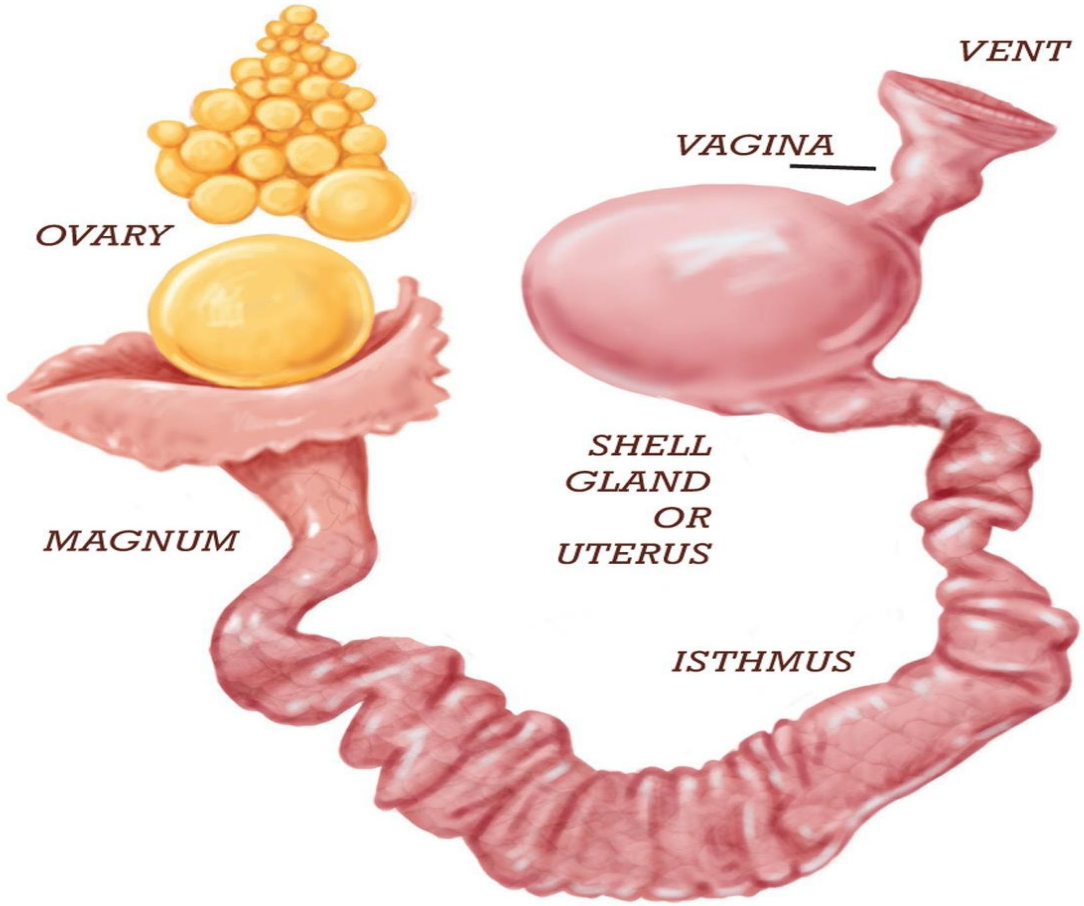
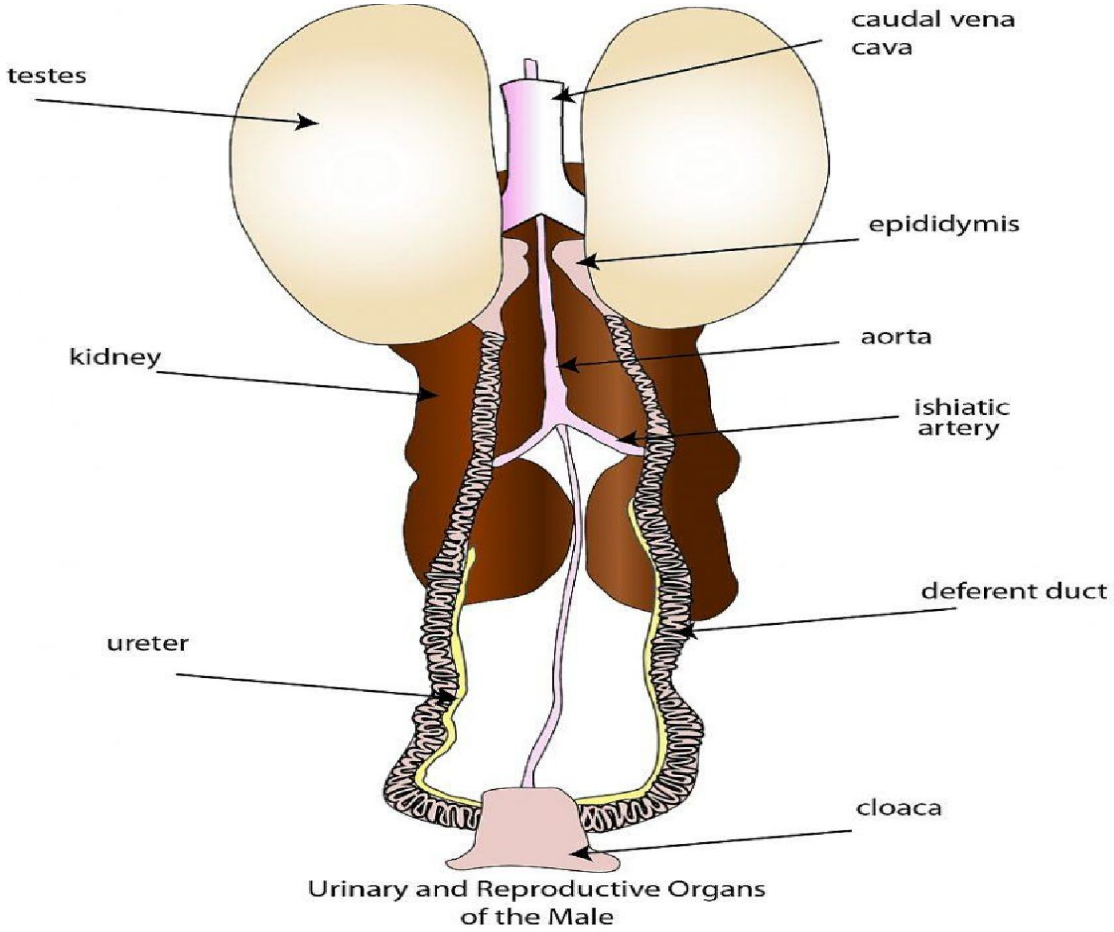
REPRODUCTIVE SYSTEM OF POULTRY





