

Food as a Weapon

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**THE ONLY THING WE
HAVE TO FEAR IS...
ANTHRAX, SMALLPOX,
EBOLA VIRUS, BUBONIC
PLAGUE, NERVE GAS, NUCLEAR
MELTDOWN, CONTAMINATED
LETTERS, AIRPLANES, SPORES...**



Siege of Kaffa

- 1346: Bubonic plague in a Tartar camp during siege of Kaffa – Tartars began catapulting plague-infected dead bodies over the walls of Kaffa as part of the siege – resulting epidemic forced surrender.



Weaponized Food in History

- 1495: Spanish infect French wine with the blood of leprosy patients.
- 1910's: Pancho Villa in Mexico buries pork and green beans for several days to produce botulinum toxin – contaminates food supplies or smears on weapons.
- 1915: German-American physician in Washington D.C. produced large amounts of Anthrax and *Burkholderia mallei* (Glanders) that were inoculated into livestock headed for Allied forces in Europe – multiple reports of secondary human infections.

Weaponized Food in History

- 1931: During an investigation of the Japanese seizure of Manchuria, Japan attempted to poison members of the League of Nations' investigative committee by lacing fruit with cholera.
- 1939: Japanese poisoned Russian water at the Mongolian border with intestinal typhoid.

Terrorism

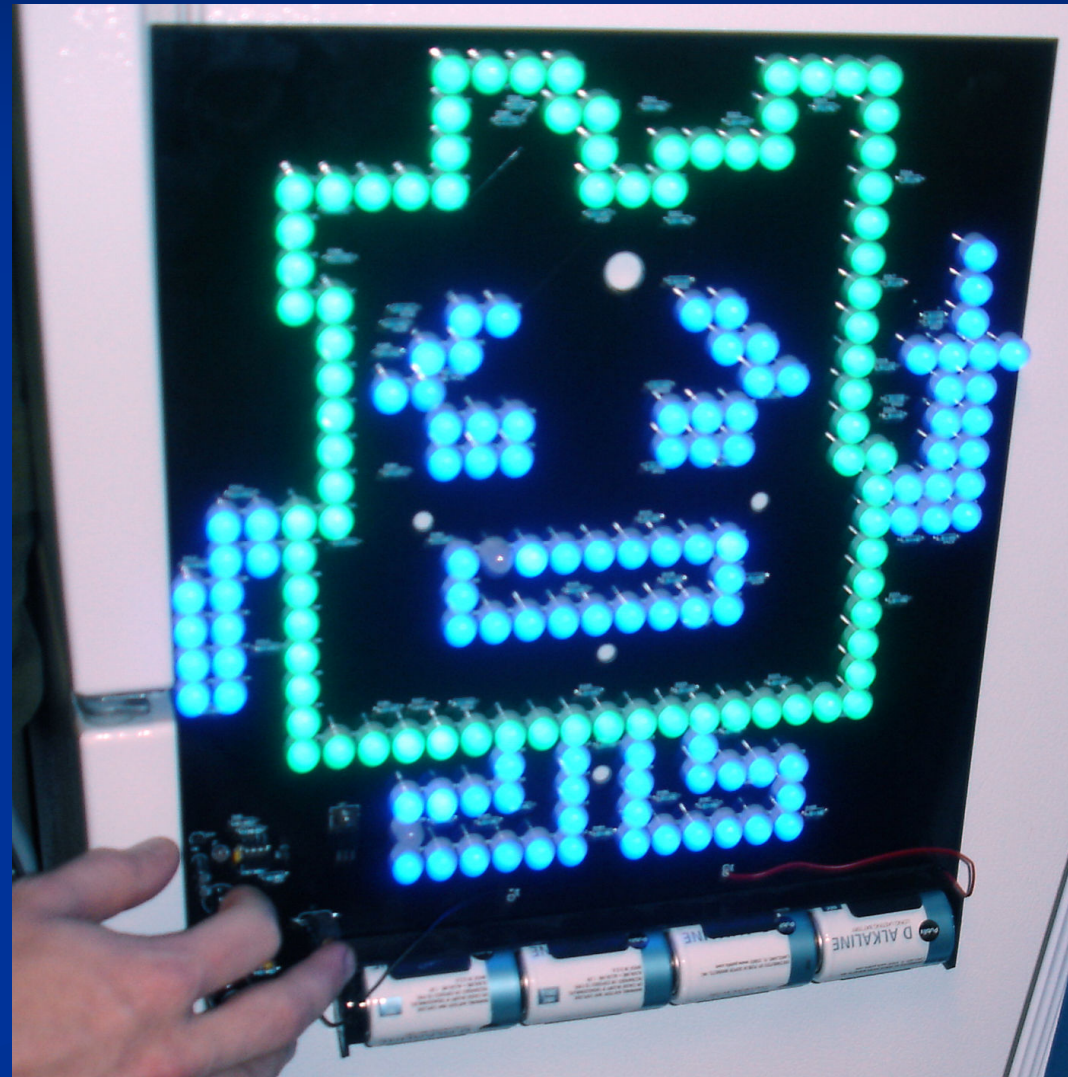
- Terrorism is not military warfare.
- Terrorism, by any method, is aimed at noncombatants.
- Terrorism's objective is fear, to make you anxious, fearful, untrusting, unwilling to engage in your usual activities, buy your usual food.
- This can result in the disruption of the economy, the stability of food supply, the disruption of food distribution, and potentially, a significant outbreak of disease.

