

## The process of egg formation in a hen's oviduct and the time an egg spends in each section

### 1. OVARY

The ovulation process begins with the release of the yolk (or ova) into the left oviduct. The most highly developed follicle gets released into the infundibulum.

### 2. INFUNDIBULUM

The yolk is captured, and the formation of the perivitelline membrane and chalazae occurs. In breeder birds, fertilization occurs in this section. 15 minutes

### 3. MAGNUM

The egg white protein (or albumen) is produced here. 3 hours

### 4. ISTHMUS

The isthmus produces the fibers that make up the inner and outer shell membranes. 1 hour

### 5. TUBULAR SHELL GLAND

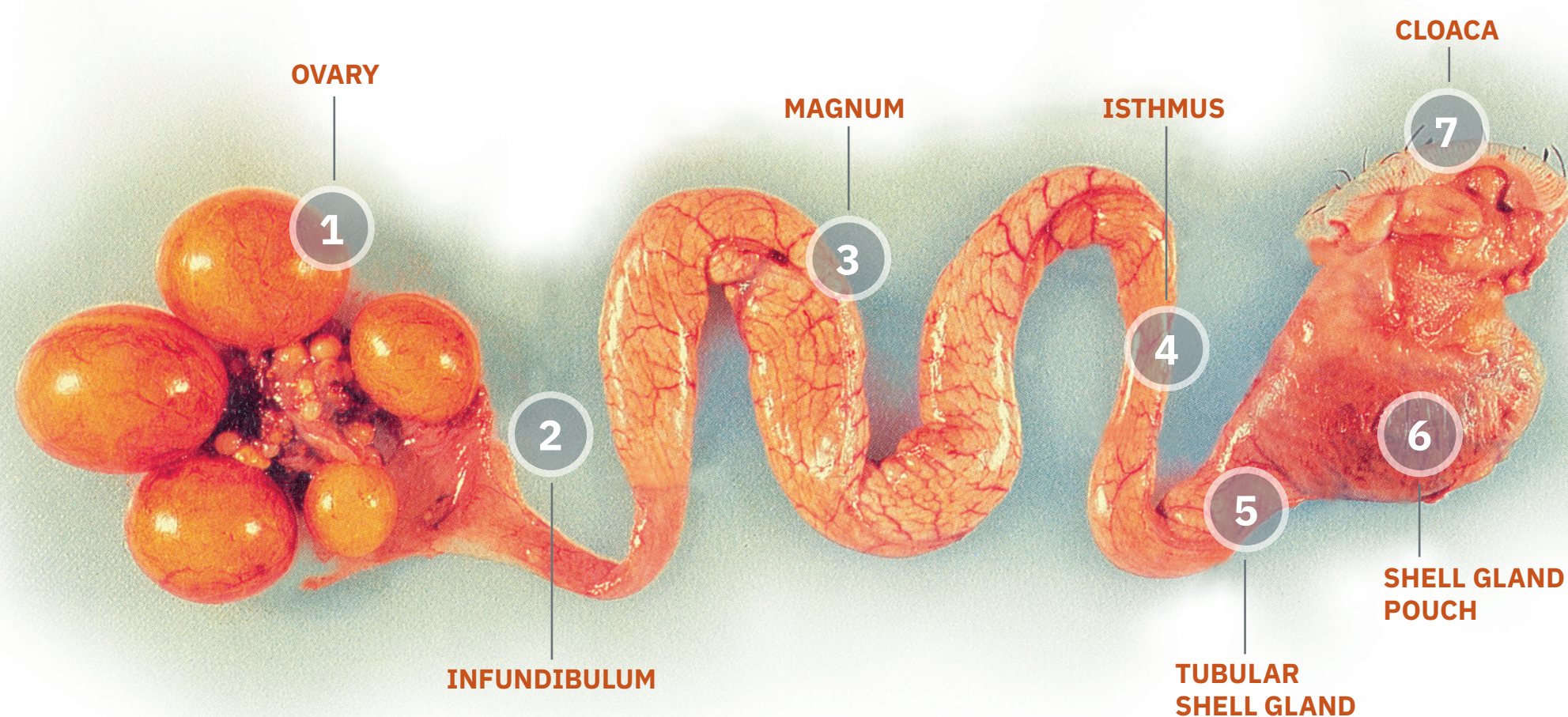
A process called "plumping" occurs when water rich with electrolytes enters the albumen and the formation of the mammillary cores commences. 5 hours

