Wildlife, Veterinary, & Agricultural Surveillance

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Post Questions in the Chat!

(we will have breaks to answer these during the workshop)

Workshop Schedule

Time	Topics
2:00—2:20 pm	Animal Surveillance & One Health
2:20—2:40 pm	Wildlife Surveillance
2:40—2:50 pm	Veterinary Surveillance
2:50—3:15 pm	Agricultural Surveillance
3:15—3:25 pm	Break
3:25—4:00 pm	R Session

Surveillance of Animals & One Health

Reasons to Conduct Animal Surveillance

Zoonoses/Vector-/Food-borne

- More than half of all infections that people can spread between animals and people

- Monitor animals because they can spread pathogens

- Examples: Brucellosis, toxoplasmosis, *Campylobacter*

Animal Disease

- Animals are susceptible to disease!

- Monitor out of interest in health of animal populations

- Examples: avian malaria, *Campylobacter*

One Health Framework

- Health of people is connected to the health of animals and our shared ecosystems

- Issues include:
  - zoonoses
  - antibiotic resistance
  - food safety
  - vector-borne diseases
  - environmental health
  - etc.

One Health Surveillance

- Promote collaborative efforts across sectors as well as eco-systemic approach to health

- One Health surveillance in practice:

sectors involved in human, animal, environmental health:
   -ministries of health, dept of livestock/fisheries/agriculture, pharmaceutical companies, private hospitals/clinicians, private veterinarians, climate/environmental data (dept of natural resources, environment)

1. institutional collaboration across sectors conducting surveillance

2. collaboration during decision-making processes

3. collaboration across disciplines

4. public-private partnerships

Fig. 2. Possible degrees of operational collaboration at the different steps of the surveillance process.

Step of the surveillance process	Possible degrees of collaboration				
Planning	Undertaken separately in each sector	Undertaken by a single sector for all surveillance components	Cross-sectoral consultation but undertaken separately in each sector	Undertaken by a multi-sectoral working group	Undertaken by a multi-sectoral body
Data collection (sampling – laboratory testing)	Undertaken separately in each sector	Undertaken by a single sector for all components	Harmonisation across sectors	Joint activities across sectors	Undertaken by a multi-sectoral body
Data sharing	No data exchange	Notification of unusual events only	Ongoing data exchange		
Data analysis/ interpretation	Undertaken separately in each sector	Undertaken separately and then compared by a single sector	Jointly undertaken by a single sector for all components	Undertaken separately and then compared by a multi-sectoral working group	Jointly undertaken by a multi-sectoral working group or body
Results dissemination	Undertaken separately for each sector	Joint dissemination in separate sectoral activities	Joint dissemination by a single sector	Joint dissemination by a multi-sectoral working group	Joint dissemination by a multi-sectoral body

1. Institutional Collaboration

- Sectors: public health, animal health, plant health, environmental health, food safety
- Coordinate:
  - governance/supervision of surveillance system
  - implementation of surveillance activities
- Usually, systems establish an inter-agency committee and/or establish documents to outline collaborations

Bordier *et al.*, *Preventive Veterinary Medicine* 181 (2020)

Collaboration

2. Decision-making Process

- Consider administrative jurisdictions within country and regionally/internationally

3. Across Disciplines

- Engagement of disciplines to aid surveillance processes
  - e.g. risk assessment, risk management, research

- May include epidemiology, veterinary medicine, entomology, microbiology, medicine, parasitology, among others

4. Public-Private Partnerships

- May occur within sectors or across sectors

- May be with individuals or through professional organizations

- Examples:
  - pharmaceutical companies
  - private veterinarians
  - private clinicians
  - feed/food operators
  - farmers
  - hunters

System Factors that Impact Collaboration

Supports to Collaboration

- existence of framework to support collaboration
  - overarching One Health program
  - may be based on regional strategies
  - other appropriate legal/institutional framework
  - supervision of collaborating sectors by single authority

- commitment of stakeholders
  - efficient communication
  - meet stakeholder objectives
  - recognition of necessity for interconnectivity in efficient surveillance

- structural supports
  - data exchange/joint database
  - national reference laboratory

