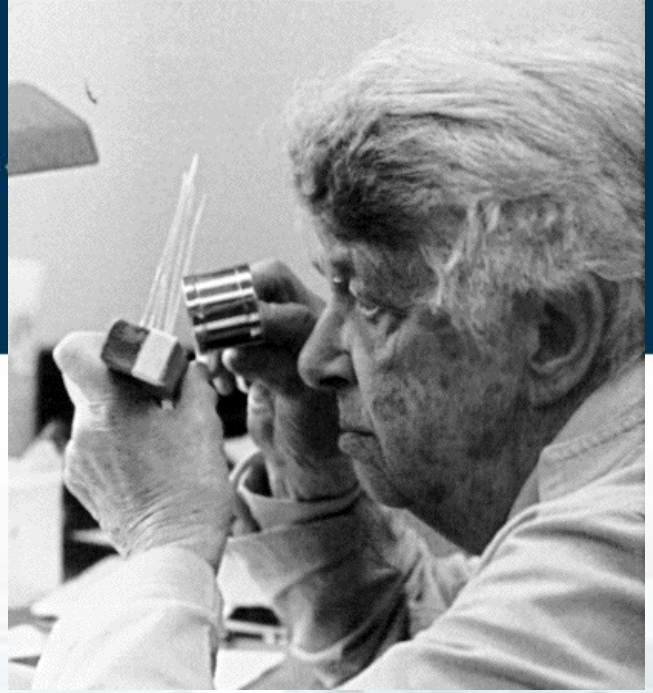
Staphylococcus epidermidis

- Part of normal skin/mucous membrane flora
- Non-pathogenic, except in compromised patients where can cause post-operative infections (brain, open heart, endocarditis, shunt infections)
- Considered an opportunistic pathogen

Streptococci

Difference between staph and strep?

Both gram positive circles



Rebecca Craighill Lancefield (1895-1981)

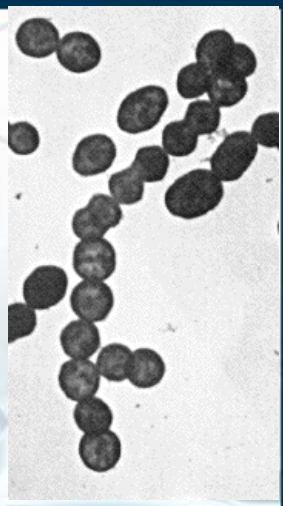
- Arranged in pairs or forming chains
- "streptos" - Greek word for twisted
- subdivided into "groups" based on
  - haemolytic properties (alpha, beta)
  - carboydrate C antigen (Lancefield classification)
  - M-protein
    - divides beta-haemolytic
    - mostly group A

Streptococcus pyogenes

- Group A, beta-hemolytic, *S. pyogenes* causes:
  - ✓ acute tonsillitis (strept throat) – can lead to rheumatic heart disease
  - ✓ impetigo, cellulitis, etc. (skin infections)
  - ✓ fever and septicaemia
- Caused by toxins Endotoxins
  - ✓ streptolysins (O and S)
    - neutrophils and macrophages
  - ✓ streptococcal pyrogenic exotoxins (Spes)
    - scarlet fever rash

Streptococcus pyogenes

- Enzymes
  - hyaluronidase (helps spreading of bacteria)
- Virtually all are penicillin G *sensitive* (vs. *S. aureus*)!!!
- Education of health personnel
- Aseptic obstetric procedures
- Early detection and treatment



Canada

Flesh-eating disease … aka

Necrotizing fasciitis

- *Streptococcus pyogenes* culprit
- Does not actually "eat" anything
- Toxin is responsible for damage

- Research indicates that
  - hijacking human plasminogen from blood, attach to surface and activate it into protease…good for spreading…
  - bacteriophage has gene encoding for enzyme allowing bacteria to escape entrapment and killing by neutrophils (white blood cells)

Streptococcus agalactiae

- Group B
- Found in vagina of health women (can cause neonatal infections)
  - ✓ early septicaemia
    - respiratory distress or shock at birth
    - high fatality rate (serious)
  - ✓ delayed meningitic form
    - 1-12 weeks post-partum
    - sequelae

Other Streptococci

Doesn't ask too much about this

Streptococcus faecalis

- Group D, aka Enterococcus
- Part of normal flora of GI-tract
- Prey on compromised individuals ☹

