

A Brief History of Anthrax in the United States

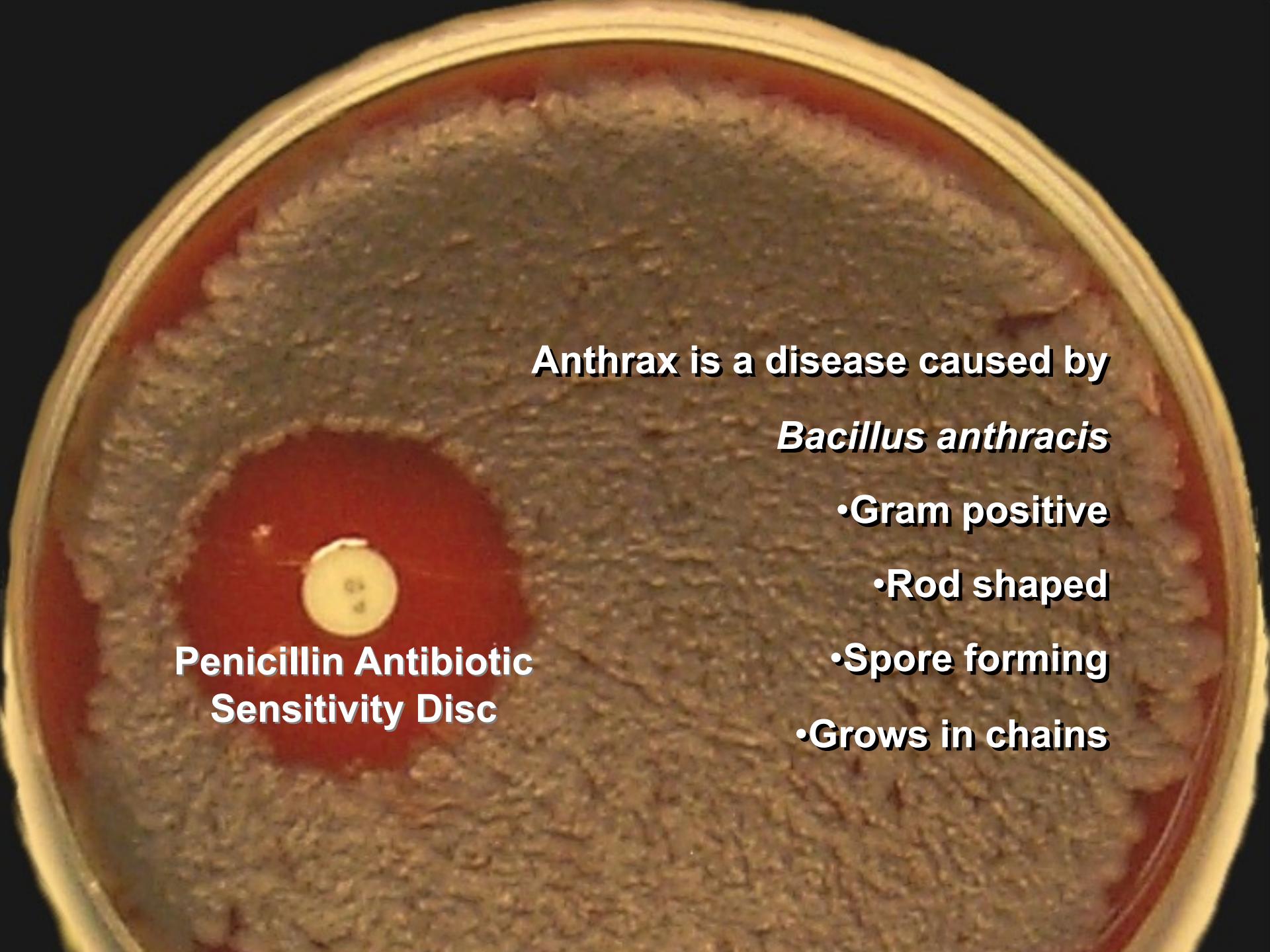
Kimothy L. Smith, DVM PhD
Department of Homeland Security
Science and Technology
Office of Research and Development



**Homeland
Security**

ANTHRAX



A petri dish with a dark brown agar surface. A yellow antibiotic sensitivity disc is placed in the center-left. A large, irregular zone of inhibition is visible around the disc, indicating sensitivity to the antibiotic.

**Penicillin Antibiotic
Sensitivity Disc**

Anthrax is a disease caused by

Bacillus anthracis

- Gram positive
- Rod shaped
- Spore forming
- Grows in chains

The Cause of Death in Cases of Anthrax is Massive Hypotension, Edema, & Shock

Plasmid pXO2:
Encodes a capsule
allowing evasion of
host macrophages



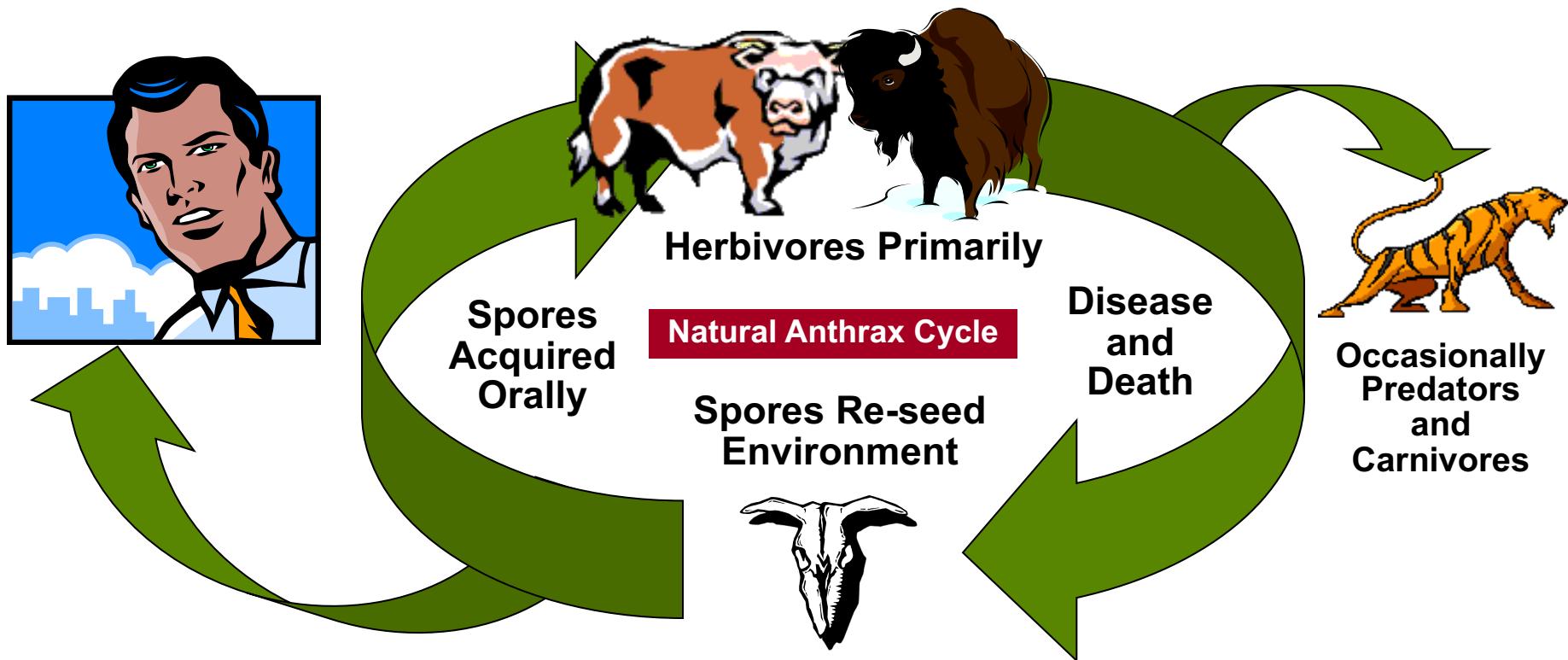
Plasmid pXO1:
Encodes a 3-part toxin
Protective Antigen
Lethal Factor
Edema Factor

In the case of inhalation anthrax,
massive pulmonary edema, also.