### 6. SHELL GLAND POUCH

The eggshell is formed and the pigmentation process occurs. 15 hours

### 7. CLOACA

The egg is laid via this section. 1 minute



## Normal Shell



### White and Brown Eggs

Some primary layer breeders are looking at eggshell breakthrough strength as a key trait. The target weight that the egg should be able to withstand is 4 kg of force.

## Abnormal Shell

### Color Change



#### Pale Shell

The degree of brown coloring in the eggshell is determined by the quality of the pigment deposited in the cuticle.

- Possible causes:
- Infectious bronchitis
  - Bird age
  - High stress in the flock
  - Egg drop syndrome
  - Use of chemotherapeutic agents (i.e., sulfonamides and nicarbazin)
  - Genetics (in brown or white hens)



#### Lilac/Pink Eggs

The egg appears to be pink or lilac due to the association between the cuticle and an extra calcium layer.

- Possible causes:
- Stress
  - Excess calcium in the feed or water



#### White Banded Eggs

If two eggs come into contact with each other in the shell gland pouch, the normal calcification process is interrupted. The first egg retained in the pouch will have an extra layer of calcium, which appears as a white band marking.

- Possible causes:
- Stress
  - Changes in lighting
  - Bird age



#### White/Brown Speckled

With smaller speckles than calcium deposits, these deposits may be laid down before or after the cuticle is formed.

- Possible causes:
- Defective shell gland
  - Disturbances during calcification
  - Excess calcium in the feed or water



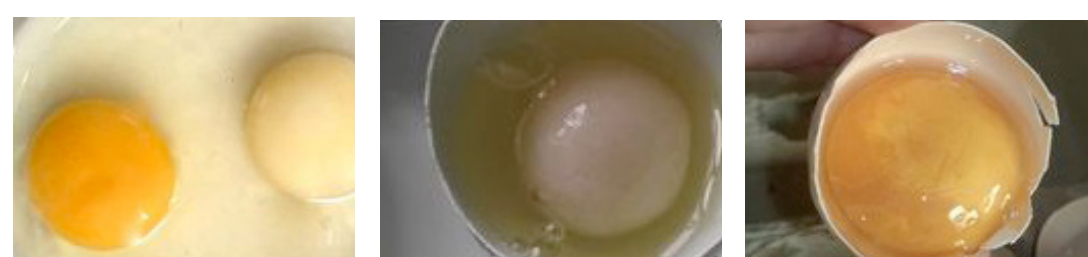
#### Mottled Shells

When placed in front of a light, the translucent areas appear mottled or glassy as a result of the shell's failure to dry out quickly.

- Possible causes:
- High humidity in the house
  - Disease
  - Mycotoxins
  - Manganese deficiency
  - Overcrowding

## Abnormal Egg Yolks & Whites

### Color Change



#### Platinum White/Blonde Yolk

The yolk is very opaque or white/blonde, but the egg white may be clear to cloudy.

- Possible causes:
- Hairworm (*Capillaria obsignata*)

#### Pale Yolk

The yolk is a pale yellow and the egg white is often clear, but it can be slightly cloudy.

- Possible causes:
- Insufficient carotenoids in feed
  - Insufficient pigments in birds coming into lay
  - Pigments not blended properly in feed
  - Feed/premix/pigments not stored or handled properly can impact pigments

#### Mottled Yolk

The yolk color is uneven or patchy, but the egg white can be clear or slightly cloudy.

