

## Enterobacteriaceae

- Escherichia
  - Klebsiella
  - Salmonella
  - Shigella
  - Proteus
  - Yersinia
  - Citrobacter
- } Lactose fermenters
- Microscopy: Gram -ve bacilli

All are motile except:

non motile → Klebsiella  
Shigella

# Escherichia

- peritrichous motility
- Indole positive
- hemolysis on blood agar

Escherichia coli

Types:

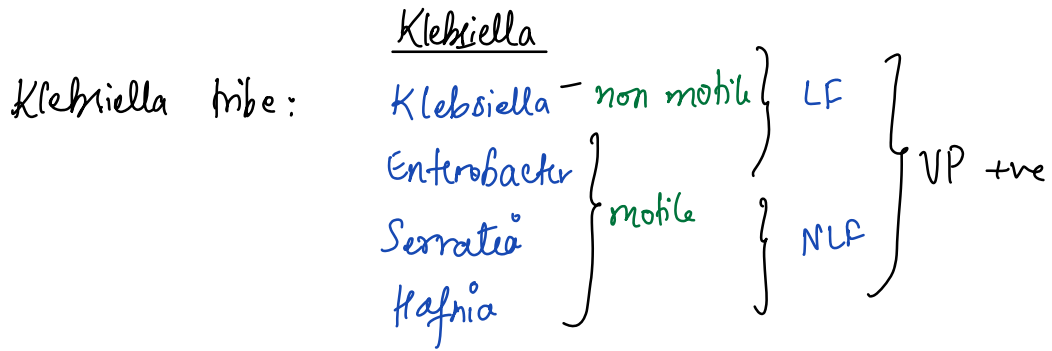
- attachment & effacement lesions on intestinal cells
- 1) EPEC (pathogenic) - diarrhoea in children **only Non-Toxigenic**
  - 2) ETEC (toxigenic) - Traveller's diarrhoea
    - labile toxin (LT) → TcAMP
    - stable toxin (ST) → TcGMP
    - ELISA (mc) (or) Eiken's precipitation test (+)
  - 3) EAEC (aggregative) - Traveller's diarrhoea EAST-1 toxin
  - 4) EIEC (invasive) - Dysentery **Urease** marker Ag **invasiveness** **Sereny test**
    - ↓
    - Guinea pig eye inoculate
    - ↓
    - Conjunctivitis (+)
  - 5) EHEC (hemorrhagic) - Dysentery **Verocytotoxin (Shiga like toxin)** inhibit ribosomes → inhibit protein synthesis → **Hemolytic Uremic syndrome** (person to person transmission (+))
    - mc serotype: EHEC O157:H7 producing Verocytotoxin
    - to differentiate EHEC O157:H7 from other E. coli
    - Sorbitol MacConkey Agar**
    - mc →
  - 6) UPEC (uropathogenic) - UTI **y/f: pili**
    - ↳ demonstration of uropathogenicity of E. coli
    - hemagglutination**

Note: to differentiate EHEC O157:H7 from other E.coli

### Sorbitol MacConkey Agar

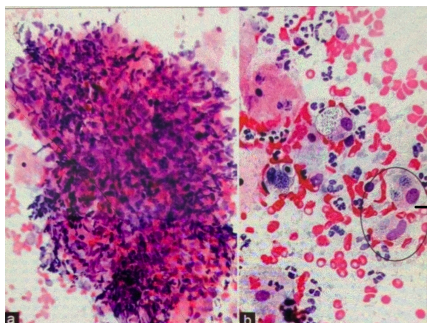
O157:H7

- does not use sorbitol & produce clear colonies on Sorbitol MacConkey Agar
- also -ve for  $\beta$ -glucuronidase using the substrate MUG test



- *Klebsiella pneumoniae* - mc causing infection in human  
Friedlander's bacilli pneumonia, UTI, wound infections, meningitis
- *K. oxytoca* - Nosocomial infection, hemorrhagic colitis
- *K. ozonae* - chronic atrophic rhinitis
- *K. rhinoscleromatis* - Rhinoscleroma  
Frisch bacillus
- *K. granulomatis* - Donoransia (STD)

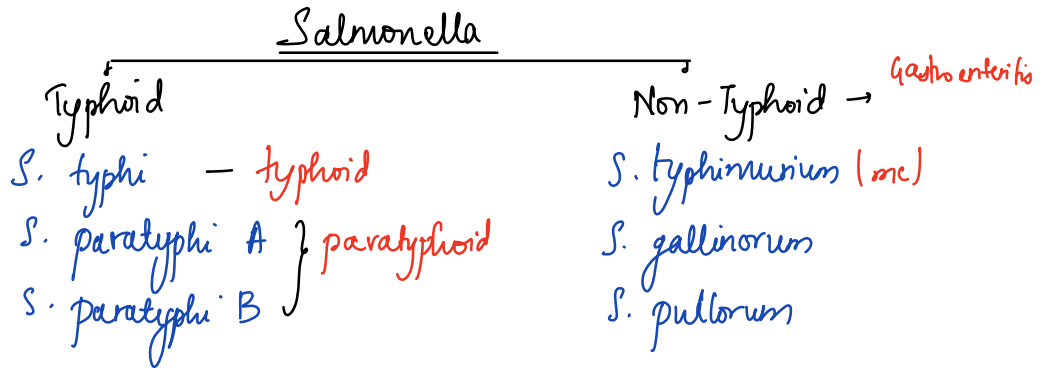
|       |                       |   |                                |
|-------|-----------------------|---|--------------------------------|
| STD 1 | Donoransia            | - | <i>Klebsiella granulomatis</i> |
|       | LGV                   | - | <i>Chlamydia trachomatis</i>   |
|       | Soft chancre          | - | <i>H. ducreyi</i>              |
|       | Hard chancre          | - | Syphilis <i>T. pallidum</i>    |
|       | Vesicles on genitalia | - | HSV - 2                        |



Donovan bodies

Papanicolaou cells





Virulence :  
factor

- 1) 'O' Ag  
(Cell wall)
- appears early & disappears early
  - less immunogenic & crossreactive
  - detected in round bottom tube

U Felix tube

- 2) 'H' Ag  
(Flagellar)
- appears earliest & disappears late
  - highly immunogenic no crossreactivity
  - detected in conical base tube

∇ Dryer's tube

3) 'Vi' Ag - (virulence) Capsular polysaccharide Ag  
heat labile, alcohol stable → *Salmonella typhi*

- less immunogenic
  - Few Abs are formed - Good prognosis
  - Absence of Vi Abs - Bad prognosis
- disappear early in convalescent stage  
(Vi Ab persist → carrier state)  
↓  
screening test for carrier state

|                |                  |
|----------------|------------------|
| Stool carriers | Urinary carriers |
| carry in bile  | carry in kidney  |
| shed in stool  | shed in urine    |
| Stool culture  | Urine culture    |

