Corynebacterium diphtheria

Lecture (13)

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Corynebacterium diphtheriae

- **Respiratory tract infections**
- **Although inhaled air contains many particles, including microorganisms, the host defense mechanisms in the respiratory tract frequently prevent infection. However, if there are large numbers of pathogenic organisms within the inspired air or if the host defenses are compromised, then infection may ensue.**

- There are â professional invaders which can infect healthy respiratory addition, there are âsecondary invaders which only infect if the host defenses are weakened, for example Pneumocystis .jiroveci in AIDS patients
- Respiratory tract infections may be caused by bacteria, viruses, protozoa, or fungi and are important in dentistry because the causative agents may be spread through respiratory and oral fluids.

CAUSES OF UPPER RESPIRATORY TRACT INFECTIONS

Organisms	Examples	Comments
Viruses	Rhinoviruses (100 antigenic types), coronaviruses	Mild symptoms in the common cold
	Adenoviruses	Pharyngoconjunctival fever
	Parainfluenza viruses	Common cold and lower respiratory tract infection
	Influenza viruses	Pharyngitis and lower respiratory tract infection
	Coxsackie A and other enteroviruses	Small vesicles, for example herpangina
	Epstein–Barr virus	In 70–90% of glandular fever patients
	Herpes simplex types 1 and 2	May be severe, with palatal vesicles or ulcers
Bacteria	*Streptococcus pyogenes*	Causes 10–20% of cases of acute pharyngitis Sudden onset, mostly in 5–10 year old children
	Corynebacterium diphtheriae	Pharyngitis often mild, but toxic illness can be severe
	Haemophilus influenzae	Epiglottitis
	Oral spirochaetes plus fusobacteria	Vincent's angina. Commonest in adolescents and adults

- Thus, both patients and the dental team are exposed to these microbes during treatment, particularly when splatter and aerosols are generated in.
- However, it is important to remember that the respiratory tract is a continuum as far as micro-organisms are concerned and many can cause infection in both parts

Corynebacteria (Genus *Corynebacterium*

General character:

1-Aerobic or facultatively anaerobic

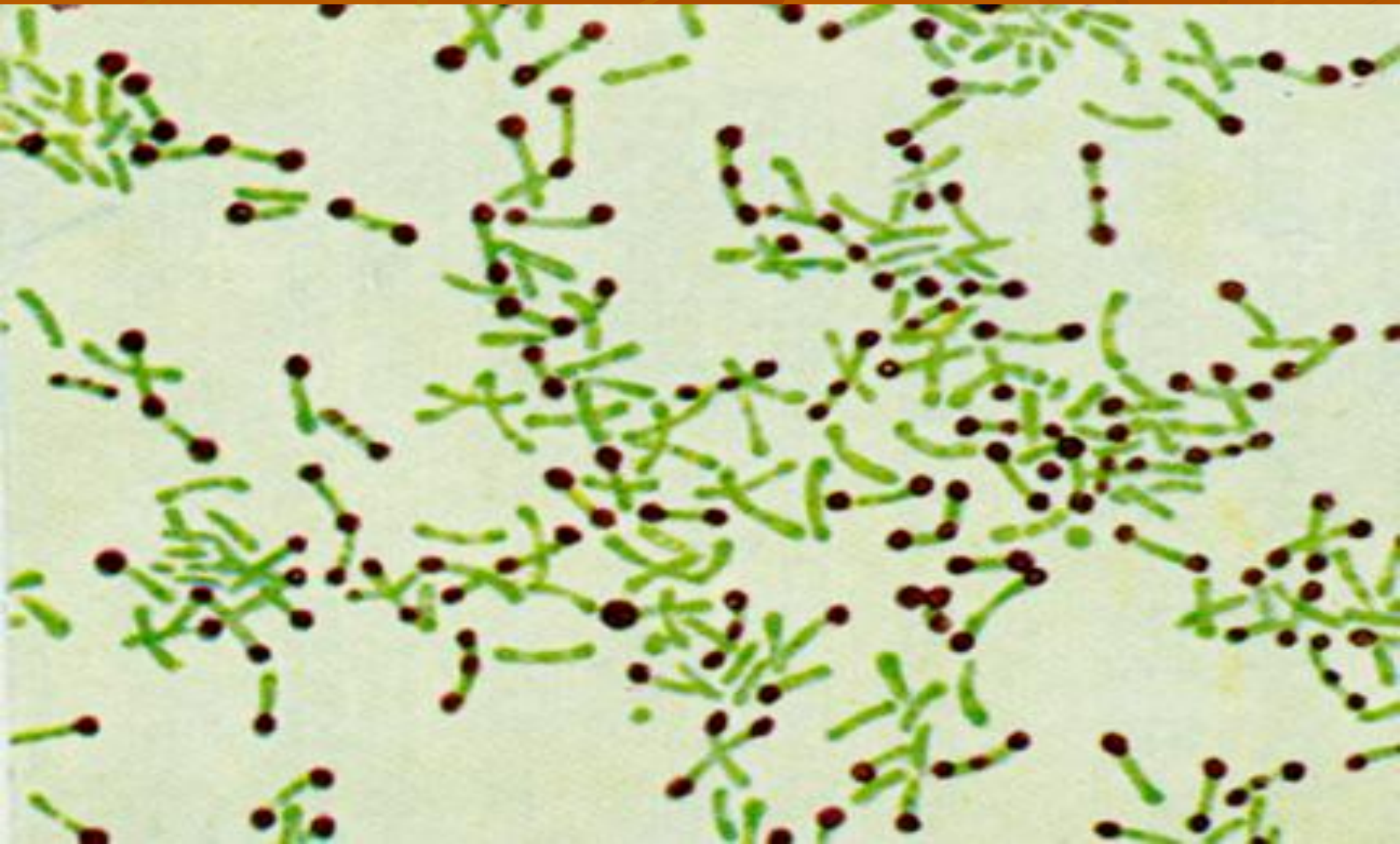
2.Small, pleomorphic (club-shaped), gram-positive bacilli that appear in short chains ("V" or "Y" configurations) or in clumps resembling "Chinese letters"

