Clostridium tetani

- flagellated and motile
- naturally found in the large intestine in humans and other animals including horses and donkeys
- passed out in faeces and contaminates the environment

Significant biochemical property

- predominantly proteolytic

Spores

- observable microscopically as a distended part at one end of the bacillus
  - described as terminal spores
  - microscopic morphology described as drumstick appearance

effects of physical changes on *C. tetani* spores

- vary according to the *C. tetani* strain
  - a. some strains form spores which are readily inactivated by commonly used physical methods of treatment of items
  - b. other strains form spores which are highly resistant to physical conditions including
    1. commonly used disinfection methods
    2. adverse environmental conditions
       . capable of survival for years in the environment
    3. boiling in water for less than 3 hours
    4. dry heat at 150 degrees c for 1 hour

Extra cellular products of *C. tetani*

- mainly
  1. **tetanolysin**
     - causes lysis of red blood cells
  2. **tetanospasmin**
     - exotoxin of *C. tetani*
     - neurotoxin
       - virulence factor essential for disease manifestations in humans
     - convertible to tetanus toxoid

Clinical implications of *C. tetani*

- causative agent of tetanus
- infection occurs through contamination of wounds by material containing spores including
  - a. soil
  - b. dirty clothes
  - c. dust
  - d. contaminated instruments and other items
- spores germinate into bacilli facilitated by reduced oxygen tension and devitalized tissues in the wound
- *C. tetani* remains localized in the infected part
- infection of the umbilical wound of a new born infant results in neonatal tetanus

- bacilli in the wound release tetanospasmin
  - diffuses into the blood circulatory systems and reaches the nervous system
  - passes through nerve trunks into the central nervous system
  - prevents the affected neurons from releasing the inhibitory mediator in motor neuron synapses resulting in over-activity of the muscles in response to stimuli
- overall effects are generalized strong sustained contractions of muscles or spasms and increased reflex responses to stimuli

Laboratory investigation of tetanus

- specimens and examination procedures as described for *C. perfringens*
- colonies of *C. tetani*
  - grows as a layer on the surface of BA
  - Gram's stain to show Gram positive bacilli
    - drumstick appearance after prolonged incubation
  - spore stain for spores after a longer incubation

Management of tetanus

1. mainly
   a. administration of tetanus antitoxin
   b. antimicrobial agents
      C. tetani is susceptible to penicillin
2. other methods include
   a. general supportive care
   b. muscle relaxants
   c. surgical management of wounds where required

prevention of tetanus

1. methods mentioned for gas gangrene and *C. perfringens*
2. immunization with tetanus toxoid
   - as part of management of traumatic wounds
   - during antenatal care for expectant mothers
   - in patients undergoing recovery from tetanus
   - as part of routine immunization of children
3. use of sterile equipment and aseptic methods in wound management child delivery and care of the umbilical wound in the new born

Clostridium botulinum

- encountered in the environment as saprophytes
  - source of contamination of various items
- flagellated and motile
- spores are placed centrally or sub-terminally on the bacillus

significant physical properties of spores

1. withstand moist heat at 100 degrees c for several hours
2. destroyed at 120 degrees c in 5 minutes

Antigens of *C. botulinum*

- several different antigens possessed
  - identified and designated alphabetical letters A up to G
  - applied in serotyping into serotypes A up to G
    - each serotype produces antigenically distinct exotoxin

referred to as botulinum toxin

Exotoxin

- neurotoxin
- significant virulence factor
- heat labile
  - destroyed at 80° c applied for 30 to 40 minutes
    - inactivated by proper heating of food which may contain the toxin

Medical significance of *C. botulinum*

- causative agent of botulism
- mainly
  1. **Food-borne botulism**
     - more frequently encountered than other types
     - severe form of food poisoning
     - develops when botulinum spores
       - contaminate foods which may be improperly
         a. cooked b. canned c. preserved
       - germinate into bacilli which multiply and release the exotoxin in the food
       - released botulinum toxin is ingested in the food when the food is consumed

2. **wound botulism**
   - secondary to wound infection by *C. botulinum*
   - relatively less common than food-borne type
   - spores contaminate wounds and germinate into bacilli which release the exotoxin

- botulinum toxin
  - binds to the presynaptic nerve endings of the peripheral nervous system and cranial nerves
  - inhibits the release acetylcholine
  - interferes with transmission of nerve impulses and causes paralysis of muscles

manifestations

- according to the muscles affected and the impaired functions

Laboratory investigation of botulism

specimens include

a. stool and other intestinal tract contents

b. suspected food

procedures

1. Gram's stain and microscopy as for other clostridial diseases

2. culture for isolation and identification
   a. as applied to other anaerobes

3. detection of botulinum toxin in
   a. blood b. left over food c. stool

Management of botulism

1. administration of antitoxin to the specific causative serotype
2. for wound botulism
   - . wound management by surgical methods
   - . antimicrobial agents administration
     - . susceptible to penicillin and metronidazole

prevention of foodborne botulism methods include

1. proper processing and canning of food
2. sufficient heating of food before consumption
   - . more so for food suspected to be contaminated
3. proper use of food preservatives

Clostridium difficile

- more resistant to commonly used antibiotics than other flora in the colon
  - majority of bacterial flora are susceptible to commonly used antibiotics
- broad spectrum antibiotics administered for other infections inhibit the susceptible organisms
- *C. difficile* is not inhibited and is able to multiply
  - produces toxins
    a. enterotoxin
    b. cytotoxin
- effects of the toxins result in antibiotic associated diarrhoeal diseases including pseudomembranous colitis

Gram negative non-spore forming anaerobic bacilli

- species of several genera encountered as
  1. normal flora in humans together with other anaerobes in specific parts
  2. potential pathogens
- genera include
  a. Bacteroides b. Porphyromonas c. Prevotella
  - all belonged to the genus Bacteroides
  - reclassified based on differences in some biological and biochemical characteristics
  - species are morphologically similar

Bacteroides

- non-motile capsulated Gram negative bacilli
- several species including *Bacteroides fragilis*

pathogenicity properties

- pathogenic species possess virulence factors including
  a. polysaccharide capsule
  b. pili
  c. enzymes
- cause various conditions in association with precipitating factors which can be
  1. trauma involving the colon
  2. presence of devitalized tissue and impairment of blood supply
  3. facultative anaerobes or other strict anaerobes in a lesion

Clinical significance of *B. fragilis*

- involved in causation of various conditions
- can be as part of a mixed infection or single causative agent
- conditions include
  1. intra-abdominal infections including appendicitis peritonitis and abscesses
  2. other infections and abscesses involving inner tissues including lungs and brain
  3. infections of female reproductive system as complications associated with reproduction
  4. bacteraemia

Fusobacterium

- pleomorphic non-motile Gram negative bacilli

species numerous include

a. *F. nucleatum* b. *F. necroforum*

significance

a. normal flora particularly in the mouth
b. causative agent of human infections
   - with other organisms in mixed infections or as a single causative agent
   - *F. nucleatum* is one of the causative agents of ulcerative gingivitis

susceptible to several antibiotics including

a. penicillin b. metronidazole c. clindamycin

Anaerobic cocci

- normal flora of mucosal surfaces together with anaerobic Gram negative bacilli

Gram positive anaerobic cocci

- various genera including *Peptostreptococcus*
- differentiated by biochemical tests and metabolic end products
- occasionally isolated from abscesses together with other anaerobes

Gram negative anaerobic cocci

Veillonella species *V. parvula*

normal flora with other strict anaerobes

may be isolated from specimens in mixed infections without pathogenic role