Terrorism

- Terrorism by any method, is best perpetrated upon the unsuspecting, the unprepared, and the uninvolved.
- Terrorism is aimed at demonstrating vulnerability; the quantity of casualties or damage is less important than the instillation of fear.

Damage Done

- In 2007, an unapproved movie advertisement causes the city of Boston to fall into gridlock as citizens (and law enforcement) believe it may be a terrorist bombing attack.



Food in Terrorism

- 1972: Right-wing group “Order of the Rising Sun” dedicated to creating a new master race, was found in possession of 30 to 40 kilograms of typhoid bacteria cultures to be used to contaminate water supplies of major midwestern cities.
- 1980: “Red Army Faction” facility in Paris contained large quantities of botulinum toxin.
- 1984: Followers of Bhagwan Shree Rajneesh contaminated a number of salad bars in Oregon with Salmonella, intending to effect the outcome of a local election. Over 750 cases of salmonellosis were determined to be caused by this act. Strain of Salmonella obtained by mail order from the American Type Culture Collection.

Food in Terrorism

- In 1999, there was an intentional food poisoning related to the addition of human feces into bakery products in Romania.
- In 2002, a tetramine rat poison was added to food served at a school, reportedly by a competitor food vendor jealous of his cousin's success.

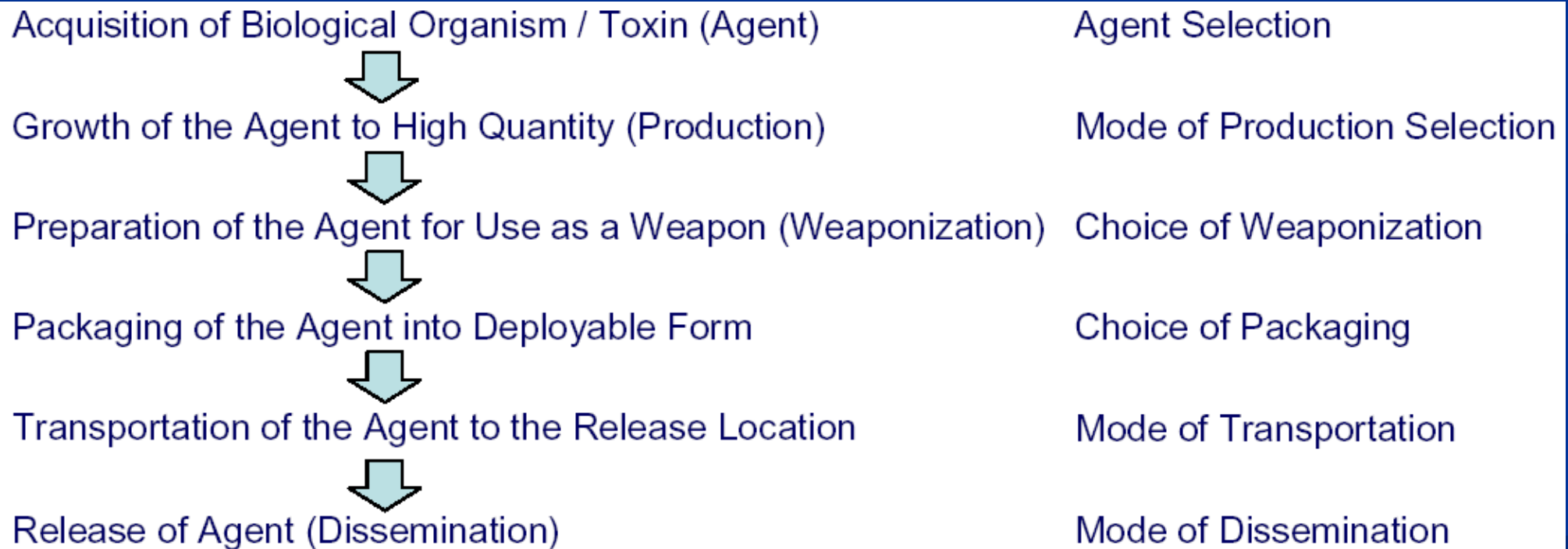
Food in Terrorism

- 2008: Sweden's security service 'Saepo' investigates possible sabotage following an incident, which left 140 people at the headquarters of the Confederation of Swedish Enterprise suffering from dysentery.
- The victims, which included employees of the association, its members, and other guests, all suffered from the illness caused by *Shigella dysenteriae* after eating in the office's cafeteria.
- Five people suffered symptoms so severe they were admitted to a hospital.