System Factors that Impact Collaboration

Barriers to Collaboration

- lack of standardization for surveillance processes

  - data collection, incomplete data, insufficient data sharing

  - unreliable alert systems

  - incomplete analysis & interpretation

- legal constraints

  - property & confidentiality of data

  - ethical issues

  - poorly defined roles for sectors

- insufficient resources

  - need for budgets to support collaborative efforts

- competing priorities

One Health Surveillance in Practice

- most focus on monitoring for zoonoses
  - including vector-borne and food-borne illness
  - also antimicrobial resistance
- animals as sentinels
  - sensitive to environmental exposures/contaminants
  - susceptible to same illnesses (e.g. Lyme disease)
  - reservoir/vector of pathogen

- One Health emphasizes health of all components: human, animal, and environment

- necessary to involve all sectors, not simply the collection of diverse data by single sector
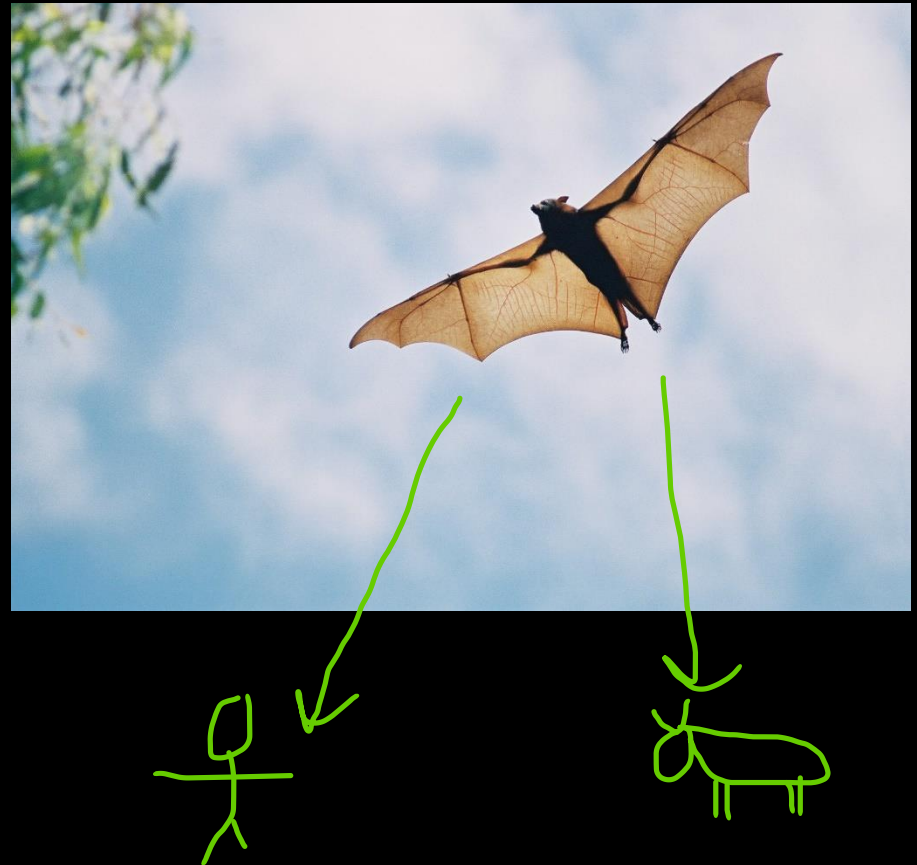
One Health in Practice
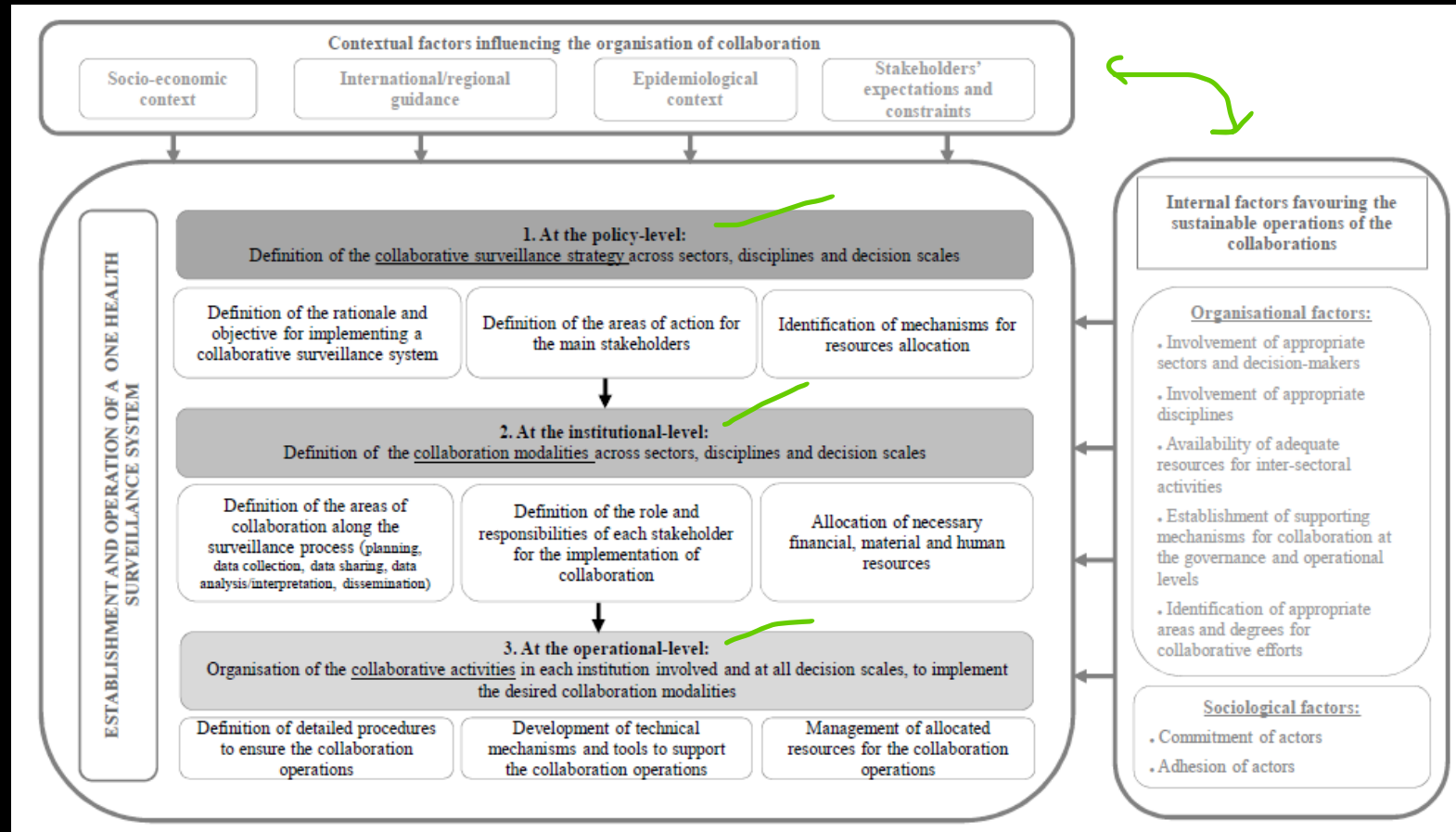
Wildlife Surveillance