Stool culture

Urine culture

## Sewer snab technique

- 1) Convalescent carrier - upto 3 weeks
- 2) Temporary / Acute carrier -  $> 3$  weeks upto 3 months
- 3) Permanent / Chronic carrier -  $> 1$  yr

Cfr: Typhoid fever

- step ladder fever
- pea soup diarrhoea
- rose spots
- relative bradycardia (Faget's sign)

Dsi : Selective media :   
 XLD - Xylose Lysine Deoxycholate } both   
 DCA - Deoxycholate citrate Agar } Salmonella   
 SSA - Salmonella Shigella Agar } shigella   
 Wilson Blair

## Widal Agglutination test (WAT)

Ab<sub>o</sub> → Ag

(∴ cross reactivity)

Antibody titre  
 $> 1:80$

|   |             |     |    |   |           |
|---|-------------|-----|----|---|-----------|
| { | Typhi       | 'O' | Ag | } | $> 1:160$ |
|   | Typhi       | 'H' | Ag |   |           |
|   | paratyphi A | 'H' | Ag |   |           |
|   | paratyphi B | 'H' | Ag |   |           |

4 fold rise in Ab titre b/w 1<sup>st</sup> & 3<sup>rd</sup> week → significant

Serial dilutions



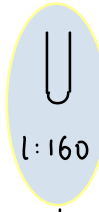
1:20



1:40

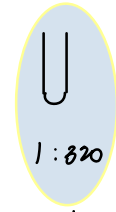


1:80



1:160

↓  
'O' Ab+



1:320

↓  
'H' Ab+

## Surgical complications of typhoid

- paralytic ileus
- intestinal hemorrhage
- perforation
- cholecystitis
- longitudinal ulcers

Ty21a → oral typhoid vaccine

## Shigella

- |                                                                                     |                                                                                                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>- <i>S. dysenteriae</i> (Group A)</li> </ul> | <ul style="list-style-type: none"> <li>- <i>S. flexneri</i> (Group B) mc India</li> <li>- <i>S. boydii</i> (Group C)</li> <li>- <i>S. sonnei</i> (Group D) mc world                             <ul style="list-style-type: none"> <li>↳ late lactose fermenter</li> </ul> </li> </ul> |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

- V/F:
- Enterotoxin
  - VMA (Virulence marker Ag)
  - Shiga toxin → inhibit ribosomes



Inhibit protein synthesis → HUS  
(mc)

| Amoebic dysentery                                                                                                                                                                     | Bacillary dysentery                                                                                                                                                               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>- <i>Entamoeba histolytica</i></li> <li>- few pus cells</li> <li>- stool not adherent</li> <li>- Charcot Leyden crystals</li> <li>-</li> </ul> | <ul style="list-style-type: none"> <li>- <i>Shigella</i></li> <li>- plenty pus cells</li> <li>- adherent</li> <li>- Ghost cells present</li> <li>- non-offensive smell</li> </ul> |

Diff: Selective media :

- XLD - Xylose Lysine Deoxycholate
- DCA - Deoxycholate citrate Agar
- SSA - Salmonella Shigella Agar

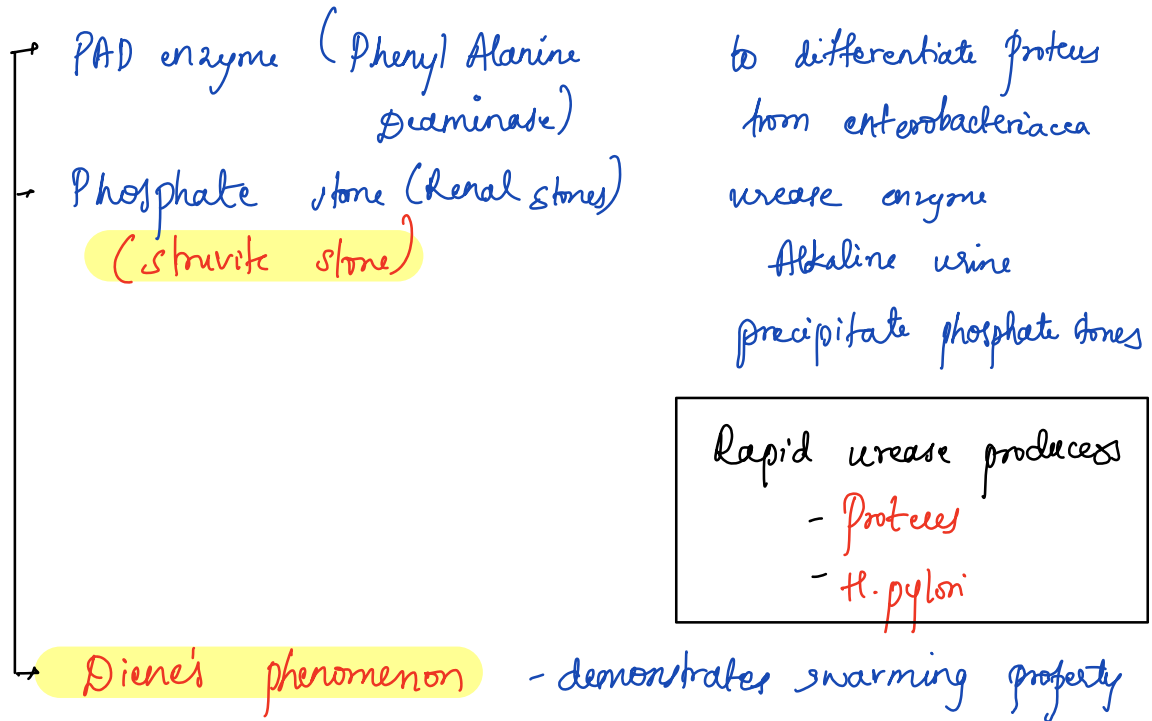
Note: Reactive arthritis after bacterial Gastroenteritis

- Salmonella
- Shigella
- Yersinia
- Campylobacter

## Proteus

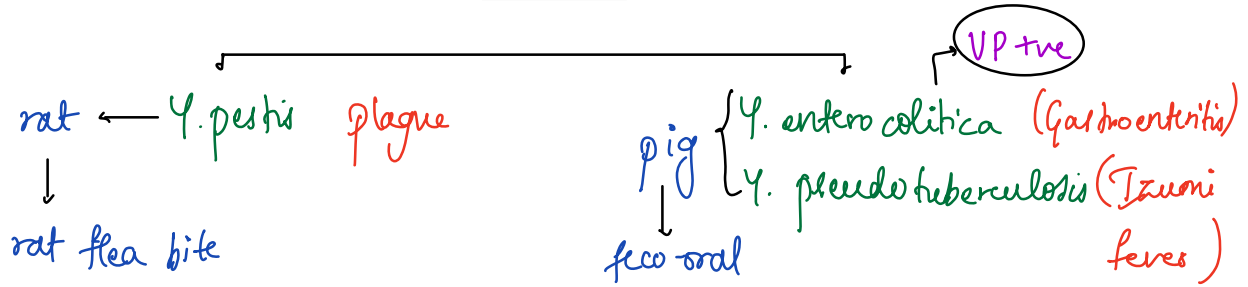
*Proteus mirabilis* (mc)

