VIBRIOS

Vibrio cholera

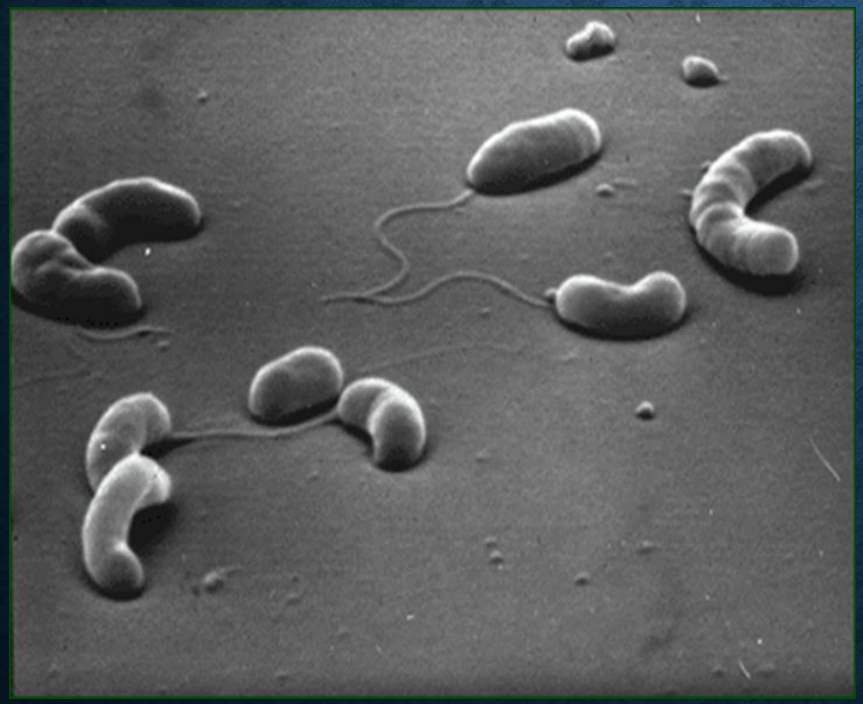
PROFESSOR DOCTOR

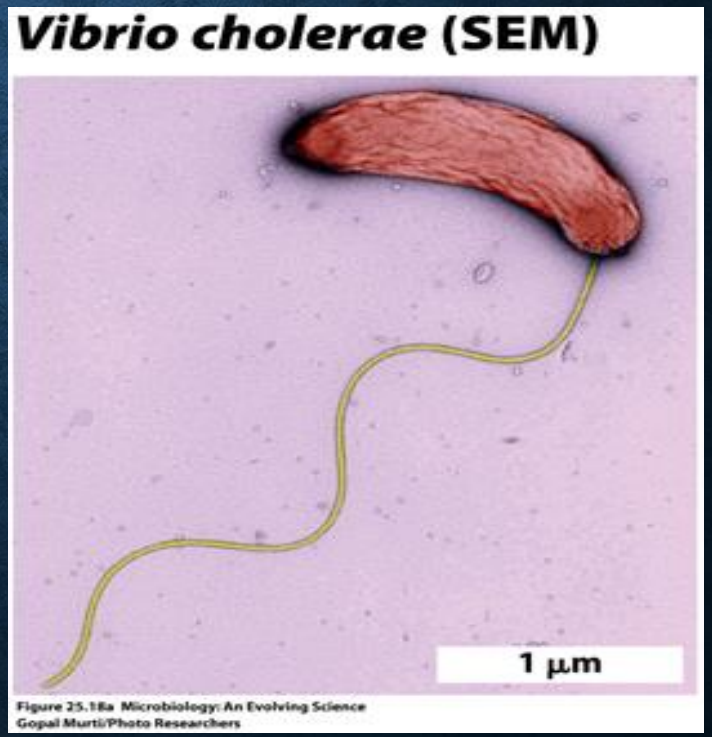
OSAMA NADHOM NIJRIS

UNIVERSITY OF SAMARRA, COLLEGE OF APPLIED SCIENCE

MORPHOLOGY

- **Gram negative comma shaped bacilli, motile with single terminal flagellum (darting motility).**





CULTURAL CHARACTERS

- **Highly aerobic**
- **Growth is favoured by alkaline pH (8-9)**
- **On alkaline peptone water, forms surface pellicle within 8 hours.**
- **On TCBS,**

produce yellow colonies.

