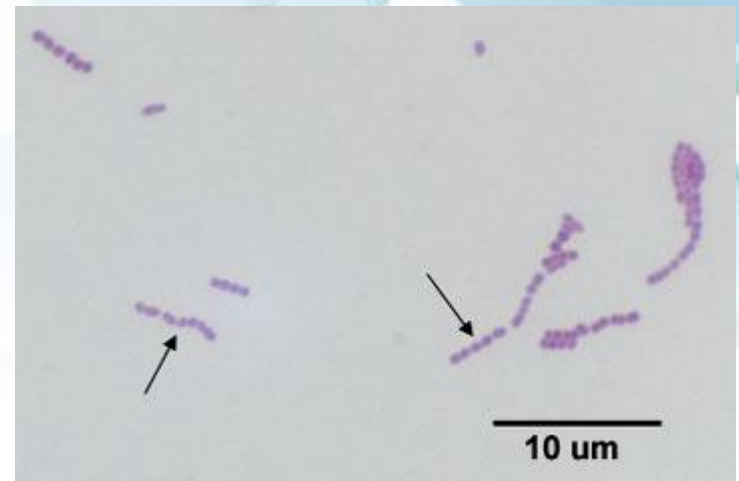
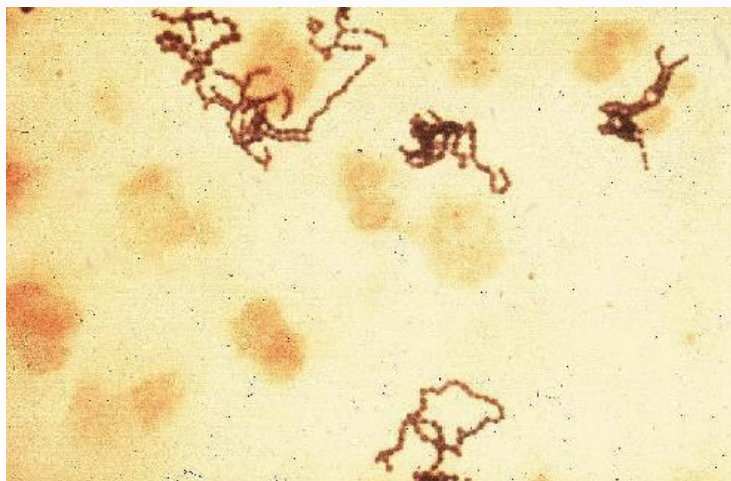
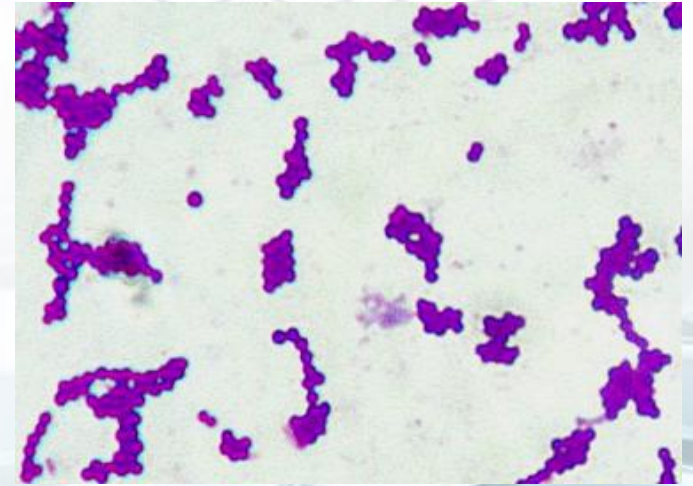
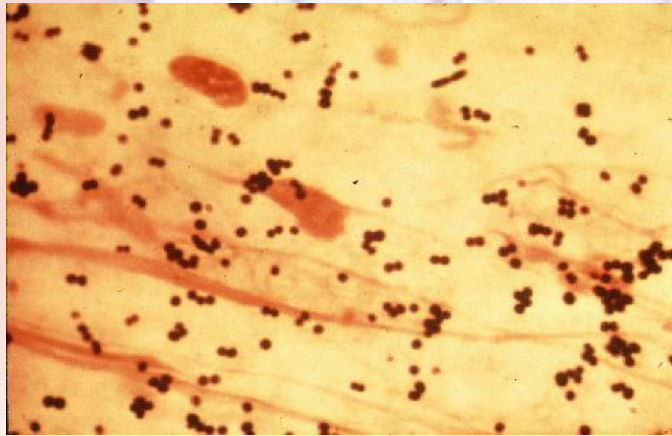


Gram Positive Cocci



Staphylococcus aureus



- “Staphule” means grape in Greek
- Toxins are quite the problem:
 - ✓ 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