CF: UTI (mc), wound infection, pulmonary infection



Note: Diene's method: staining method for Mycoplasma

## Yersinia - Zoonotic



- Non motile

- motile differential motility

↳ 25° - motile  
↳ 37° - non-motile

- Bipolar staining  
(Wayson staining)  
Methylene blue



safety pin  
appearance

- No safety pin appearance

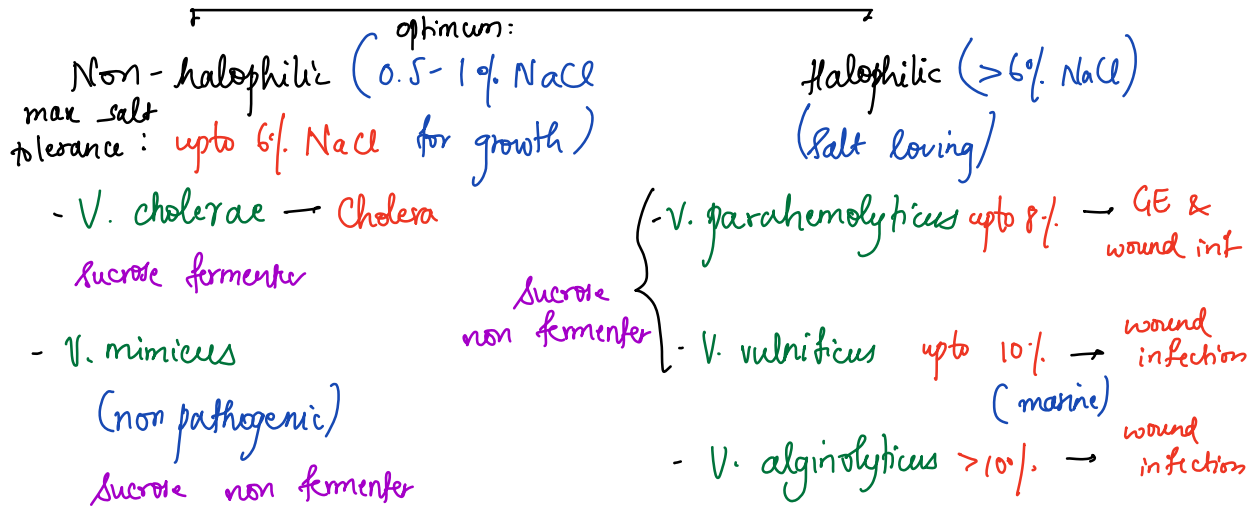
Rx of plague - Streptomycin

Note: *Yersinia enterocolitica* - Pseudoappendicitis

Oxidase positive  
bacteria

Vibrio  
Pseudomonas  
Campylobacter  
Helicobacter

## Vibrio

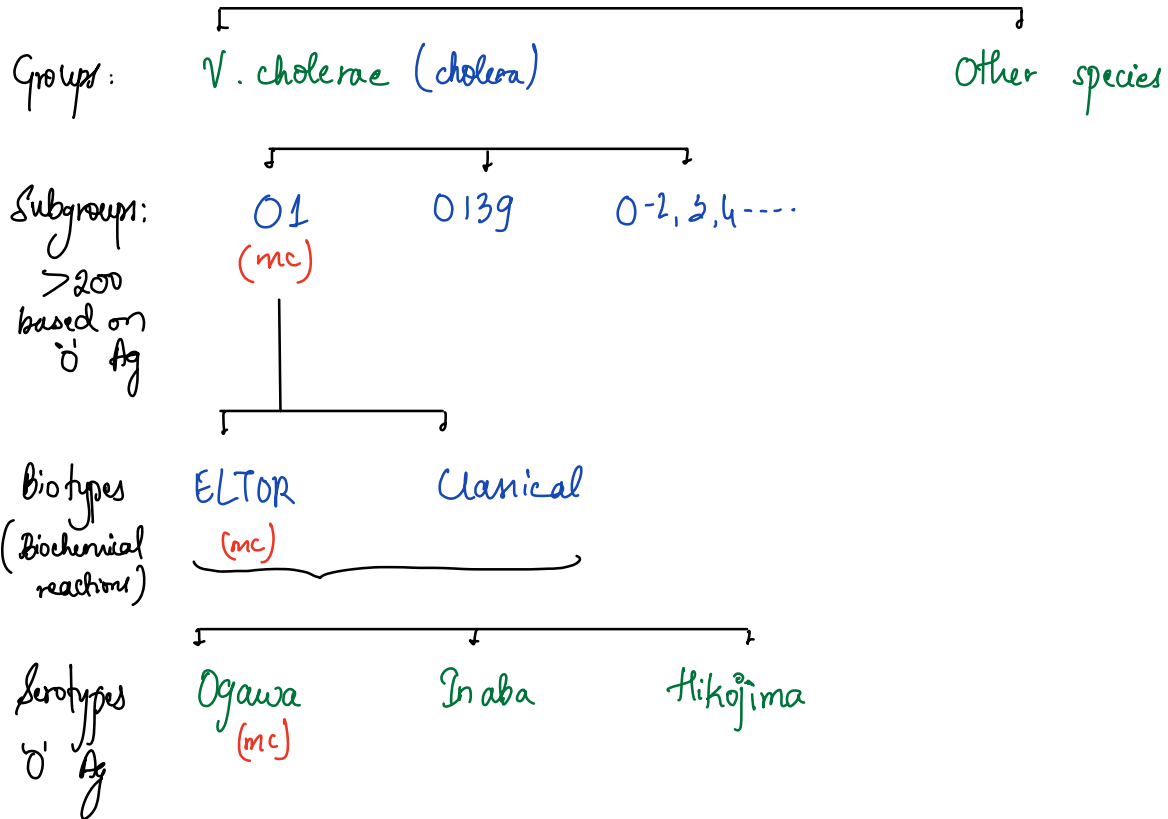


| <u>Maximum salt tolerance</u> |   |       |
|-------------------------------|---|-------|
| - Staph aureus                | - | 10%.  |
| - Enterococcus                | - | 6.5%. |
| - V. cholerae                 | - | 6%.   |
| - V. parahaemolyticus         | - | 8%.   |
| - V. vulnificus               | - | 10%.  |
| - V. alginolyticus            | - | >10%. |