(Thiosulfate-citrate-

bile salts-sucrose agar)

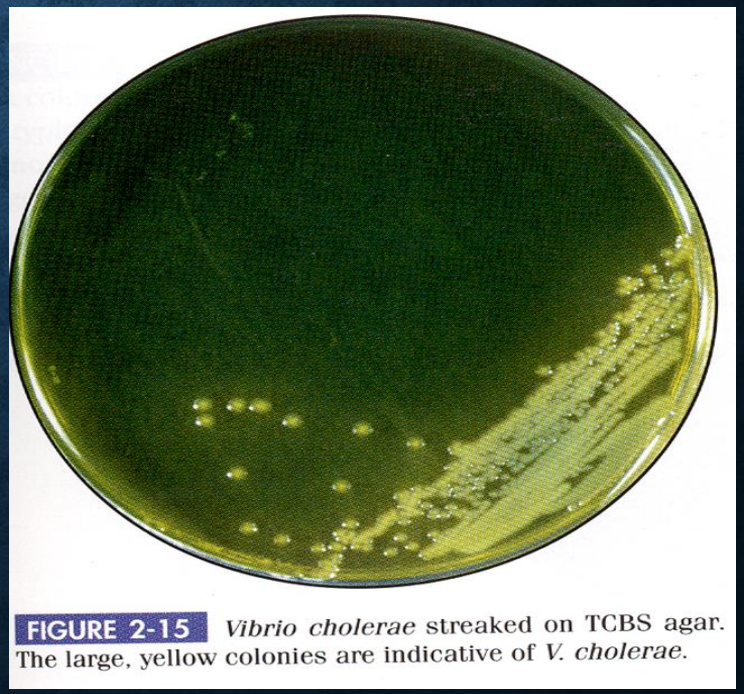


FIGURE 2-15 *Vibrio cholerae* streaked on TCBS agar. The large, yellow colonies are indicative of *V. cholerae*.

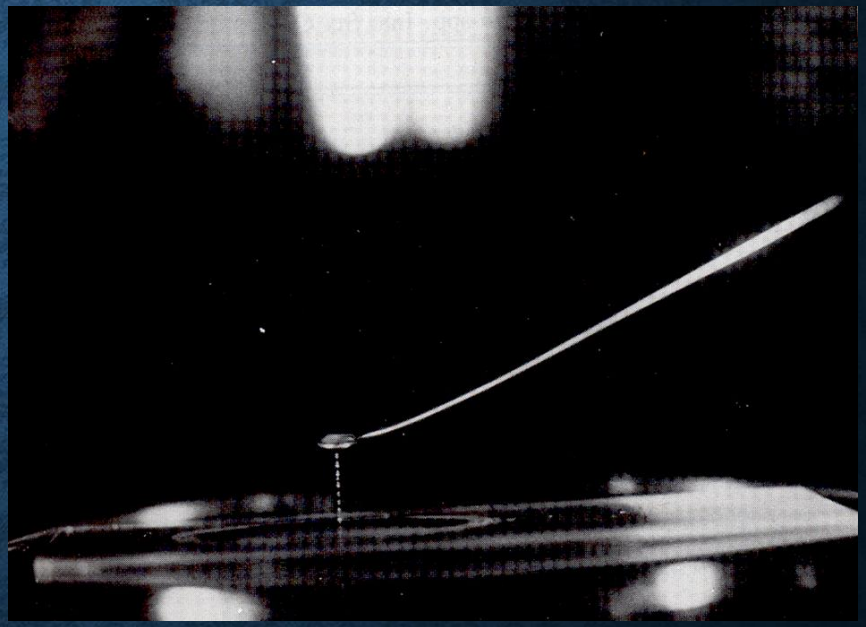
BIOCHEMICAL REACTIONS

- **Ferment glucose, maltose, mannite, sucrose with production of acid only.**
- **Oxidase positive**
- **Indole positive**
- **Cholera red reaction positive**

a test for Cholera vibrio whereby the addition of 3–4 drops of sulfuric acid (concentrated, chemically pure) to an 18-hour-old bouillon or peptone culture of the organism produces a rose-pink to claret color.

