

Big Red Biosecurity Program

MODULE 1

Terms, Definitions and Concepts



Description of Module 1

Those terms, definitions and concepts important to understanding the principles of biosecurity are presented in this module.

Terms, Definitions and Concepts

Biosecurity – Definition

- Different things to different people or groups
- Has changed over the years
 - Originally from preventing infectious diseases
 - Now includes biologic terrorism threats
- For our purposes
 - Inclusive definition
 - Bio = life
 - Security = to protect
 - Those practices that protect something of interest to us
 - Examples:
 - Animals: Herd of cattle, flock of birds, herd of horses
 - Facilities: Livestock premise, veterinary clinic, dairy

Terms, Definitions and Concepts

Biosafety – Definition

- For our purposes
 - Inclusive definition
 - Bio = life
 - Safety = to safeguard from harm
 - Those practices that protect ourselves from harm
 - Examples:
 - Biosafety cabinet
 - **Personal Protective Equipment (PPE)**
 - Safety goggles, respirator, face shield, Tyvek suit

Terms, Definitions and Concepts

Biosafety PPE



Biosecurity PPE



Why is Biosecurity Important?

- What are we protecting from?
 - Answer = DISEASES
- Biosecurity is first line of defense
 - Preventative measures (i.e., prevents exposures/infections)
 - Decreases:
 - Spread of diseases
 - Losses due to mortality and morbidity
 - Economic losses from disease
 - Public health concerns
 - Use of disease treatments and preventatives
 - Usage of antibiotics = decreases antimicrobial resistance
 - In some instances use of vaccines = decreases resistant strains
 - Increases
 - Health and well-being
 - Profitability
 - “Required” by some government programs (USDA NPIP)

Why is Biosecurity Important?

By [Roy Graber](#) on August 23, 2017

McDonald's reducing antibiotic use in chicken globally

Company sets timelines for removing antibiotics important to human medicine for its broiler supplies in markets across the world

[McDonald's](#), having already eliminated the use of antibiotics important to human medicine for its U.S. broiler supply, is now setting timelines to eliminate the use of such antibiotics from its broiler supply in other parts of the world.



Terms, Definitions and Concepts

Components of a biosecurity program

- **Conceptual biosecurity**
 - The planning and selection of a site of physical facilities and structures
- **Structural biosecurity**
 - The physical facilities and infrastructure
 - Type of structure
 - Materials
 - Equipment
 - Etc.
- **Operational biosecurity**
 - Standard operating procedures (SOPs)
 - Traffic management
 - Education and training
 - Etc.

Terms, Definitions and Concepts

A biosecurity plan/program

- Components of a biosecurity plan
 - Conceptual, Structural, Operational
 - All needed
 - If one fails, others compensate



Terms, Definitions and Concepts

What is **DISEASE**?

- Definition—a particular abnormal condition, a disorder of a structure or function, that affects part or all of an organism. (Wikipedia)
- Examples:
 - Broken arm
 - Head cold
- When disease causes death = **mortality**
- When disease causes “sickness” = **morbidity**

Terms, Definitions and Concepts

Types of disease

- Put a term in front of “disease”
- Examples:
 - Organ/organ system
 - Heart disease/cardiovascular disease
 - Lung disease/respiratory disease
 - How diseases are transmitted
 - Food-borne disease
 - Sexually transmitted diseases (STDs)
 - Congenital/hereditary/genetic disease
 - Communicable/transmissible/contagious disease

Terms, Definitions and Concepts

Types of disease

- **Infectious** diseases
 - Involves a **pathogen** that replicates in a **host**
 - Pathogen = etiologic (causative) agent of a disease
 - **Host** = organism (animal, plant, other) of interest
 - Typical pathogens
 - Viruses
 - Bacteria
 - Internal and external parasites
 - Pathogens replicate and are transmitted to new hosts
 - Person to person = **communicable** disease
 - Animal to animal = **transmissible**
 - Animal to person (or other animal species) = **zoonotic infectious** disease (zoonosis)
 - Person to animal = reverse zoonosis or anthroponosis

Terms, Definitions and Concepts

Examples of infectious diseases of poultry

- All poultry
 - Coccidiosis
 - Avian influenza
 - Newcastle disease

Chickens

- Infectious bronchitis (IB)
- Infectious bursal disease (IBD)
- Marek's disease

Turkeys

- Hemorrhagic enteritis (HE)
- Bordetella avium

Terms, Definitions and Concepts

Types of disease

- **Noninfectious** diseases
 - Does not involve a **pathogen** that replicates in a **host**
 - Pathogen = **etiologic** (causative) **agent**
 - Typically involves a metabolic or structural function abnormality