3.Cells contain metachromatic granules (visualize with methylene blue stain &albert stain)

4.Lipid-rich cell wall contains meso-diaminopimelic acid, arabino-galactan polymers, and short-chain mycolic acids

5-Lysogenic bacteriophage encodes for potent exotoxin in virulent strains

Corynebacterium diphtheria



Pathogenic Corynebacterial Species

1-Corynebacterium diphtheriae

2-Corynebacterium jeikeium

3-Corynebacterium urealyticum

Corynebacterium diphtheriae

General character:

1-Respiratory diphtheria (pseudomembrane on pharynx) and cutaneous diphtheria

2-Prototype A-B exotoxin acts systemically

Toxoid in DPT and TD vaccines

- 3-Diphtheria toxin encoded by tox gene introduced by lysogenic bacteriophage (prophage)
- 4-Selective media: cysteine-tellurite; serum tellurite; Loeffler's
- 5-Gravis, intermedius, and mitis colonial mrophology

Virulence factors:

- **The major virulence factor is exotoxin encoded on lysogenized bacteriophage.**
- **The diphtheria toxin is a classic A-B toxin**
- **Which action by shuts down protein synthesis and kills the cell.diphtheria toxin B (binding) component ’’direct’’ the toxin primarily to the oropharyngeal mucosa ,heart and nerve cell.**

Transmission &pathogenes:

- **Transmission is by respiratory droplets.**
- **Diphtheria colonize but dose not invade the oropharynx.forming dirty white pseudomembrane (dead cells,fibrin and grey pigment) “bull neck”(cervical lymphadenitis from this site the bacteria release the exotoxin into the bloodstream which damages heart &neural cells by interfering with protein synthesis.**