FEMALE REPRODUCTIVE SYSTEM

Two parts

1) ovary

2) oviduct

- At time of early embryonic development two ovaries and two oviducts are present
- Only left pair ovary and oviducts are persist in all species of adult bird
- Except in kiwi both ovaries develops but only left oviducts remain functional

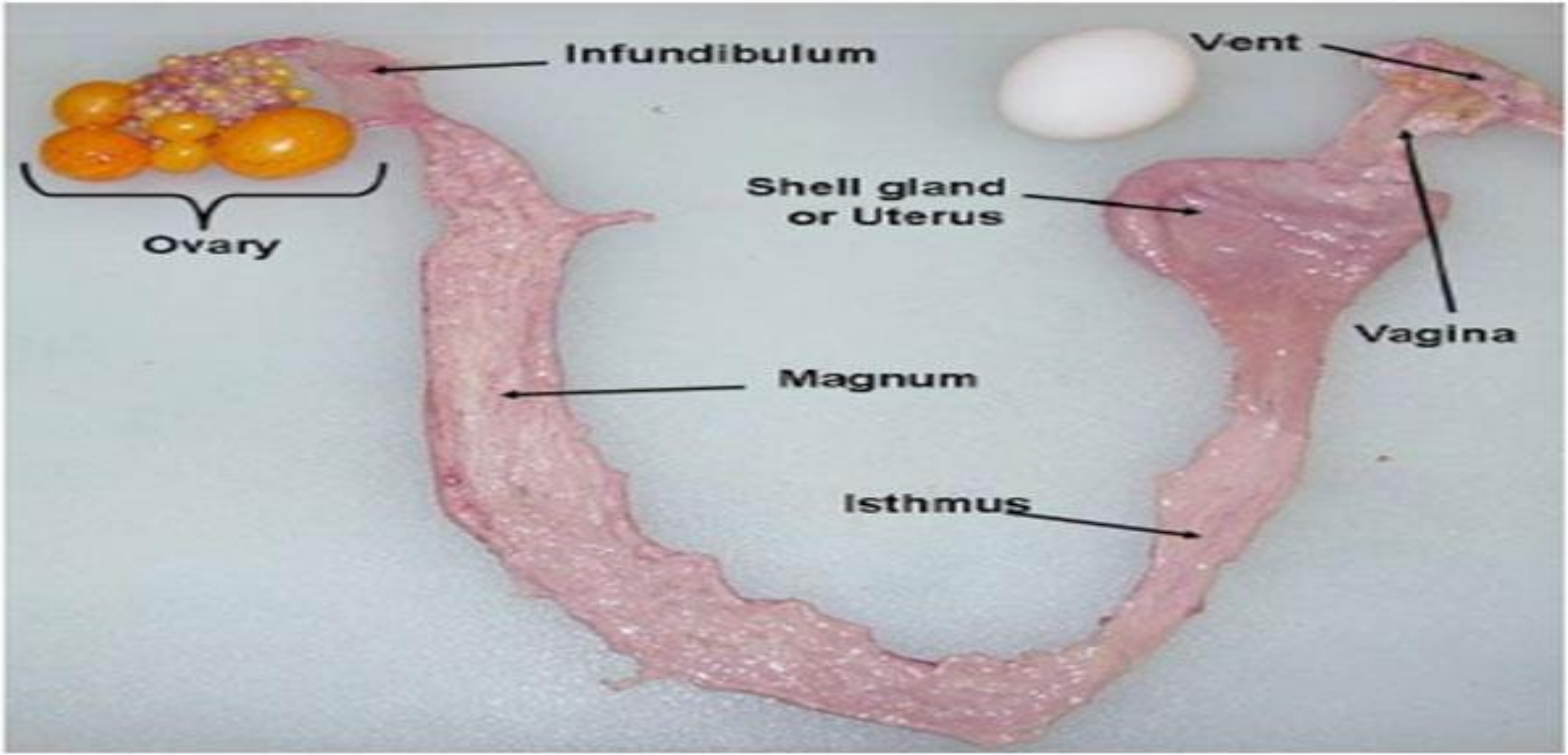


Figure 1 Figure showing different parts of the poultry reproductive system, starting from ovary, infundibulum, magnum, isthmus, uterus, vagina and vent

OVARY

- Before maturity size is small
- Mature ovary consist of numerous developing follicle appears like cluster of grape
- Attached to abdominal wall by help of mesovarium ligament
- A pullet chick have 10,000- 20,000 potential eggs
- Most of them never developed to point of ovulation
- During ovulation each ovum is surrounded by a vitelline membrane