Terms, Definitions and Concepts

Examples of noninfectious diseases of poultry

- Suffocation
- Drowning
- Trauma
- Toxicity
 - Error in feed formulation
 - Contamination of feed

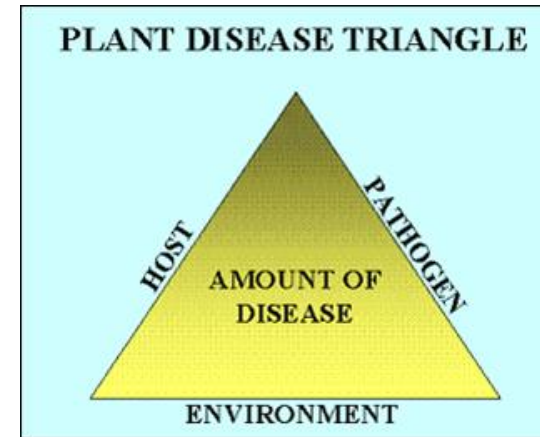
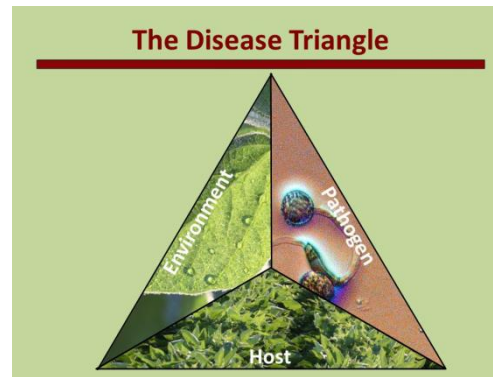
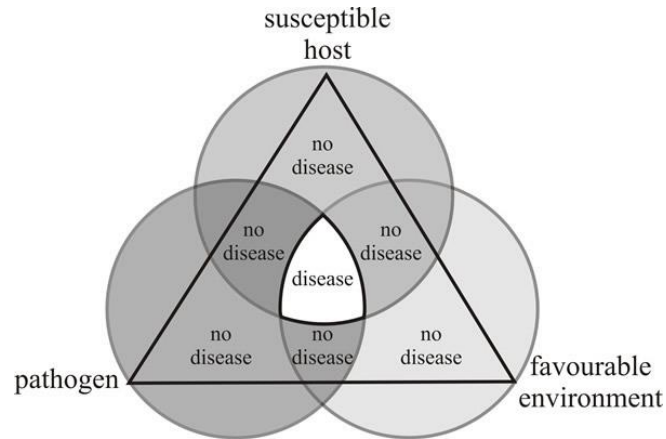
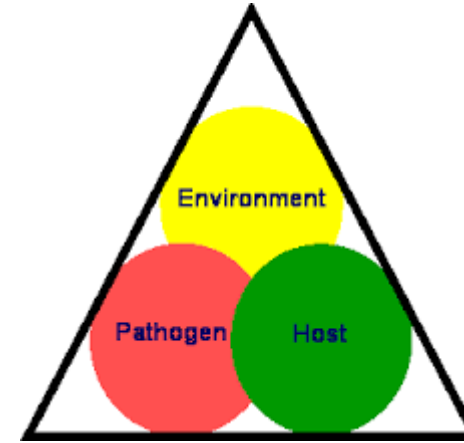
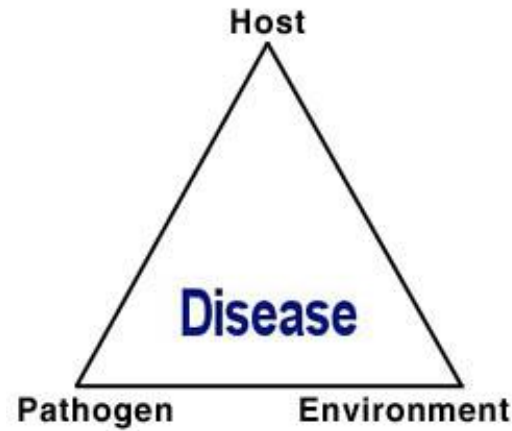
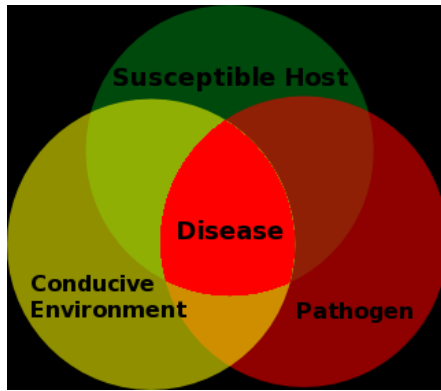
Terms, Definitions and Concepts