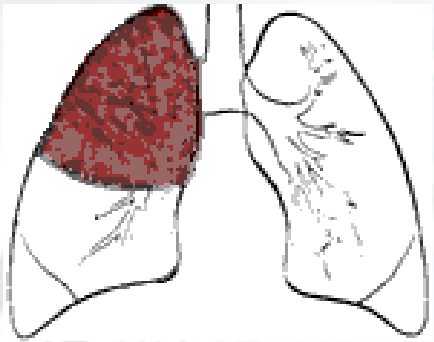
Viridens streptococci

- Found in oral cavity of health individuals
- Can cause endocarditis in individuals with damaged heart valves

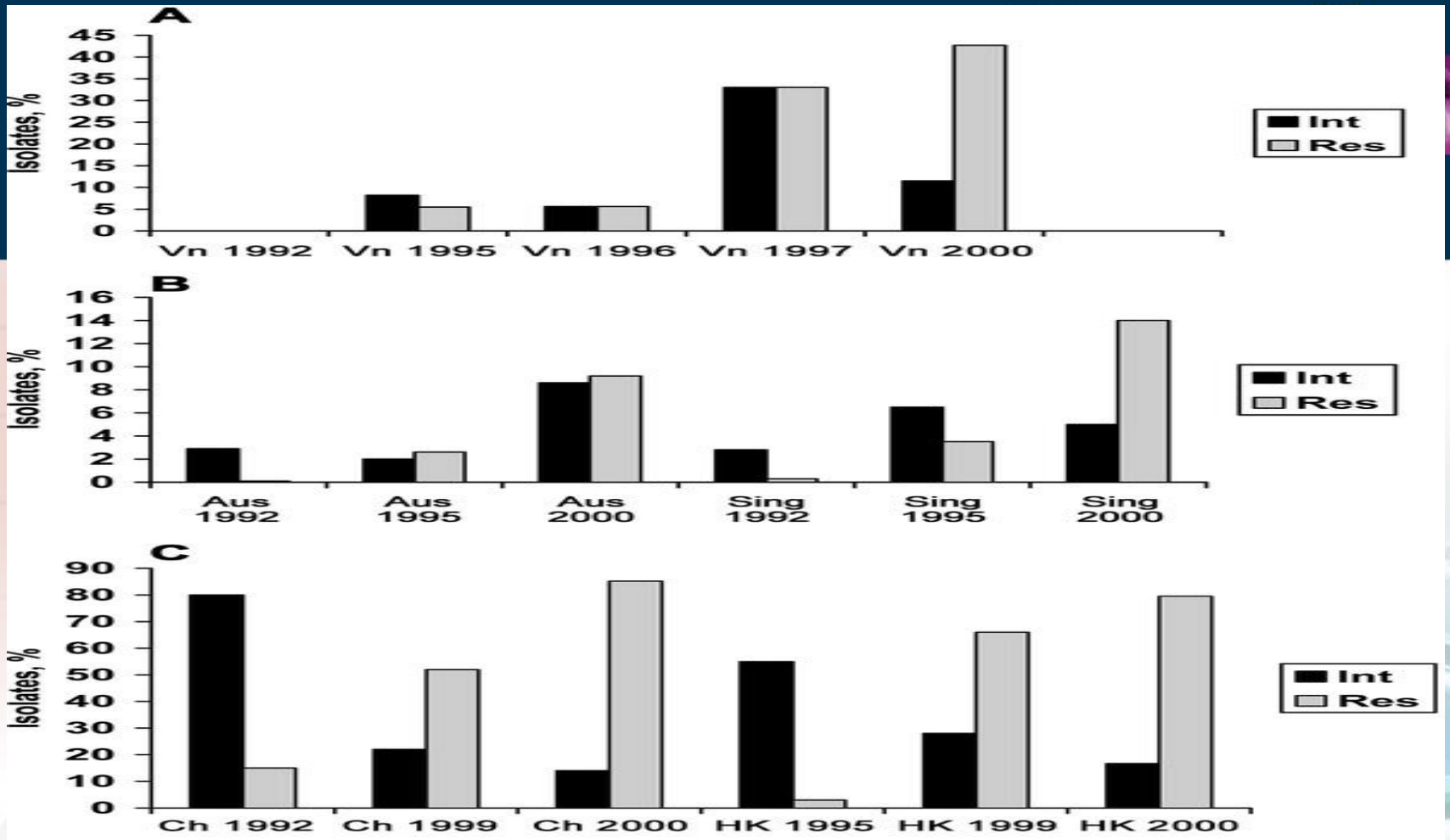
Streptococcus pneumoniae

Know a lot about this

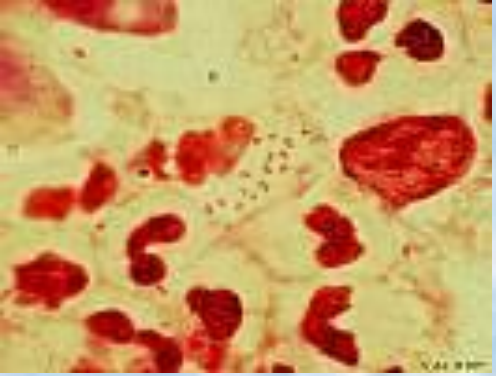
- Also known as pneumococcus - you can vaccinate against this
- Polysaccharide capsule has antiphagocytic properties
  - ✓ ~90 distinct capsular serotypes
- Found in naso-pharynx of healthy individuals
- Can cause
  - ✓ lobar pneumonia
  - ✓ meningitis



- Prevention strategies (elderly, alcoholics, crowded living, vaccination)



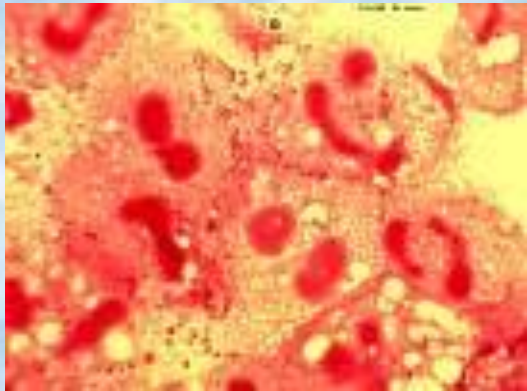
Evolution of quinolone resistance in selected countries in the World Health Organization Western Pacific Region, in *A,* Vietnam (Vn); *B,* Australia (Aus) and Singapore (Sing); *C,* China (Ch) and Hong Kong Special Administrative Region (HK). Int, intermediate, less susceptible to ciprofloxacin (MIC, 0.12-0.5 mg/L); Res, resistant to ciprofloxacin (MIC, 1 mg/L) (Antibiotic Resistance in *Neisseria gonorrhoeae*, J.W. Tapsall, *Clinical Infectious Disease*, 2005)