**Homeland
Security**

Human disease occurs after infection by spores from contaminated meat (oral) handling contaminated objects (cutaneous) or breathing them (inhalation)



Homeland
Security

Anthrax is a Disease of Wildlife and Domestic Animals



Typical Anthrax Clinical Presentation



**Homeland
Security**



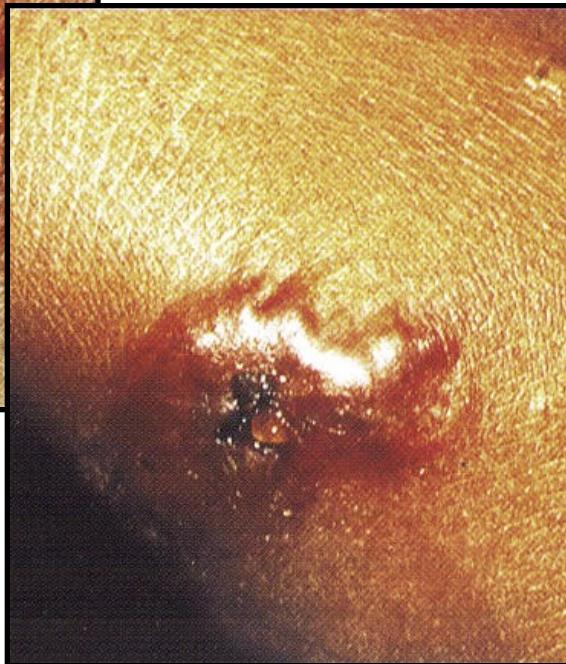
Anthrax is often undiagnosed and unreported



Humans can Contract Three Forms of the Disease

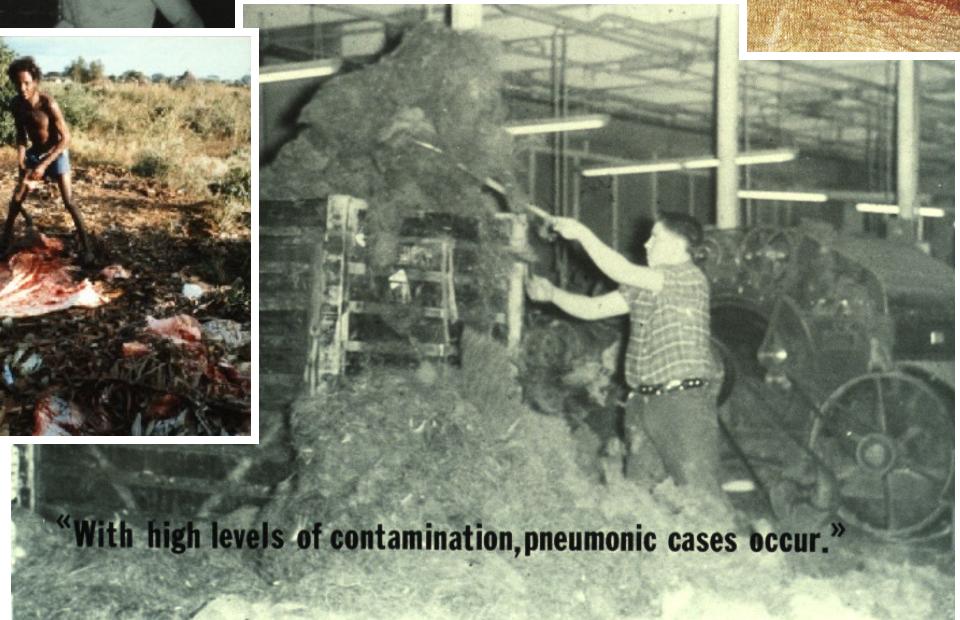
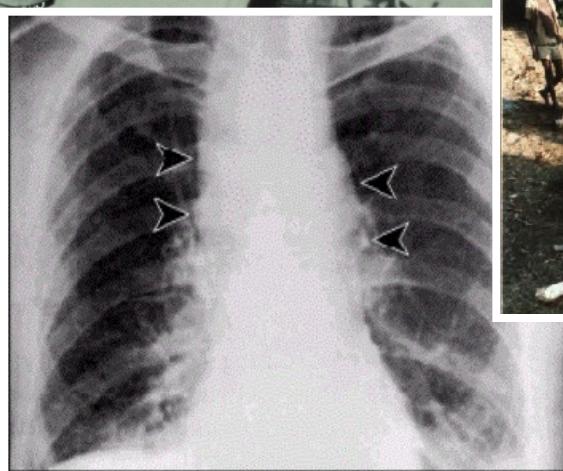
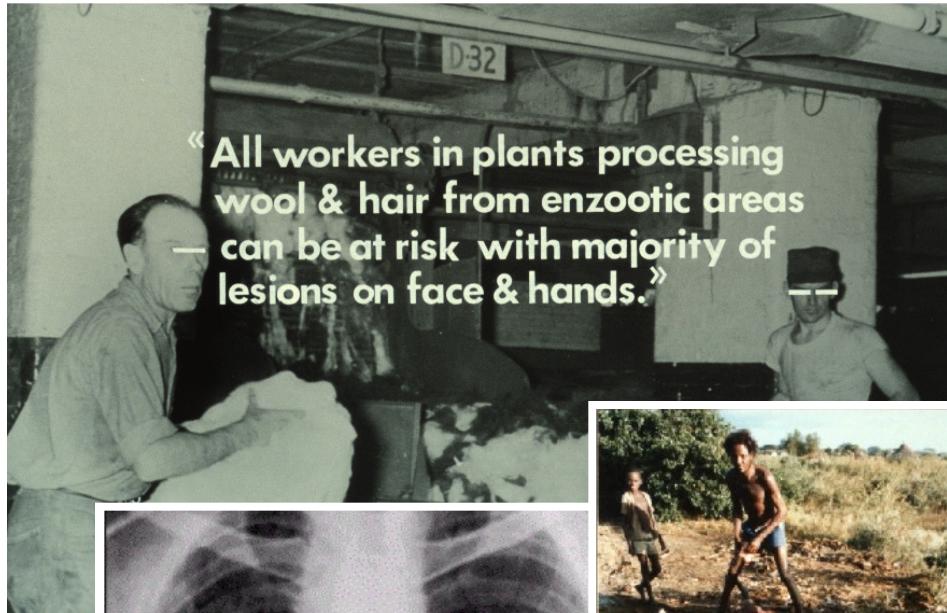