**VR Classification**  
Ventakaraman Ramakrishnan

based on  
H antigen



|                                | <i>Vibrio cholerae</i> | El Tor |
|--------------------------------|------------------------|--------|
| - Hemolysis                    |                        | +      |
| - Voges Proskauer              |                        | +      |
| - Chick red cell agglutination |                        | +      |
| - Polymyxin B sensitivity      | +                      |        |
| - Group IV phage sensitivity   | +                      |        |

✓ Susceptible to phage V

Vibrio cholerae O1

non capsulated

V/f : Cholera toxin

↑ cAMP

C/f : Cholera disease

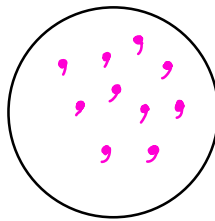
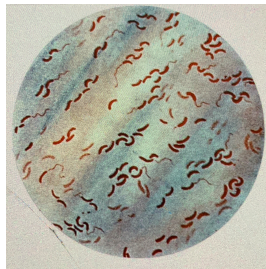
Life threatening diarrhoea  
(usually no fever)

Rice watery diarrhoea

Dis :

Microscopy :

G/S :



comma shaped

Fish in stream appearance

*V. vulnificus* - School of fish appearance

Hanging drop :

Darting motility

Culture :

Selective :  
media

Alkaline bile Salt Agar

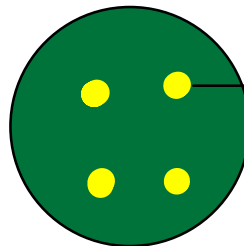
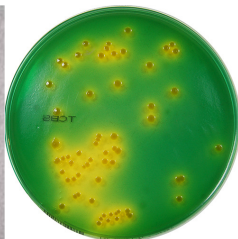
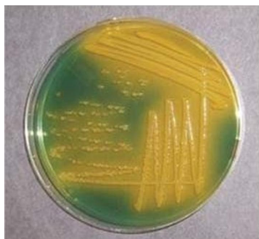
Monon's TTT Agar

(Taurocholate Tellerite Trypticase)

TCBS

(mc)

(Thiosulphate Citrate bile Salt Sucrose)



Yellow color colonies

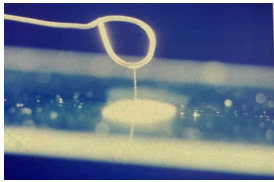
↓  
sucrose fermenter

Transport media : - Cary blair medium  
- VR medium  
- Autoclaved sea water

Enrichment media : - Alkaline peptone water  
- Monon's peptone water

Special tests :

1) String test



colony + Bile salt  $\rightarrow$  try to lift the colony  
(0.5% Na deoxycholate)

String is formed  
( $\because$  V. cholerae are lysed by)  
sodium deoxycholate)

2) Cholera red reaction

colony + Conc.  $H_2SO_4$   $\rightarrow$  Red color

Vibrio cholera O 139

- milder disease

- capsulated

- aka Bengal strains

1<sup>st</sup> case Chennai  $\rightarrow$  West Bengal

- Serotyping to differentiate (epidemics)

## Carrier in Cholera

- Incubatory carrier : shed vibrio only in brief incubation period of 1-5 days
- Convalescent carrier : shed for 2-3 weeks
- Healthy / Contact carrier : had subclinical infection & shed vibrio for <10 days
- Chronic carriers : can shed for months to years  
may have persistent infection in Gallbladder

\* Vibrio parahaemolyticus

V/F : **capsulated**

C/F : wound infection  
Gastroenteritis

h/o raw seafood consumption

Asis :

Microscopy → bipolar staining

**safety pin appearance**

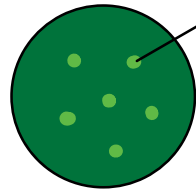
hanging drop → No darting motility  
motile

Culture → TCBS

Green colonies



lucrose non fermenter



- **Wagatsuma agar**  
(type of blood agar)

→ Hemolysis



**Kanagawa phenomenon**

- string test +ve  
- swarming (+)

- Urease test - Urease +ve

| <u>Pseudomonas</u> |                     | Oxidase | Motility | C/F                                 | Special                                     |
|--------------------|---------------------|---------|----------|-------------------------------------|---------------------------------------------|
| Non fermenters     | - Pseudomonas       | +       | +        |                                     |                                             |
|                    |                     |         | swimming |                                     |                                             |
|                    | - Burkholderia      | +       | +        |                                     |                                             |
|                    | pseudomallei        |         |          | Mallei disease<br>(Vietnam bomb dx) | Safety pin appearance<br>(bipolar staining) |
|                    | - Whitmore bacillus |         |          |                                     |                                             |
|                    | - Burkholderia      | -       | -        |                                     |                                             |
|                    | mallei              |         |          | Glanders disease                    |                                             |
|                    | - Stenotrophomonas  | -       | +        |                                     |                                             |
|                    | malophilia          |         |          |                                     |                                             |

Burkholderia pseudomallei - Ashdown medium

Note: Burkholderia cepacia → resistant to  
 "Ceftazidime"  
 Aminoglycosides  
 polymyxins &  
 1st & 2nd gen Ceph

Drugs used - Meropenem  
 Ceftazidime  
 piperacillin  
 Ticarcillin

DOC: Cotrimoxazole

*Pseudomonas aeruginosa* mc

V/F : Exotoxin A  $\longrightarrow$  Inhibit EF<sub>2</sub>  $\longrightarrow$  Inhibit protein synthesis

Pigments - pyocyanin (mc) blue green color  
pyoverdins - yellow  
pyomelanins - brown  
pyorubins - red

C/F : pneumonia, UTI, wound infection, abscess

Swimmer's ear in children  
Malignant otitis externa in diabetes  
Ecthyma gangrenosum -



central black eschar

- Scombroid poisoning - due to intake of fish not refrigerated properly
  - bacteria act on compounds in fish, releasing histamine (enteric gram -ve bacteria)
- Hot tub folliculitis / Jacuzzi syndrome

mc organisms causing

① infection in burns pt

② infection in cystic fibrosis pts → pseudomonas having  
alginate layer

↓

mucoid colonies

③ contamination of disinfectant

Δsis

Microscopy : Gram -ve bacilli  
Twitching motility

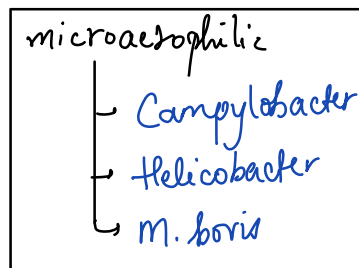
Culture : Selection : Cefrimide agar  
media

Rx: Ceftriaxime + Aminoglycosides



- Campylobacter jejuni

cf : Diarrhoea



$\Delta^{ts}$ : Microscopy: Gram stain - S shaped  
hanging drop - Darting motility