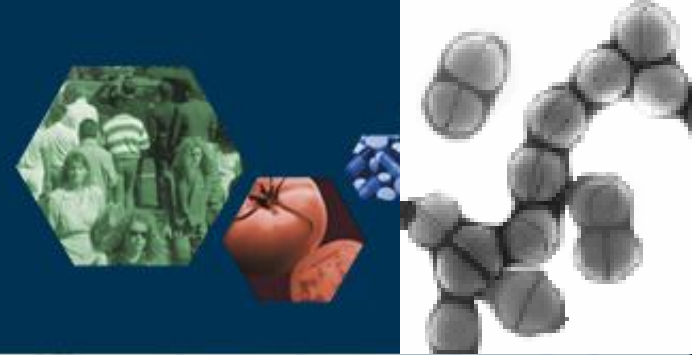


➤ Enzymes:

- ✓ Coagulase (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
 - ✓ Food poisoning, toxic shock syndrome, scalded skin syndrome

Staphylococcus aureus



- Important cause of hospital acquired nosocomial infections from stitch abscesses, infected wounds, or generalized infections
- Preventative measures include
 - ✓ Aseptic technique in ER and OR, wound precaution
 - ✓ Education of health personnel
 - ✓ Handwashing!



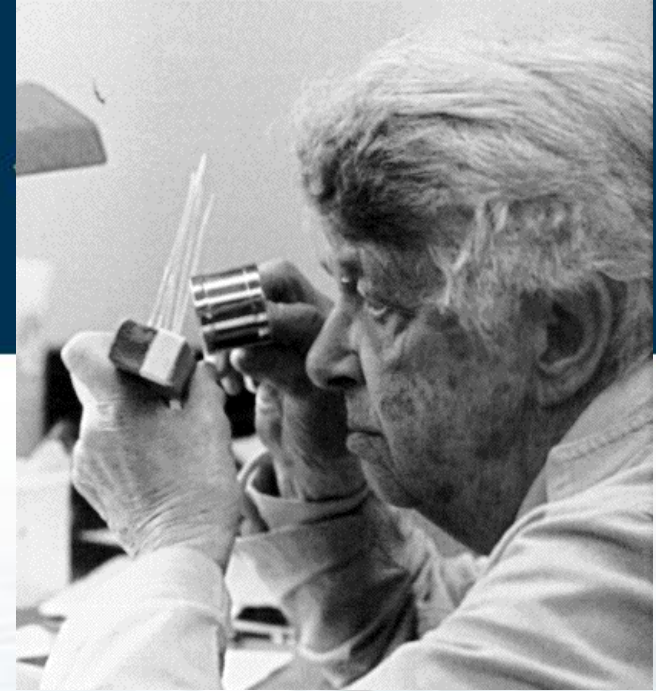
Staphylococcus epidermidis



- 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

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



Rebecca Craighill Lancefield
(1895-1981)

Streptococcus pyogenes



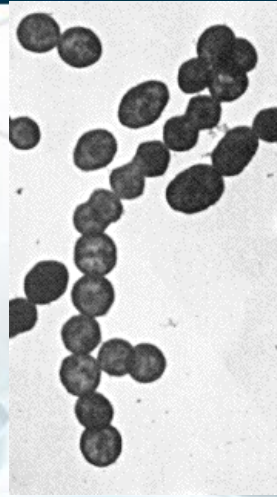
- Group A, beta-hemolytic, *S. pyogenes* causes:
 - ✓ acute tonsillitis (strept throat) – can lead to rheumatic heart disease
 - ✓ impetigo, cellulitis, etc. (skin infections)
 - ✓ fever and septicaemia
- Caused by toxins
 - ✓ streptolysins (O and S)
 - neutrophils and macrophages
 - ✓ streptococcal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