Motivation for Wildlife Surveillance

- evidence for circulation of pathogens

  - public health interest

  - veterinary interest

- high proportion of pathogens related to wildlife

Challenges

- Wildlife surveillance is complex and may require multiple experts
  - management authorities
  - research institutes

- Separate activities may be inefficient

- Budget/resource allocation

- Wildlife do not stay within borders

Wildlife Surveillance in Practice

- active
  - targeted sampling of wildlife populations
  - specific pathogen, specific animal population

- passive
  - pathological examination of wildlife found sick or dead

- periodic monitoring of pre-defined number of wild animals

- research groups
  - high risk areas
  - opportunistic samples

- notifiable animal diseases

World Organization for Animal Health

Wildlife Surveillance

- choose some species/groups for active surveillance with supplementary passive surveillance, depending on:
  - burden of diseases
  - presence/abundance of wildlife
  - presence/abundance of veterinary animals

- additional surveillance (passive only) for other species
  - animals in contact with humans
  - cause of death/disease status for found animals
  - environmental sampling

Example: Wild Boar

- active & passive
  - targeted and opportunistic sampling

- specific diseases, sampling, or inspections may be conducted by different coordinating units
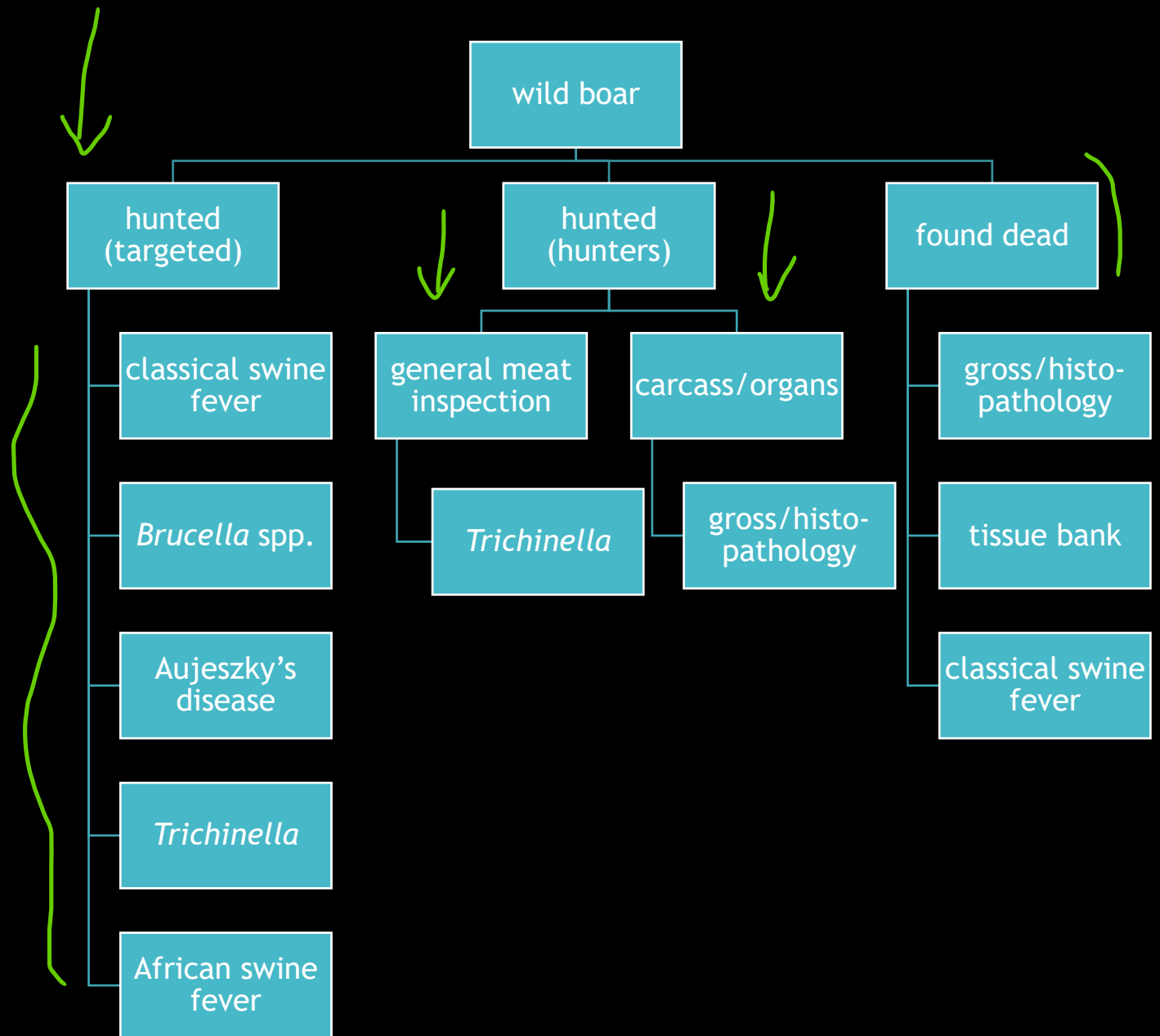
Example: Rodents