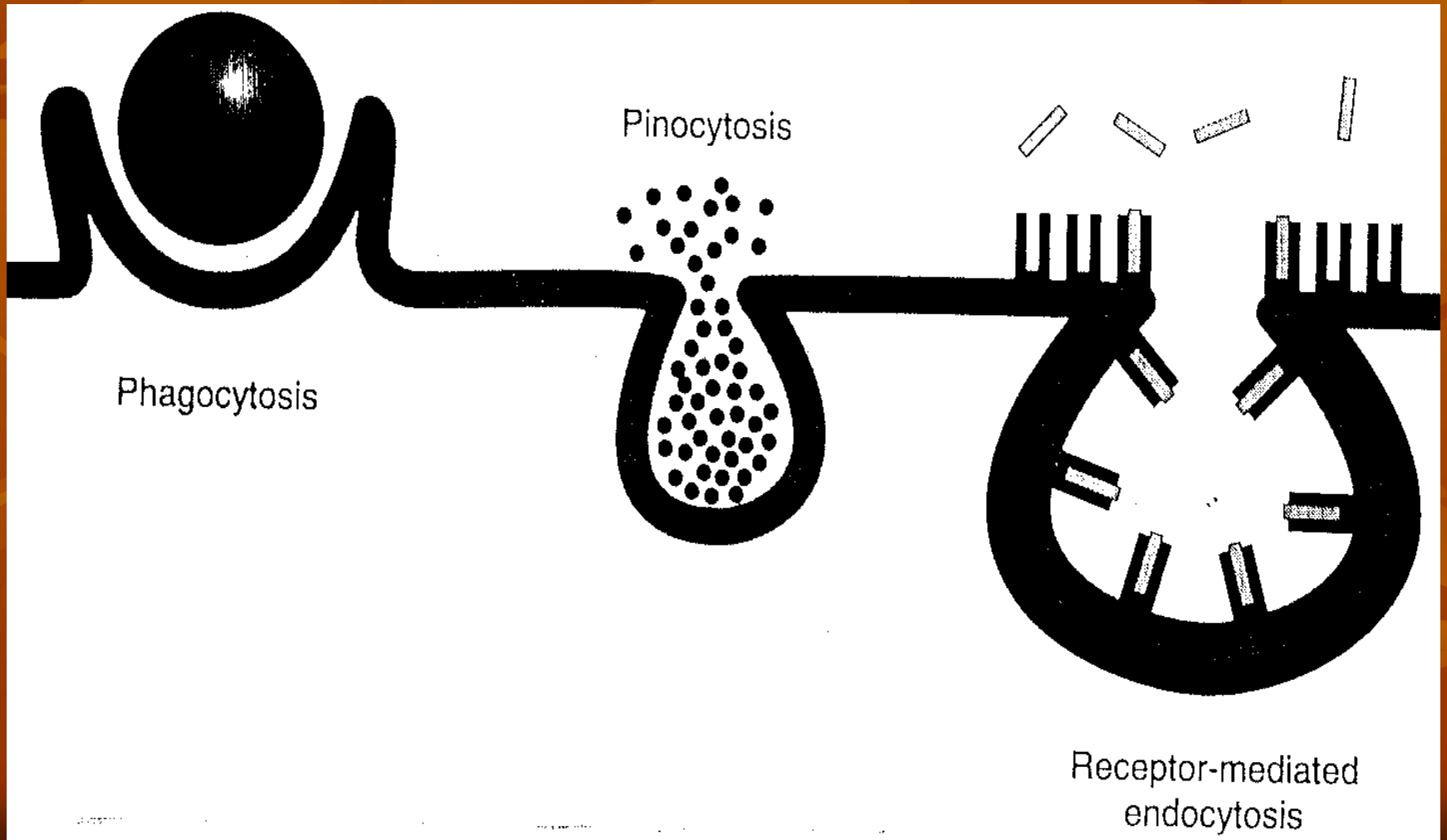
10 y/o boy with severe diphtheria

- conjunctivitis
- pharyngeal membrane
- bull neck
- severe myocarditis
- all vaccines contraindicated

