Neisseria meningitidis is a Gram-negative, non-spore forming, non-motile, encapsulated, and non-acid-fast diplococci, which appears in kidney bean shape under the microscope. There are thirteen types (serogroups) of Neisseria meningitidis, nine of which cause invasive disease (A, B, C, D, X, Y, Z, 29E and W-135). Meningococcal disease is an illness caused by Neisseria meningitidis causing meningitis or septicemia. 10% of the populations are carriers of the bacteria. Epidemics are most commonly due to serogroups A,B,C.

1. **Disease/Infection**
   N. meningitidis has a wide range of manifestations, ranging from transient mild sore throat to fatal meningitis or meningococcal septicemia. Meningitis and septicemia are the most common presentations of the disease.

2. **Pathogenicity**
   Recent studies of LAI and exposures have indicated that manipulating suspensions of N. meningitidis outside a BSC is associated with a high risk for contracting meningococcal disease. Invasion of organisms from the respiratory mucosa into the circulatory system can cause infection that can range in severity from subclinical to fulminant fatal disease.

   At least eight incidents of infection among laboratory workers with at least one death have been reported as of 1974. Two fatal cases were reported in 1988. The most recent fatal case was in 2012.

   a. **Special Populations at Risk**
      Complement deficiency involving both the late and early components of the complement system have been associated with increased susceptibility to meningococcal infection. Asplenic people are susceptible to fulminate bacteremia.

3. **Biosafety Information**
   a. **Risk Group/BSL**
      Risk Group 2
      Biosafety Level 2 Practices
   b. **Modes of Transmission**
      Transmission occurs by direct contact with infectious respiratory droplets or oral secretion.

<table>
<thead>
<tr>
<th>Transmission</th>
</tr>
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<tbody>
<tr>
<td>Skin Exposure (Needlestick, bite, or scratch):</td>
</tr>
<tr>
<td>Direct skin contact with N. meningitidis.</td>
</tr>
<tr>
<td>Mucous Membrane Splash to Eye(s), Nose or Mouth:</td>
</tr>
<tr>
<td>Yes, Direct skin contact with organism</td>
</tr>
<tr>
<td>Inhalation:</td>
</tr>
<tr>
<td>Exposed to respiratory droplets.</td>
</tr>
<tr>
<td>Ingestion:</td>
</tr>
<tr>
<td>Ingestion unlikely</td>
</tr>
</tbody>
</table>

c. **Host Range/Reservoir**
   Humans

d. **Symptoms**
   **Transient meningococcemia**: Patients present with mild flu-like symptoms such as fever, joint pain, and occasionally rash. The illness lasts for a few days or weeks.
   **Meningitis**: Most patients present with signs of meningeal irritation, including, neck stiffness, bulging fontanelle (in infants), irritability, lying on one side away from light, and inability to extend the knee when hip is flexed in supine position (positive kernig’s sign). Convulsions, declining level of consciousness, and coma may occur. The petechial rash of meningococcemia may also occur.
**Meningococcemia:** Patients present with rapid onset of fever, vomiting, photophobia, convulsions, skin rash, lethargy, irritability, drowsiness, diarrhea, muscular pain, arthralgia, and rarely, acute abdominal pain. The characteristic meningococcal rash is due to disseminated intravascular coagulation, caused by meningococcal bacteremia, and can result in loss of digits and limbs in some cases. In severe cases patients may present with septic shock, leading to respiratory failure, renal failure, coma, and even death within 24 hrs. of onset of symptoms.

**Chronic meningococcal disease:** Rare manifestation of N. meningitidis infection. Patients present with chronic intermittent high fever, joint pain, and headache, with or without skin lesions.

Other manifestations of N. meningitidis infection include septic arthritis; upper or lower respiratory tract infections such as otitis media, pharyngitis, bronchitis, and pneumonia; pericarditis; myocarditis; endocarditis; and conjunctivitis.

e. **Incubation Period**
2-10 days (average 2-4 days); Invasive infections occur within 14 days of acquisition of the bacteria.

f. **Viability**
*N. meningitidis* is highly susceptible to common disinfectants. Common disinfectants used against vegetative bacteria include 1% sodium hypochlorite, 70% ethanol, phenolics, 2% glutaraldehyde, formaldehyde, and peracetic acid.

g. **Survival Outside Host**
*N. meningitidis* does not survive well outside of host. It has, however, been reported to survive on glass and plastic at ambient temperatures for hours to days.

**Information for Lab Workers**

1. **Laboratory PPE**
   Personal protective equipment includes but is not limited to gowns with tight wrists and ties in back, disposable gloves, combination safety glass and mask or a face shield. Facilities for washing and changing clothing after work should be available.