Infectious dose

- Definition (Wikipedia)–the amount of a pathogen (measured in number of microorganisms) required to cause an infection in the host.
 - ID_{50} – infectious dose 50% of population
 - $TCID_{50}$ – tissue culture 50% - used to titer viruses
 - EID_{50} – egg infectious dose 50% - used to titer viruses
 - LD_{50} – lethal dose 50% - used to titer toxins
 - Amount varies with pathogen
 - Low ID_{50} = high **virulence** (or **pathogenicity**)
 - High ID_{50} = low virulence
- Old saying – “too much of anything is not good for you”
 - In high enough doses = anything may be toxic or infective
 - Example – water

Terms, Definitions and Concepts

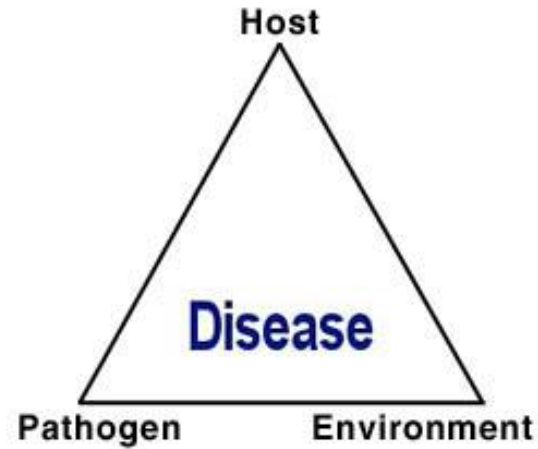
Host/Pathogen/Environment Relationship



Terms, Definitions and Concepts

Host/Pathogen/Environment Relationship

- Balance between:
 - Host defenses and susceptibilities
 - Virulence and ID of pathogen
 - Type of environment that favors one or the other



Your Cell Phone Is 10 Times Dirtier Than a Toilet Seat. Here's What to Do About It

[Abigail Abrams](#)

Aug 23, 2017

TIME Health

For more, visit [TIME Health](#).

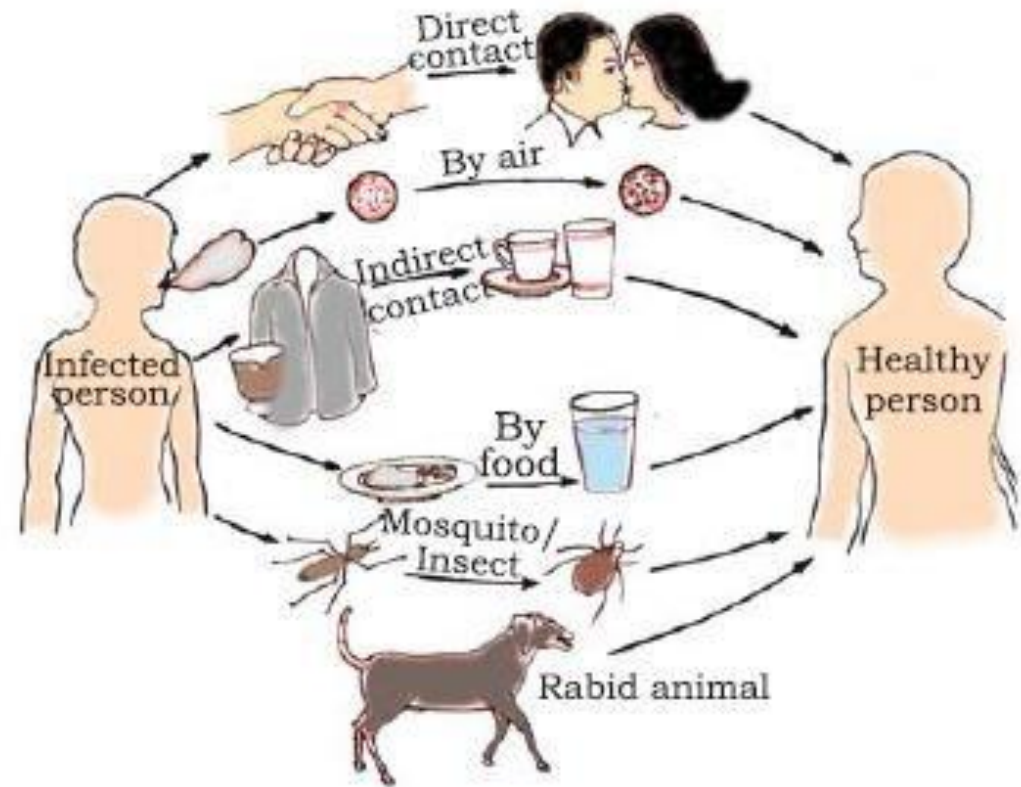
Most people don't give a second thought to using their [cell phone everywhere](#), from their morning commute to the [dinner table](#) to the doctor's office. But research shows that cell phones are far dirtier than most people think, and the more germs they collect, the more germs you touch.

