

# *Biological Monitoring*

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**Training Course on  
Cooperative Monitoring  
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- **What are Biological Weapons?**
- **How are They Different from Chemical Weapons?**
- **The Biological Weapons Threat**
- **The Biological Weapons Convention**
- **Other International Biological Regimes**
- **The Infectious Disease Threat**
- **Additional Steps to Mitigate the Biological Threat**
- **Summary**

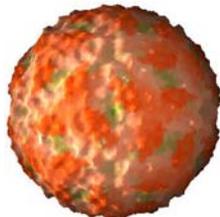
- **Anti-human agents**

- **Incapacitating**

- Staphylococcal Enterotoxin B
- Venezuelan Equine Encephalitis
- Tularemia

- **Lethal**

- Botulinum Toxin
- Smallpox
- Plague
- Anthrax



*FMD virus*



*Plague bacteria*

- **Anti-animal agents**

- Foot and Mouth (FMD)
- Brucellosis
- Glanders
- Anthrax

- **Anti-plant agents**

- Wheat stem rust
- Rice Blast
- Late Blight of Potato



*Potato infected by Late Blight disease*

# Differences between Biological and Chemical Weapons

- **Weight-for-weight, biological weapons are more toxic than chemical weapons**
  - Contagion potential
  - However, biological agents are unstable/fragile
- **Dual use nature of BW**
  - Seed stocks/chemicals/reagents
  - Equipment
  - Facilities
  - Clandestine activities
    - “plausible deniability”
- **Prophylaxis/treatment**
  - Antibiotics, vaccines



*Anthrax bacteria*

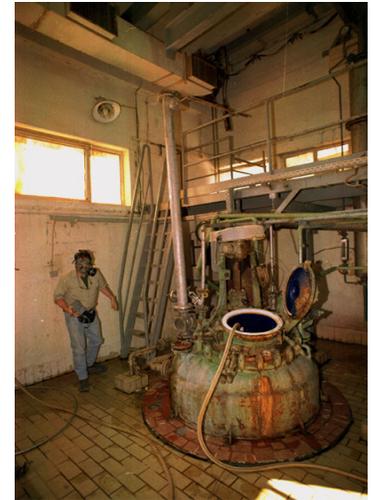


*Ciprofloxacin antibiotic*

# The Biological Weapons Threat

## ● State Programs

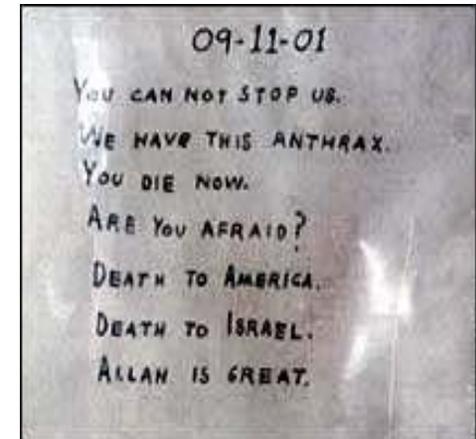
- Past-offensive BW programs: Canada, France, Germany, Iraq, Italy, Japan, Soviet Union (Russian Federation), United Kingdom, United States
- Currently, more than 10 nations have offensive BW programs
  - ◆ U.S. State Department has identified six countries: Iran, Iraq, Libya, N. Korea, Sudan, and Syria



*Iraqi BW fermentors*

## ● Sub-State Activities

- Rajneeshi religious cult (Oregon, 1984): disseminated salmonella toxin in salad bars of restaurants; 751 people ill
- Aum Shinrikyo religious cult (Japan, early 1990s): failed to develop anthrax or outline toxin weapons
- American anthrax attacks (U.S., 2001): 5 people have died of inhalation anthrax disease; perpetrator(s) still at-large



*U.S. Anthrax letter*

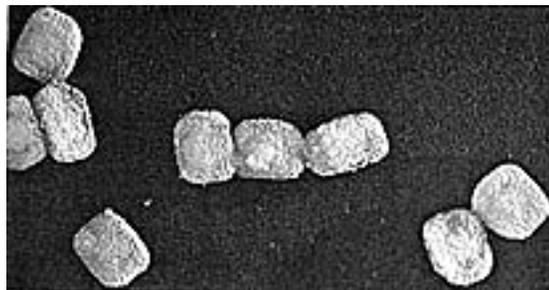
# Biological and Toxin Weapons Convention (BTWC)