Culture : Selective - Skirrow's media

Helicobacter

- *Helicobacter pylori*

C/F : diarrhoea  
peptic ulcer disease  
Gastric carcinoma

$\Delta^{tu}$ : Microscopy : - Warthin silver stam staining technique

- Corkscrew motility

- lophotrichous 5-7 flagella  
sheathed



Culture : Selective - Skirrow's media

|            |   |                    |
|------------|---|--------------------|
| Rickettsia | } | Non culturable     |
| Chlamydia  |   |                    |
| Mycoplasma | } | Atypical pneumonia |
| Legionella |   |                    |

### Rickettsia

- vascular endothelial injury
- Black eschar → characteristic in 50% cases

Widal Felix test → Heterophile Agglutination test

- detect Abs of rickettsia
- by adding Proteus antigens
  - OXK
  - OX2
  - OX19

### Acute encephalitic syndrome

|                             |                         |
|-----------------------------|-------------------------|
| 1 <sup>st</sup> mc in India | - Japanese encephalitis |
| 2 <sup>nd</sup> mc          | - scrub typhus          |

| Rickettsial disease                                                                                                                                    | Causative Agent                                            | Vector                                 | Route of transmission              | Weil Felix test                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|----------------------------------------|------------------------------------|------------------------------------------|
| Typhus group (rash spares face)<br>1) Epidemic typhus<br>Recurrent epidemic typhus <i>B. tularensis</i><br>2) Endemic typhus <i>R. mooseri</i> disease | <i>R. prowazeki</i><br><i>R. typhi</i> / <i>R. mooseri</i> | Louse<br>Flea                          | autoinoculation<br>autoinoculation | OX 19+<br>OX 19+                         |
| Chiggerosis<br>3) Scrub typhus<br><i>Encephalitis R. r. Dooly</i>                                                                                      | <i>O. tsutsugumushi</i> (Orientia)                         | Trombiculid Mite larval - Chigger form | bite                               | OX K+<br>Rapid: SCT (lateral flow assay) |
| Spotted fever group<br>1) Rocky mountain spotted fever                                                                                                 | <i>R. rickettsiae</i>                                      | Tick                                   | bite                               | OX 2+                                    |
| 2) Indian tick typhus/<br>Mediterranean spotted fever                                                                                                  | <i>R. conorii</i>                                          | Tick                                   | bite                               | OX 19+                                   |
| Boutonneuse fever<br>3) Rickettsial pox                                                                                                                | <i>R. akari</i>                                            | Mite                                   | bite                               | Negative                                 |
| Other diseases                                                                                                                                         |                                                            |                                        |                                    |                                          |
| 1) Q Fever (Query)                                                                                                                                     | <i>Coxiella burnetii</i>                                   | No vector                              | Inhalation                         | Negative                                 |
| 2) Trench fever (5 day fever)                                                                                                                          | <i>Bartonella quintana</i>                                 | Louse                                  | autoinoculation                    | Negative                                 |

$\Delta$  <sup>14</sup> : Microscopy : Gram -ve bacilli very small  $\rightarrow$  usually not seen in sample

Culture :   
  $\left\{ \begin{array}{l} \text{Embryonated egg culture} \quad \text{yolk sac} \\ \text{Tissue culture} - \text{McCoy cell line} \end{array} \right.$

Special : Neil Mosseri reaction  $\rightarrow$  Inoculate intraperitoneally in Guinea pig   
  $\downarrow$    
 testicular inflammation   
 only *R. typhi* (mosseri)

Note:

$\left. \begin{array}{l} \text{Chlamydia} \\ \text{Rickettsia} \end{array} \right\}$  earlier considered as viruses   
  $\therefore$  - filtered by membrane filter   
 - intracellular multiplication

$\uparrow$  Dx of *Coxiella burnetii* cannot be done using Giemsa stain of thin peripheral smear   
 Dx is mainly by serology.   
 i.e. in titre of specific Abs

Note: Transovarial transmission  
passing on disease causing bacteria  
from parent arthropod to offspring arthropod

- *Orientia tsutsugamushi* - Scrub typhus
- *Rickettsia rickettsii*
- *Rickettsia conorii*
- *Rickettsia akari*

Q: Rx of scrub typhus → Doxycycline  
in pregnancy → Azithromycin

Rocky mountain spotted fever - rash starts @ wrists & ankles  
then spreads to trunk, palms & soles

Typhus - rash starts centrally & spreads out  
saves palms & soles

#### Ehrlichiosis

*Ehrlichia*, vector is tick. Monocytes with morulae **B** (mulberry-like inclusions) in cytoplasm.

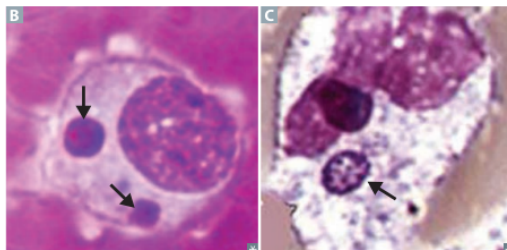
#### MEGA:

Monocytes = Ehrlichiosis

Granulocytes = Anaplasmosis

#### Anaplasmosis

*Anaplasma*, vector is tick. Granulocytes with morulae **C** in cytoplasm.



Q: Q fever : *Coxiella burnetii*

- obligate intracellular pathogen
  - filterable
  - Gram -ve (better stained w/ Gimenez, Giemsa stain)
  - Weil Felix cannot be used
  - No vector transmission in humans  
(Ixodid tick transmission seen in animals)
  - Heat resistant ( $\therefore$  survives holder method of pasteurization)
- No Rash

*Coxiella burnetii*  $\rightarrow$  common cause of culture -ve endocarditis

*Bartonella henselae*  $\rightarrow$  causes bacillary angiomatosis  
Cat scratch disease  
presentation: blister on hand w/ axillary lymphadenopathy

ask pt about h/o exposure to cat

*Bartonella bacilliformis*  $\rightarrow$  - Oroya fever  
- sandfly

|          |                              | <u>Chlamydia</u> |      | obligate intracellular                       |                                     |
|----------|------------------------------|------------------|------|----------------------------------------------|-------------------------------------|
| Species: |                              | serotypes        |      |                                              |                                     |
| -        | <i>C. trachomatis</i>        | TRIC             | many | A, B, C                                      | → Trachoma                          |
|          | <div>HP bodies</div>         |                  |      | D to K                                       | → Inclusion conjunctivitis          |
|          |                              |                  |      |                                              | NGU - Non-gonococcal urethritis (m) |
| -        | <i>C. trachomatis</i>        | LGV              | many | L <sub>1</sub> L <sub>2</sub> L <sub>3</sub> | → LGV                               |
|          |                              |                  |      |                                              | EP - 10-30 days                     |
| -        | <i>C. psittaci</i>           |                  | many |                                              | → psittacosis                       |
|          | <div>LCL bodies</div>        |                  |      |                                              |                                     |
| -        | <i>C. pneumoniae</i><br>(mc) |                  | one  |                                              | → Atypical pneumonia                |