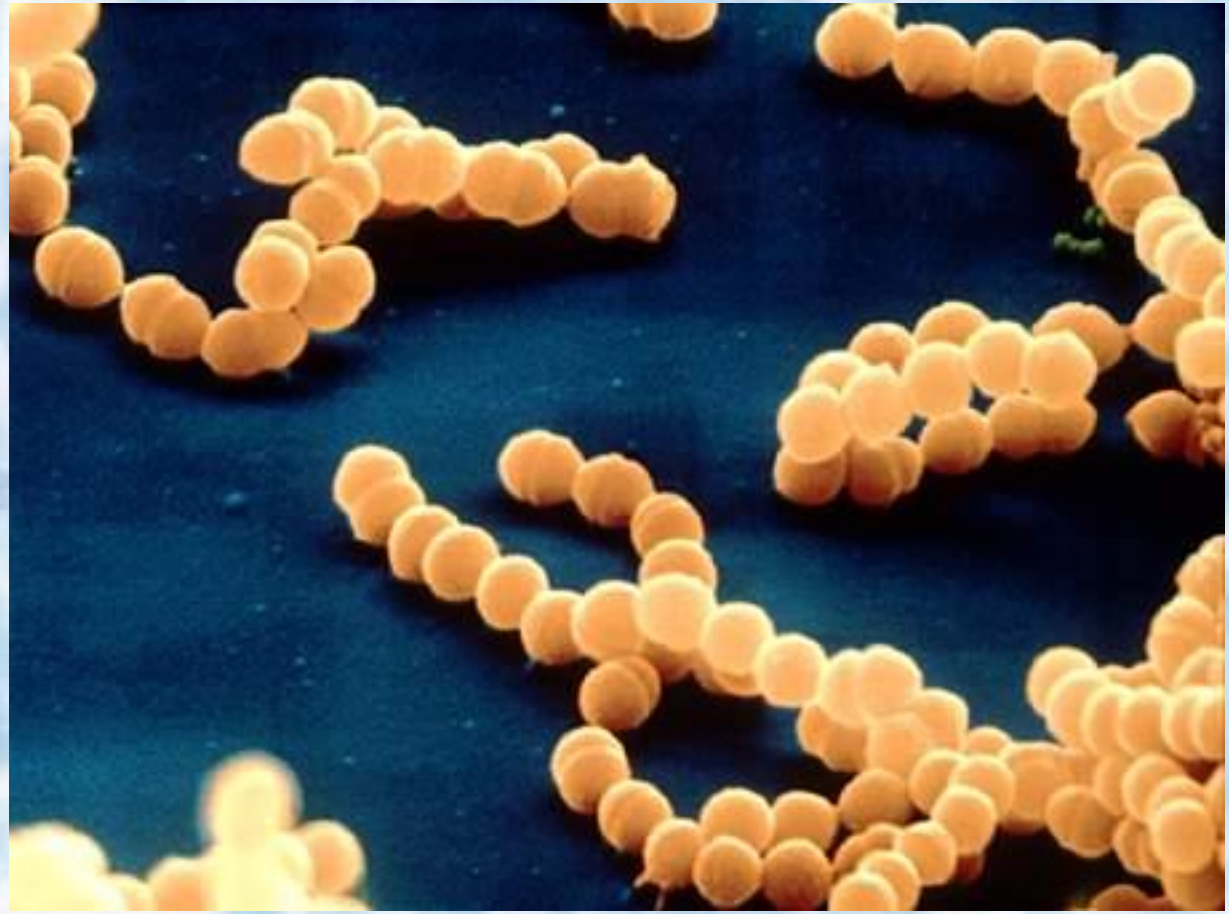
Neisseria gonorrhoeae

Gram Negative Cocci

Neisseria meningitidis



NEISSERIA MENINGITIDIS



N. meningitidis

- Gram negative diplococci What else is a diplococci? - strep something
- Laboratory isolation using chocolate agar, 5-10% CO_2, 37 C
  - use selective media (i.e., Thayer-Martin) when isolating from nasopharynx
- Frequently found in the naso-pharynx of healthy individuals
- Antiphagocytic polysaccharide capsule
  - 13 different serogroups
  - A, B, C, X, Y and W135 most prevalent

N. meningitidis

- Carriers can occasionally develop infection or pass organism to non-immune individuals who develop infection

- Only infects humans!!!
  - usually children or those living in crowded living quarters
  - occasional epidemics

- Infection can result in
  - Meningitis
  - Septicaemia (starts as skin rash)