In fact, your own hand is the biggest culprit when it comes to putting filth on your phone. Americans check their phones about 47 times per day, according to a [survey by Deloitte](#), which affords plenty of opportunities for microorganisms to move from your fingers to your phone.

Terms, Definitions and Concepts

How diseases are spread

- **Modes (routes) of disease transmission**
 - Depends on disease / disease agent
 - Common routes:
 - **Direct contact**
 - **Aerosol** (i.e., by air)
 - Indirect contact = **fomites (inanimate)**
 - **Oral (food-borne/fecal oral)**
 - Insects and bugs = **vectors (animate)**
 - **Mechanical vectors** – e.g., flies
 - **Biological vectors** – e.g., mosquitoes

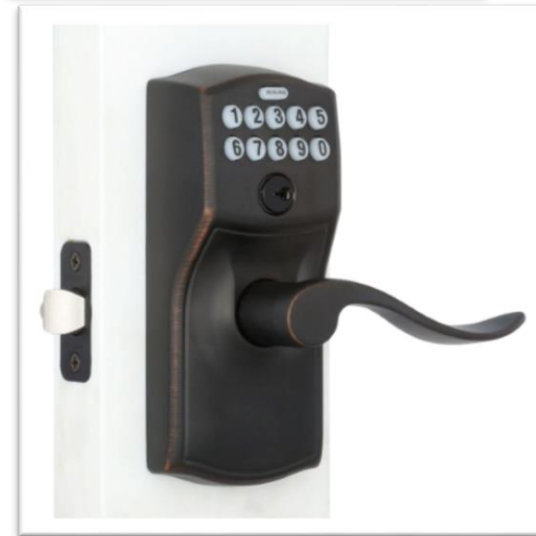


Terms, Definitions and Concepts

A biosecurity plan/program

- Logical and based on “common sense”
- Principles and concepts are NOT new
 - New terminology (e.g. compartmentalization)
 - New technology

Evolving Technology



Evolving Technology



Evolving Technology

Now being used routinely on farms

- Tracks personnel/equipment
- Can restrict/deny access.



Biosecurity Terms and Concepts

A biosecurity plan/program

- Components of a biosecurity plan
 - Conceptual = site selection
 - Placement of facilities, roadways, etc.
 - Typically isolated away from traffic or populations
 - Poultry considerations for wild waterfowl: ponds, crops, fly-ways
 - Sometimes not possible or limited selection
 - Structural = types of facilities
 - Types of rearing facilities (open range vs buildings), building materials, equipment, etc.
 - Operational = procedures and practices
 - Traffic (vehicular and personnel), signage, PPE, etc.
 - Training, compliance, documentation, etc.

Biosecurity Terms and Concepts

A biosecurity plan/program

- Components of a biosecurity plan
 - Conceptual, Structural, Operational
 - All needed
 - If one fails, others compensate