- The group claiming responsibility for the attack is a leftist, internet-based group, which had previously staged demonstrations outside of the association's headquarters.

Biological Weapons: Requirements for Effective Deployment

- Reliably virulent
 - Stable viability/toxicity; causing infection/toxicity
 - Susceptible target population
- Reliable delivery
 - Difficult to detect
 - Difficult to detoxify/disinfect

Biological Weapons: Requirements for Effective Deployment



Agents for Food Bioterrorism

- Most likely agents that are naturally proved to effectively transmit through the vector of food.
- Usually easy to obtain, easy to culture, requires little “weaponization”.

Agents for Food Bioterrorism

- I. Assassination
 - a. Botulinum toxin
 - b. Cyanide; nitrites; heavy metals
 - c. Mycotoxins: aflatoxins, mushroom (*Amanita phalloides*)
 - d. Puffer fish
 - e. Ricin (Castor bean)
 - f. Algal and bacterial “bloom” toxins: saxitoxin, microcystins

Agents for Food Bioterrorism

II. Synchronous, disabling illness

- a. Enterotoxins from *Staphylococcus aureus*, *B. cereus*
- b. Endo-enterotoxin *Clostridium perfringens*
- c. Mycotoxins (aflatoxin, T-2, DON, DAS, islanditoxin, ochratoxin, rubratoxin, zearalenone, eltrin, etc.)
- d. Mushroom
- e. Dinoflagellate toxin

Agents for Food Bioterrorism

III. Diarrheal disease

- a. *Salmonella*
- b. *Campylobacter*
- c. *Vibrio cholerae*
- d. *Cryptosporidia*
- e. *Giardia*
- f. *Calicivirus* (Norwalk virus and others)
- g. *Shigella*
- h. *E. coli*

Agents for Food Bioterrorism

- IV. Diarrheal disease with systemic complications
 - a. *E. coli* O157:H7: hemolytic uremic syndrome
 - b. *Salmonella* (enteric fever strains): arthritis, cardiomyopathy, soft tissue infection
 - c. *Campylobacter*: Guillain-Barré syndrome
 - d. *Yersinia enterocolitica*: cholestasis, arthritis, meningitis
 - e. *Ascaris*: pulmonary infiltration, asthma, eosinophilia
 - f. *Listeria monocytogenes*: miscarriage, meningitis