  - Waterhouse-Friderichsen Syndrome (complication of septicaemia…most severe form of septicaemia by *N. meningitidis*)

Meningitis Baby Watch

Tense or bulging soft spot

High temperature

Very sleepy/staring expression/too sleepy to wake up

Is your baby getting worse fast? Babies can get ill very quickly, so check often.

Vomiting/refusing to feed

Irritable when picked up, with a high pitched or moaning cry

Breathing fast/ difficulty breathing

Blotchy skin, getting paler or turning blue

Extreme shivering

A stiff body with jerky movements, or else floppy and lifeless

'Pin prick' rash/marks or purple bruises anywhere on the body

Sometimes diarrhoea

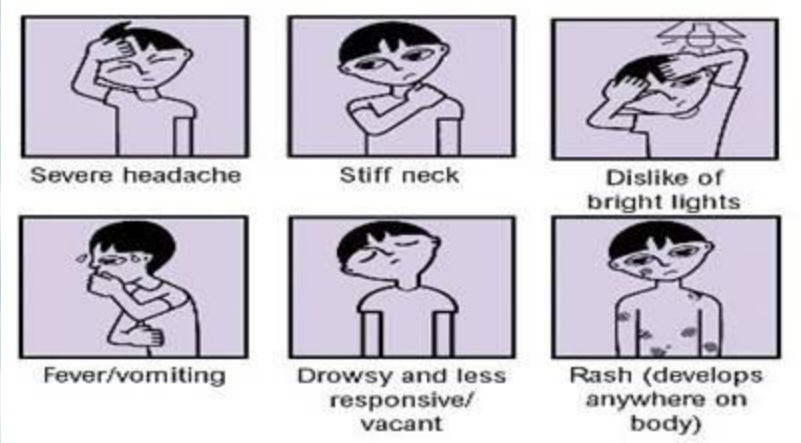
Cold hands and feet

…first described in 1894 by Arthur Francis Voelcker (1861-1946)

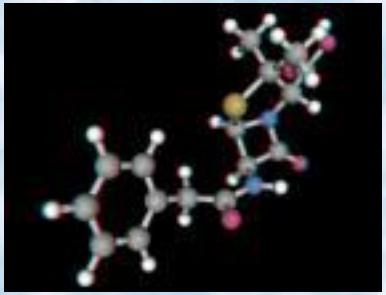
…then in 1901 by the British dermatologist Ernest Gordon Graham Little (1867-1950).