2. **Containment**
   Research should be conducted using Biosafety Level 2 practices, equipment, and facility design. Gloves and gowns should be worn when handling infected laboratory animals and when there is the likelihood of direct skin contact with infectious materials. Animal studies may be performed at ABSL-3. BSL-2 practices, containment equipment, and facilities are recommended for activities using clinical materials and diagnostic quantities of infectious cultures.

3. **In Case of Exposure/Disease**
   1. For injuries in the lab which are major medical emergencies (heart attacks, seizures, etc...):
      a. **Medical Campus:** call or have a coworker call the Control Center at 4-4144.
      b. **Charles River Campus:** call or have a coworker call campus security at 617-353-2121.
      You will be referred to or transported to the appropriate health care location by the emergency response team.

   2. For lab exposures (needle sticks, bite, cut, scratch, splash, etc…) involving animals or infectious agents, or for unexplained symptoms or illness call the ROHP 24/7 hour number (1-617-414-ROHP (7647); or, 4-ROHP (7647) if calling from an on-campus location) to be connected with the BU Research Occupational Health Program (ROHP) medical officer. ROHP will refer you to the appropriate health care location.

   3. Under any of these scenarios, always inform the physician of your work in the laboratory and the agent(s) that you work with.

   4. Provide the wallet-size agent ID card to the physician.

4. **Vaccination**
   There are vaccines against some serogroups of N. meningitidis. The vaccines are safe and highly effective. The vaccine may be used to control outbreaks of meningococcal disease caused by serogroups A, C, Y, and W-135.
Meningococcal vaccine is recommended for lab workers with routine exposure to the agent. No vaccine is currently available for serogroup B.

**Information for First Responders/Medical Personnel**

1. **Public Health Issues**  
   Person-to-person transmission (highly contagious) occurs through droplets shed from the upper respiratory tract or direct contact with oropharyngeal secretions through sharing of drinks or intimate kissing; transfer via contaminated fomites has been postulated but is considered rare. An individual remains infectious as long as meningococci are present in respiratory/oral secretions or until 24 hours after initiation of effective antibiotic treatment. In suspected meningitis cases, droplet Precautions for first 24 hours of antimicrobial therapy; mask and face protection during intubation.

2. **Diagnosis/Surveillance**  
   Monitor for symptoms. Culture of clinical specimens from a sterile site on blood agar with stain test can be used for diagnosis. Other methods include polymerase chain reaction (PCR), antigen detection and enzyme-linked immunosorbent assay (ELISA).

3. **First Aid/Post Exposure Prophylaxis**  
   Perform one of the following actions:
   
<table>
<thead>
<tr>
<th>Skin Exposure (Needlestick or scratch):</th>
<th>Immediately go to the sink and thoroughly wash the wound with soap and water for 15 minutes. Decontaminate any exposed skin surfaces with an antiseptic scrub solution.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mucous Membrane Splash to Eye(s), Nose or Mouth:</td>
<td>Exposure should be irrigated vigorously.</td>
</tr>
<tr>
<td>Splash Affecting Garments:</td>
<td>Remove garments that may have become soiled or contaminated and place them in a double red plastic bag.</td>
</tr>
</tbody>
</table>

Chemoprophylaxis is recommended for close contacts of patients with meningococcal disease, such as anyone exposed to oral secretions from infected person. Chemoprophylaxis should be given within 24 hours of diagnosis of the disease. Antibiotics used for chemoprophylaxis include oral rifampin, oral ciprofloxacin, and intramuscular ceftriaxone.

4. **Treatment**  
   Treated with a 3-7 day course of intravenous or intramuscular penicillin or ceftriaxone. Other antibiotics used for treatment of meningococcal diseases include chloramphenicol, fluoroquinolones, and meropenem.

5. **References**
   - Biosafety in Microbiological and Biomedical Laboratories; Deborah E. Wilson, DrPH, CBSP  Director Division of Occupational Health and Safety National Institutes of Health  Bethesda, Maryland L. Casey Chosewood, M.D.  Director Office of Health and Safety  Centers for Disease Control and Prevention Atlanta, Georgia; US Government Printing Office, Washington DC.  5th Edition; 2007
   - CDC MMWR: Exposure to Patients with Meningococcal Disease on Aircrafts ---United States, 1999—2001; [http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5023a2.htm](http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5023a2.htm)
   - Diagnosis and management of meningococcal disease for clinicians and clinical microbiologists; [http://neisseria.org/nm/diagnosis/](http://neisseria.org/nm/diagnosis/)
Neisseria meningitidis

Clinical Information for Healthcare Professionals: http://www.cdc.gov/meningitis/clinical-resources.html