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



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

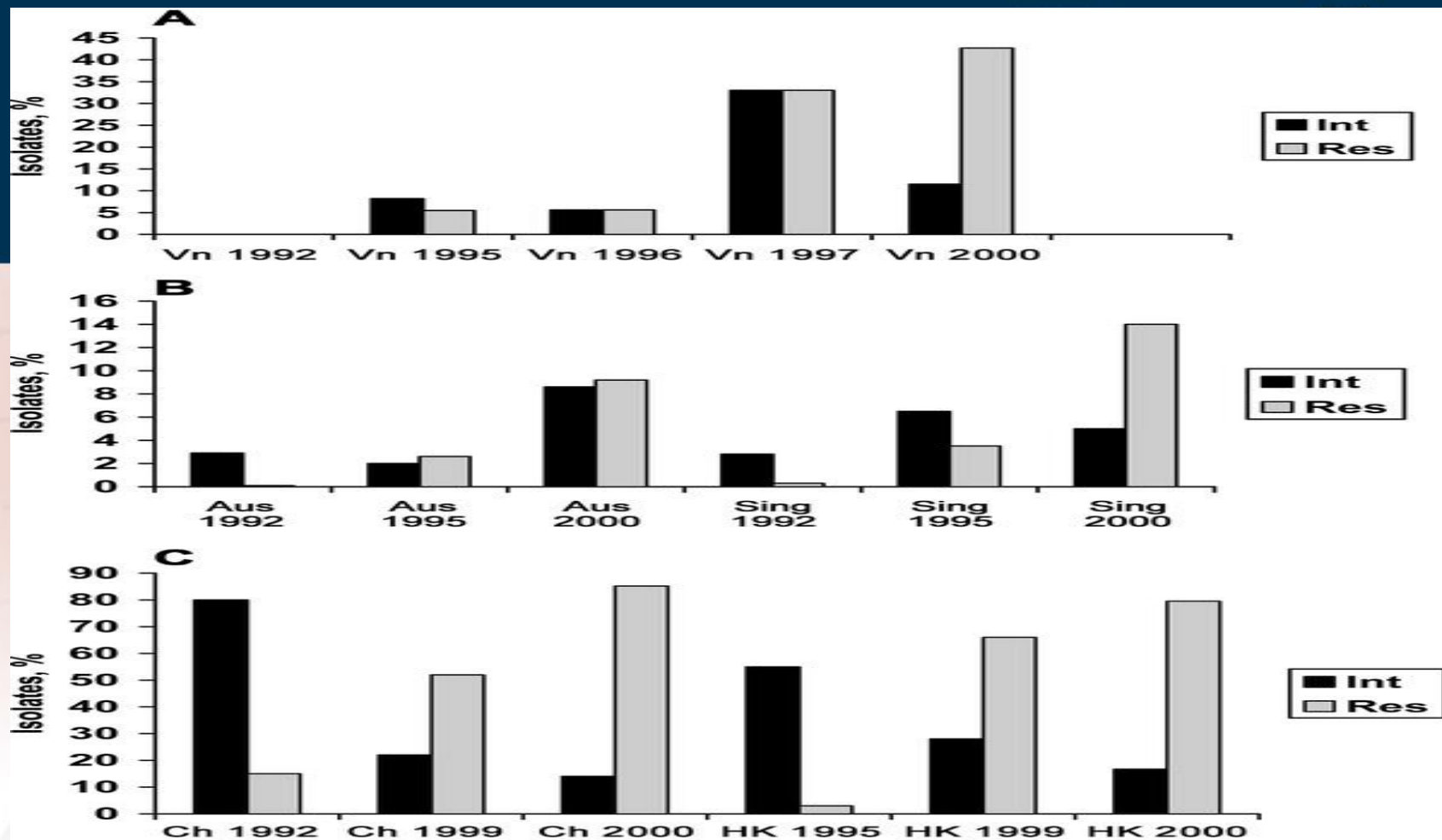


Streptococcus pneumoniae



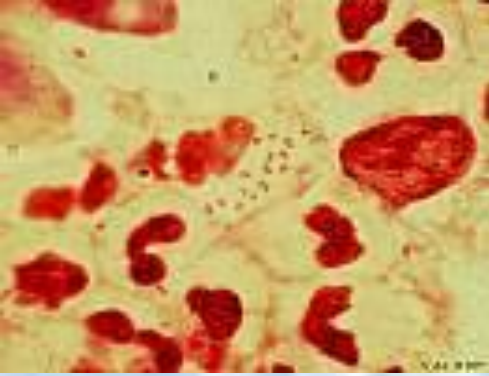
- Also known as pneumococcus
- Polysaccharide capsule has antiphagocytic properties
 - ✓ ~90 distinct capsular serotypes
- Found in naso-pharynx of healthy individuals
- Can cause
 - ✓ lobar pneumonia
 - ✓ meningitis
- Prevention strategies (elderly, alcoholics, crowded living, vaccination)





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)

