Poultry Physiology: Adaptation to the Environment

AgScience Poultry Science Curriculum
Section 4
Introduction

What is health?
- General condition or state
- Absence of disease

Physiological processes must be maintained for health

What are some physiological processes that must be maintained for health?

Heart rate (beats/min)
- Chicken – 250-300
- Turkey – 160-175

Respiration Rate (breaths/min)
- Chicken – 12-36
- Turkey – 28-49

Body Temperature
- Chicken – 101-103°F
- Turkey – 105-109°F

Important to understand the impact of the animals environment on physiological processes to make sound information-based management decisions\(^1\)
Poultry are **homeothermic animals**, or warm blooded mammals.

**Homeothermic animals** must maintain a nearly constant inner body temperature.

**Homeostasis** is the maintenance of a constant body temperature

- Heat output = heat input

Animals produce heat through normal body processes such as metabolism

- Use heat to stay warm if environmental temperature is cold
- Dissipate this heat if environmental temperature is too warm
Mechanisms of Heat Loss

Because maintenance of homeostasis is critical homoeothermic animals must have a way to dissipate excess heat.

Two forms of heat loss:
- Sensible
- Insensible

Three forms of sensible heat loss:
- **Conduction** - Heat exchange between two objects that are in contact that differ in temperature.
- **Convection** – Heat movement by streams of particles
- **Radiation** – Flow of heat without the aid of a material medium

ADD GRAPHIC
Mechanisms of Heat Loss

Insensible heat loss:
Heat loss that does not increase the temperature of the surrounding air

ADD GRAPHIC
Thermoregulation

Series of processes to maintain body temperature:

Active thermoregulation:
- Increased heart rate
- Panting
- Sweating (Not in birds)

Passive thermoregulation:
- Vasoconstriction
- Vasodilatation
- Behavioral changes

Vasoconstriction – narrowing of the blood vessels, used to conserve body heat

Vasodilatation – widening of the blood vessels, used to dissipate body heat
**Temperature Regulation**

**Heat Production:**

- Smaller birds produce less total heat
  - More produced/unit body weight
- Big birds produce more heat
  - Less produced/unit body weight
Environmental effects on physiology

Commercial poultry grown in contained environment

Protect from extreme environmental changes

Temperature, relative humidity, wind speed

Temperature –

- At 70°F, 75% of heat loss in sensible

- Greater than 85°F amount of insensible heat loss increases

Humidity –

- Affects insensible heat loss

- Amount of water that can be absorbed by air decreases as humidity increases
Environmental effects on physiology

Ambient temperature effects feed and water intake

As temperature increases:

- Water intake increases as moisture loss through insensible heat loss increases.
- Feed intake decreases as environmental temperature increases

The heat produced through consumption and metabolism of feed is called **heat increment**.

**Heat increment** is detrimental to birds particularly in Hot and Intolerably Hot zone.
Poultry Health

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Section 4 continued
Disease Prevention

“An ounce of prevention is worth a pound of cure”

- Proper nutrition
- Sanitation
- Biosecurity
- Vaccination

“Biosecurity is the first line of defense on farm for protecting animals from disease”¹

Why Biosecurity?

Minimize risk of disease transmission from outside sources
Reduce transmission between groups on same farm
Common Biosecurity Practices:

- Poultry houses should be kept locked
- Separate clothes for working on-farm (can include showering prior to entering facility)
- 3 days clean – Allowing 3 day window between visiting different flocks
- Control visitor traffic
- Visitors should wear protective clothing
  Plastic boots, hair nets etc.
- Before entering facility scrub vehicles undercarriage and tires with disinfectant
- Clean and disinfect all equipment prior to use
- Dispose of mortality properly
- Avoid contact with wild game
Remember: Definition of Health

Disease – Any other state than complete health

Symptom vs. Clinical sign

Animals – clinical sign

Clinical signs include:

- Fever, weight loss, reduced performance

Lesion – Change in body organ

- Size
- Color
- Shape

Tumor or abcess

Being able to recognize clinical signs is critical for any farmer!
Health and Disease

Predisposing Cause—

Stress, poor conformation, malnutrition

Direct Cause –

Pathogen – Disease causing agent

Bacteria
Virus
Parasite
Protozoa
Fungi

Infectious disease – can be communicated from one animal to another

ADD GRAPHIC
Disease Causing Agents

Bacteria

- Single-celled organisms
- Ubiquitous
- Some cause disease if appropriate infectious dose
  
  Example: Salmonella, Cholera, etc.

Virus

- Non-living organism, DNA/RNA in protein coat
- Only reproduce in host organism
  
  Example: Marek’s Disease, Infectious Bronchitis, etc

Infectious dose – amount of pathogen required to cause infection in host
Disease Causing Agents

Parasite

Organism that lives on or in host organism and get food from the host

Ex. Fowl mite

Protozoa

Single-celled organisms

Parasitic or free-living

Ex. Coccidiosis

Fungi

Multi-cellular eukaryotic organisms

Some cause disease, typically if ingested in old feed ingredients

Ex. Mycotoxicosis
Lifecycle of Infectious Disease

1. Pathogen must gain entrance to body
2. Assimilation and multiplication in host
3. Exit host
4. Infect another host

Which of pathogens previously mentioned would be considered infectious?

Bacteria and Virus

ADD GRAPHIC
Infectious Disease Transmission

Recognize potential disease carriers is key to maintaining a healthy flock

Some common methods of infectious disease transmission:

- Introducing/coming into contact with other diseased birds
- Introducing/coming into contact with healthy birds that could be carriers of disease
- Bringing contaminated equipment on-farm
- Shoes and clothing of visitors
- Unclean water
- Rodents and wild birds
- Contaminated delivery trucks (live haul trucks, feed trucks, etc)
Health and Disease

Pathogenicity – Ability of an organism to cause disease

Virulence – Degree of pathogenicity

Less pathogenic (less virulent) organisms will only cause disease in compromised host

More pathogenic (more virulent) organisms will cause disease in healthy animals

Clinical Disease – Clinical signs are evident

Subclinical disease – Clinical signs are not readily evident/observable; Animals with subclinical disease will often be carriers

Acute Disease – Often characterized by sudden onset of symptoms, termination of disease either recovery or death (2-3 weeks)

Chronic Disease – Develop slowly over period of weeks, often reduced performance noted instead of clinical signs
Immunity is a state of resistance in the animal to a disease-producing agent.

Two general categories of acquired immunity:

Active and Passive

Passive Immunity – Maternal immunity (Colostrum in mammals); introduction of antibodies

Active Immunity – Natural exposure and recovery; production of antibodies against specific antigens; vaccines, also known as acquired immunity

Humoral Immunity – Immune cells that fight infection, macrophages and heterophils

Antibodies – Proteins produced by the body that label cells of infectious agents for destruction by macrophages and heterophils
Vaccination

Commonly done in hatchery

In-ovo vaccine

Technology developed for vaccinating chicks while still in egg

Spray vaccine

Some flocks may need to be vaccinated on-farm

Laying flocks

Other vaccine administration methods:

Drinking water

intraocular

Intranasal

Wing web

Sub Q