- Prohibits the development, production, & stockpiling of biological weapons agents, toxins, equipment, & means of delivery by State Parties
- Open for signature April 10, 1972
- Entered into force March 26, 1975
- 144 State Parties
  - 18 signatories have not ratified
  - 31 non-signatory nations
- No provisions for verification of compliance



*250 Gauge Bombs*



*Smallpox virus*



*Fermentors*

- **Second Review Conference (1986)**

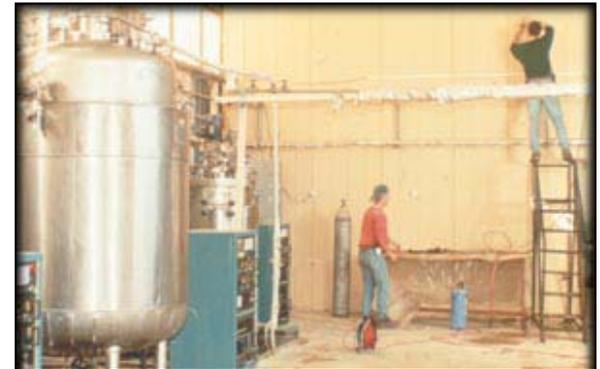
- **Voluntary, annual data exchanges: to decrease secrecy, promote confidence & cooperation in permitted biological activities; politically binding**
- **Promotion of scientific and technical contacts for peaceful purposes**



*United Nations, Geneva*

- **Third Review Conference (1991)**

- **Poor reporting: clarification and addition of information exchange measures**
- **Formation of Ad Hoc Group of Verification Experts (VEREX) to develop potential verification measures**
  - ◆ **Off- & On-site measures considered**



*Inspection & monitoring of  
BW facility in Iraq*

## ***Off-Site Measures:***

- Information monitoring
  - ✿ surveillance of publications
  - ✿ surveillance of legislation
  - ✿ data on transfers, transfer requests and production
  - ✿ multilateral information sharing
- Data exchange
  - ✿ declarations
  - ✿ notifications
- Remote sensing
  - ✿ surveillance by satellite
  - ✿ surveillance by aircraft
  - ✿ ground-based surveillance
- Inspections
  - ✿ sampling and identification
  - ✿ observation
  - ✿ auditing

## ***On-Site Measures:***

- Exchange visits
  - ✿ international arrangements
- Inspections
  - ✿ interviewing
  - ✿ visual inspections
  - ✿ identification of key equipment
  - ✿ auditing
  - ✿ sampling and identification
  - ✿ medical examination
  - ✿ random & short-notice
- Continuous monitoring
  - ✿ by instruments
  - ✿ by personnel

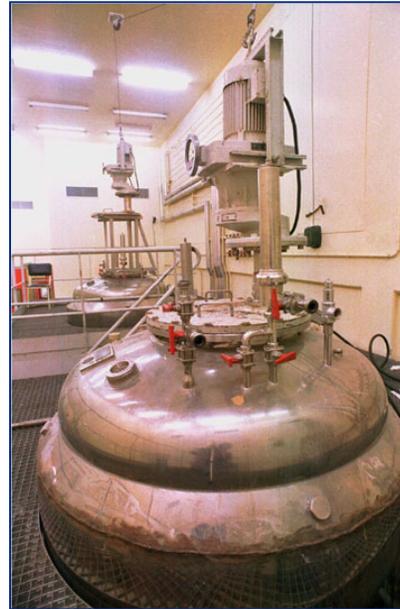
# Strengthening the Convention

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- **Special Conference (1994)**
  - **Accept VEREX report**
  - **Establishment of Ad Hoc Group (AHG) with a mandate to negotiate a legally binding protocol to the BTWC**
  
- **Fourth Review Conference (1996)**
  - **Legally binding provisions still under negotiation**
  
