

Slide 1	Staphylococcal Enterotoxin B (SEB) 	
Slide 2	Overview • Organism • History • Epidemiology • Transmission • Disease in Humans • Disease in Animals • Prevention and Control Center for Food Security and Public Health Iowa State University - 2004	In today's presentation we will cover information regarding the toxin Staphylococcal enterotoxin B and its epidemiology. We will also talk about the history of the agent, how it is transmitted, the species that it affects (including humans), and the clinical signs seen. Finally, we will address prevention and control measures.
Slide 3	Agent 	
Slide 4	Staphylococcal Enterotoxin B • Bacterial toxin – <i>Staphylococcus aureus</i> • Easily soluble in water • Very resistant to temperature fluctuations – Withstands boiling for several minutes – Freeze dried remains active for one year Center for Food Security and Public Health Iowa State University - 2004	<i>Staphylococcus aureus</i> produces many enterotoxins, and Staphylococcal enterotoxin B (SEB) is one example. SEB is a relatively stable compound that is easily soluble in water, very resistant to temperature fluctuations and can withstand boiling for several minutes. SEB can remain infective in the freeze dried form for at least one year. SEB is generally produced when there is an overgrowth of the staph organism, which occurs under the correct environmental conditions. <i>Staphylococcus aureus</i> grows very well at temperatures between 68° F and 99° F (20° C and 37° C). Growth is generally inhibited by competing organisms, but staphylococci can thrive in high concentrations of salt and sugar that other organisms cannot tolerate.
Slide 5	History 	

Slide 6	History • 1942-1969 – SEB stockpiled by U.S. during bioweapons program • Numerous endemic food poisoning incidents – Exact numbers not known – Most cases are not reported Center for Food Security and Public Health Iowa State University - 2004	SEB was one of the seven biological agents stockpiled by the U.S. during its bioweapons program, which was terminated in 1969. SEB is the cause of numerous food poisoning epidemics, but the actual incidence is unknown since many cases are so mild that patients often times do not recognize they have food poisoning and thus do not seek medical care. The number of reported cases of SEB in medical facilities also often goes undetermined.
Slide 7	Transmission Center for Food Security and Public Health Iowa State University	
Slide 8	Transmission: Humans • Reservoirs – Many mammals, birds, humans • Routes of exposure – Inhalation • Aerosolization • Likely bioterrorism attack – Ingestion • Foodborne illness • Community event • Church picnic  Center for Food Security and Public Health Iowa State University - 2004	There are two routes of exposure of SEB. The most common route is through ingestion (the toxin is produced in unrefrigerated meats, dairy and bakery products), and is most commonly seen in large group settings like a picnic or other large community event. Inhalation could also occur due to a bioterrorism attack. <i>Staphylococci</i> are present in a wide variety of mammals and birds and are also commonly found on environmental surfaces. Humans are also thought to be a main source of the organism since <i>Staphylococci</i> may be present in the nasal passages, throat, hair and skin of healthy people, and also in cuts, pustules and abscesses.
Slide 9	Disease in Humans Center for Food Security and Public Health Iowa State University	
Slide 10	Clinical Signs: Inhalation • Incubation – 1-6 hours • General symptoms – High fever (103-106°F) • May persist for 5 days or more – Chills – Myalgia Center for Food Security and Public Health Iowa State University - 2004	The onset of SEB is about 1-6 hours. General symptoms include a sudden onset of a high fever which generally persists for several days. Chills and myalgia are often also seen.

S l i d e 1 1	Clinical Signs: Inhalation • More severe – Non-productive cough (up to 4 weeks) – Retrosternal pain – Shortness of breath • Higher exposure levels – Shock and death Center for Food Security and Public Health Iowa State University - 2004	More severe symptoms of SEB are a non-productive cough that can persist for several weeks, retrosternal pain and shortness of breath. With very high exposure levels, SEB is anticipated to cause shock and even death, though this is not the common picture of exposure.
S l i d e 1 2	Clinical Signs: Ingestion • Ingestion of preformed toxin • Incubation – 1-8 hours • Abrupt onset intense nausea, vomiting, cramping, abdominal pain, diarrhea • Most cases self-limiting – Resolve 8-24 hours Center for Food Security and Public Health Iowa State University - 2004	The ingestion of the heat-resistant preformed toxin causes foodborne illness, not the ingestion of the organism. The incubation period for SEB when it is ingested is one to eight hours, but can take up to 18 hours. Infection is generally characterized by a sudden onset of intense nausea and vomiting; abdominal cramping and diarrhea can also be seen. Most cases of infection are self-limiting with resolution of symptoms in 8-24 hours.
S l i d e 1 3	Diagnosis • Cleared from the serum rapidly – Collect serum as early as possible – Difficult to detect by symptoms • If many individuals are symptomatic – Also collect sera from those not showing clinical disease • Significant antibody response 2-4 weeks post-exposure  Center for Food Security and Public Health Iowa State University - 2004	SEB is cleared from the serum rapidly, making it difficult to detect at the time when the patient begins to show symptoms. However, specific laboratory tests are available to detect SEB. Serum should be collected as early as possible after exposure. In situations where many individuals are symptomatic, sera should be obtained from those not yet showing evidence of clinical disease. Most patients develop a significant antibody response, but this may require 2-4 weeks following exposure.
S l i d e 1 4	Treatment • Supportive care only • No prophylactic treatment available • No vaccine available – Many under development  Center for Food Security and Public Health Iowa State University - 2004	Currently there is no treatment for SEB. Supportive care is recommended. Most patients would recover fully after initial acute phase of their illness, but would generally be unfit for military duty for one to two weeks after exposure. SEB is classified as an incapacitating agent because aerosol exposure does not result in death but profound incapacitating illness lasting as long as two weeks. This would be devastating on the battlefield in times of war. Preliminary animal studies for a SEB vaccine have been encouraging. Development, safety, and immunogenicity testing in humans is anticipated for the near future. Image: vaccine vials
S l i d e 1 5	Prevention and Control Center for Food Security and Public Health Iowa State University	

Prevention and Control

- Decontamination
 - 0.5% sodium hypochlorite solution
 - 10-15 minute contact time
- Standard precautions
 - Implemented for health care workers
- Follow FDA/USDA guidelines for proper handling of food

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Decontamination of affected areas should be done with a 0.5% sodium hypochlorite bleach solution. The contact time required for disinfections is 10-15 minutes. Health care workers should follow standard precautions. Proper food handling and preparation should help to reduce foodborne illness. Keep hot foods hot and cold foods cold. Heat foods to appropriate temperatures and cool leftovers quickly. Handle food using proper hygiene and wash hands often. (see FDA or USDA websites for more information about food safety and food handling).

SEB as a Bioweapon

- Easily aerosolized
- Stable
- Can cause multi-organ system failure, shock, and death when inhaled at very high dosages
- Incapacitating agent
 - May cause temporary, incapacitating illness of 2 week duration

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Although an aerosolized SEB toxin weapon would not likely produce significant mortality, it could render 80 percent or more of exposed personnel clinically ill and unable to perform their duty for 1-2 weeks. The demand on the medical and logistical systems could be overwhelming.

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