One of these is: Cutaneous Anthrax



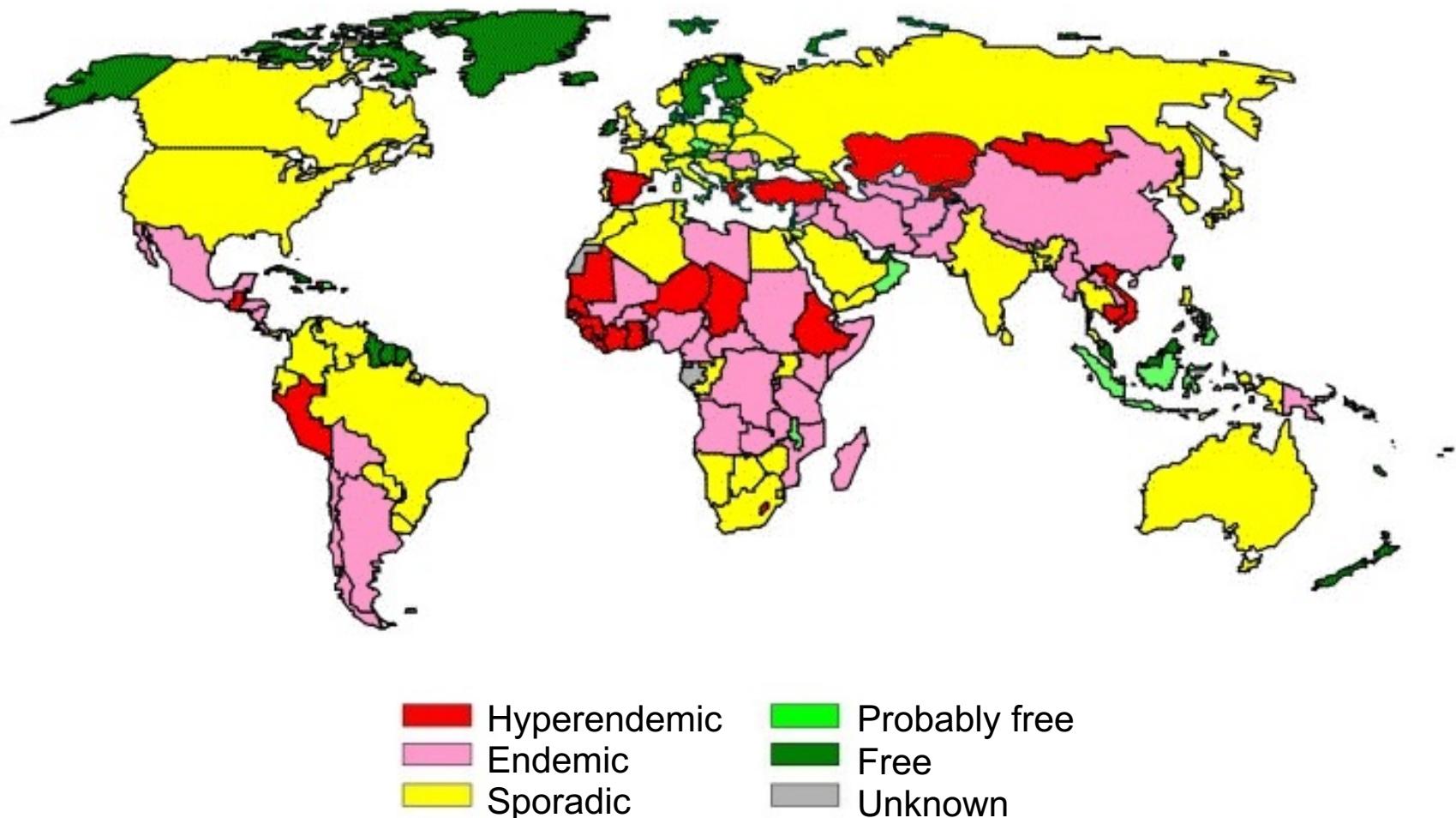
**Homeland
Security**

Human Anthrax: Cutaneous, Inhalation and Gastrointestinal



Homeland
Security

Global Anthrax 1999

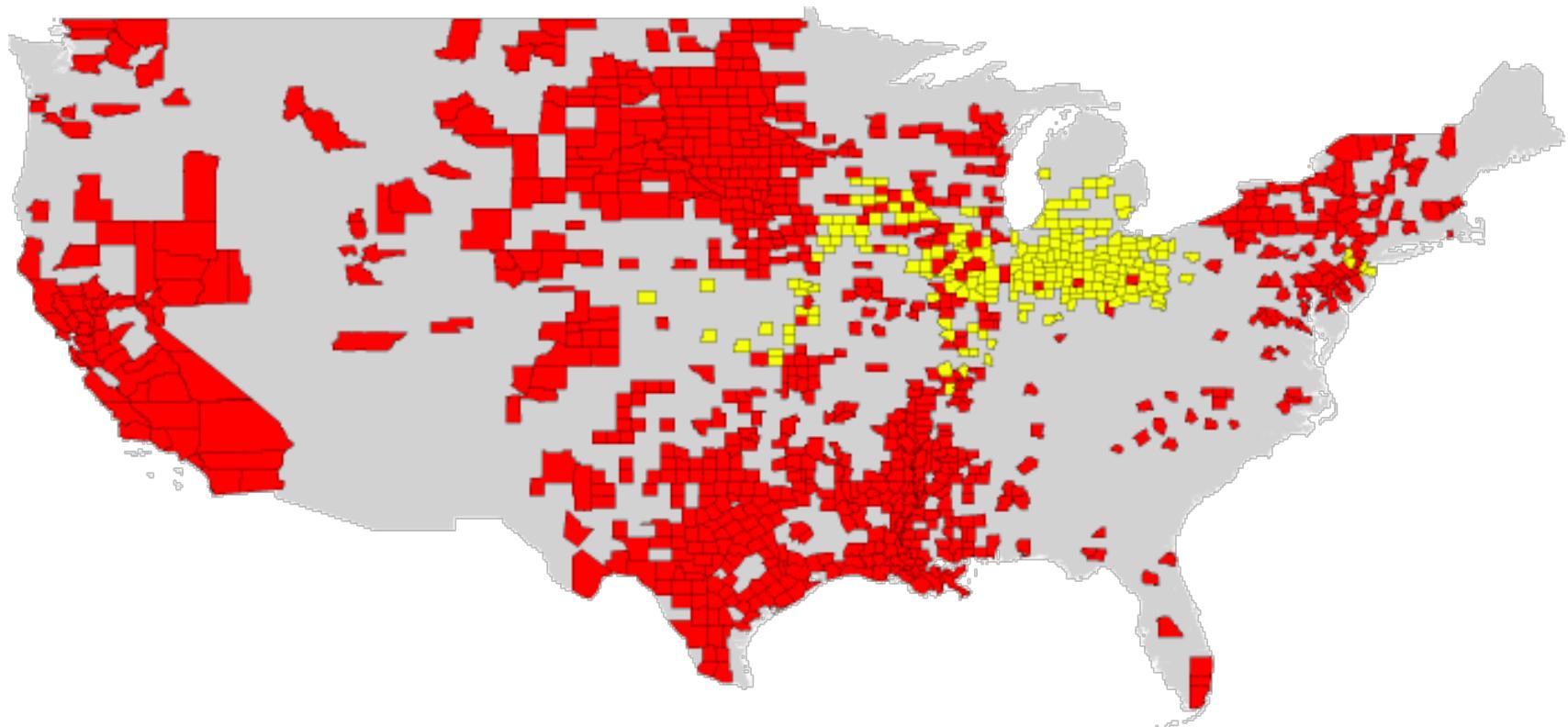


http://www.vetmed.lsu.edu/whocc/mp_world.htm



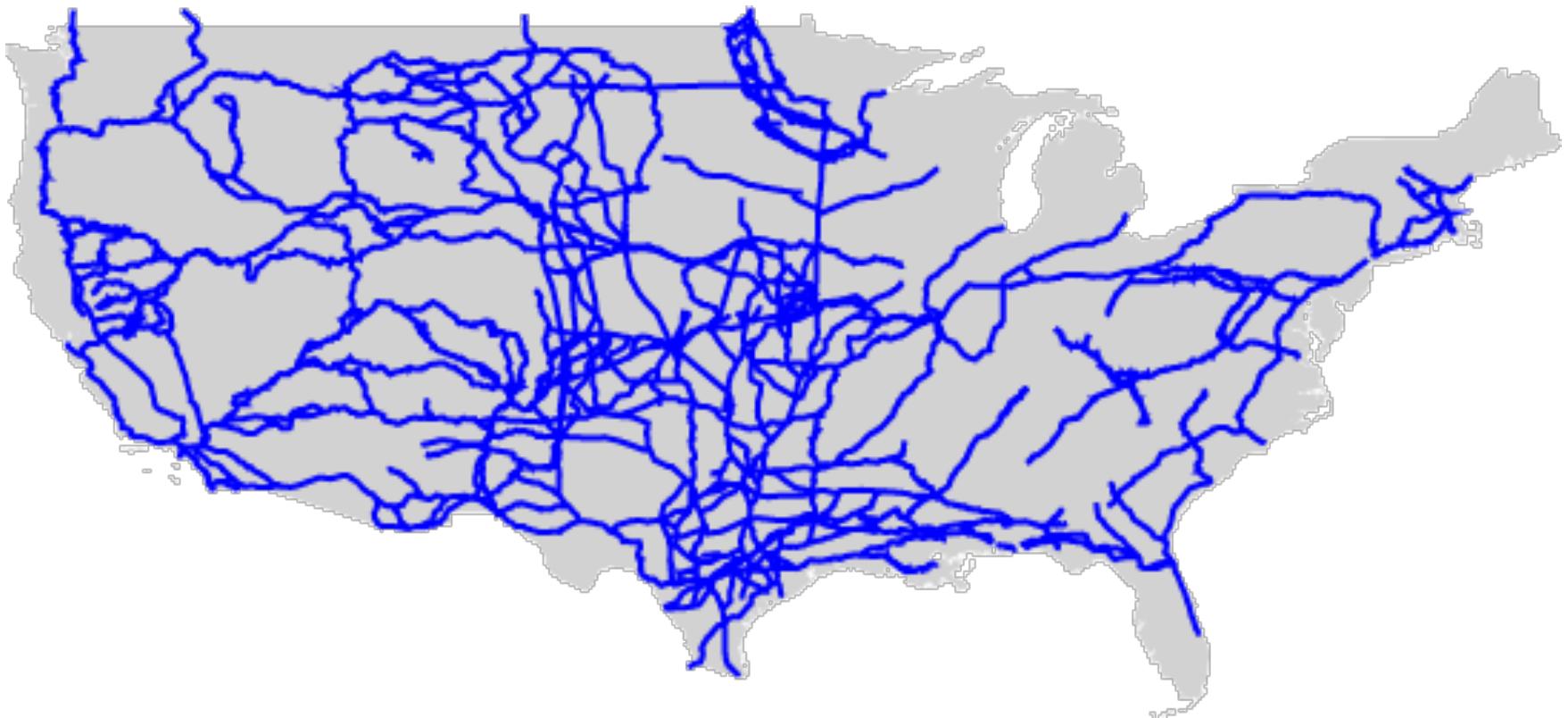
Homeland
Security

100 Years of Anthrax in the US