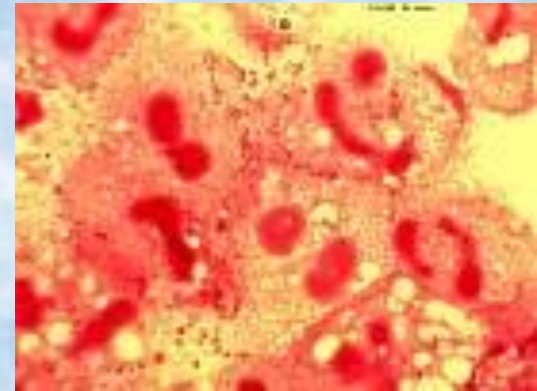




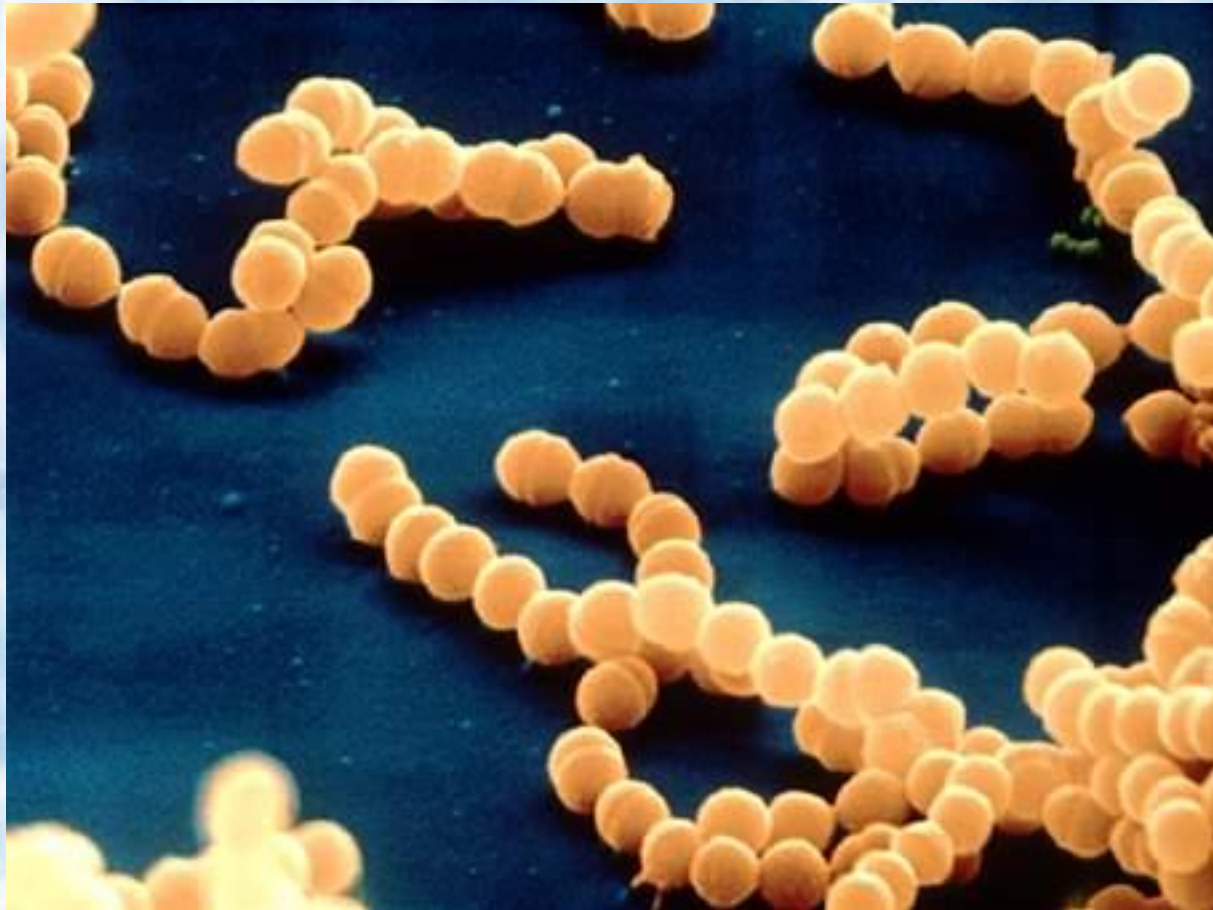
Neisseria gonorrhoeae

Gram Negative Cocci

Neisseria meningitidis



NEISSERIA MENINGITIDIS



N. meningitidis



- ❖ Gram negative diplococci
- ❖ Laboratory isolation using chocolate agar, 5-10% CO₂, 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