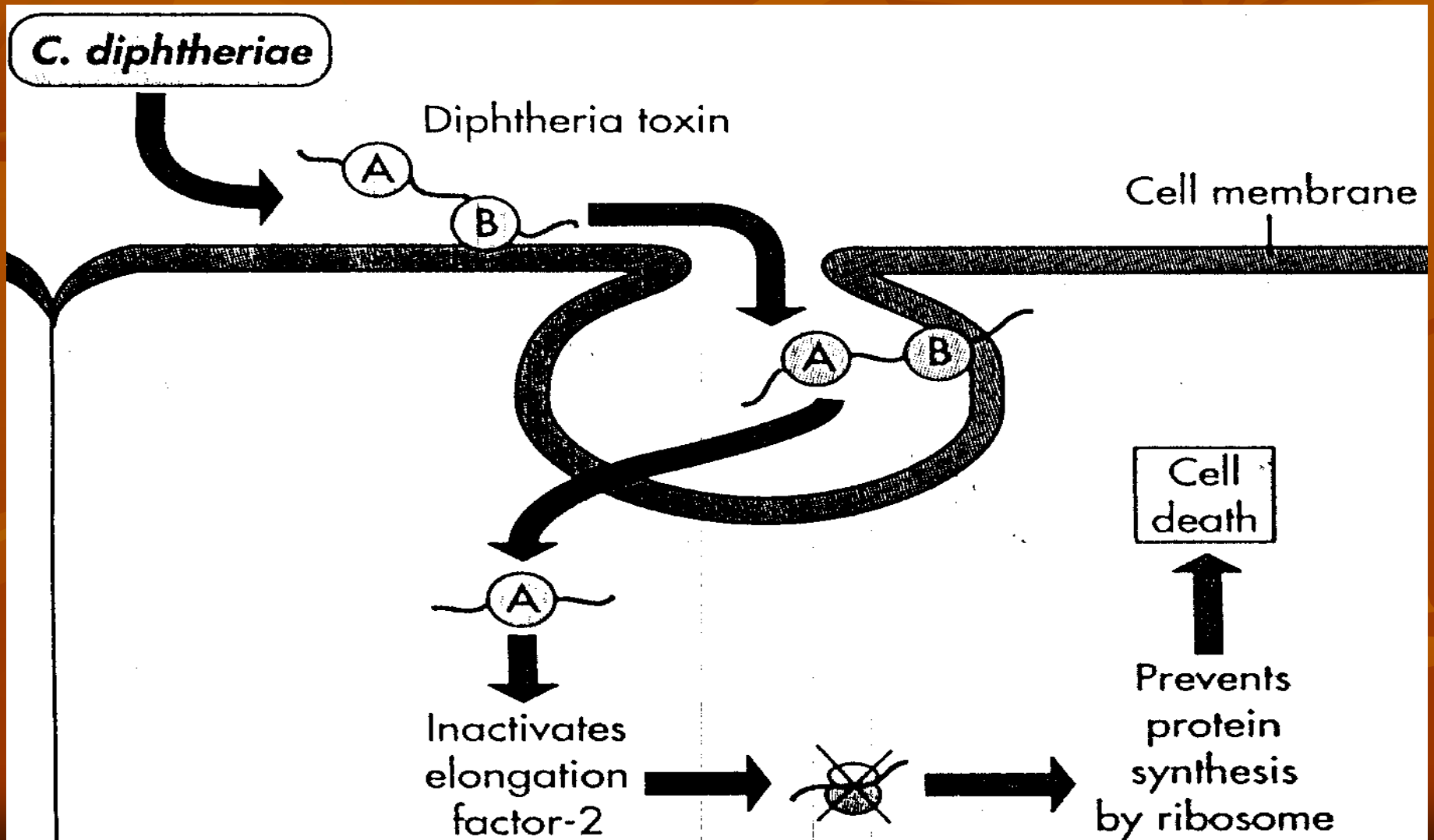
CDC

Mechanism action of diphtheria toxin:

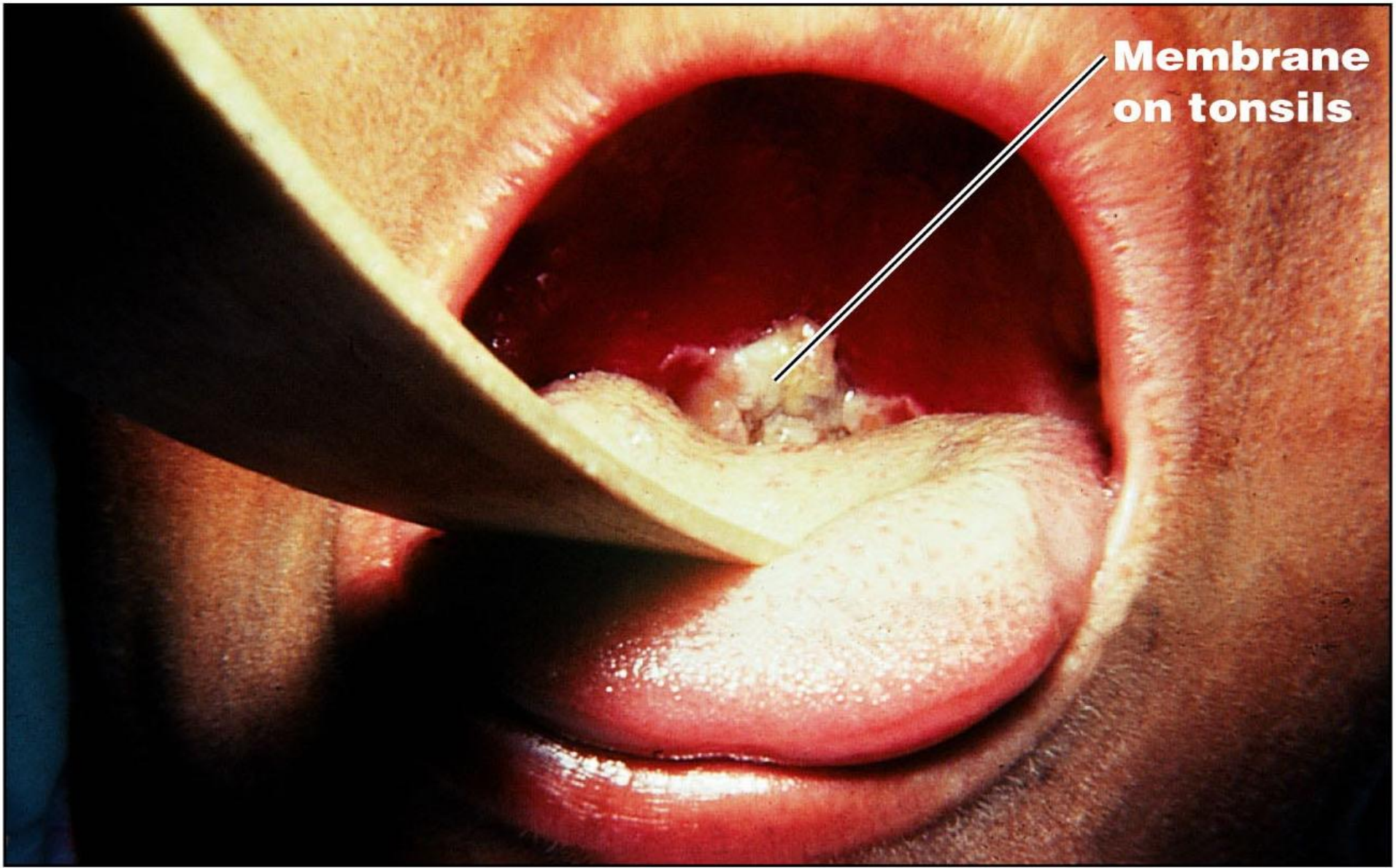
- **Diphtheria toxin is aprototype A-B baterial toxin. B- subunit binds receptors on the surface of host cell facilitating internalization by endocytosis the low pH of the endosome triggers cleavage of the two subunit releasing**
- **The calalytic A subunit into the cytoplasm .this action complete shutdown of protein synthesis and cell death by binding to eukaryotic elongation factor-2(EF-2)**