STRINGING AFTER EMULSIFICATION

String test positive: when a colony is emulsified in a drop of 0.5% sodium deoxycholate in distilled water, within one minute, the cells lyse and DNA strings when a loopful is lifted from the slide. This test differentiates vibrio cholerae form Aeromonas hydrophila which is string test negative.

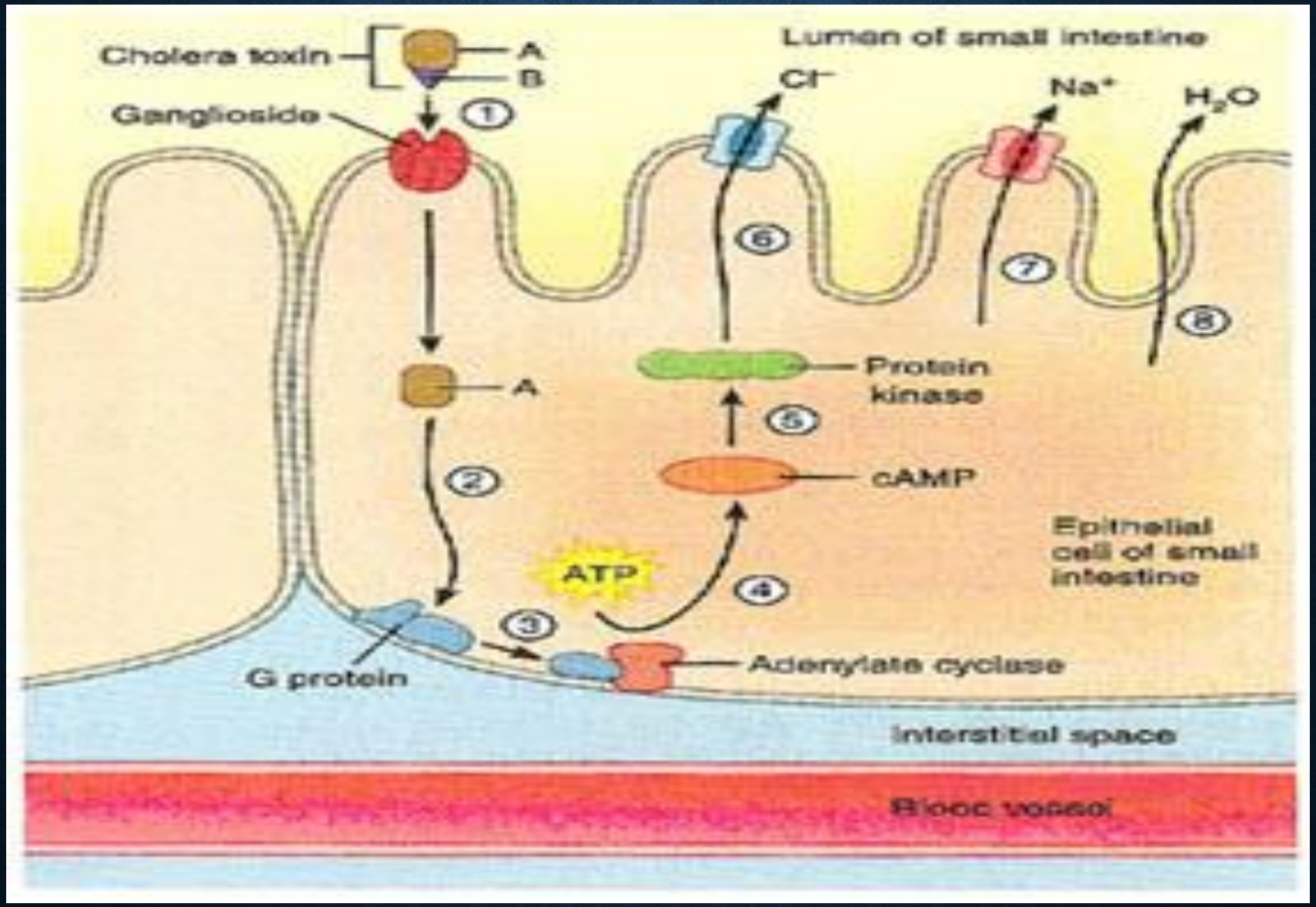


SEROLOGICAL CHARACTERS

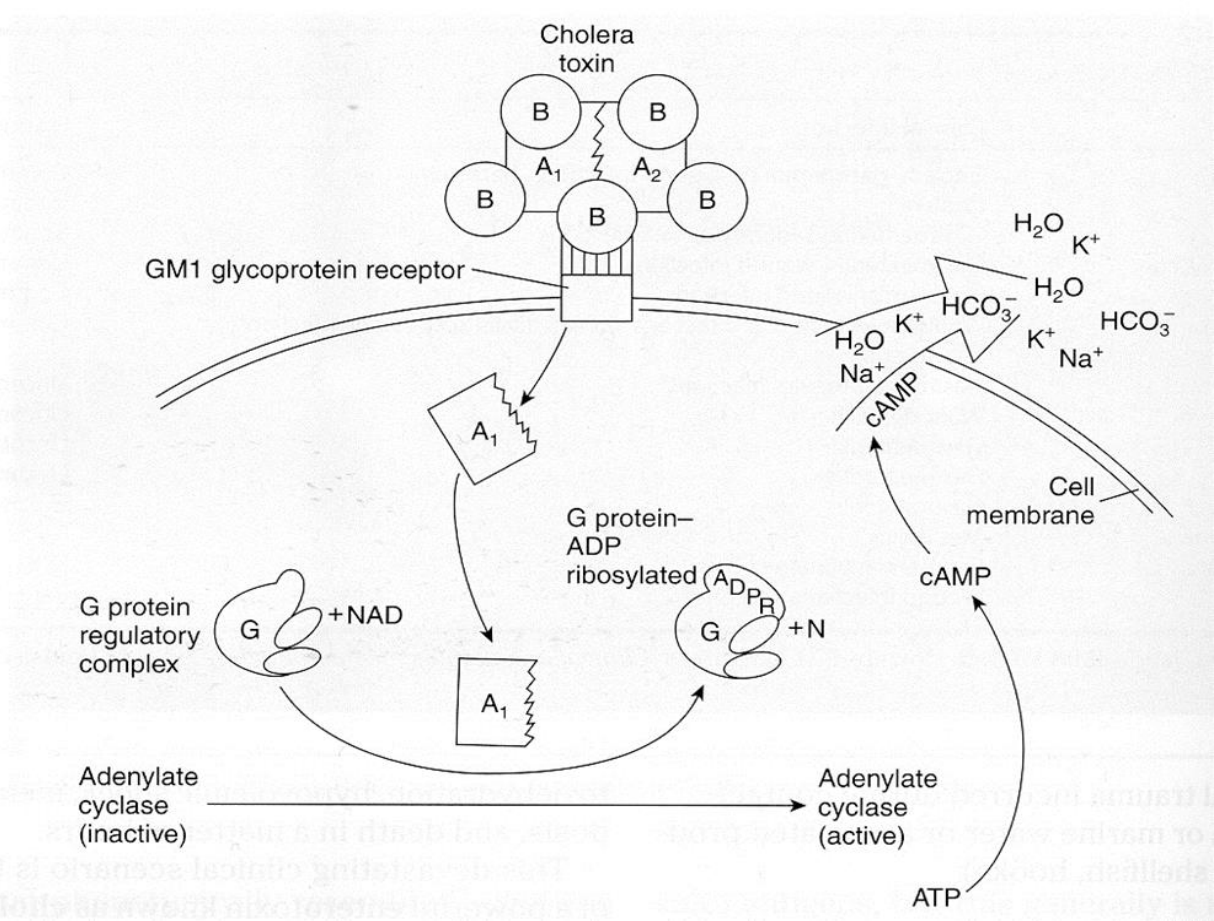
- **Vibrio cholerae are serogrouped according to O antigen into at least 139 serogroups.**
- **O1 and O 139 cause classic epidemic cholera in humans.**
- **Non O1/non O 139 cause sporadic cholera like disease.**
- **O1 serogroup includes 2 biotypes: the classic V. cholerae and El Tor and three serotypes: Inaba, Ogawa and Hikojima.**
- **El Tor strains are:**
  - **VP positive**
  - **Lyse sheep RBCs**
  - **Agglutinate chicken red blood cells**
  - **Resistant to polymyxin B and cholera phage IV**
- **Vibrio cholerae O 139 is similar to EL Tor but capsulated.**