Breathing fast/difficulty breathing

Extreme shivering

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

Sometimes diarrhoea

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

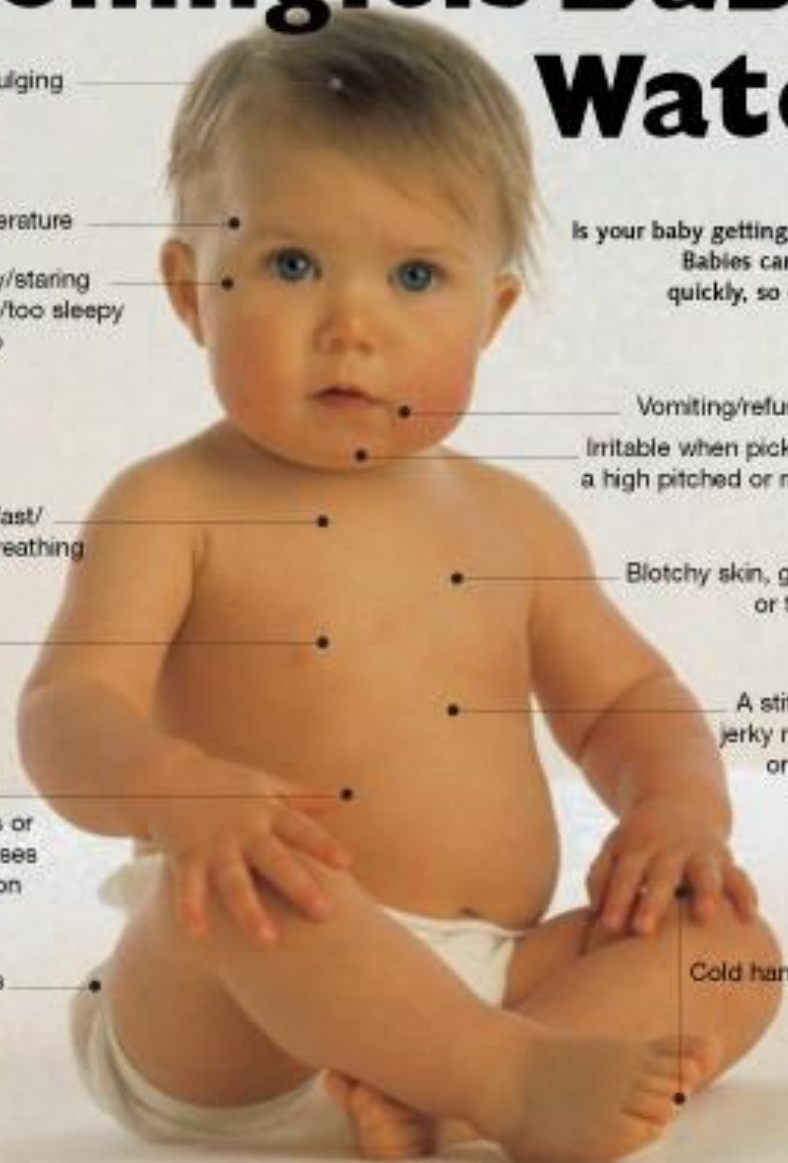
Vomiting/refusing to feed

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

Blotchy skin, getting paler or turning blue

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

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...



Severe headache



Stiff neck



Dislike of bright lights



Fever/vomiting



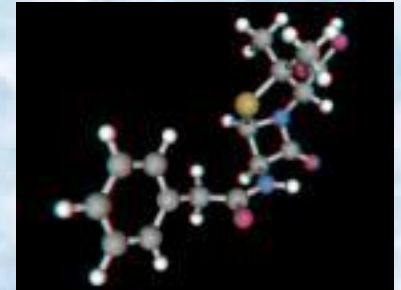
Drowsy and less responsive/
vacant



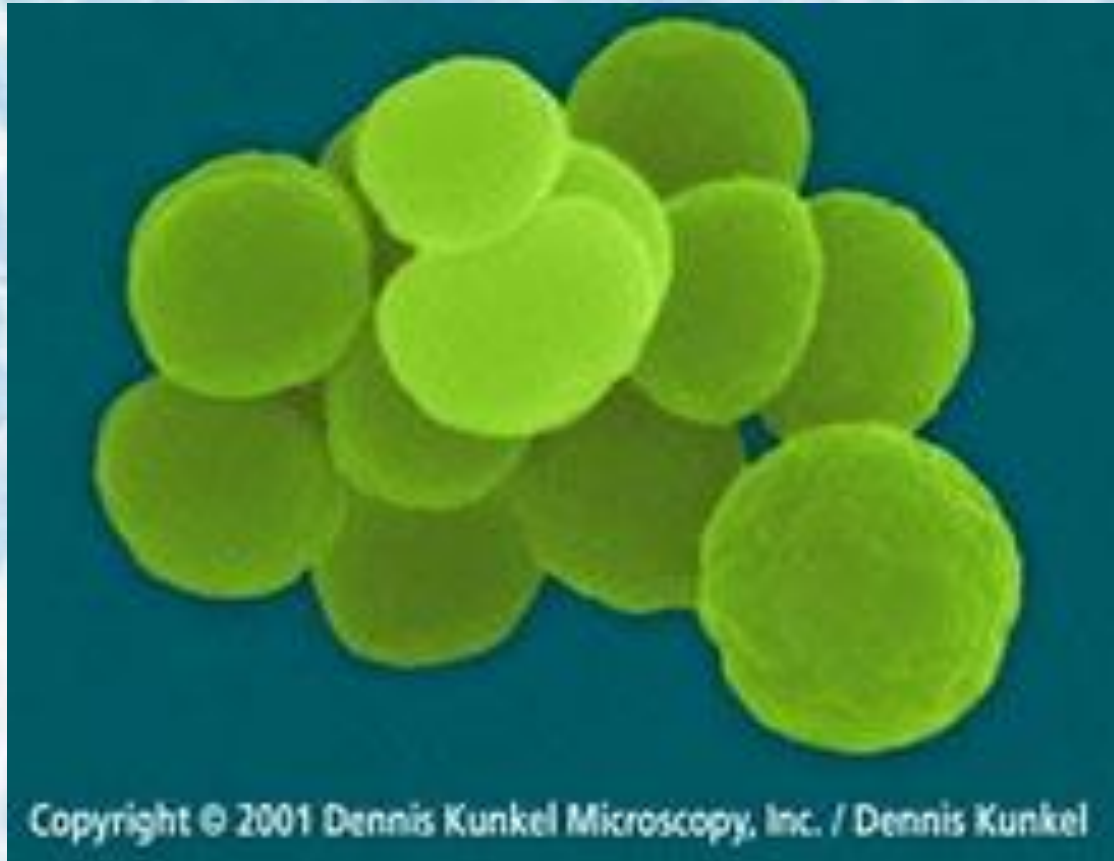
Rash (develops anywhere on
body)