Pinocytosis
Phagocytosis
Receptor-mediated
endocytosis

Mechanism of Action of Diphtheria Toxin: Inhibition of Protein Synthesis



Diphtheria



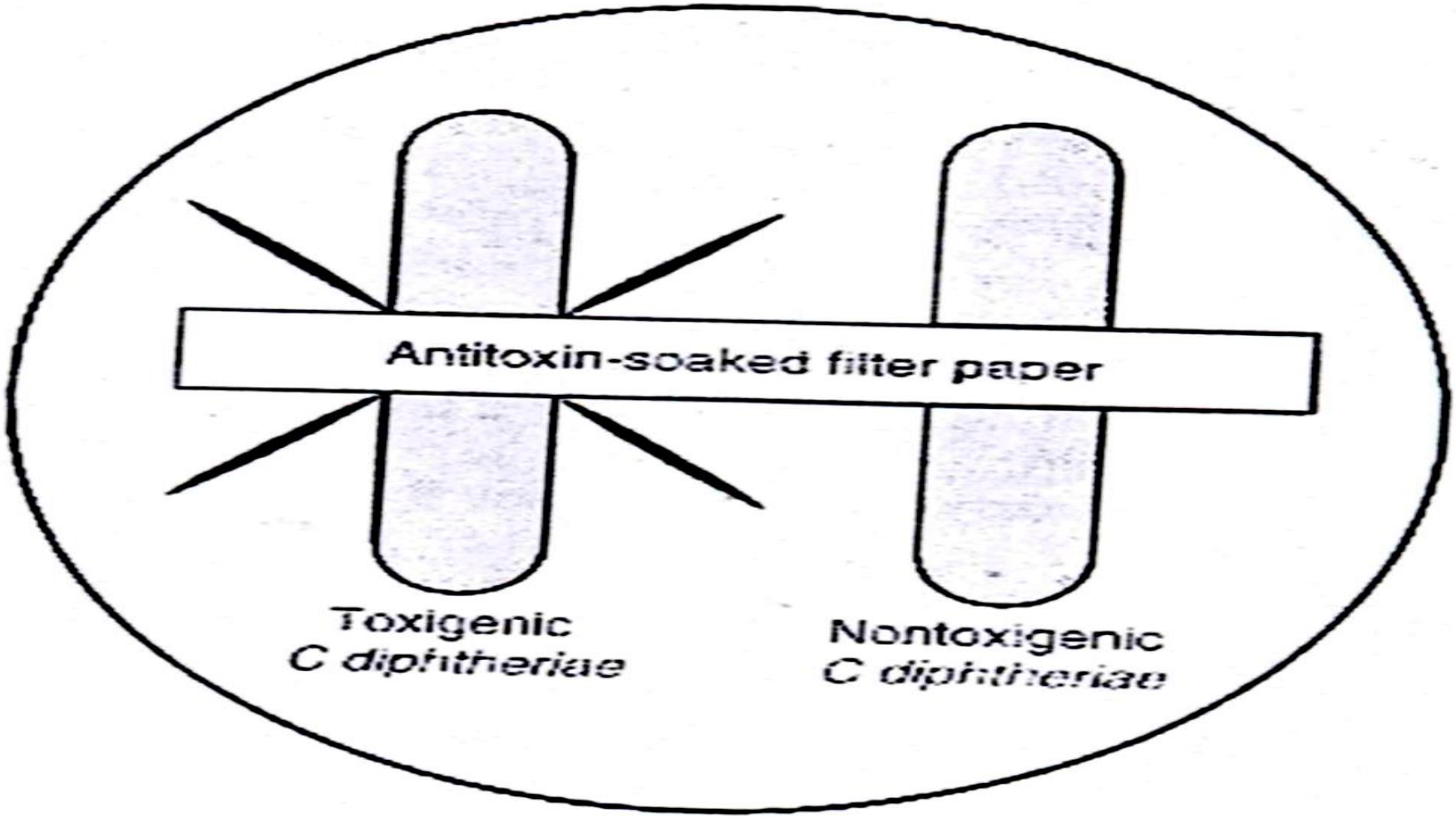
Diagnosis :

- **1-Albert staining to demonstration the chaines letter arrangement & metachromatic granules.**
- **2-throat swab for cultured on lofflers media or Tellurite media**
- **3-Eleck test: Invitro it is a double –diffusion test to detection precipitin line of diptheria toxin on agar plate**

ELECK TEST

- **It is double diffusion test performed directly on surface of agar plate sticking with diphtheria .After paper strip is impregnated with antiserum to toxin . If strain is Toxin producing precipitation of Toxin with antitoxin serum will forming precipitation line, after 48 hr incubation at 37 C bacteria growth will diffuse Toxin in agar & Where meet optimum concentration will so precipitin line form**

Eleck Test


Antitoxin-soaked filter paper
Toxigenic
C diphtheriae
Nontoxigenic
C diphtheriae

Prevention:

- **Diphtheria is effectively controlled by immunization.**
- **1-Active immunization against toxoid induces antibodies directed against the B-subunit**
- **2-These antibodies prevent receptor binding by toxin.**