**Homeland
Security**

Overland and Cattle Trails Spread Anthrax in the US



Homeland
Security

Soils Associated with Anthrax

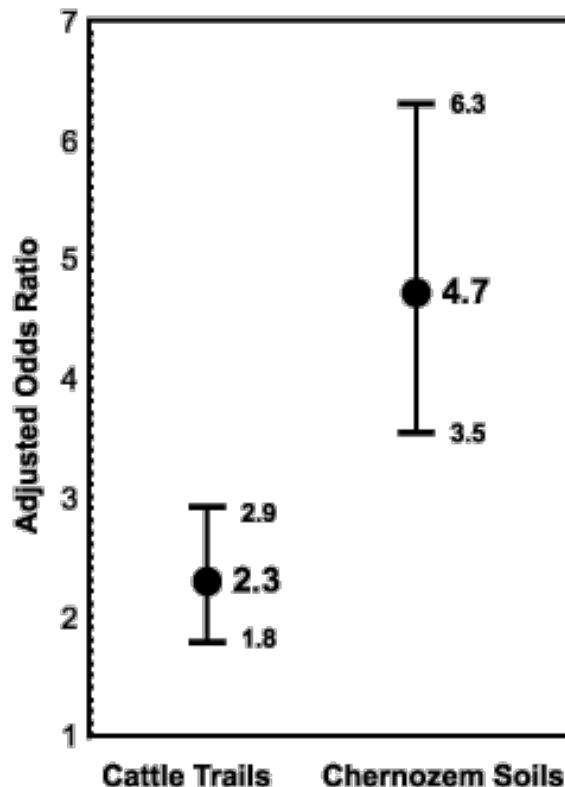


**Homeland
Security**

Statistical Analyses of Anthrax

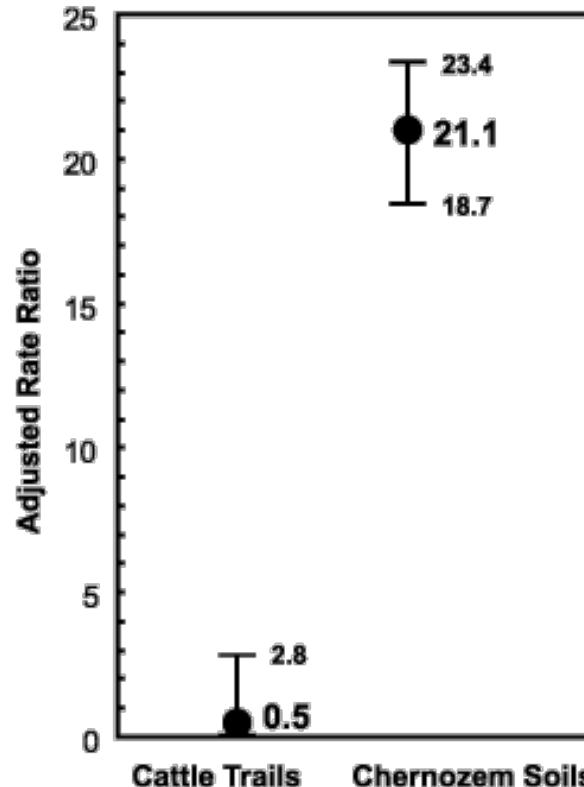
A

100 Year Study

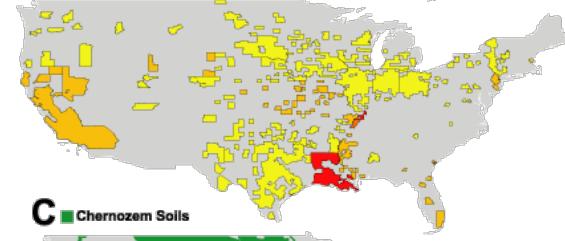
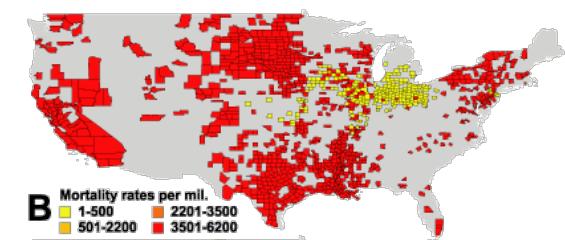