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



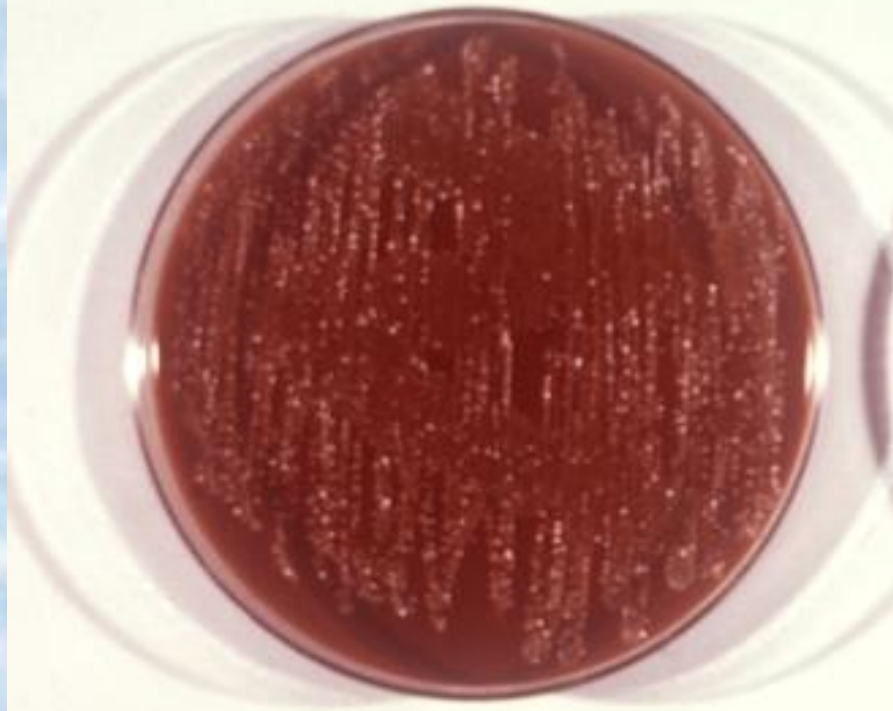
N. gonorrhoeae



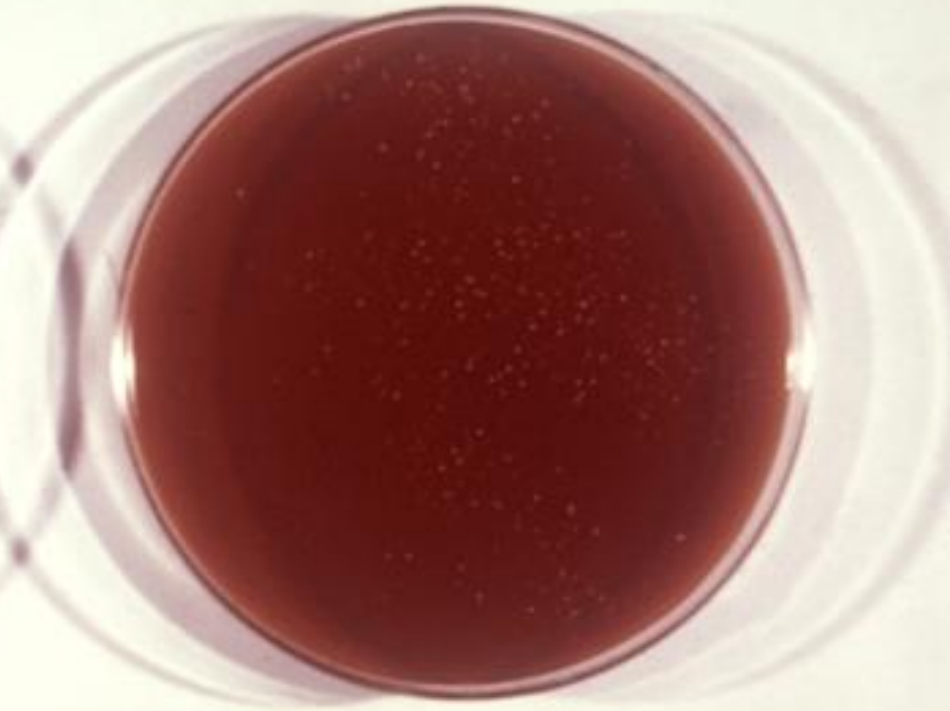
- ❖ Gram negative diplococci, 0.6-1µm in diameter 
- ❖ In a clinical lab, grow on Thayer-Martin plates, in damp environment with CO₂
 - VERY sensitive to drying and changes in temperature
- ❖ Causative agent of STD gonorrhea
- ❖ In US, it is the second highest reported STD, after chlamydia
 - >350,000 cases/year reported in the US (2001)
 - Number of cases is now decreasing every year