Biosecurity Terms and Concepts

A biosecurity plan/program—the basics

- How to keep enemies/intruders/pathogens away

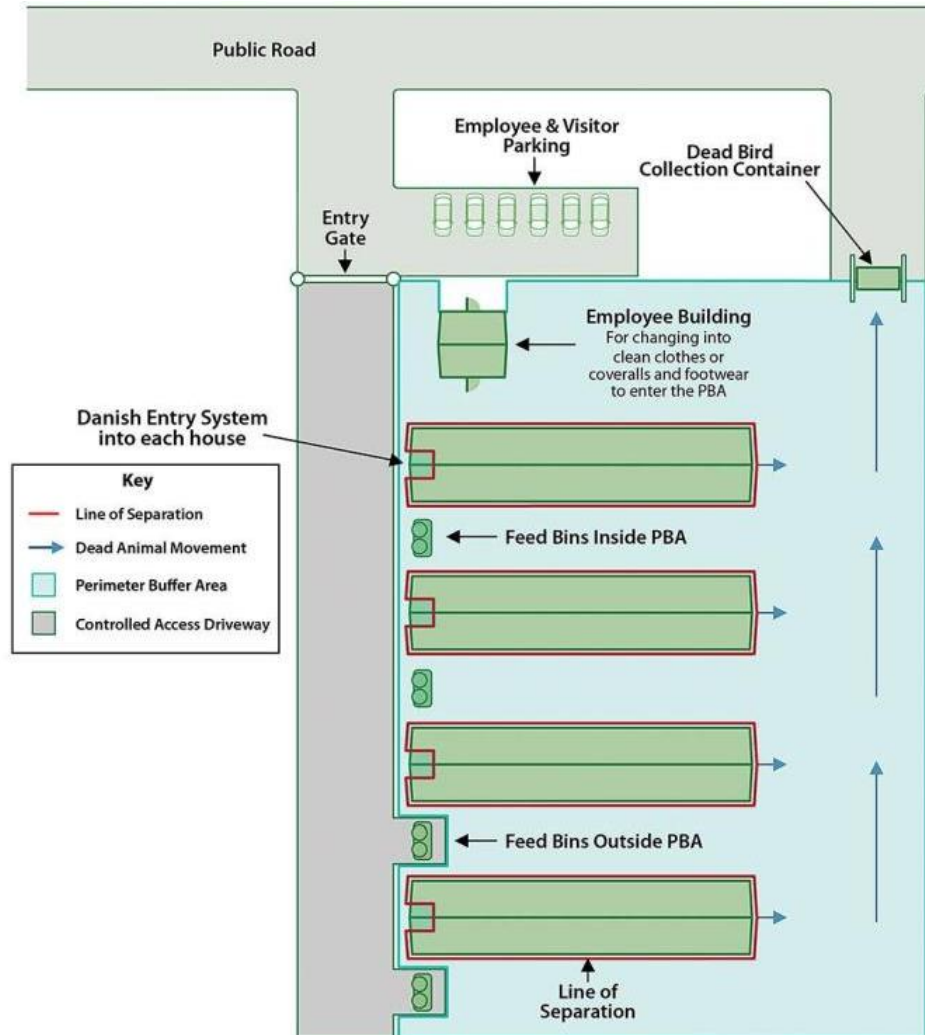


Biosecurity Terms and Concepts

A biosecurity plan/program—the basics

- How to keep enemies/intruders/pathogens away
 - Walls = **Lines of Separation**
 - Moat = **Perimeter Buffer Area**