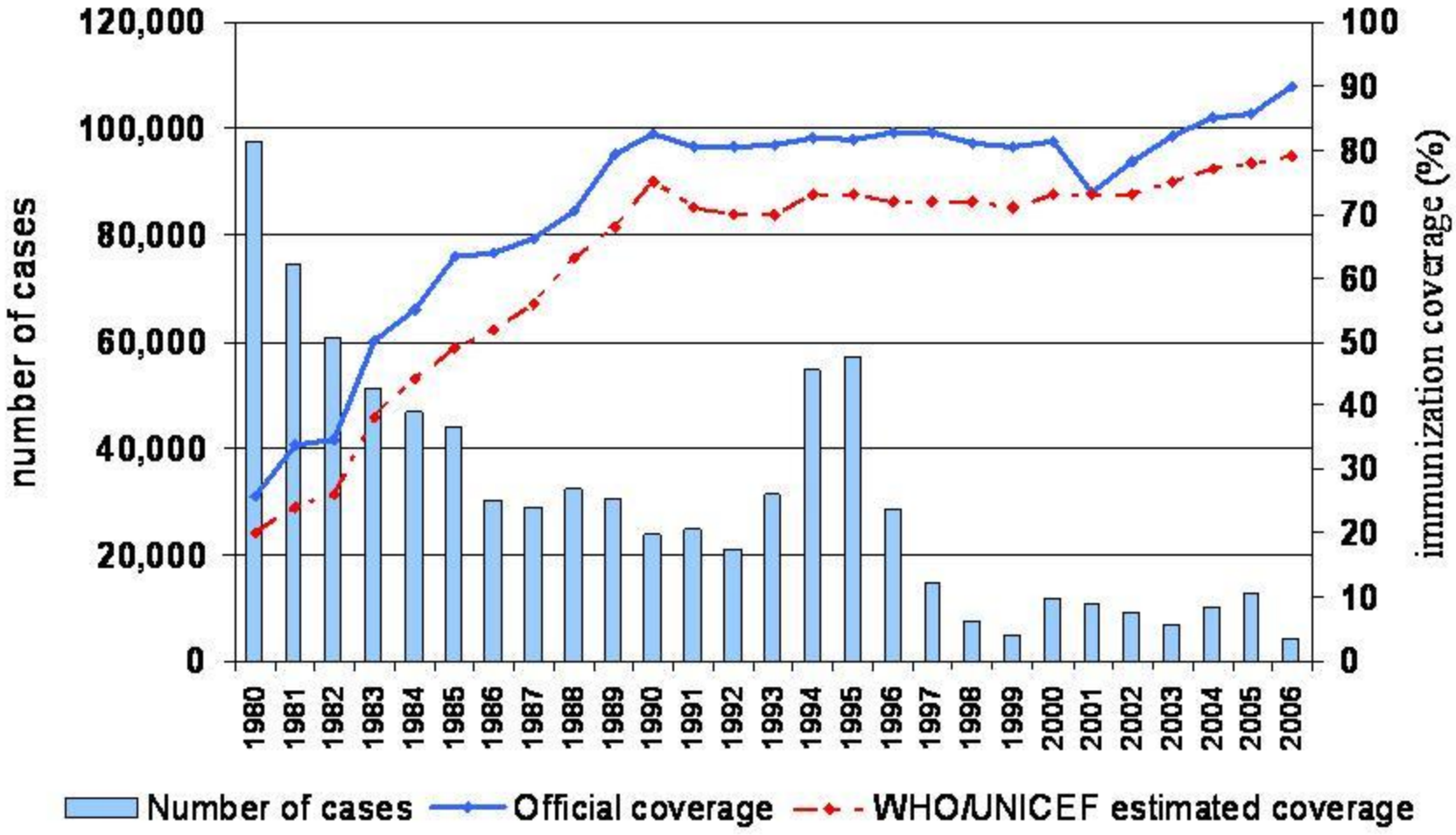
Treatment:

- **The treatment strategy involve combination of antitoxin administration and antibiotics such as penecillin or erythromycin**

Role of Treatment

- Passive immunization is given with an antitoxin to those who are suspected of having the disease already. In addition, penicillin, or erythromycin, is given, not only to stop further growth of the bacteria, but also to prevent the patient from becoming a carrier after recovery. A procedure known as the Schick test is used to determine whether a person is susceptible to the diphtheria bacterium.

Diphtheria global annual reported incidence and DTP3 coverage, 1980-2006



Source: WHO/IVB database, 2007

193 WHO Member States. Data as of September 2007

Date of slide: 04 October 2007

WHO

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THE END.