Agents for Food Bioterrorism

- V. Animal and Crop Diseases
 - a. Food and Mouth Disease
 - b. Hog Cholera
 - c. Velogenic Newcastle Disease
 - d. Brucellosis
 - e. Anthrax
 - f. African Swine Fever
 - g. Avian Influenza
 - h. Rinderpest
 - i. Wheat Smut
 - j. Rice Blast
 - k. Miscellaneous insect

- Dutch CSF (Classical Swine Fever) outbreak of 1997-98

Impact: 700,000 pigs in 429 infected herds destroyed

> 8 million pigs slaughtered preemptively or for animal welfare reasons.

Total direct and indirect losses est. at \$2.3 billion.

Vulnerabilities in Food Production and Distribution

- No effective food security program, high labor turnover, uneducated workers, low wages.
- Long distances between supply source and site.
- Multiple transfers of supplies between supply source and site.
- Insecure water supply and treatment facility.

Vulnerabilities in Food Production and Distribution

- Using local suppliers and food handlers in regions with antipathy or hostility.
- Imported whole foods and ingredients.
- Large and diversified distribution.
- HACCP inadequate for intentional contamination.

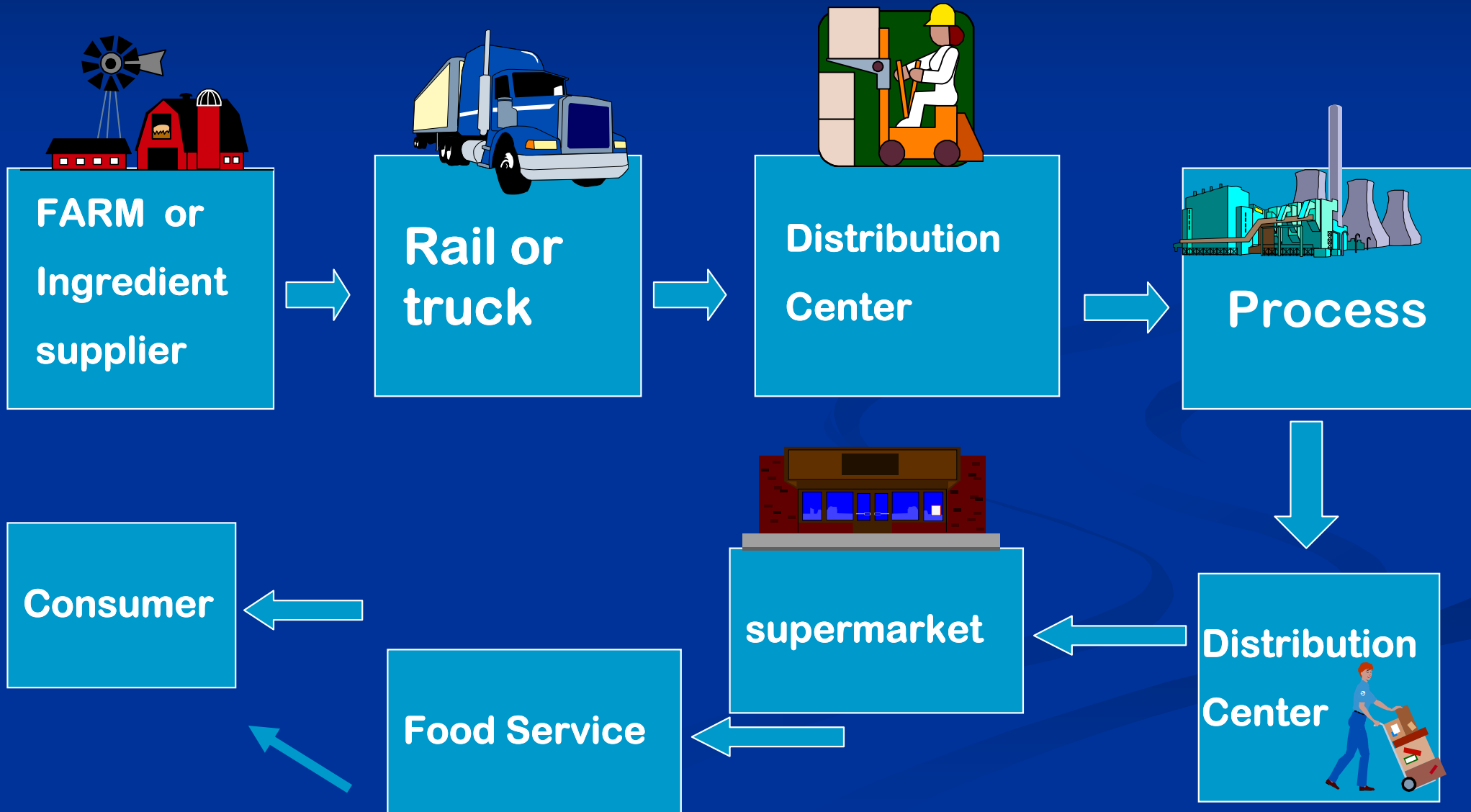
According to some

- Imported foods are the biggest threat – only 1 to 2% of imported food is inspected.
- Used to be that <90 of 300 entry points into the U.S. for foreign products had an FDA inspector (doubled since 9/11).

Securing the Nation's Transportation Infrastructure

- 130 million cars, 70 million light trucks
- >690,000 buses
- 7.1 million commercial trucks
- 500 million cross U.S. borders annually
- 5,525 mi border with Can, 1,989 mi Mexico
- 95,000 mi shoreline
- 3.4 million sq. mi. commercial zones