B

10 Year Study

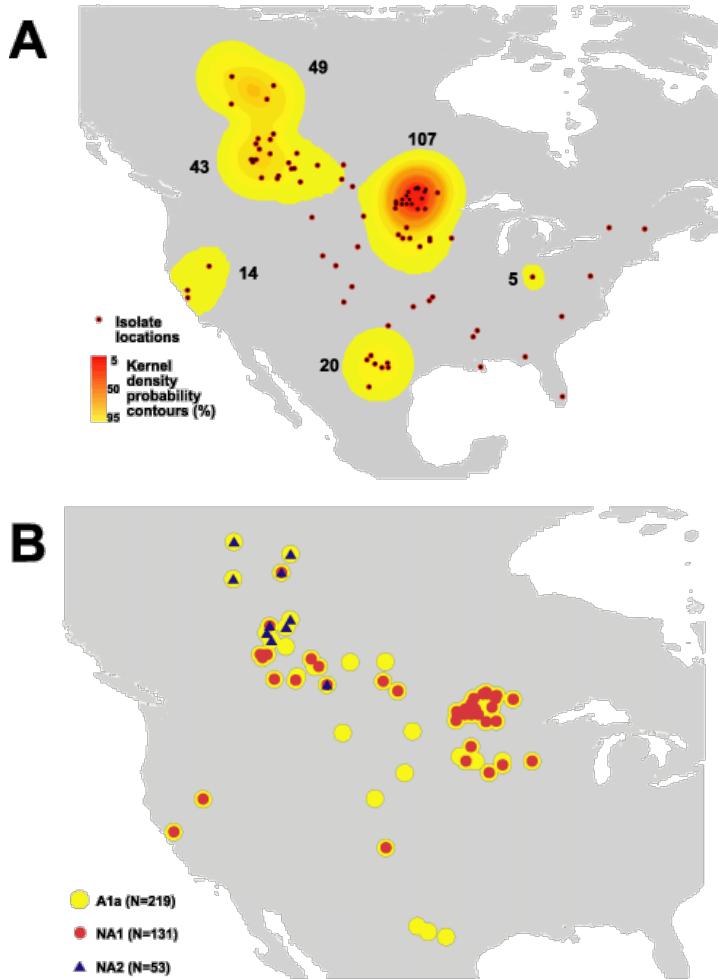


A Counties Reporting Anthrax Cases Cases Linked to Feed and Vaccine



Homeland
Security

Genetic Analyses of Anthrax



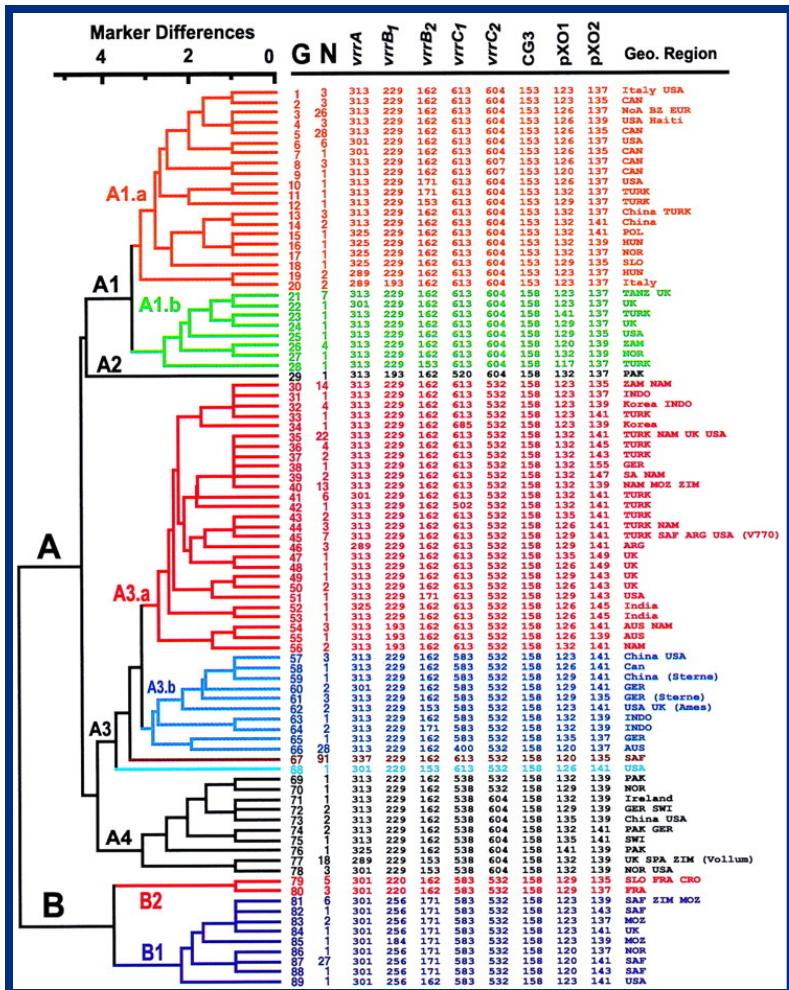
264 *Bacillus anthracis* isolates from North America

“Endemic” *Bacillus anthracis* Genetic Groups (A1a which includes NA1 and NA2)