Biosecurity Terms and Concepts

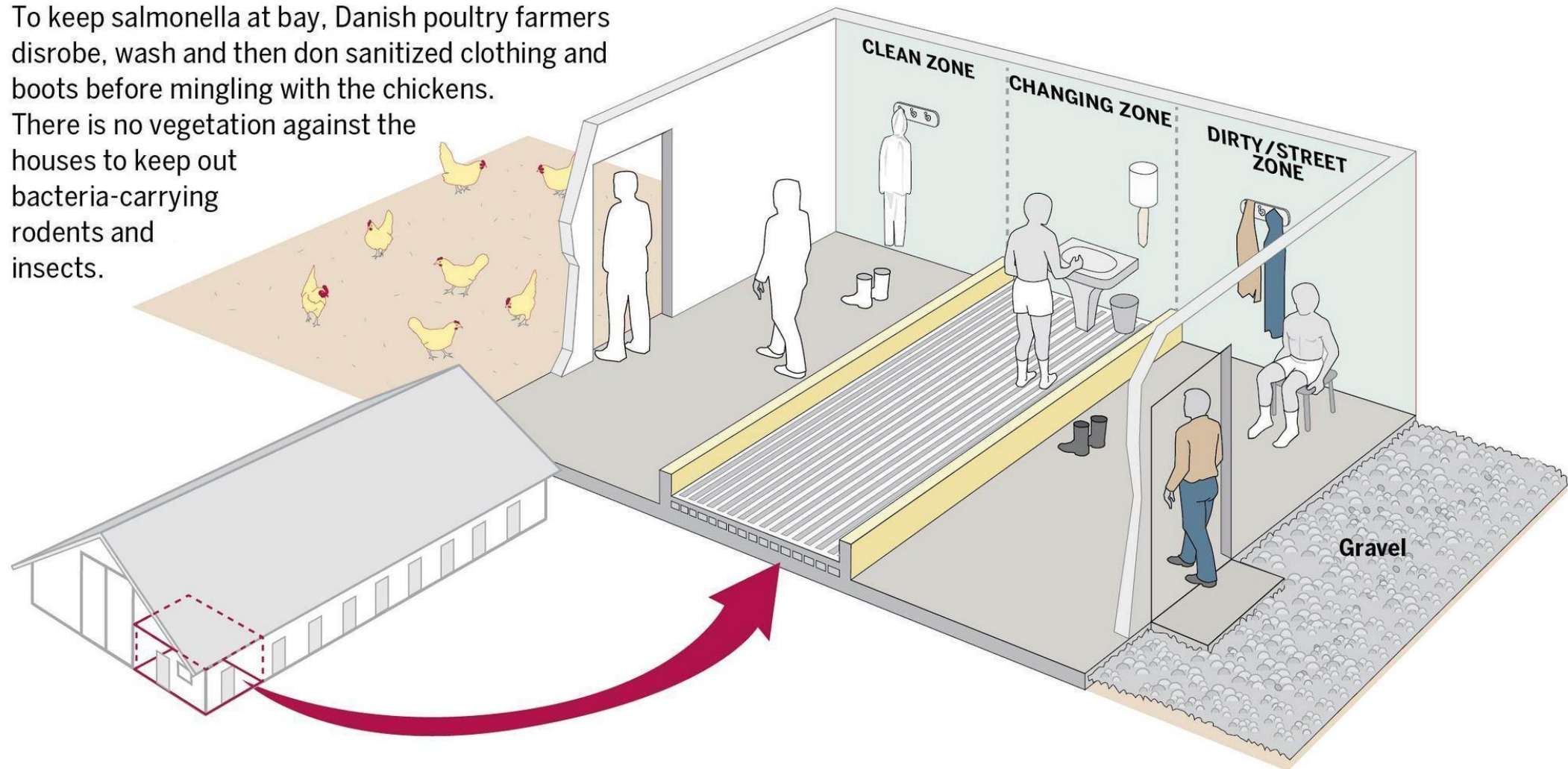


The perimeter buffer area in green is fenced to exclude vehicle and human traffic. Note that feed can be delivered without the trucks entering the perimeter buffer area.

Center for Food Security and Public Health, Iowa State University

Biosecurity Terms and Concepts

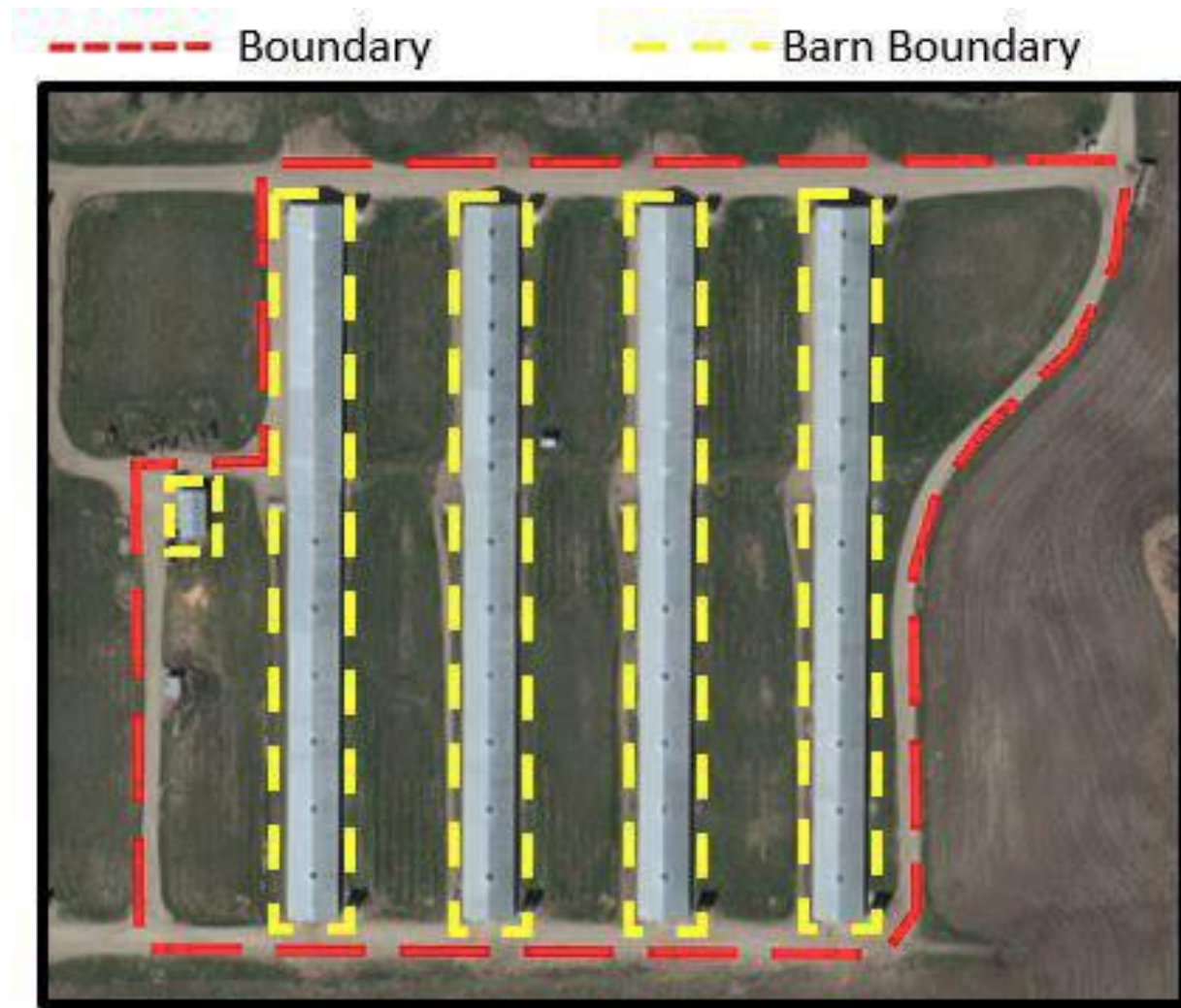
To keep salmonella at bay, Danish poultry farmers disrobe, wash and then don sanitized clothing and boots before mingling with the chickens. There is no vegetation against the houses to keep out bacteria-carrying rodents and insects.