- active & passive
  - targeted and opportunistic sampling

- specific diseases, sampling, or inspections may be conducted by different coordinating units

Example: Birds

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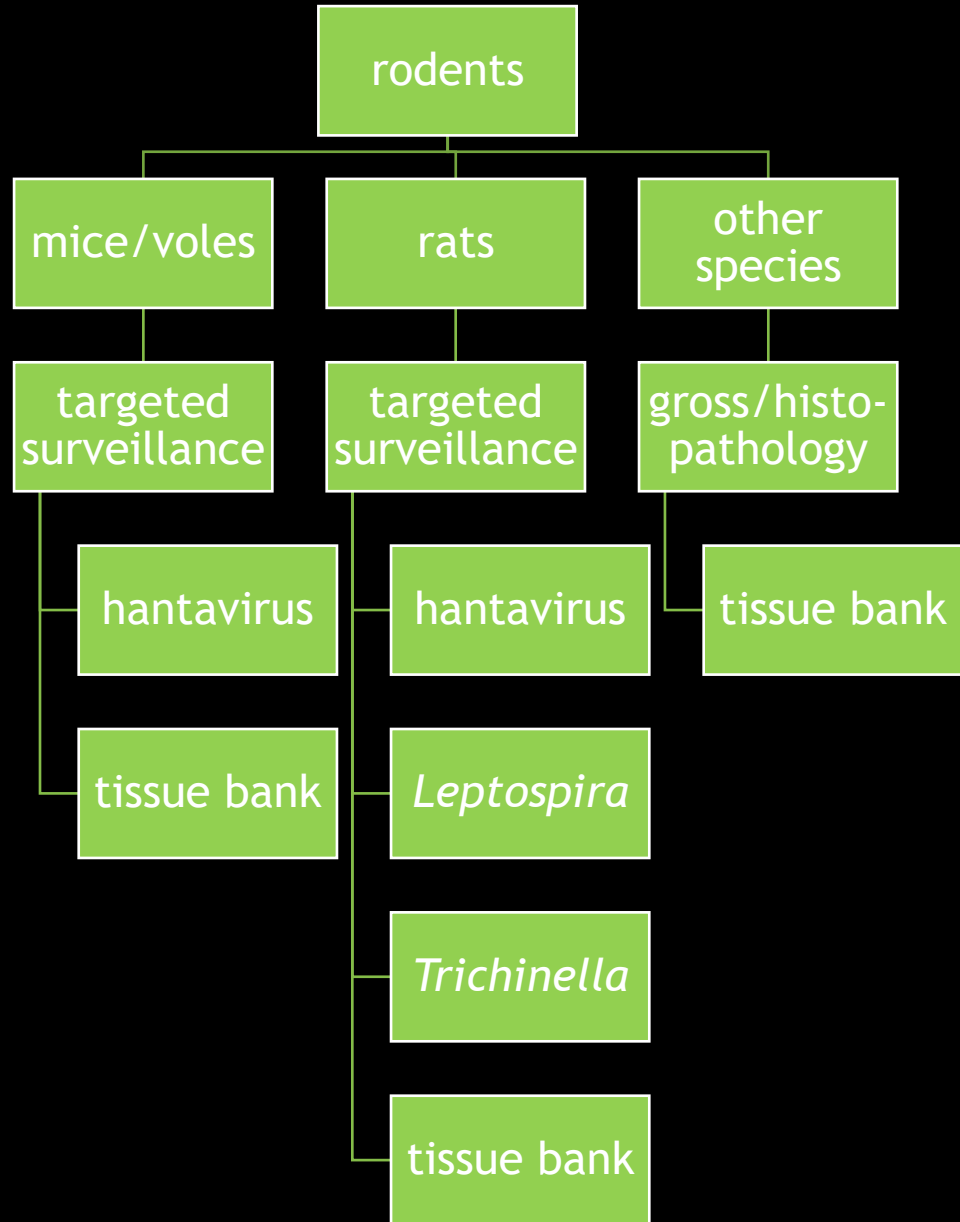