Food Process Distribution Chain



Legislative Action

- Public Health Security and Bioterrorism Preparedness and Response Act of 2002
- Otherwise known as Bioterrorism Bill: Overwhelmingly passed by the House (425-1) and the Senate (98-0) and signed by the President in to law on June 12, 2002.
- Title III: Protecting Safety and Security of Food and Drug Supply
- Authorizes \$545 million for the Food and Drug Administration (FDA) and US Department of Agriculture (USDA) to hire hundreds of food-import inspectors, develop new methods to detect contaminated foods, and protect crops and livestock.

Diagnostic Assays Identified As Needed by Government Agencies

- Tests spectrum of antimicrobial resistance or genetic manipulation.
- High-throughput screening (e.g., microchip-based platforms) containing microbial signature profiles.
- Tests identifying multiple pathogens simultaneously in a single sample.
- Novel assays based on human immune or other physiological responses.

Autonomous Pathogen Detection System (APDS)



- Lawrence Livermore National Laboratory (Livermore, CA)
- A continuous and fully automated monitoring system that can identify pathogens in the air.

RAMP Reader



- The RAMP reader by Response Biomedical Corp. (Burnaby, BC, Canada) can perform tests to detect various biowarfare agents, such as anthrax and ricin.
- In addition, NIAID has placed a high priority on these biodefense diagnostics and encourages applicants to focus on them.

Handheld Advanced Nucleic Acid Analyzer (HANAA)



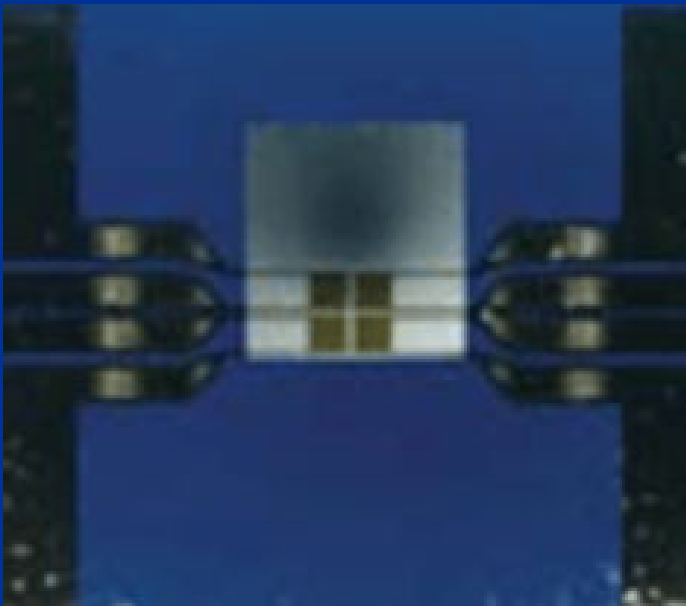
- Laurence Livermore Lab
- Handheld PCR (DNA) detection system
- USAMRIID collaborator

Gene Xpert (Cepheid Inc.)