Biosecurity Terms and Concepts



Biosecurity Terms and Concepts



Biosecurity Terms and Concepts



Infectious Diseases/Infectious Agents/Pathogens

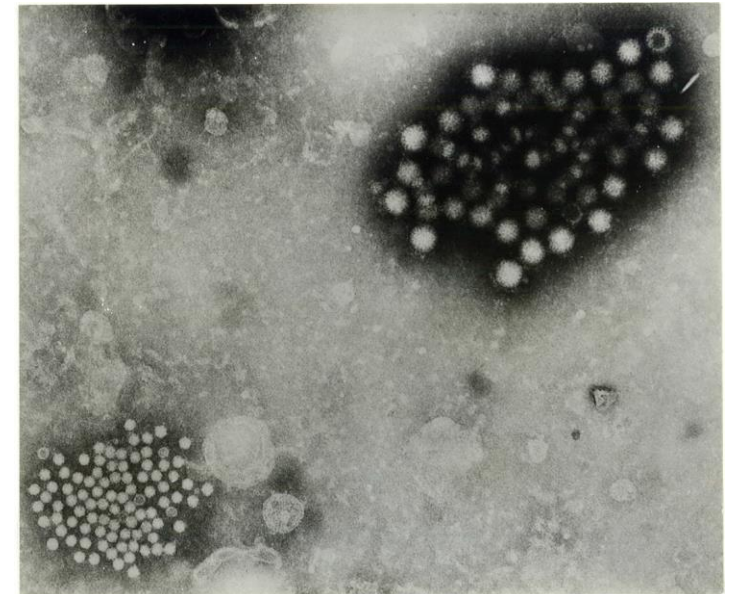
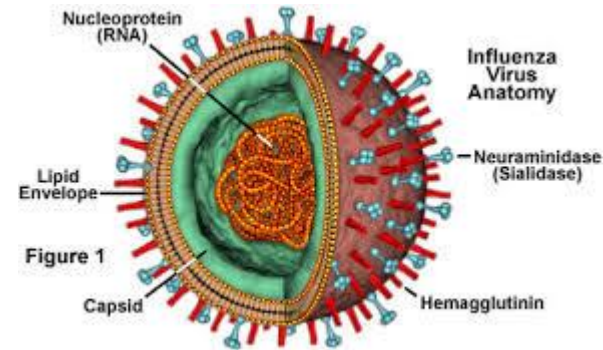
What are these things?

- Most infectious diseases of poultry are caused by microorganisms:
 - Viruses (e.g., avian influenza, Newcastle disease)
 - Bacteria (e.g., *Salmonella spp.*, *E. coli*)
 - Parasites
 - Internal (e.g., coccidia, ascarids)
 - External (e.g., Northern fowl mites, lice)
- Microorganisms can't be seen with the naked eye so we must use some type of instrument to see them (e.g. microscope).

Viruses

Viruses

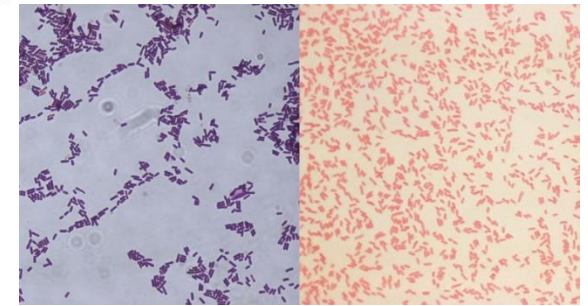
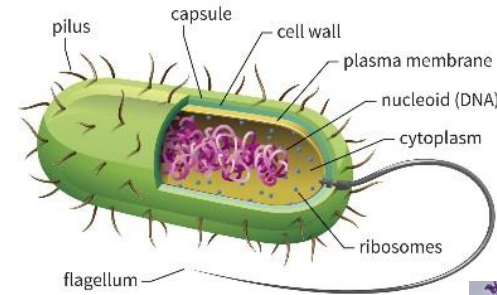
- The smallest and simplest microorganism
 - Must use an electron microscope to see them
 - Can be attached to dust particles, droplets, etc.
- Many types and characteristics
 - Many sizes and shapes
 - Some are pathogenic (i.e., disease causing) and others are not (Hi path/Lo path)
 - Some survive for long periods in the environment
- All viruses need a cell to replicate/reproduce
 - Cannot replicate (i.e., grow) without a bird (importance of barn downtime)
 - Organic matter (i.e., dirt, feces, feathers, etc.) protects viruses (importance of cleaning along with disinfecting)