It was first reported as an entity by Waterhouse in 1911, and the subject was comprehensively reviewed in 1918 by the Danish paediatrician Carl Friderichsen

….so it was called Waterhouse-Friderichsen syndrome…



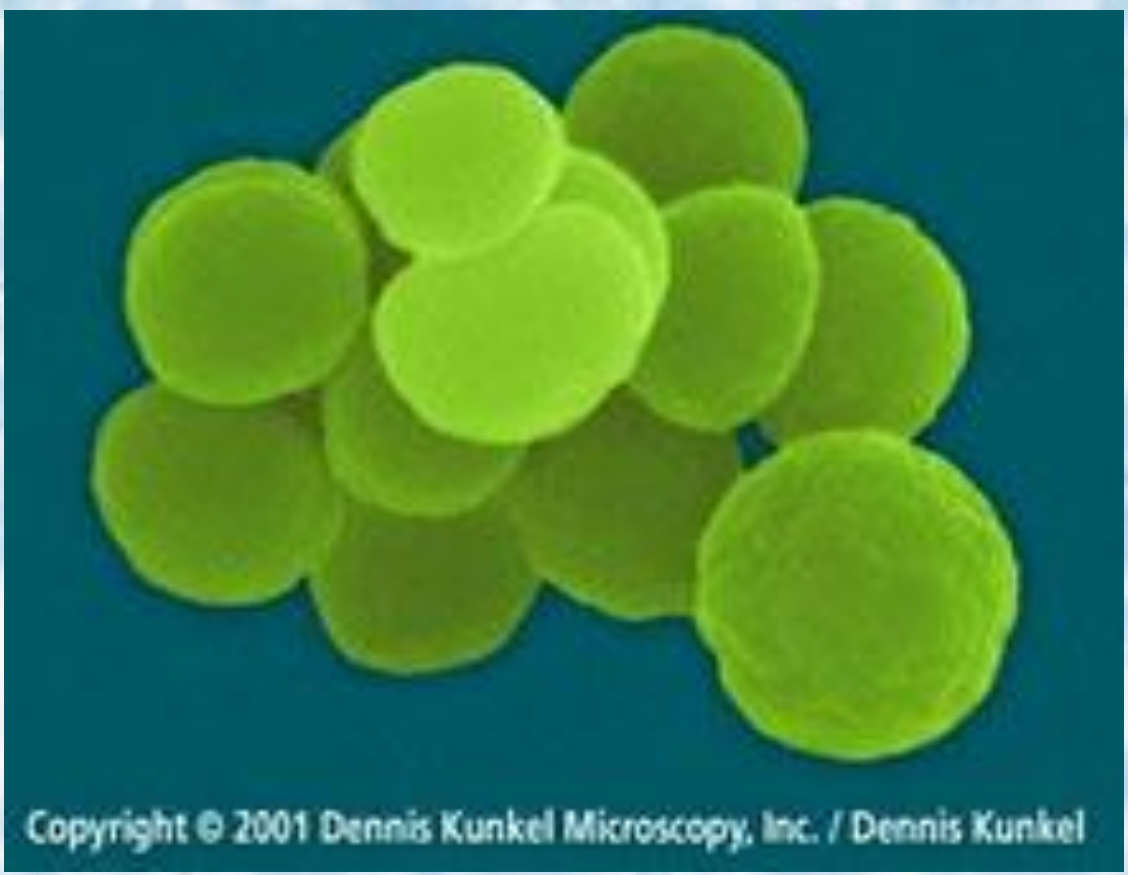
Prevention and Treatment



- Penicillin is primary antibiotic used

- Vaccination is recommended for children (11-12 years), teenagers and college/university students living in dormitories
  - Conjugated vaccine for serogroups A, C, Y and W135
  - Now have meningococcus vaccine for infants at 2-5 months (serogroup C)