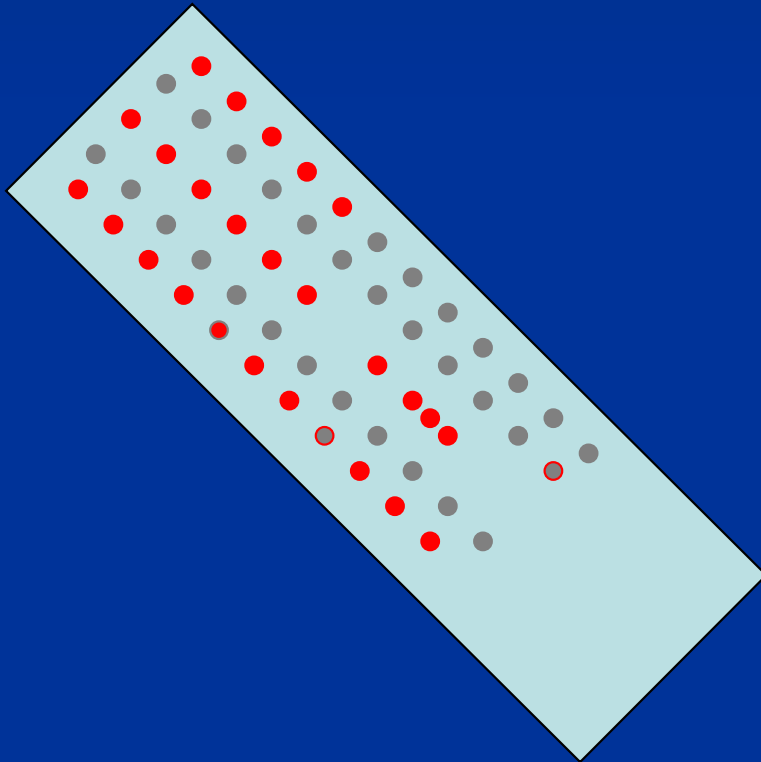
- Sunnyvale, California
- Independent PCR Systems with single disposable cartridge

Force Amplified Biological Sensor (FABS)



- Rapid automated sensor for detection of bacteria, virus, proteins
- Purdue University

DNA Microarray



- Multi-Pathogen, Multi-Gene, Highly Specific, Up to 2000 base-pair sequences can be identified on a single slide.

Can agriculture and food producers afford high tech analysis?

- Agriculture not high profit-margin business.
 - Stiff domestic and foreign competition.
 - Land & equipment: major overhead costs.
 - Will prophylaxis and security be affordable?
-
- Grain farmer ~ 1 cent / bottle of beer
~ 5 cents / \$1 loaf of bread

CARVER + Shock

- CARVER is an acronym for the following six attributes used to evaluate the attractiveness of a target for attack:
 - *Criticality* - measure of public health and economic impacts of an attack
 - *Accessibility* - ability to physically access and egress from target
 - *Recuperability* - ability of system to recover from an attack
 - *Vulnerability* - ease of accomplishing attack
 - *Effect* - amount of direct loss from an attack as measured by loss in production
 - *Recognizability* - ease of identifying target
- A seventh attribute, **Shock**, has been added to the original six to assess the combined health, economic and psychological impacts of an attack within the food industry.

<http://www.cfsan.fda.gov/~dms/vltcarv.html>

Counterterrorism Objectives

- Secure employees in food production, distribution, and service; background checks.
- Trained employees to preserve food security.
- Affordable, broad range diagnostic equipment.
- Secure/inspected ingredients (including water supply).
- Secure transportation.
- Response plan in place when an agent is suspected/detected.