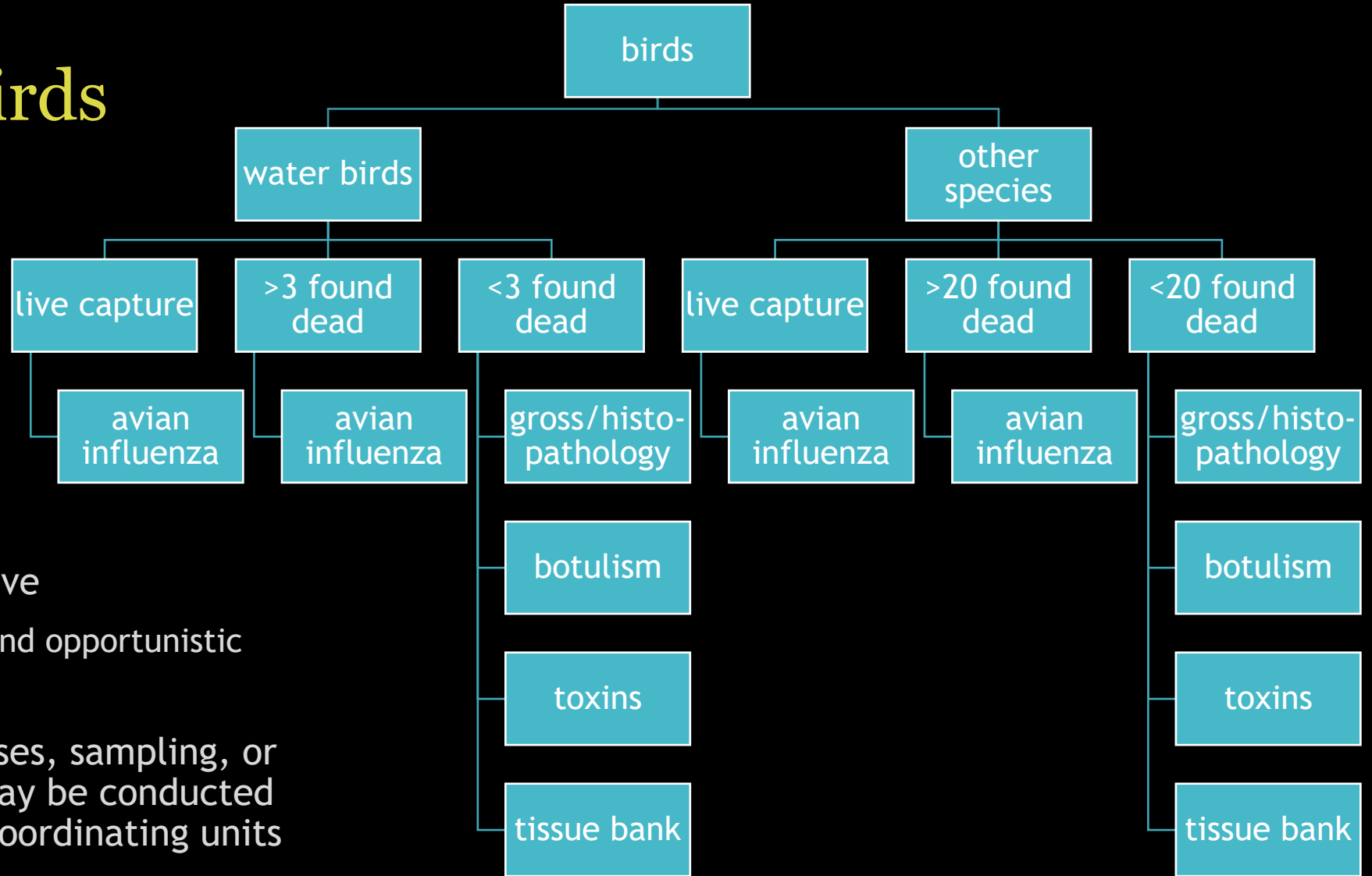
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  - targeted and opportunistic sampling
- specific diseases, sampling, or inspections may be conducted by different coordinating units