Bacteria

Bacteria

- Are small but larger and more complex than viruses
 - Need a light microscope to see them
 - Can be attached to dust particles and droplets
- Many types and characteristics
 - Many sizes and shapes
 - Some are pathogenic (i.e. disease causing)
 - Some are healthy for us and part of our normal microbiota (e.g. gut health)
 - Some survive for long periods in the environment
- Bacteria can grow on their own
 - They need the right conditions for growth
 - Temperature – warm temperatures best for growth extreme heat kills (e.g. boiling, baking, cooking)
 - Need substrate / media (i.e. food) for growth (importance of cleaning along with disinfecting)
 - Bacteria can be treated with antibiotics
 - Kills “good bacteria” along with pathogenic bacteria
 - Develop antimicrobial resistance (AMR) – major concern to animal and human health
 - Good biosecurity leads to healthier birds which leads to less antibiotic usage
 - NAE = no antibiotics ever



Parasites

Parasites

- Are the largest and most complex microorganisms
 - Many can be seen with the naked eye
 - Intestinal worms
 - External parasites – mites, lice
 - Some of the life stages (e.g., eggs, oocysts) are only seen with a microscope
- Many types and characteristics
 - Many sizes and shapes
 - Some are pathogenic (i.e., disease causing) and others are not (Hi path/Lo path)
 - Some survive for long periods in the environment
- Many parasites have complicated life cycles that may involve other animals
 - Organic matter (i.e., dirt, feces, feathers, etc.) protects and/or harbors parasites (importance of cleaning along with disinfecting)
 - Certain environmental conditions favor propagation/infectivity (e.g., wet, warm litter conditions and coccidiosis)
- Parasites can be treated with drugs
 - Can develop resistance to drugs



National Poultry Improvement Plan (NPIP)

What is it? (<http://www.poultryimprovement.org>)

- Established in the 1930's to eliminate Pullorum disease (caused by *Salmonella pullorum*)
- Cooperative partnership between
 - Poultry industry = voluntary participation
 - State government
 - Federal government
- Goal is to apply new diagnostic technology for the improvement of poultry health and poultry products
- Has been extended to include:
 - *Salmonella pullorum*, *Salmonella typhoid*, *Salmonella enteridis*
 - *Mycoplasma gallisepticum* (MG), *Mycoplasma synoviae* (MS), *Mycoplasma meleagridis* (MM)
 - Avian influenza (AI)
- Types of birds include:
 - Commercial poultry (i.e., layer and broiler chickens)
 - Turkeys
 - Waterfowl
 - Exhibition and backyard poultry
 - Gamebirds

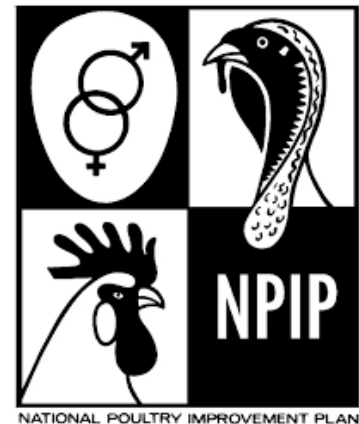
NPIP Biosecurity Program

Established 14 principles for evaluating poultry biosecurity

- These are referred to as Standard E
- Audits of the biosecurity program will be conducted by the appropriate state agency
- NPIP audits
 - Will be a “table-top” audit (i.e. not a site visit)
 - Required every two years
 - Will require:
 - Biosecurity plan’s training materials
 - Documentation of implementation of the NPIP Biosecurity Principles
 - Corrective actions taken
 - Biosecurity officer’s annual review
 - Completeness and compliance of the NPIP Biosecurity Principles

NPIP Biosecurity Principles

1. Biosecurity Responsibility
2. Training
3. Line of Separation
4. Perimeter Buffer Area
5. Personnel
6. Wild Birds, Rodents, Insects
7. Equipment & Vehicles
8. Mortality Disposal
9. Manure & Litter Management
10. Replacement Poultry
11. Water Supply
12. Feed & Replacement Litter
13. Reporting Morbidity & Mortality
- 14. Auditing**



End of Module 1