

# BACTEROIDES spp.

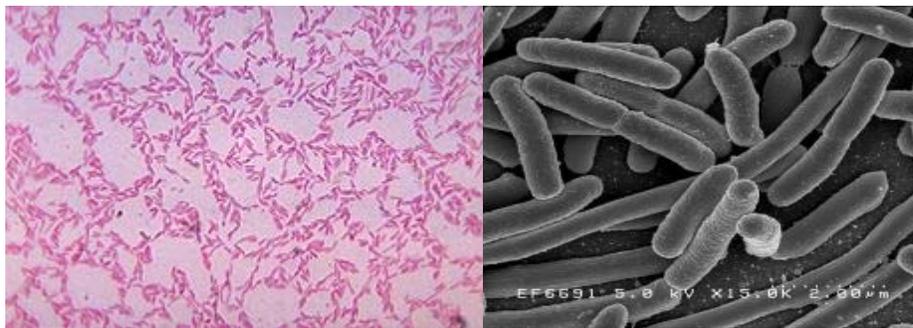
## PATHOGEN SAFETY DATA SHEET - INFECTIOUS SUBSTANCES

### INFECTIOUS AGENT

**NAME:** *Bacteroides* spp. or related genera, formerly considered as *Bacteroides*

**SYNONYM OR CROSS REFERENCE:** Species associated with sepsis, abscess or surgical infections include *B. caccae*, *B. coagulans*, *B. coprocola*, *B. eggerthii*, *B. fragilis*, *B. massiliensis*, *B. nordii*, *B. ovatus*, *B. plebeius*, *B. pyogenes*, *B. salyersiae*, *B. stercoris*, *B. tectus*, *B. thetaiotaomicron*, *B. uniformis*, *B. vulgatus*.

**CHARACTERISTICS:** The gram-negative *Bacteroides* spp. or closely related genera are capsulated obligatory anaerobic bacilli that are non-spore forming, pale-staining, and some are motile by peritrichous flagella, while other taxa are non-motile. *Bacteroides*, *Parabacteroides*, *Odoribacter* are generally bile resistant, distinguished from genera which are bile sensitive. They are normally commensal, found in the intestinal tract of humans (mouth, colon, urogenital tract) and other animals. Many cultures of *Bacteroides* strains display brown to black pigmentation on blood agar media caused by esculin hydrolysis.



*Bacteroides* spp., gram-stained<sup>1)</sup>

*Bacteroides fragilis* cells<sup>2)</sup>

### HAZARD IDENTIFICATION

**PATHOGENICITY/TOXICITY:** *Bacteroides* spp. represents an important anaerobic bacterial genus associated with human infections. In combination with other facultative/strict anaerobes, they are responsible for the majority of localized abscesses within the cranium, thorax, peritoneum, liver, and female genital tract. They can cause pulmonary abscesses when naturally-occurring oropharyngeal *Bacteroides* and closely related genera are aspirated into the lung. These taxa can lead to many types of diseases, some of which can be fatal, including noma (cancrum oris), human apical periodontitis, endocarditis, pelvic inflammatory disease, suppurative thrombophlebitis, and wound infections. Organisms from oral flora also have a role in dental abscesses and infectivity of human bites.

*Bacteroides fragilis* is the most common opportunistic pathogen of *Bacteroides* spp. Spread to bloodstream (bacteremia) is more common for *B. fragilis* than any other anaerobe. Deep pain and tenderness below the diaphragm are typical of *B. fragilis* infection. Widespread intra-abdominal abscesses may be associated with fever and abdominal pain.

**EPIDEMIOLOGY:** Worldwide - *Bacteroides* spp. or closely related genera are part of the normal flora of the gastrointestinal and respiratory tract, the mouth, and the female genital tract. Infections are normally endogenous, originating from the patient's own intestinal flora. People who consume a considerable amount of meat show higher numbers of *Bacteroides* spp.

**HOST RANGE:** Humans, dogs, cats and other animals.

**INFECTIOUS DOSE:** Unknown.

**MODE OF TRANSMISSION:** Infection results from displacement of *Bacteroides* spp. or closely related genera from normal mucosal location as a result of trauma such as animal/human bites, burns, cuts, or penetration of foreign objects, including those involved in surgery. There is no evidence that organisms are invasive on their own.

**INCUBATION PERIOD:** Incubation period is variable and depends on the inoculum and the site of involvement but is usually 1 to 5 days.

**COMMUNICABILITY:** Low; human-to-human transmission is possible through clenched-fist wounds and skin penetrating human bites.

## DISSEMINATION

**RESERVOIR:** Present as part of normal flora in of the gastrointestinal tract, the mouth, and the female genital tract of humans and other animals.

**ZOONOSIS:** Yes, skin penetrating animal bites could lead to infection.

**VECTORS:** None.

## STABILITY AND VIABILITY

**DRUG SUSCEPTIBILITY:** Susceptible to chloramphenicol, clindamycin, and metronidazole. Piperacillin-tazobactam combinations as well as tigecycline are active against most strains of Gram-negative rods. Ertapenem, imipenem, and meropenem are consistently active against most anaerobes. Moxifloxacin is moderately active against many strains.

Use of  $\beta$ -lactamase inhibitors (i.e. clavulanate, sulbactam) and  $\beta$ -lactam (i.e. ampicillin, ticarcillin) has been used to circumvent resistance. Cefoxitin or imipenem ( $\beta$ -lactams) have been used effectively alone for some strains.

