

**Lec. *Bacteroides*, *Tannerella*, *Porphyromonas* and *Prevotella***

The genera described in this chapter are obligately anaerobic, short Gram-negative rods or coccobacilli. Historically, only the *Bacteroides* genus was known, but the application of new taxonomic techniques has resulted in the definition of three additional genera: *Tannerella*, *Porphyromonas* and *Prevotella*. Together they comprise a substantial proportion of the microflora of the dental plaque, intestine and the female genital tract.

- *Bacteroides* spp. are mainly restricted to species found **predominantly in the gut** and are the most common agents of serious anaerobic infections; *Bacteroides fragilis* is the main pathogen.
- *Tannerella* spp. are black-pigmented, anaerobic rods, strongly implicated as a major pathogen of periodontal disease. *Tannerella forsythia* is frequently isolated with *Porphyromonas gingivalis*, indicating an ecological relationship between them.
- *Porphyromonas* spp. are asaccharolytic, pigmented species and form part of the normal oral flora. They are agents of periodontal disease and hence considered as **periodontopathic** organisms.
- *Prevotella* spp. include saccharolytic oral and genitourinary species; some species are periodontopathic.

Collectively, *Tannerella*, *Porphyromonas* and *Prevotella* species are referred to as **black-pigmented anaerobes**, as some organisms from these genera form a characteristic brown or black pigment on blood agar

***Bacteroides******Bacteroides fragilis*****Habitat and transmission**

*Bacteroides* species are the most predominant flora in the intestine (10<sup>11</sup> cells per gram of faeces), far outnumbering *Escherichia coli*. They cause serious anaerobic infections such as intra-abdominal sepsis, peritonitis, liver and brain abscesses, and wound infection.

**Characteristics**

Strictly anaerobic, Gram-negative, non-motile, non-spore-forming bacilli, but may appear pleomorphic. The polysaccharide capsule is an important virulence factor.

**Culture and identification**

These organisms have stringent growth requirements; they demonstrate slow growth on blood agar and appear as grey to opaque, translucent colonies. They grow well in Robertson's cooked meat medium supplemented with yeast extract. Identified by biochemical tests, growth inhibition by bile salts, antibiotic resistance tests and gas-liquid chromatographic analysis of fatty.

**Pathogenicity**

Mainly the result of its **endotoxin** and **proteases**. No exotoxin has been reported. Other organisms, such as coliforms, are commonly associated with sepsis. The latter facultative anaerobes utilize oxygen in the infective focus and facilitate the growth of

the anaerobic *Bacteroides* strains. Consequently, many *Bacteroides* infections are **polymicrobial** in nature.

#### **Treatment and prevention**

Sensitive to metronidazole and clindamycin. Resistant to penicillins, first-generation cephalosporins and aminoglycosides. Penicillin resistance is due to  $\beta$ -lactamase production. As *Bacteroides* spp. are normal gut commensals, infections are **endogenous** and diseases are virtually impossible to prevent.

#### **Tannerella**

*Tannerella forsythia* (formerly *Bacteroides forsythus* and *Tannerella forsythensis*)

#### **Habitat and transmission**

Both supragingival and subgingival sites but more common in the latter; the degree of isolation strongly related to increasing pocket depth and, increasingly, recovered from sites that converted from periodontal health to disease and sites with periodontal breakdown, hence considered a **consensus periodontal pathogen**. Indeed, *T. forsythia*, *Treponema denticola* and *P. gingivalis* are considered the three agents of 'red complex' bacteria almost always associated with periodontal disease



Fig. 1 Black-pigmented colonies of periodontopathogen *Porphyromonas gingivalis* on blood agar. The pigment is thought to be related to breakdown products of the blood.

#### **Characteristics**

Non-motile, pleomorphic, spindle-shaped Gram-negative rods.

#### **Culture and identification**

Grows anaerobically, but sometimes requires up to 14 days for visible growth. Growth enhanced by co-cultivation with *Fusobacterium nucleatum*. Media supplemented with *N*-acetylmuramic acid enhances growth.

#### **Pathogenicity**

Periodontal pathogen in both human and animals; induces apoptotic cell death; invades epithelial cells *in vitro* and *in vivo*. Its endotoxin, fatty acid and methylglyoxal production are considered virulence factors; increased levels found in ligature-induced periodontitis and peri-implantitis in dogs.

#### **Porphyromonas**

#### ***Porphyromonas gingivalis***

#### **Habitat and transmission**

Found almost solely at subgingival sites, particularly in advanced periodontal disease: considered a **consensus periodontal pathogen**. As mentioned above, *P. gingivalis*, *T. forsythia* and *Treponema denticola* are considered the three agents of 'red complex' bacteria almost always associated with periodontal disease. *P. gingivalis* is sometimes recovered from the tongue and tonsils.

## **Characteristics**

Non-motile, asaccharolytic, short, pleomorphic, Gram negative coccobacilli. highly proteolytic pathogen that utilizes protein substrates as the main source for energy production and proliferation.

## **Culture and identification**

Grows anaerobically, with dark pigmentation, on media containing lysed blood; identified by biochemical characteristics, DNA and molecular probes are now used to identify these organisms directly from plaque samples.

## **Pathogenicity**

An aggressive periodontal pathogen in both humans and animals (e.g. guinea pig, monkey, beagle dogs); its fimbriae mediate adhesion and the capsule defends against phagocytosis. Produces a range of virulence factors including collagenase, endotoxin, fibrinolysin, phospholipase A, many proteases that destroy immunoglobulins, gingipain, a fibroblast-inhibitory factor, complement and haem sequestering proteins, and a haemolysin.

## ***Prevotella***

This genus includes a number of pigmented as well as non pigmented species that are moderately saccharolytic; all produce acetic and succinic acid from glucose. *Prevotella melaninogenica* is the type species.

## ***Prevotella* spp.**

### **Habitat and transmission**

The predominant ecological niche of all *Prevotella* species appears to be the human oral cavity. Strains of *Prevotella intermedia* are associated more with periodontal disease, while *Prevotella nigrescens* is isolated more often from healthy gingival sites.

### **Culture and identification**

Non-motile, short, round-ended, Gram-negative rods; brown-black colonies on blood agar (when pigmented). Molecular techniques are required to differentiate some species.

### **Pathogenicity**

*P. intermedia* is closely associated with periodontal disease and shares a number of virulence properties exhibited by *P. gingivalis*. These organisms are classified as belonging to the 'orange complex' bacteria associated with the developmental stages of periodontal disease, and precedes the arrival of the 'red complex' group of bacteria. The pathogenicity of other subdivided species awaits clarification. Oral non-pigmented species such as *Prevotella buccae*, *Prevotella oralis* and *Prevotella dentalis* are isolated on occasion from healthy subgingival plaque. Some of the latter are associated with disease, and increase in numbers and proportions during periodontal disease. different *Prevotella* taxa have been reported as causative for halitosis (oral malodor).

## **Reference:**

- .BOOK: Essential microbiology for dentistry 2012. Elsevier Ltd. Fourth edition, Lakshman Samaranayake. Elsevier Ltd.

And other references

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