### Bodies

|   |                                 |                                            |
|---|---------------------------------|--------------------------------------------|
| [ | Reticular body - intracellular  | → Replicative - active metabolism          |
|   | chlamydia present in host cell  |                                            |
| ] | Elementary body - extracellular | → Infective                                |
|   | daughter chlamydia outside cell | - No replication<br>- No active metabolism |

Δ<sup>sis</sup>: Microscopy - Gram -ve → very small - usually not seen on M/c in sample  
bacilli

Culture - [ Embryonated egg culture gold sac  
Tissue culture - McCoy cell line

IOC: NAAT

## Mycoplasma

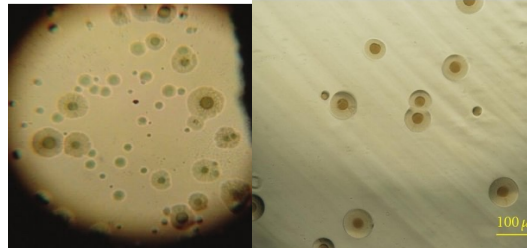
- *Mycoplasma pneumoniae*  
aka **Eaton's agent**

cell wall deficient bacteria

- resistant to cell wall inhibiting antibiotics
- triple layered cell membrane
  - contains sterol/cholesterol
  - Gliding motility**

C/F : *Atypical pneumoniae*  
*Non gonococcal urethritis*

$\Delta$ sis : Microscopy : **Dienes' method**



Culture : PPLO agar  
(Pleuropneumonia like organisms)

**Fried egg colonies**

- *Mycoplasma*  
- *Malassezia furfur*

Special test :

Heterophile Agglutination test {

- 1) **Cold agglutinin test** detect Abs using Human RBC Ag
- 2) **Streptococcal MG test** detect Abs using Streptococcal MG Ag



## Heterophile Agglutination test

- Paul Bunnell test - EBV
- Weil Felix test - Rickettsia
- Cold agglutinin test } Mycoplasma
- Streptococcal M<sub>H</sub> Ag test }

## Legionella

Legionella pneumophila

Source: AC, air coolers

Cf : Atypical pneumonia associated  $\pm$  diarrhoea

Myocarditis

Bacteria - Legionella

Virus - HSV, Coxsackie B

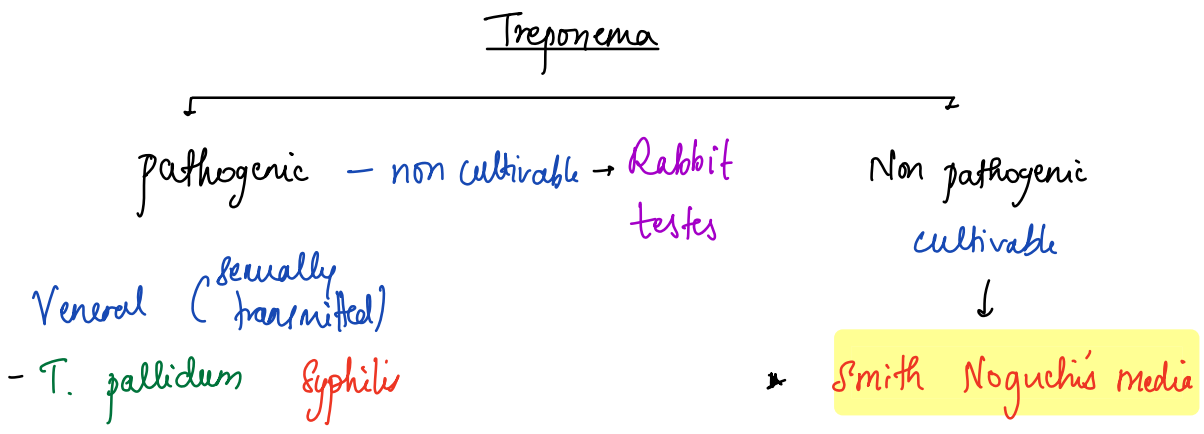
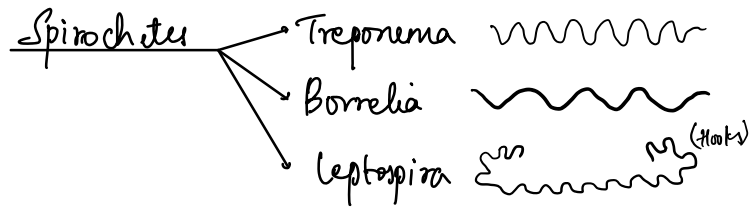
Parasite - Trichinella

Dis : Microscopy : Gram -ve bacilli

Selective media : BCYE agar

(buffered Charcoal Yeast Extract)

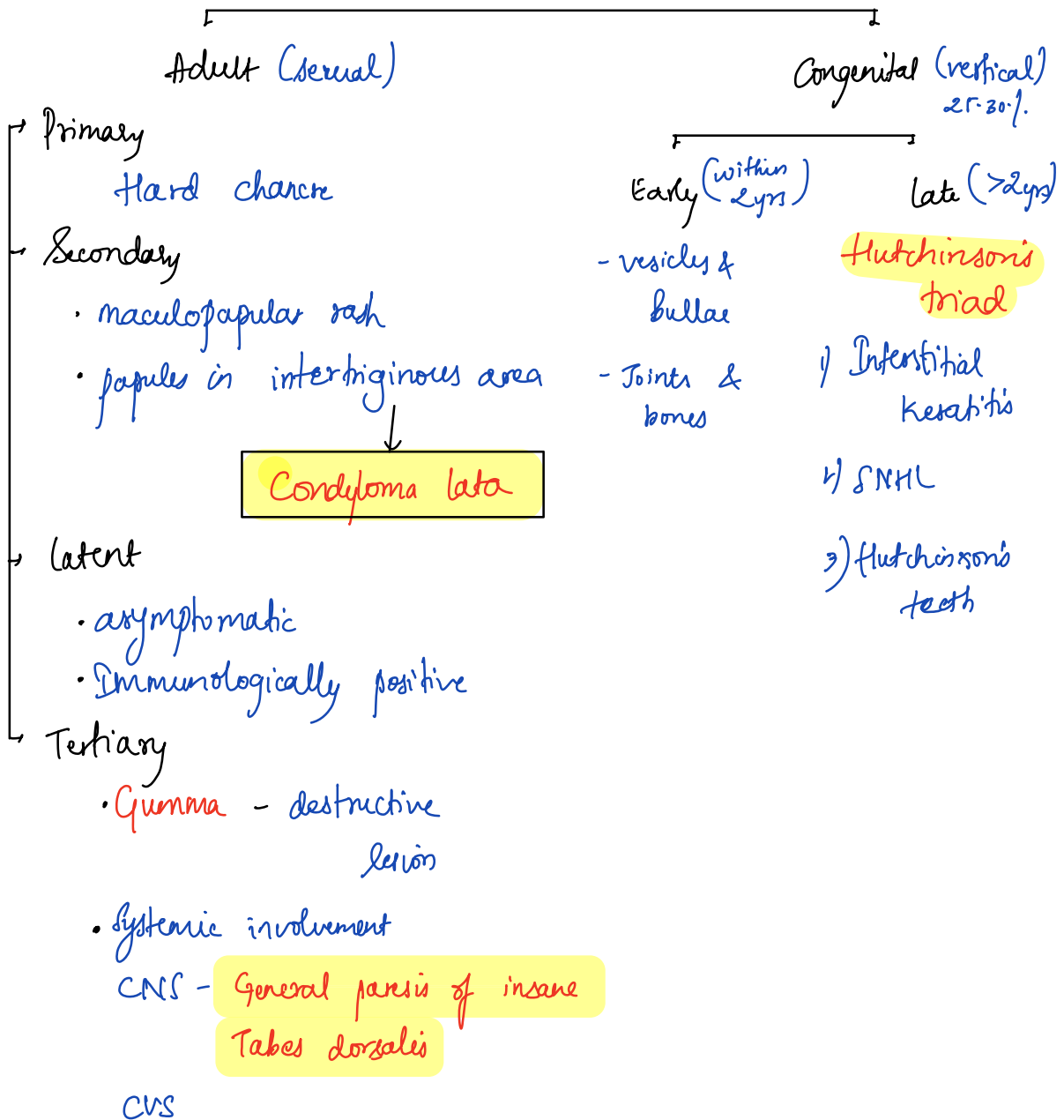
- spiral 
- this organism - silver impregnation staining  
motility by dark field microscope
- Endoflagella