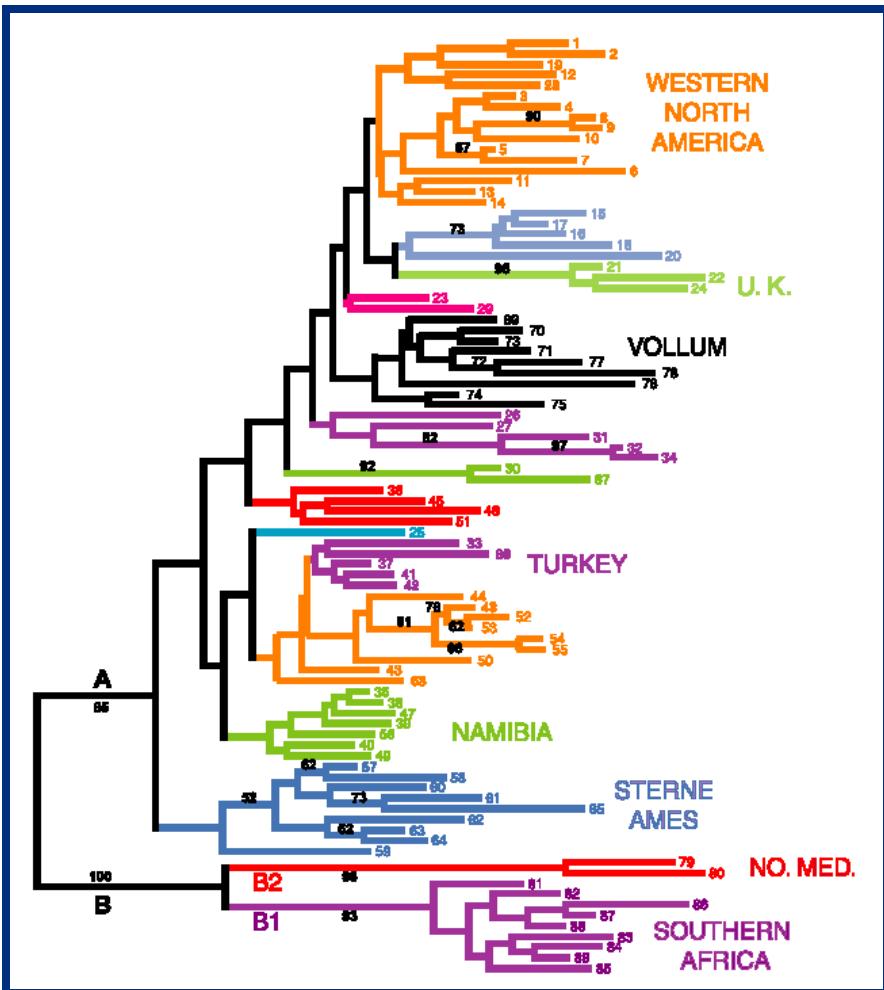


Homeland Security

VNTR Typing used to Analyze a Worldwide Collection of *B. anthracis*



UPGMA Dendrogram of *B. anthracis* 8 Marker MLVA Showing 89 Unique GTs



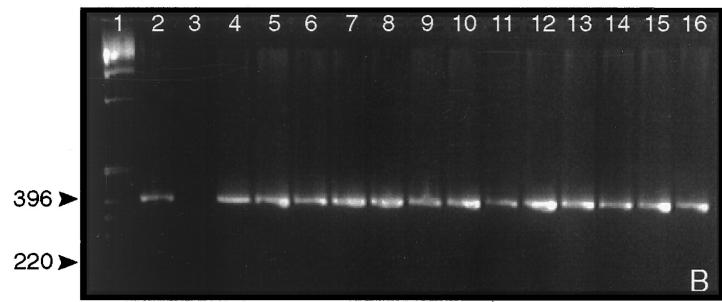
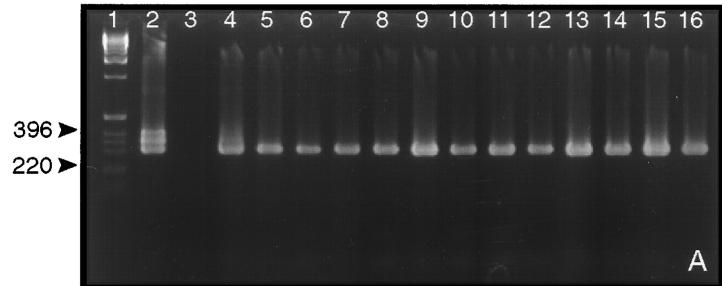
NJ Dendrogram of *B. anthracis* 36 Marker MLVA 89 Unique GTs

Sverdlovsk Anthrax Incident, 1979

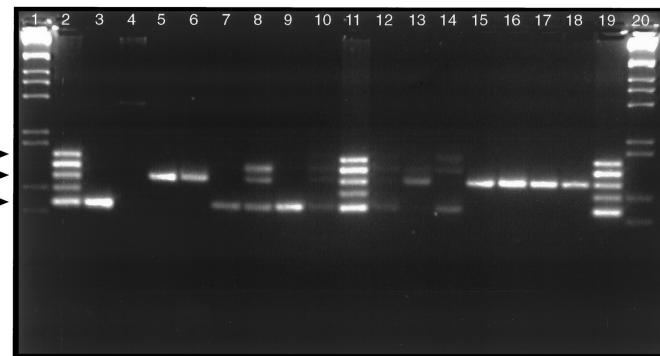


Homeland
Security

Sverdlovsk Anthrax Incident, 1979



Multiple fragment sizes for *vrrA* loci



Sverdlosvk 1979

Between 120 and 400 persons sick

At least 75 died

Initial report blamed contaminated meat

Later linked to release from bio-weapons facility

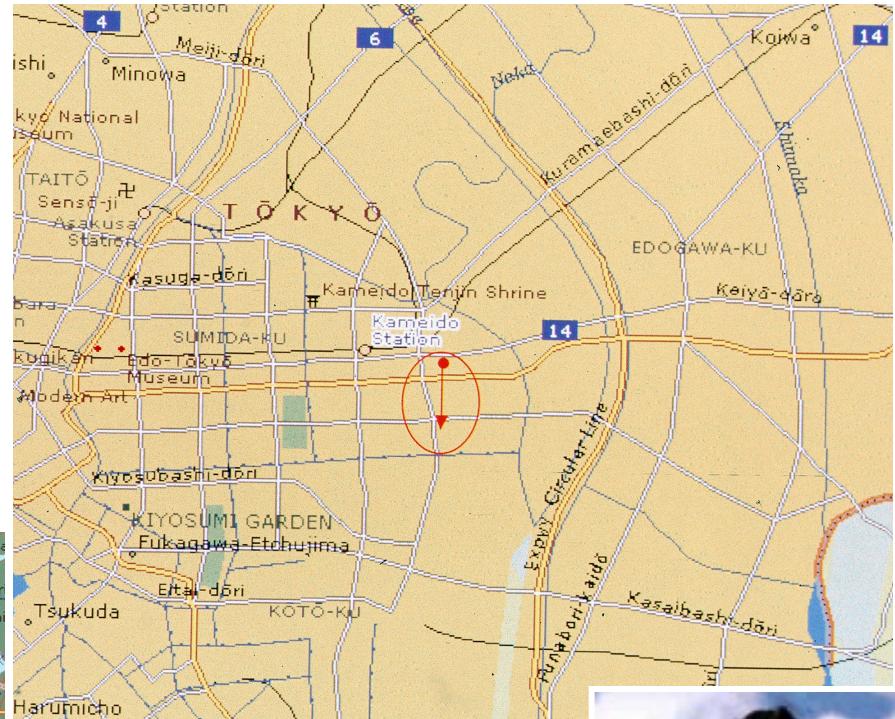


Military housing south of Compound 19

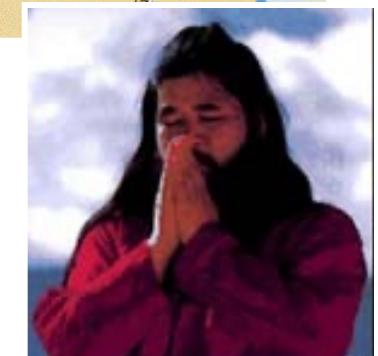


Homeland
Security

Aum Shinrikyo Anthrax Attack



**Aum Shinrikyo
Anthrax Attack
1993**



Aum leader Chizuo Matsumoto
aka Shoko Asahara



**Homeland
Security**



Sterne Livestock Vaccine Strain

Kameido (Aum Shinrikyo) Isolate



- Both isolates lack pXO2 plasmid
- Fragment sizes match for 7 loci



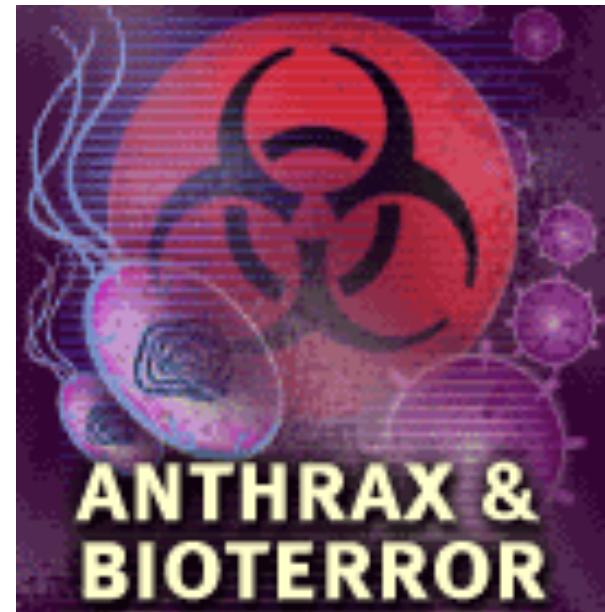
Homeland
Security

ANTHRAX AND BIOTERROR

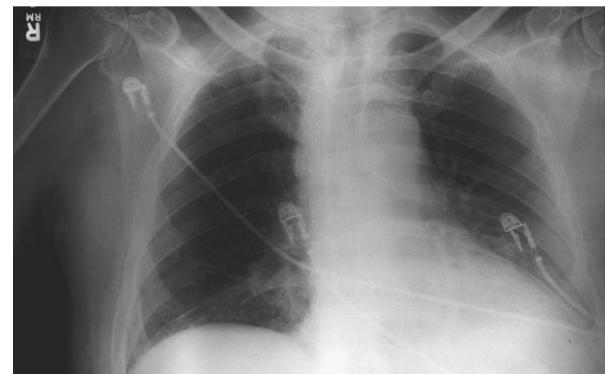
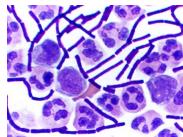