- Possible causes:
- Poor handling or storage of eggs
  - Gossypol in cottonseed meal
  - Some de-worming drugs (or a combination)
  - Gallic or tannic acid
  - Raw soybean meal (not heat-treated)



#### Discolored Egg Whites

The egg white may be cloudy or darken to a yellow, green or pink hue.

- Possible causes:
- Excess riboflavin
  - Cottonseed meal and oil
  - Aging of eggs
  - Poor egg storage conditions
  - Hairworm
  - Marshmallow weed/plant

#### Green Tinged Yolk or White

The yolk and/or egg white can be light to dark green with an olive color.

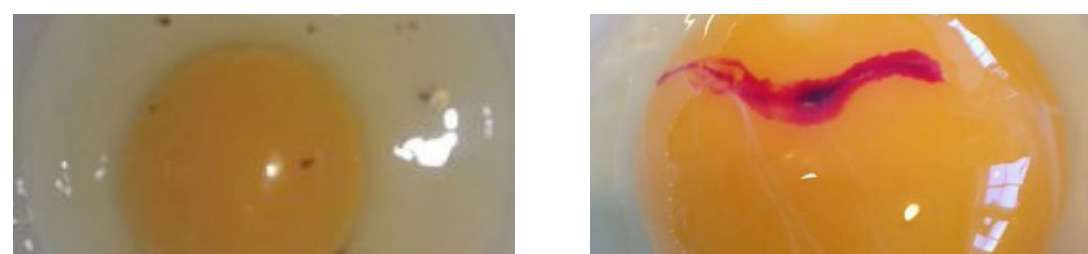
- Possible causes:
- Cottonseed oil
  - Shepherd's purse weed/plant
  - Marshmallow weed/plant
  - Excess riboflavin
  - *Pseudomonas* spp. (will fluoresce green under UV light and is accompanied by a sour smell)

#### Red Yolk or White

A red spot in the egg yolk can be small or large. Sometimes, the egg white can be blood red with a yellow yolk or with a blood-spot yolk.

- Possible causes:
- Insufficient vitamin A or K
  - Excessive amount of Lucerne meal
  - Sulphaquinoxaline
  - Mold ingestion or fungal toxins
  - Too many light hours
  - Sudden occurrence of stress
  - Sudden movements
  - Avian encephalomyelitis
  - Genetic component

### Spots



#### Meat Spot

A piece of tissue from the ovary or oviduct or broken-down blood spots is found in the yolk or egg white. They are usually brown/grey-tinged and can be small or large.

- Possible causes:
- Bird age
  - Genetic component
  - Stress
  - Panic in the flock
  - Mold ingestion or fungal toxins
  - Too many light hours

#### Blood Spot

A red spot in the egg yolk can be small or large. Sometimes, the egg white can be blood red with a yellow yolk or with a blood-spot yolk.

- Possible causes:
- Insufficient vitamin A or K
  - Excessive amount of Lucerne meal
  - Sulphaquinoxaline
  - Mold ingestion or fungal toxins
  - Too many light hours
  - Sudden occurrence of stress
  - Sudden movements
  - Avian encephalomyelitis
  - Genetic components

### Runny



#### Runny Egg White

The egg white is thin and watery and spreads out over a large space when the egg is cracked open.

- Possible causes:
- Eggs stored for a long time
  - High storage temperature with low humidity
  - Rough egg handling
  - Packing eggs with the air cell pointed upward
  - Bird age
  - Infectious bronchitis
  - Egg drop syndrome
  - Mycotoxins
  - Ammonia
  - Genetic components

### Coarse Texture



#### Worms

A small, thin roundworm is found in the yolk or egg white.

- Possible causes:
- Intestinal roundworms that have migrated to the oviduct

### Damaged



#### Dirty Eggs

Staining from manure can be different colors and textures, which can cover a small or large portion of the shell. Usually, the staining colors range from white to dark brown, and the texture may be grainy to smooth.