VIRULENCE FACTORS

- **V. cholerae enterotoxin(choleragen)**
  - **Heat labile**
  - **Two subunits A, B**
  - **Subunit B binds to enterocytes enabling subunit A to enter the cells.**
  - **Subunit A activates adenyl cyclase enzyme which increases the level of intracellular cAMP resulting in hypersecretion of water and electrolytes.**
  - **Severe diarrhea occurs up to 20L/day.**


Cholera toxin
A
B
Ganglioside
1
Lumen of small intestine
Cl⁻
Na⁺
H₂O
6
7
8
A
Protein kinase
5
2
cAMP
Epithelial cell of small intestine
ATP
4
3
G protein
Adenylate cyclase
Interstitial space
Blood vessel

CHOLERA TOXIN ACTIVITY



PATHOGENESIS

- The disease is endemic in Indian subcontinent.
- Occurs in worldwide epidemics.
- Transmitted by fecal contamination of food and water.
- May be transmitted by inadequately cooked marine shell-fish such as shrimp and oysters.
- Infection is restricted to the intestine with no blood invasion.
- For infection to occur, a large number of bacteria must be ingested because the organism is sensitive to gastric acidity.
- The organism attaches to the microvilli of the intestinal cells.
- Then, it produces mucinase enzyme and the enterotoxin.

CLINICAL PICTURE

- **Incubation period is: 1-4 days.**
- **severe vomiting, rice watery diarrhea.**
- **Complications include: dehydration, acidosis, shock and death.**
- **Convalescent carriers may occur.**

LABORATORY DIAGNOSIS

- Secondary case during an epidemic
- Cases are diagnosed by microscopic examination of stools for comma shaped bacilli with darting motility which can be immobilized by specific anti-O sera
- First case in a non-endemic area
- The stool is inoculated in alkaline peptone water for 6-8h.
- Then, subculture is done on TCBS.
- The growing colonies are identified by:
- Wet mount…..> for darting motility
- Gram stain……> Gram negative comma shaped bacilli
- Biochemical reactions……> sugar fermentation, oxidase, indole, cholera red reaction and string test
- Agglutination tests…….> with specific anti-O1 and 139 sera.
- Direct methods for detection of V. cholerae O1 and O139 include immunofluorescence and PCR for detection of cholera toxin gene.

TREATMENT

- Intravenous fluids to correct fluid and electrolyte imbalance.
- Tetracyclines, however, resistance has emerged.
- Prophylaxis
- Public health measures.
- Chemoprophylaxis by tetracyclines for exposed persons.
- Vaccines: confers 50% protection and only for 6 months.
- Killed bacteria given in 2 Intramuscular doses with one week interval (induces antibacterial not antitoxin antibodies).
- Recombinant oral live attenuated vaccine.
- Oral vaccine containing killed cells and purified subunit B.

VIBRIO PARAHEMOLYTICUS

- **Halophilic vibrio.**
- **Marine organism transmitted by ingestion of contaminated seafood.**
- **It causes gastroenteritis (nausea, vomiting, diarrhea, abdominal cramps). It is self limited.**
- **It produces hemolysin.**
- **It is urease positive.**