Neisseria gonorrhoeae

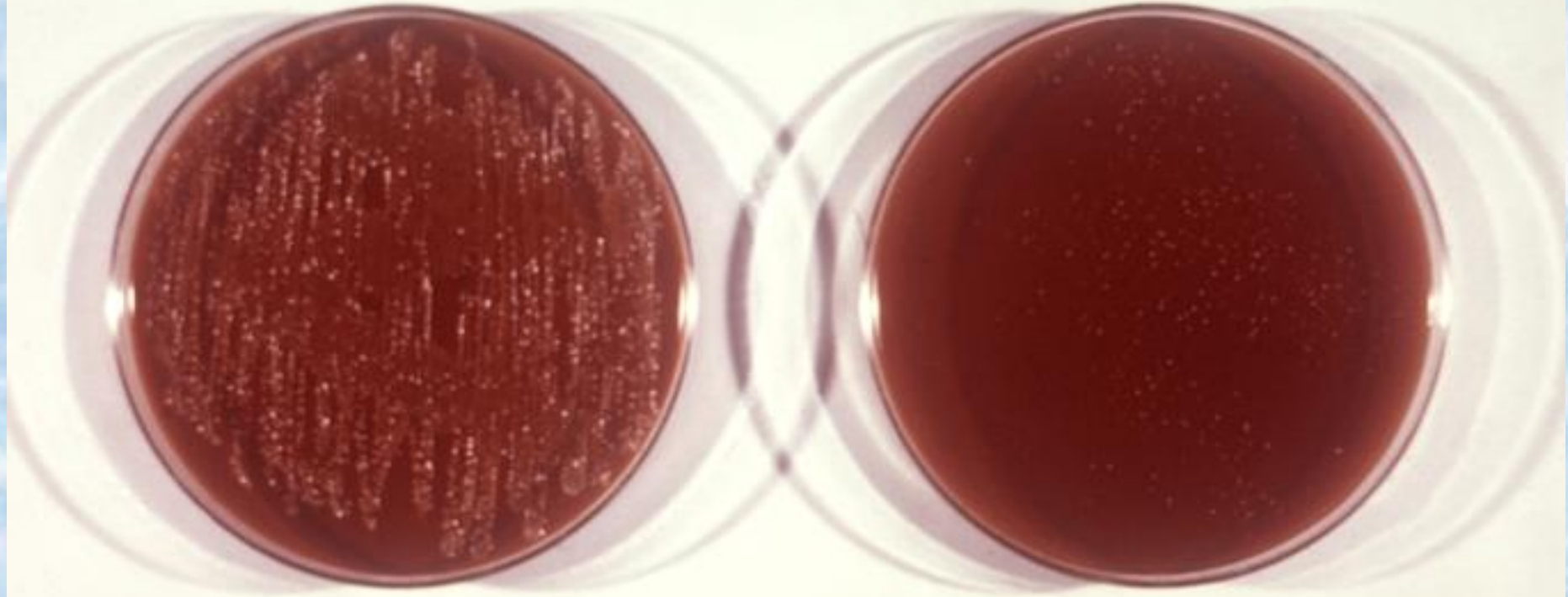


N. gonorrhoeae

- Gram negative diplococci, 0.6-1μm in diameter
- In a clinical lab, grow on Thayer-Martin plates, in damp environment with CO_2
  - VERY sensitive to drying and changes in temperature
- Causative agent of STD gonorrhea
- In US, it is the second highest reported STD, after chlamydia
  - >350,000 cases/year reported in the US (2001)
  - Number of cases is now decreasing every year

Rectal Specimen

(Testing for *Neisseria gonorrhoeae*)