- Possible causes:
- Wet droppings
  - Large amounts of indigestible compounds in the feed
  - Poor gut health
  - Electrolyte imbalance/saline water
  - Disease (e.g., bacterial, viral, parasitic)
  - Stress



#### Blood-stained Eggs

Usually from pullets in early lay, eggs are contaminated by smears of blood from a prolapsed cloaca, vent pecking or cannibalism.

- Possible causes:
- Overweight pullets
  - Pullets coming into lay
  - Sudden, large increases in day length
  - Poor hygiene (in the cage, trays, belt pick-up system)
  - Vent pecking, cannibalism



#### Cracks

This problem includes hairline cracks, star cracks or large cracks that result in a hole in the shell.

- Possible causes:
- Heat stress
  - Saline water
  - Bird age
  - Inadequate nutrition (e.g., calcium, vitamin D3, trace minerals)
  - Mycotoxins
  - Mechanical fracture



#### Broken and Mended

A diagonal break occurs during formation and is mended again before lay.

- Possible causes:
- Stress during calcification



#### Mottled Shells

When placed in front of a light, the translucent areas appear mottled or glassy as a result of the shell's failure to dry out quickly.

- Possible causes:
- High humidity in the house
  - Disease
  - Mycotoxins
  - Manganese deficiency
  - Overcrowding

### Misshappen



#### Shell-less Eggs

Laid without a shell layer, these eggs are protected only by the shell membrane.

- Possible causes:
- Immature shell gland
  - Disease (e.g., avian influenza, Newcastle disease virus, infectious bronchitis, egg drop syndrome)
  - Inadequate nutrition (e.g., calcium, phosphorus, manganese or vitamin D3)
  - Heat stress
  - Stress



#### Corrugated Eggs

Characterized by a very rough, corrugated surface, these eggs are produced when plumping is not controlled and terminated.

- Possible causes:
- Heat stress
  - Saline water
  - Bird age
  - Poor nutrition, especially related to calcium and vitamin D3
  - Mycotoxins
  - Infectious bronchitis



#### Body-Checked Eggs

The egg is cracked in the shell gland pouch and then repaired before lay.

- Possible causes:
- Incorrect lighting
  - Stress
  - Bird age
  - Overcrowding



#### Wrinkled Eggs

Eggs with thinly creased and wrinkled surfaces.

- Possible causes:
- Stress
  - Infectious bronchitis
  - Defective shell gland
  - Overcrowding



#### Misshapen Eggs

These eggs are too small or large, round instead of oval, or differ in other ways from the normal shapes.

- Possible causes:
- Immature shell gland
  - Disease (e.g., avian influenza, Newcastle disease virus, infectious bronchitis, egg drop syndrome)
  - Stress
  - Overcrowding

### Excess Calcium



#### White/Brown Speckled

With smaller speckles than calcium deposits, these eggs may be laid down before or after the cuticle is formed.

- Possible causes:
- Defective shell gland
  - Disturbances during calcification
  - Excess calcium in the diet or water



#### Lilac/Pink Eggs

The egg appears to be pink or lilac due to the association between the cuticle and an extra calcium layer.

- Possible causes:
- Stress
  - Excess calcium in the diet or water



#### Pimpled Eggs

Classified by small lumps of calcified material on the egg shell, the severity of pimples depends on the foreign material present during the calcification process.

- Possible causes:
- Bird age
  - Strain of bird
  - Inadequate nutrition
  - Stress



#### Calcium Coated

An extra layer of calcium can be seen all over the egg or on just one end.

- Possible causes:
- Defective shell gland
  - Disturbances during calcification
  - Excess calcium in the diet or water



#### Calcium Deposit

These eggs are classified by white, irregularly shaped spots deposited on the external surface of the shell.

- Possible causes:
- Defective shell gland
  - Disturbances during calcification
  - Excess calcium in the diet or water

## Yolk Color Chart

16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

## Shell Color Chart

Some breeds of hens naturally lay green/blue-tinged eggshells (e.g., the Ameraucana and Favaucana breeds)

15 14 13 12 11 10 9 8 7 6 5 4 3 2 1