FDA/CFSAN Food Defense Research Needs

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Food Defense Research

Four Primary Food Defense Research and Laboratory Needs

- New Methods
- Prevention Technologies
- Agent Characteristics
- Dose-Response Relationships

Four Primary Food Defense Research and Laboratory Needs

- **New Methods**
  - Validation of field methods for the detection of microbiological and chemical agents
  - Development of new field methods for the detection of microbiological and chemical agents
  - Technology transfer of field methods
  - Development of laboratory-based confirmation methods
  - Development of techniques for fingerprinting agents
  - Sampling techniques

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Four Primary Food Defense Research and Laboratory Needs

- **Prevention Technologies**
  - Priority intervention technologies and related factors include thermal treatments, ionizing radiation treatments, ultra-violet radiation (UV) treatments, acidification, dehydration / water activity, disinfectant / biocides, temperature, freezing, and fermentation.
  - Examples of microbial agents include *B. anthracis, F. tularensis, B. abortis, Y. pestis, C. parvuum*, and *S. dysenteriae*.
  - Examples of chemical agents include abrin, amanitin, aconitine, colchicine, digoxin/digitalis, fluoroacetic acid, nicotine sulfate, picrotoxin, ricin, strychnine, and tetrodotoxin.

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- **Agent Characteristics**
  - Examining the effect of food characteristics and processing conditions on the stability of biologically derived toxins (*e.g.,* ricin, abrin, amanitin) and toxic chemicals (*e.g.,* nicotinic acid, organophosphates, fluoroacetic acid)
  - Determining the growth and survival kinetics of *Y. pestis* and *F. tularensis* in foods as affected by temperature, pH, water activity, and the presence of commonly used antimicrobials
  - Determining the growth and survival characteristics of *Burkholderia mallei* and *Burkholderia pseudomallei* in foods
  - Characterizing the radiation resistance of *B. anthracis* spores in selected foods

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- **Agent Characteristics (cont'd)**
  - Determining the effects of food composition parameters on the radiation doses needed to inactivate vegetative cells of microorganisms.
  - Characterizing the stability of biologically derived toxins and toxic chemicals during lactic acid fermentations of the type used to produce fermented dairy products;
  - Establishing partition coefficient values needed to develop solvent extraction methods for the separation of various biologically derived toxins and toxic chemicals from foods.

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Four Primary Food Defense Research and Laboratory Needs

- Dose-responses relationships for oral ingestion via foods
  - Microorganisms
    - *Francisella tularensis, Yersinia pestis, Brucella* spp., *Burkholderia mallei, Burkholderia pseudomallei*, etc
  - Biologically derived toxins
    - Ricin, abrin, picrotoxin, etc.
  - Toxic chemicals
    - Organophosphate pesticides, nicotinic acid, fluoroacetic acid, tetramine, etc.

Methodological Challenges: Sample Size

- Detection systems going to smaller and smaller samples
- Our need is the opposite: How to take a bigger sample - #1 detection research priority
- Real world: Have approximately 20 minutes to examine cargo coming across the border

How to Take the Right Sample?

- Cannot assume homogeneous distribution in a production lot or even a single item
- Cannot assume that contaminant is on surface
- Cannot assume that contamination is geographically or temporally homogeneous
- Effective terrorism does not require all items be contaminated

Sampling as a Limitation

- Way around the problem is to take:
  - More samples
    - Cost limited
  - Larger samples
    - New technologies
  - Smarter samples
    - Effective screening technologies (e.g., FT-NIR)
    - Better intelligence

Modeling, Simulation, and Analysis Needs

- Critical need for economic modeling and estimates for response and recovery from an intentional food contamination event
  - Cost of human illness and death
  - Cost of decontamination
  - Cost of disposal of food or equipment
  - Cost of destruction of food manufacturing facility
  - Etc….

Modeling, Simulation, and Analysis Needs

- Critical need for elaboration on social science issues to have a better understanding of the psychological and sociological response from the public to an intentional food contamination event
  - Determination of the degree of the loss of confidence in the food supply
  - Determination of the desire/need for parents to not send their children to school
  - Determination of the desire/need for the public to remain at home and not go to work
  - Determination of the loss of productivity across other sectors due to people not reporting to work
  - Determination of the degree of loss of confidence in the U.S. government

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Modeling, Simulation, and Analysis Needs

- Critical need to have a better understanding of the costs and benefits of preparedness and mitigation strategies.

- Critical need to understand the most effective places to apply countermeasures within the farm-to-table continuum. Dynamic models could assist the sector in determining what technology needs to be developed or implemented, is cost-effective, and provides sufficient benefits to justify the expenditure.

Summary

Research needs in the following areas:

- New Methods
- Prevention Technologies
- Agent Characteristics
- Dose-Response Relationships
- Sampling
- Modeling, Simulation, and Analysis

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Questions??

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