**DRUG RESISTANCE:** Resistance against antibiotics is increasingly common, and frequently observed with penicillin, ampicillin, cephalothin, tetracycline, piperacillin, chloramphenicol, kanamycin, colistin, rifampicin, vancomycin, and the aminoglycosides. The *B. fragilis* group is commonly resistant to expanded and broad spectrum cephalosporins, including  $\beta$ -lactamase-resistant drugs such as cefoxitin, and clindamycin. Strain resistance to imipenem and metronidazole, although it has been detected worldwide, are rarely encountered. Resistance to quinolones is increasing. Some members of *B. fragilis* group have shown resistance to ampicillin-sulbactam and amoxicillin-clavulanate combination therapies. Isolates often produce  $\beta$ -lactamase, often making penicillin based antibiotics ineffective.

**SUSCEPTIBILITY TO DISINFECTANTS:** More specific information on *Bacteroides* spp. is not available, but most bacteria have been shown to be susceptible to low concentration of chlorine, 1% sodium hypochlorite, 70% ethanol, phenolics such as orthophenylphenol and ortho-benzyl-paua-chlorophenol, 2% aqueous glutaraldehyde, iodine, formaldehyde, and peracetic acid (0.001% to 0.2%).

**PHYSICAL INACTIVATION:** Information specific to *Bacteroides* and like genera is not available, but most bacteria can be inactivated by moist heat (121°C for 15 min - 30 min) and dry heat (160-170°C for 1-2 hours).

**SURVIVAL OUTSIDE HOST:** *Bacteroides* and like genera have been detected in feces infected water by polymerase chain reaction (PCR) for at least 2 weeks at 4°C; 4 to 5 days at 14°C; 1 to 2 days at 24°C; and 1 day at 30°C.

# FIRST AID / MEDICAL

**SURVEILLANCE:** Monitor for symptoms. The gross appearance (purulence, necrotic tissue) and characteristic odor of a specimen may give a clue to the presence of an anaerobic infection caused by organisms such as *Bacteroides* spp. The Gram stain is the fastest and simplest method to detect these agents. Molecular methods are becoming a commonly used diagnostic tool.

For wound infections: Identification requires careful sampling to avoid contamination by normal, non-infectious flora. Swab samples are frequently misleading. Preferred method is to aspirate purulent lesions with sterile syringe following disinfection of skin surface. Internal purulent discharges or from surgically removed tissue samples can be sampled by biopsy. Samples must be transported from collection site under anaerobic conditions.

**FIRST AID/TREATMENT:** Administer appropriate drug therapy. Drainage of abscesses and debridement of necrotic tissue are the mainstays of treatment. Antimicrobial therapy is complicated by the fact that abdominal *B. fragilis* isolates almost always produce  $\beta$ -lactamase.

**IMMUNISATION:** It has been demonstrated that antibodies to capsular polysaccharides facilitate classical complement pathway killing; however, there is no evidence that this confers immunity to reinfection. There is evidence that cell-mediated immunity may be protective.

**PROPHYLAXIS:** Metronidazole, imipenem, and amoxicillin seem to be effective against *B. fragilis* and *B. thetaiotaomicron*. Studies using a rat model have shown that pretreatment using oral vancomycin/imipenem resulted in undetectable levels of *Bacteroides* spp.

# LABORATORY HAZARDS

**LABORATORY-ACQUIRED INFECTIONS:** None reported to date.

**SOURCES/SPECIMENS:** Feces, wound exudates, tissues (intestinal tract, vagina, respiratory tract), and laboratory animal bites.

**PRIMARY HAZARDS:** Accidental parenteral inoculation; direct contact of mucous membranes (or wounds, cuts on skin); skin penetrating animal bites.

**SPECIAL HAZARDS:** None.

# EXPOSURE CONTROLS / PERSONAL PROTECTION

**RISK GROUP CLASSIFICATION:** Risk Group 2. This risk group applies to the genus *Bacteroides*, and may not apply to every species within the genus or other genera outlined here.

**CONTAINMENT REQUIREMENTS:** Containment Level 2 facilities, equipment, and operational practices for work involving infectious or potentially infectious materials, animals, or cultures. These containment requirements apply to the genus *Bacteroides*, and may not apply to each species within that genus or other genera outlined here.

**PROTECTIVE CLOTHING:** Lab coat. Gloves when direct skin contact with infected materials or animals is unavoidable. Eye protection must be used where there is a known or potential risk of exposure to splashes.

**OTHER PRECAUTIONS:** All procedures that may produce aerosols, or involve high concentrations or large volumes should be conducted in a biological safety cabinet (BSC). The use of needles, syringes, and other sharp objects should be strictly limited. Additional precautions should be considered with work involving animals or large scale activities.

# HANDLING AND STORAGE

**SPILLS:** Allow aerosols to settle and, wearing protective clothing, gently cover spill with paper towels and apply an appropriate disinfectant, starting at the perimeter and working towards the centre. Allow sufficient contact time before clean up.

**DISPOSAL:** Decontaminate all wastes that contain or have come in contact with the infectious organism before disposing by autoclave, chemical disinfection, gamma irradiation, or incineration.

**STORAGE:** Properly labeled and sealed containers.

## REFERENCE

Pathogen Safety Data Sheet (PSDS) for *Bacteroides* has been modified from the ones produced by the Public Health Agency of Canada as educational and informational resources for laboratory personnel working with infectious substances.

- 1) Picture from Wikipedia
- 2) Picture from [www.sciencebuzz.org](http://www.sciencebuzz.org)