- **Fifth Review Conference (November-December 2001)**
  - **Attempt to resolve differences over “rolling text” and Chairman’s text**
  - **U.S. proposes that the Conference terminate the AHG's mandate**
    - ◆ **Consider draft Protocol flawed; concern about biological terrorism**
    - ◆ **U.S. proposes a series of alternative measures to strengthen the Convention**
  - **Consensus decision was reached to adjourn the the Conference until November 11, 2002**

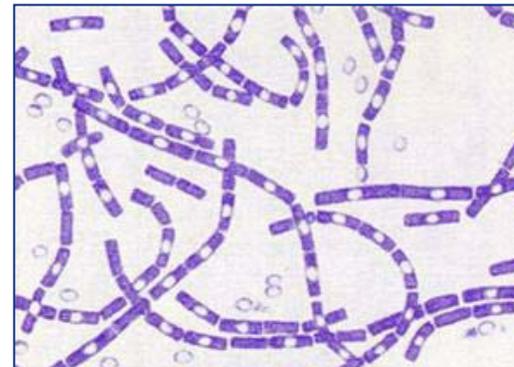
- Informal and voluntary consortium of 30 nations; operates by consensus
- Separate but complementary to the BTWC
- Holds annual meetings at which members:
  - share information about proliferation dangers
  - work to harmonize national export controls for BW materials and related technologies
- Has established control lists for human, plant and animal pathogens, dual-use equipment and technologies



*Fermentation vessel*



*BL-4 equipment*



*Anthrax bacteria*

- **Convention for Biological Diversity (1993)**
  - **Formulated under the UN Environment Programme to support**
    - **conservation of biological diversity and the sustainable use of its components**
    - **the fair and equitable sharing of benefits arising from the use of genetic resources**
    - **mechanisms for international scientific and technical cooperation**
  - **Cartagena Protocol on Biosafety (2000)**
    - **Addresses transboundary movement, transit, handling and use of all living modified organisms that may have adverse effects on biological diversity and human health**
      - **Advance Informed Agreement (AIA) Procedure**
      - **Shipping documentation**
      - **Biosafety Clearing House**



# The Infectious Disease Threat

- “Infection knows no national boundaries”
- Worldwide concern: leading cause of premature death in children and young adults
- Factors Affecting Growth and Spread
  - Globalization
    - ◆ population increases and changing economic conditions
    - ◆ increased international travel, trade, and immigration
    - ◆ climate change and vector migration
  - Microbial adaptation and natural mutations
    - ◆ emerging infectious agents in humans and animals: Hantavirus, Ebola virus, Nipah virus
  - Liberal use of antibiotics:
    - ◆ Promotion of drug-resistant bacteria: Tuberculosis, Malaria, Hepatitis B & C



*Avian Influenza, Hong Kong*



*FMD outbreak, U.K.*

# Additional Steps To Mitigate Biological Threats

- Domestic

- Stockpiling of vaccines and antibiotics
- Formation and training of crisis-response teams
- Syndromic and epidemiological surveillance
- Decontamination
- Safeguarding and accounting of dangerous pathogens
- Development of biological sensors and detectors



*Decontamination technologies*



*U.S. Biological Integrated Detection System (BIDS)*



*Laboratory biosecurity*

- International
  - Peaceful biological research collaborations between U.S. researchers and former Soviet bioweaponers
  - Dismantlement of former BW equipment; safeguarding pathogen collections
  - Environmental & Epidemiological Monitoring: Aral Sea region



*Kazakh plague researcher*



*Dismantlement of Kazakh BW facility*



*Aerial photo of Aral Sea (1985)*

- **Dual-use nature of biotechnology—its suitability for both legitimate public health and illicit weapons applications—has led to the availability of relevant materials, equipment and expertise for biological weapons purposes to state and non-state actors**
  - **Limited effectiveness of classical “supply-side” approaches to BW nonproliferation, such as national export controls on dual-use materials and production equipment**
  - **“Demand-side” strategies that create disincentives to the acquisition of BW, such as global or regional arms control regimes and confidence-building measures, offer best hope of slowing and reversing proliferation**
  - **Complimentary measures can provide a web of deterrence for BW proliferation: biosecurity, disease monitoring, detection systems, prophylaxis, education & ethics training**