Homeland
Security

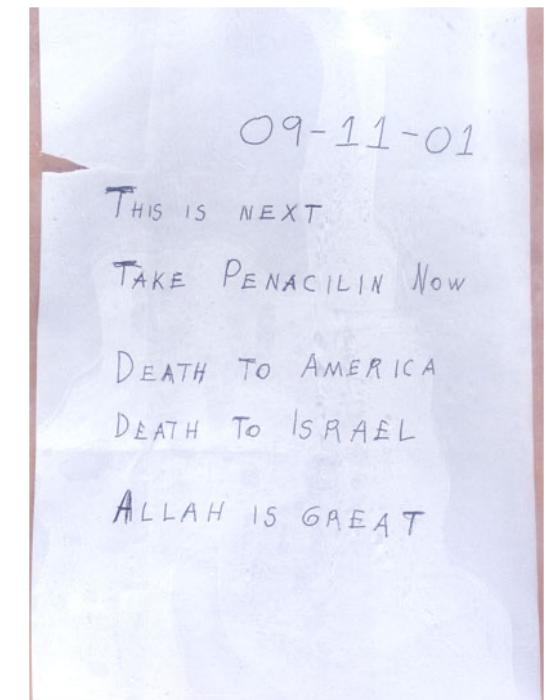
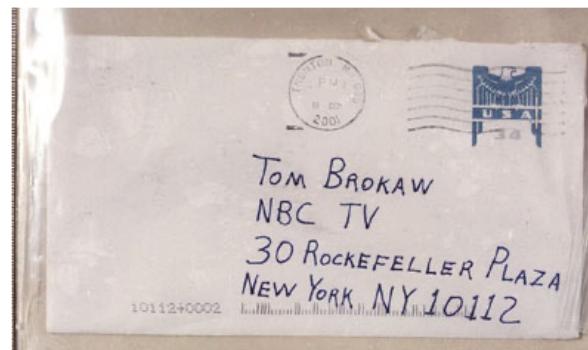
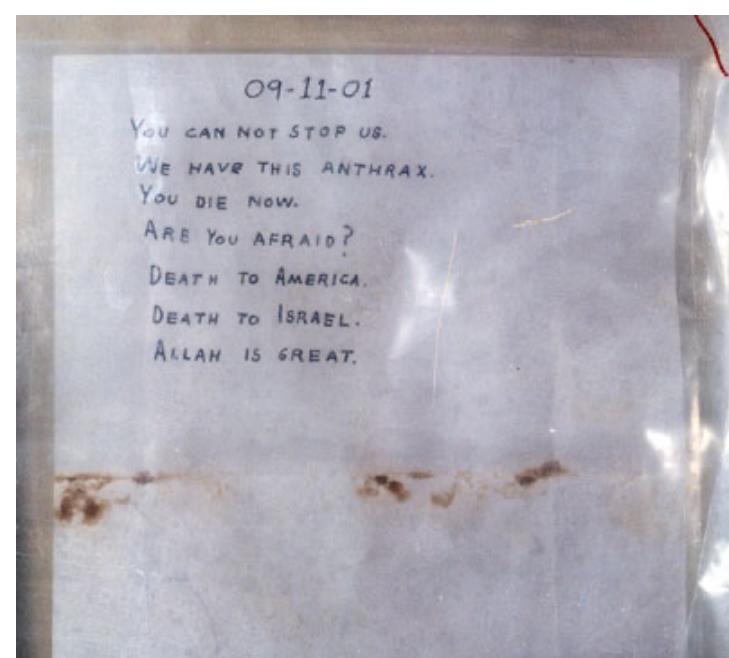
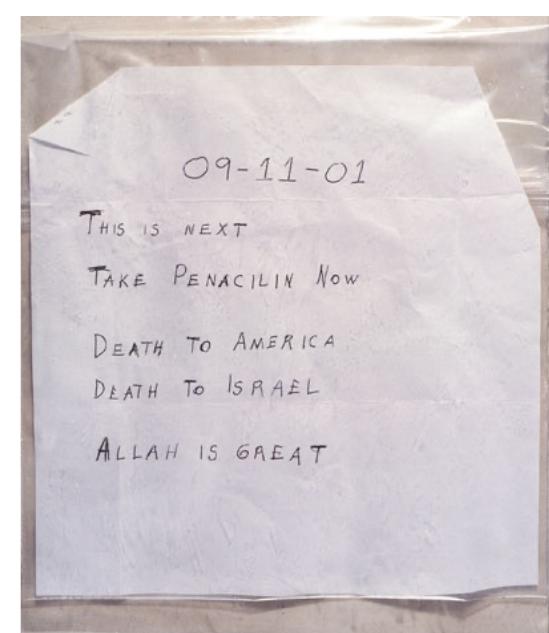
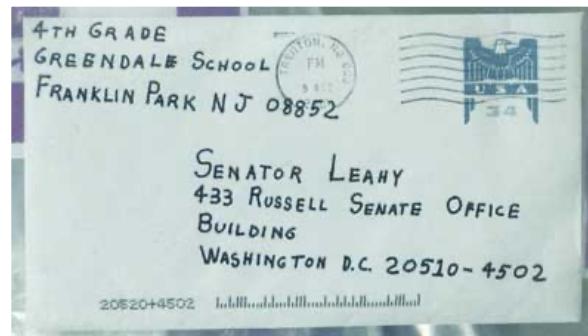
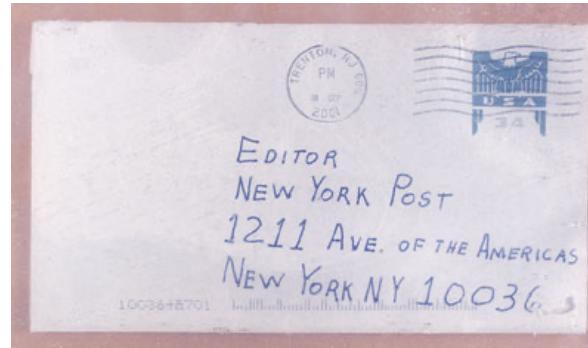
Sept. 18, 2001	Trenton	<u>Mailing of anthrax letters</u> to NBC and NY Post and probably to the National Enquirer.
Sept. 20	St. Petersburg	<u>Mailing of hoax letters</u> to NBC and probably to NY Post [and National Enquirer?]
Sept. 21	place?	<u>Mailing of accusatory letter</u> to Quantico Marine Base accusing Dr. Asaad, former USAMRIID scientist, as terrorist.
Sept. 19-25	NYC	<u>NBC received and opened ANTHRAX letter</u> (brown granular sandy); not recognized as dangerous, and <u>not reported by media</u> .
Sept. 25	NYC	<u>NBC received and opened HOAX letter</u> postmarked 20 Sept; notified FBI but incident <u>not reported by media</u> .
Oct. 1	DC	Washington Times article quoting SH (reprint from 11 Aug 97).
Oct. 2	Boca Raton	Stevens (AMI) checked into hospital, near death, undiagnosed.
Oct. 4	Boca Raton	<u>First report of anthrax case, 5pm (Stevens, AMI)</u> .
Oct. 5	Boca Raton	Death of first anthrax victim (Stevens, inhalation anthrax).
Oct. 5	St. Petersburg	<u>Mailing of hoax letters</u> hoax letters to J. Miller at NY Times and H. Troxler at St. Petersburg Times.
Oct. 5-8	US media	Suspicion of possible bioterrorism is increasing but mail not implicated.
Oct. 6-7	Boca Raton	At AMI, spores found in 2nd worker and on Stevens' computer keyboard.
Oct. 8	Boca Raton	<u>2nd worker (Blanco, mailroom worker) at AMI sick, nasal spores detected</u> ; FBI takes over investigation, seals AMI office. Blanco later confirmed to have inhalation anthrax.
Oct. 9	US media	Looks like bioterrorism (letters not yet recognized as source).
Oct. 9	St. Petersburg	<u>Troxler (St. P Times) opened hoax letter</u> .
Oct. 9	Trenton	<u>Mailing of anthrax letters</u> to Daschle and Leahy.
Oct. 10	Boca Raton	<u>3rd AMI worker (2nd in mailroom) tests positive for anthrax</u> . FBI now conducting criminal investigation. Anthrax strain appears to be Ames.
Oct. 10-12	US media	<u>First suspicion that source of anthrax at AMI might be a letter</u> (not found), since two of those affected work in mailroom.
Oct. 12	NYC	<u>Miller at NYT opened hoax letter</u> .
Oct. 12-13	US media	<u>First reports of any anthrax or hoax letters to media</u> .
Oct. 12	NYC	<u>NBC cutaneous anthrax case reported</u> (Brokaw's Assistant). First symptom was 25 Sept.