Vectorborne Diseases

- Often makes more sense to conduct surveillance on vectors

- Presence and abundance of disease vectors

- Understanding of timing of increase in vector populations

- Presence of pathogens in specific vectors

Veterinary Surveillance

Motivation for Veterinary Surveillance

- evidence for circulation of pathogens
  - public health interest
  - veterinary interest

Strategies: Within Veterinary Clinics

- active, targeted, passive, syndromic

- animals or environmental
  - areas of clinic, areas frequented by animals

- goals:
  - understanding baselines for clinic/catchment area
  - detection of hospital acquired infections

Strategies: Clinics as Sentinels

- need mechanism for reporting detection to public health authorities

- goals:

  - detection of zoonoses, vector- or food-borne illnesses affecting humans

- examples

  - Lyme disease in dogs

  - Neurological symptoms in horses (WNV)

Agricultural Surveillance

Motivation for Agricultural Surveillance

- health of animals used in food production

- tracking of antimicrobial resistance

- food safety

Agricultural Surveillance

- surveillance strategies used depend on disease of interest and underlying risk of disease

- national programs as well as regional networks, research groups, pharmaceuticals

Strategies: Individual Sampling

- testing of every animal over a certain age

- frequency of testing determined by underlying risk for geographic area

  - pre- and post-movement

  - pre-sale

  - enhanced surveillance if disease is identified

- data maintained centrally

- after testing, herds are certified

Strategies: Aggregate Sampling

- Aggregate sampling of large herds more efficient and effective

- No need for animal restraint

- Available due to improvements in diagnostics

Strategies: Aggregate Sampling

- Bulk tank sampling

    - cattle, goat, sheep dairies

    - single or multiple tanks with thousands of gallons of milk

    - represent health of lactating females

    - collection with pipette/dipper from tops of tanks after agitation

- Testing via:

    - nucleic acid detection

        - border disease, bovine viral diarrhea, *Coxiella burnetti*, foot and mouth, *etc.*

    - antibody detection

        - *M. bovis*, foot and mouth disease, *etc.*

    - culture/isolation

        - *M. bovis, S. aureus, etc.*

Strategies: Aggregate Sampling

- Oral fluid sampling

  - cattle, swine

  - provide a rope in the pen, recover sample from rope

  - may indicate active infection or presence of pathogen in the environment (*i.e.* feed)

- Testing via:

  - nucleic acid detection
    - foot and mouth disease, African swine fever, influenza A, *etc.*

  - antibody detection
    - *M. bovis*, PRRS, *etc.*

  - culture/isolation
    - influenza A

Strategies: Market Sampling

- for some diseases, marketplaces are a convenient point at which to capture many herds/flocks and may be a source of infection

- live animals

- environment

    - feces, feathers, mud, water, air, surfaces (cages, equipment)

Strategies: Market Sampling

Environmental Samples

- flexible, easy to adapt

- acceptable to sellers

- cost-effective, rapid, easy to implement

- no animal capture

- safer (reduced aerosolization)

- no individual data

- interpreting timing of positive result

Live Birds

- need live birds

- less acceptable to sellers

- more labor-intensive, time intensive due to capture of animals

- animal capture is stressful

- risk of virus aerosolization

- collection of individual-level data

- sample represents animal group tested

Antimicrobial Resistance

- Monitoring of pathogens of human/veterinary interest

- Pathogens

  - *Salmonella* spp., *Campylobacter*, *Enterococcus*, *E. coli*, *S. aureus*, *Streptococcus* spp. *etc.*

- testing of live animals at farm and slaughterhouse and of products in retail

- focus on diseased or healthy animals

Antimicrobial Resistance

- national or regional testing programs, pharmaceutical-sponsored monitoring

- testing
  - phenotype or genotype
  - cutoffs to determine resistance

Vectorborne Disease

- surveillance occurs at animal level but capture of vectors also appropriate

- monitoring presence of known vectors and detecting introduction of new vectors

- vectors: *Culicoides*, mosquitoes, ticks, sandflies

- pathogens: bluetongue virus, *Tularaemia*, Rift Valley fever, African swine fever, *etc*.

Wildlife/Veterinary Surveillance

- Use of One Health framework can help achieve efficient surveillance systems across animals, humans, and environments

- Collaborations between animal health, public health, food safety, antimicrobial resistance monitoring, pharmaceuticals, veterinarians

- Diverse sampling strategies depending on disease burden, pathogen, populations being monitored

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