Rectal Specimen

(Testing for *Neisseria gonorrhoeae*)

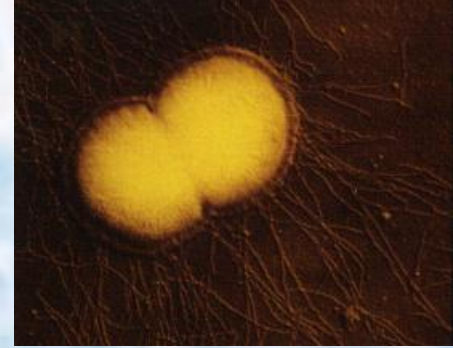


Chocolate Medium
Overgrowth




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

N. gonorrhoeae



❖ Clinical gonorrhoea

- **MEN**: causes acute infection of urethra (90-95%)
- **WOMEN**: 50% are ASYMPTOMATIC!!! 
- Cervicitis
- If untreated can cause PID, sterility

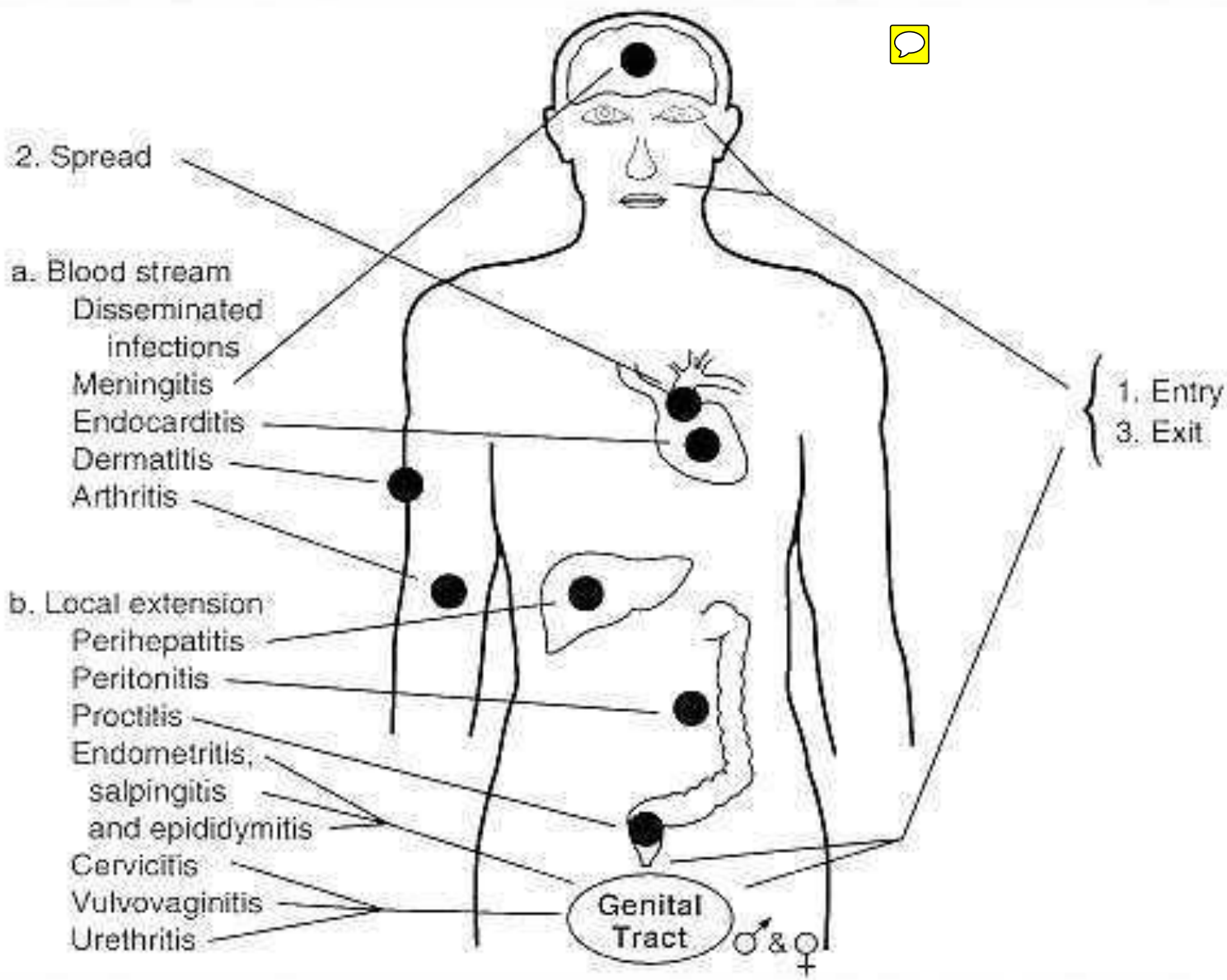
❖ Disseminated Gonococcal Infection (DGI)

- 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)