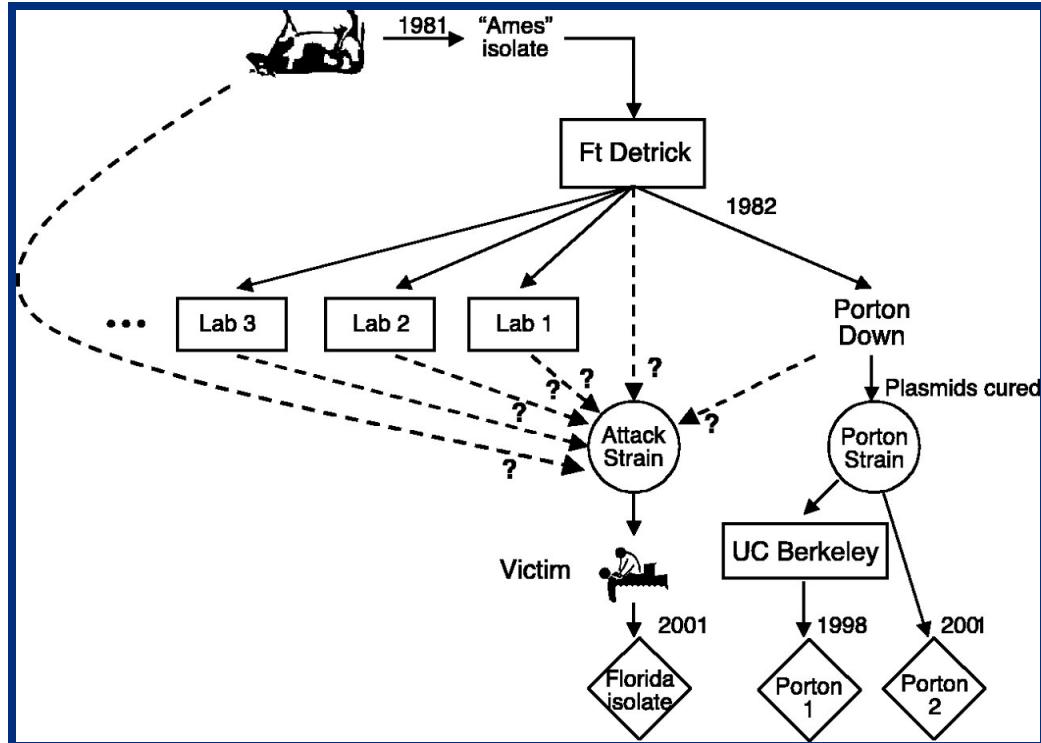
CSF smear Thoracic radiograph



**Homeland
Security**



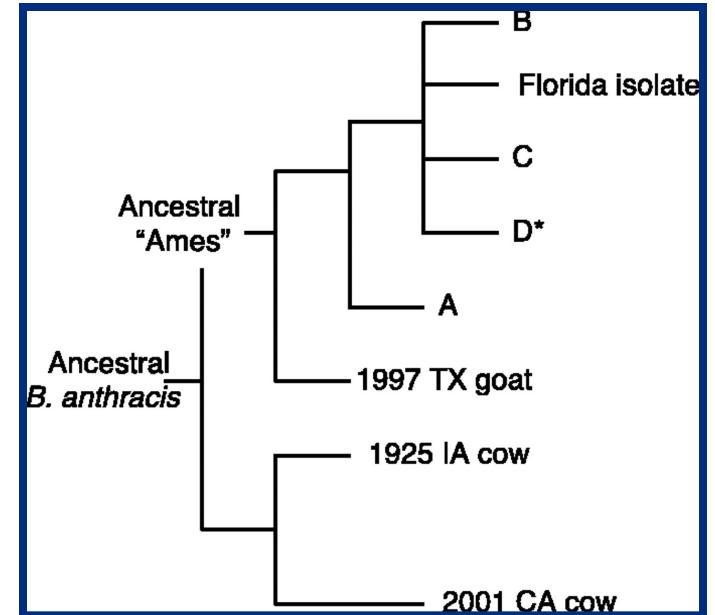
Typing the Florida Isolate



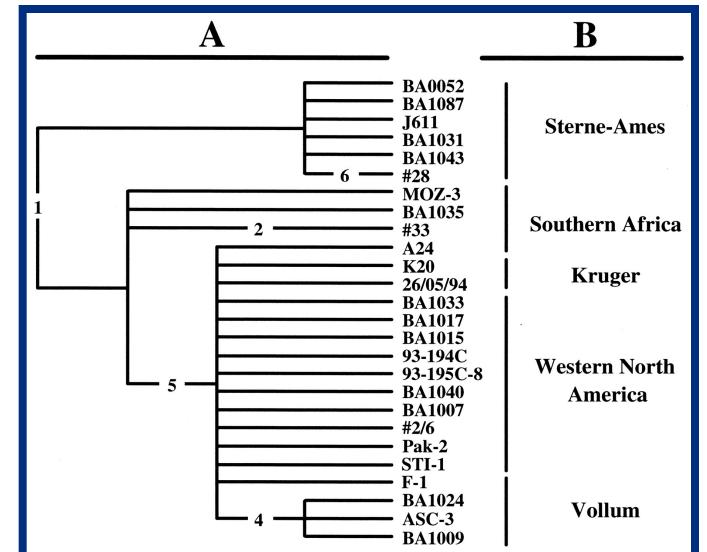
Suggested Relationships of Ames Isolates



Homeland
Security



Dendrogram based on plasmid markers



MP dendrogram based on pag SNPs

Acknowledgements





Homeland Security