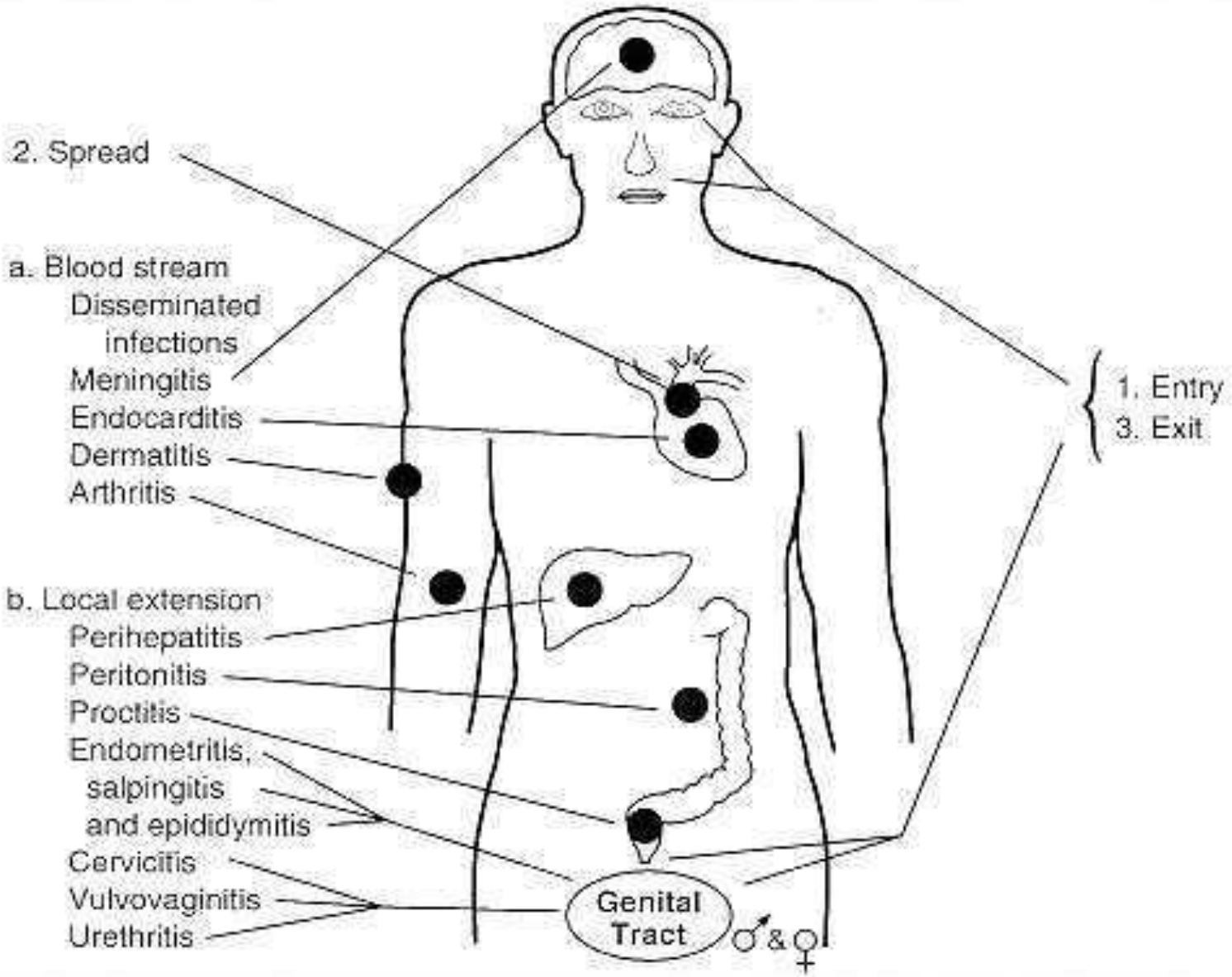
Chocolate Medium
Overgrowth

Thayer-Martin Medium
***Neisseria* Only**

N. gonorrhoeae

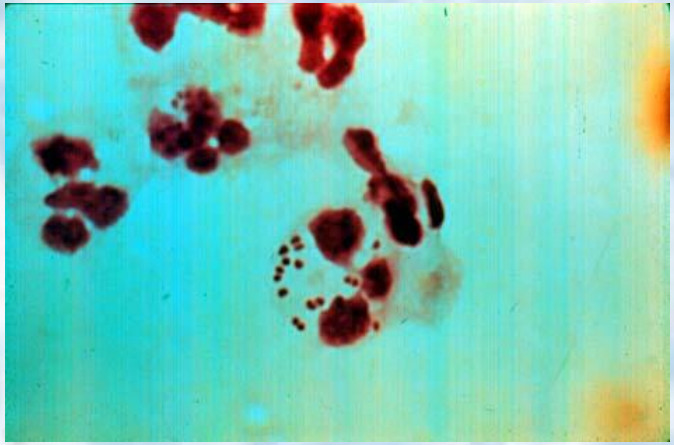
- Clinical gonorrhea
  - **MEN**: causes acute infection of urethra (90-95%)
  - **WOMEN**: 50% are ASYMPTOMATIC!!!
    - Cervicitis
    - If untreated can cause PID, sterility
- Disseminated Gonococcal Infection (DGI)
  - 1-3% cases, usually women
  - Fever, skin infection, arthritis
- Neonatal infections
  - Rare, but newborns can acquire infection from mother during birth
  - Causes gonococcal ophthalmia neonatorum (acute purulent conjunctivitis)