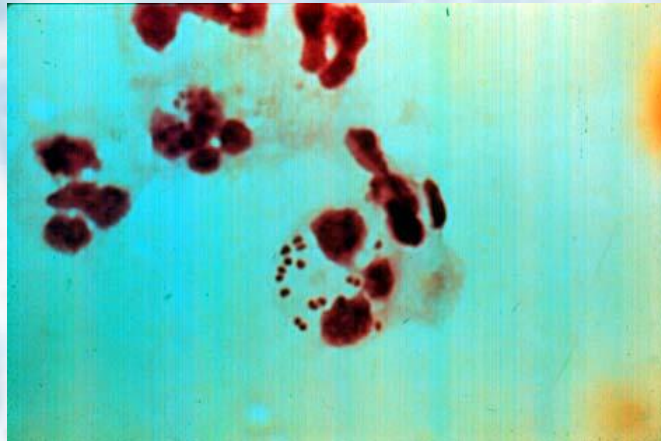
Clinical manifestations of *N. gonorrhoeae*



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 intracellular G-ve diplococci

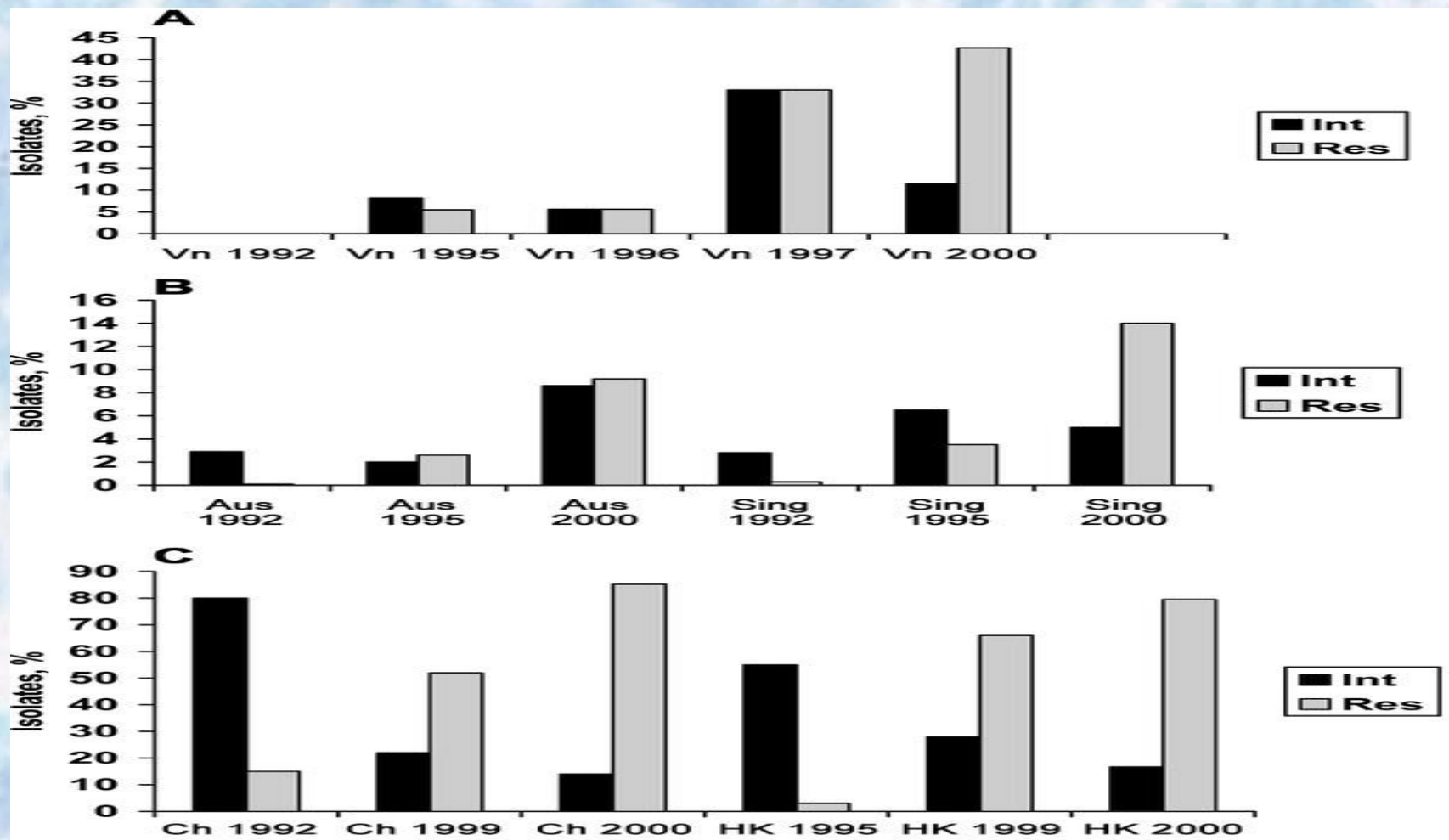
N. gonorrhoeae



❖ 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





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)