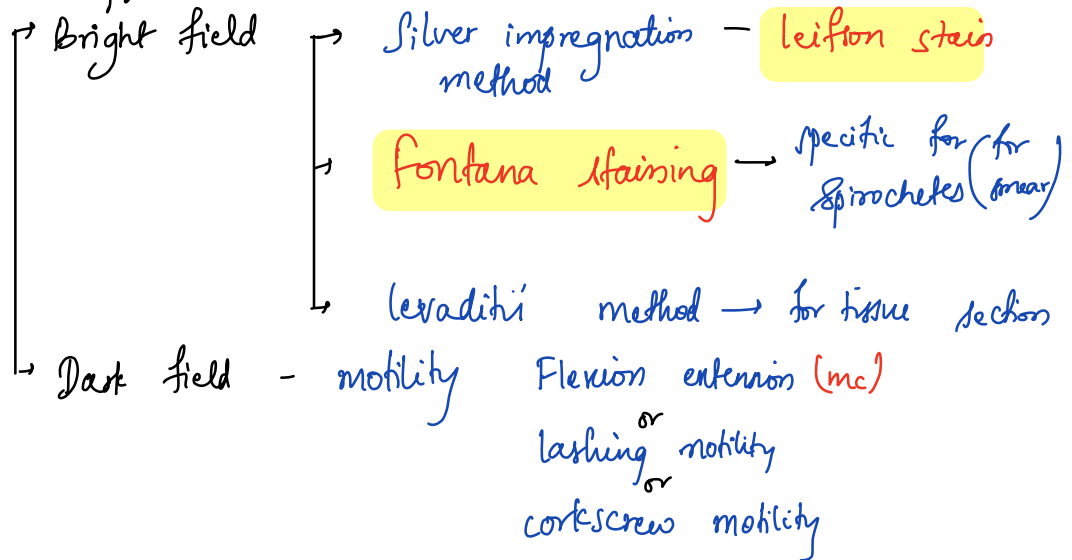
- Non venereal (other routes of transmission)
- T. pertenue - Yaws
  - T. endemicum - Bejel (End Syphilis)
  - T. carateum - Pinta

# Treponema pallidum

C/F: Syphilis



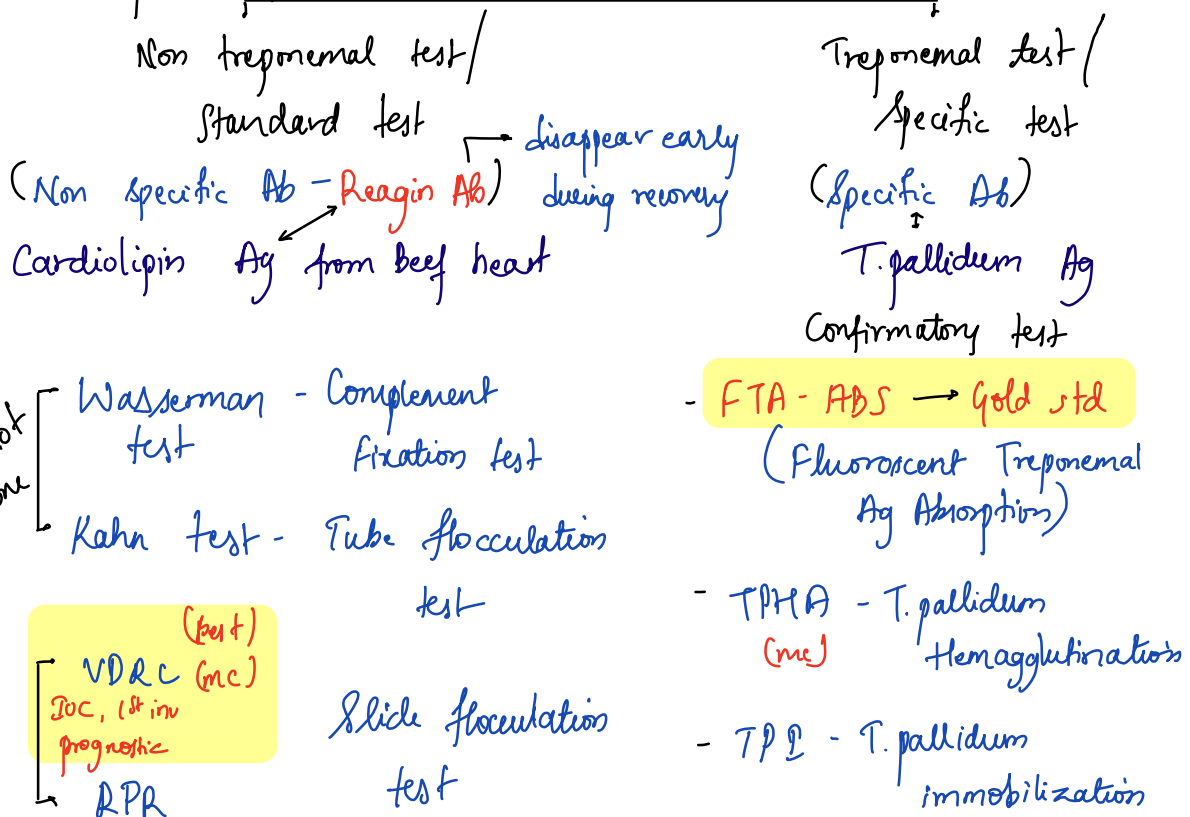
Asi - Microscopy (for all spirochetes)