Clinical manifestations of *N. gonorrhoeae*



N. gonorrhoeae

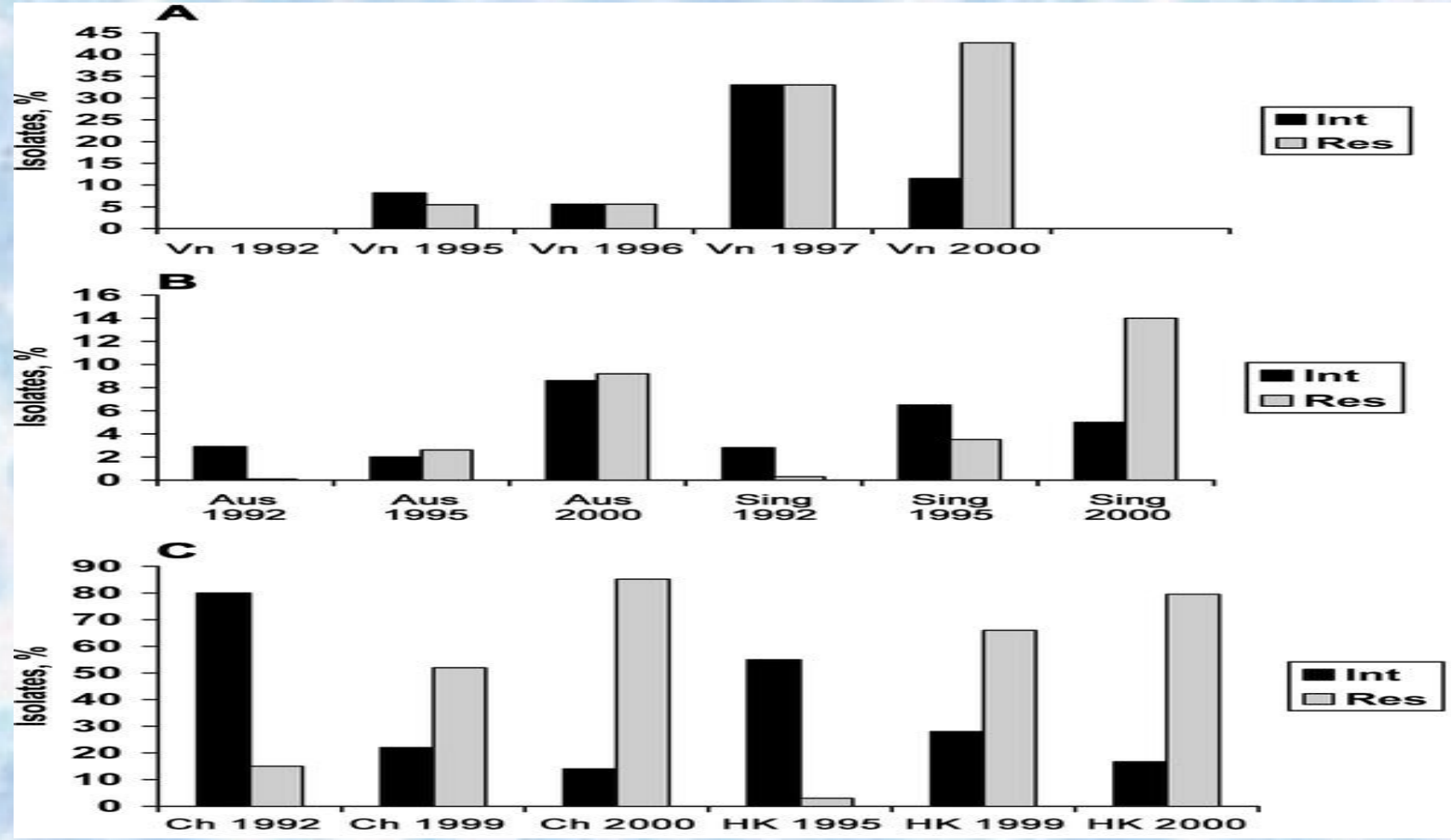
- **DIAGNOSIS**
  - **MEN**: use microscopy to directly observe swabs of urethral discharge
  - **WOMEN**: culture is necessary from endocervical, urethral and anal swabs



Urethral smear with intracelllar G-ve diplococci

N. gonorrhoeae

- **PREVENTION and TREATMENT**
  - **Penicillin resistance is emerging (South-East Asia, West Africa, Canada and US)**
  - **Treat using ceftriaxone, cefixime, ciprofloxacin or ofloxacin combined with doxycycline/azithromycin**
  - **Resistance to ciproflaoxacin (quinolones) emerging**
  - **SIMULTANEOUS treatment of partners is ESSENTIAL**
  - **No vaccine available**



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A feature used for laboratoey diagnosis of strepticocci is:
a) they are all beta haemolytivc
b) they are usually arranged in pairs or chains
c) penicillin resistance
d) they all produce hyaluronidase

The Lancefeild groups are used to distinguish what?
a) antigens of streptocci
b) antigens of streptococcal toxins
c) antigens of staphylocci
d) antigens of gram positive