- Culture: non cultivable

Rabbit testes

- Special tests



## Borrelia

Species

Disease

Transmission

*B. burgdorferi*

- Lyme's disease

Ixodid tick



**Erythema migrans**

- annular rashes - migratory 



Lyme's disease :

Stage I : Erythema migrans, flu like symptoms

Stage II : early disseminated

2° lesions, carditis, AV block,

Bell's palsy, transient arthritis

tx: Doxycycline

Stage III : late disseminated

encephalopathy, peripheral neuropathy  
chronic arthritis

*B. recurrentis*

- Relapsing fever

louse

*B. vincentii*  
(commensal)

- Vincent's angina  
gingivostomatitis

predisposing: injury  
factor

Δ<sup>id</sup> : Microscopy: same as treponema

Culture: **Modified Kelly's medium**

## Leptospira

Leptospira interrogans  
(zoonotic disease)

Rainy season

Rice field

Rat's urine

C/F : leptospirosis → involves • RES - hepatosplenomegaly  
(macrophages)

Weill's disease

• renal

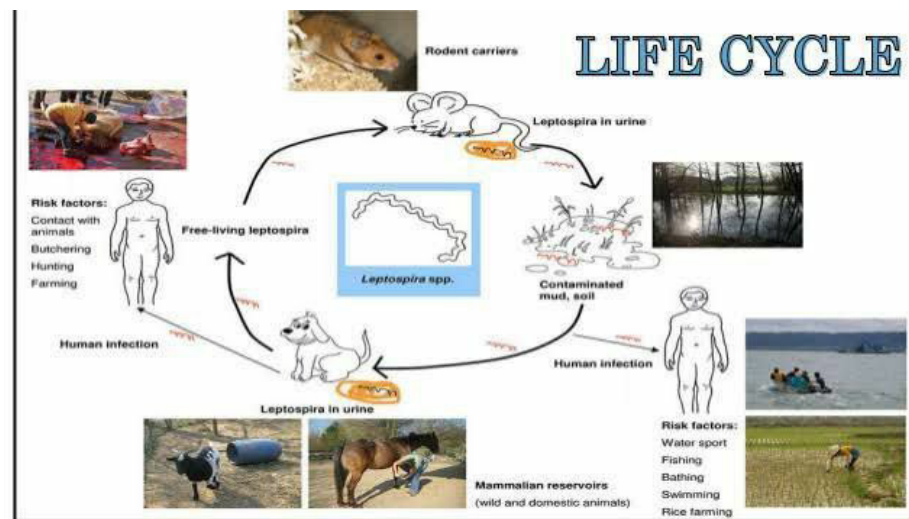
• pulmonary hemorrhage

fever, icterus, conjunctival suffusion & dermatoma x 15 days

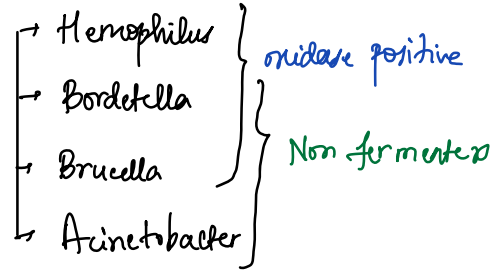
Diagnosis : Microscopy: same as treponema

Culture : EMTH medium

Special : MAT (microscopic agglutination test)



## Gram Negative Cocci



## Hemophilus (11<sup>th</sup> to pneumococcus)

### Hemophilus Influenza B

U/P: capsule  
IgA proteases  
Endotoxin: LPS

C/F:

- Acute epiglottitis (mc)
  - lobar pneumonia
  - Meningitis
- children 3-7 yrs

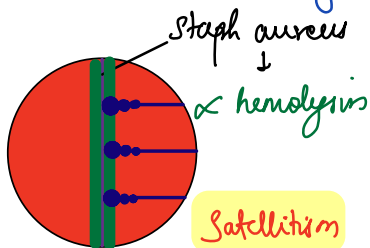
Δ<sup>id</sup>: Microscopy - Gram negative cocci

Culture: Selective media - **Fild's Digest Agar**

does not grow on blood agar - ∴ requires Factor V (intracellular)

Factor X (extracellular)

∴ grows on Chocolate agar (∴ hemolyzed)



## Henophilus ducreyi

CF : soft chancre (STD)

Δ<sup>is</sup> : Microscopy - Gram stain : Gram negative coccobacilli

School of fish appearance

Bipolar staining : Safety pin appearance

- Yersinia pestis
- Vibrio parahaemolyticus
- Burkholderia pseudomallei
- Henophilus ducreyi
- Klebsiella granulomatis

## Henophilus agrippicus

CF : Brazilian purpuric fever

- fever
- purpura
- conjunctivitis



## Bordetella

### Bordetella pertussis

CF: pertussis disease / whooping cough / 100 days cough

IP: 7-14 days

3 stages: - catarrhal - highly infective  
- paroxysmal - whoop ⊕  
- convalescent - recovery

DOC: Erythromycin

Di: Microscopy: Gram -ve coccobacilli

Thumb print appearance

Culture: Bordet Gengue medium

Bisected pearl appearance

aluminium paint appearance

Brucella (III<sup>r</sup> to leptospira)  
(intracellular)  
*Brucella melitensis*  
zoonotic — cattle

C/F: *Brucellosis* / *Malta fever* / *Undulant fever*

- RES — hepatosplenomegaly
- *musculo/skeletal* — myalgia & arthralgia
- other systems

Rx: Streptomycin + Doxycycline

Δ<sup>id</sup>: Microscopy: Gram negative coccobacilli

Culture: Selective media: *Trypticase Soy Agar*

Special: SAT (Standard Agglutination Test)  
Milk ring test

All *Brucellae* are catalase ⊕

urease ⊕

oxidase ⊕ except → *B. ovis*<sup>s</sup>

*B. neotomae*

*Castaneda method of blood culture* - biphasic culture

Blood cultures in trypticase

soya broth (Castaneda's

method): Biphasic medium.

Sample inoculated bottle has to

be tilted to flow the broth over

solid medium and keep it upright

position at 37°C.

The growth of *brucellae* is

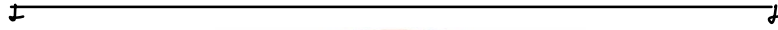
extremely slow.

Bone marrow cultures are more

sensitive than blood.



## Swarming



Gram +ve

*Cl. tetani* (mc)

*b. cereus*



Gram -ve

*Proteus* (mc)

*Pseudomonas*

*V. parahaemolyticus*

*erratia*