- As ovum develops yolk is added

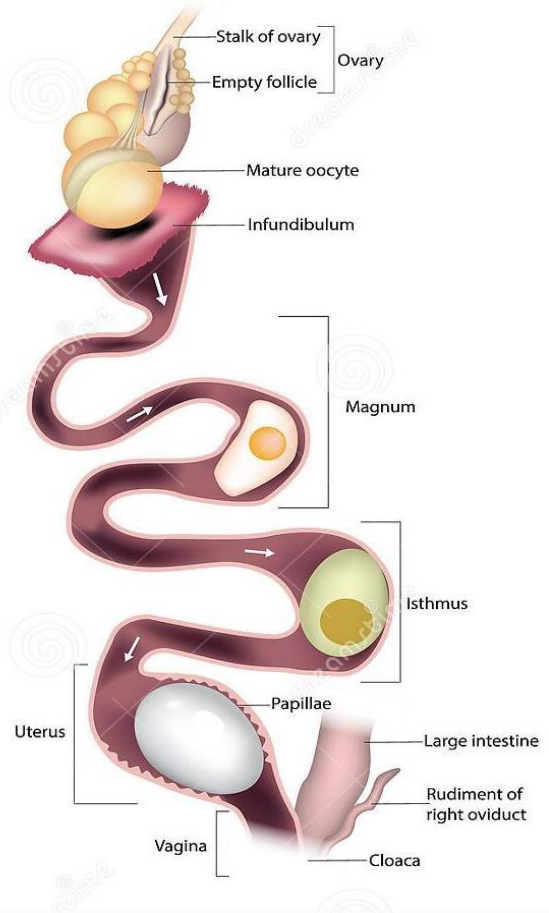
- Color of yolk is yellow comes due to yellowish fat soluble pigment called as Xanthophyll
- Hens fed yellow maize or allow to range on grass , typically have dark yellow yolk
- Hens fed on diets with white maize , sorghum, millet or wheat typically have pale yolk
- Color of yolk can be improved by adding marigold petal (xanthophyll)

- Liberation of ovum from follicle is called ovulation
- Ovulation normally occur 14-75 minutes after oviposition (laying of fully formed egg)
- Yolk size in the egg – up to 40 mm in diameter
- On distal surface of mature follicle has a area which is devoid of blood vessels called as stigma from where follicle splits to release yolk in to oviduct
- If follicle splits from place other than stigma numerous blood vessels will rupture and result in blood spot in eggs

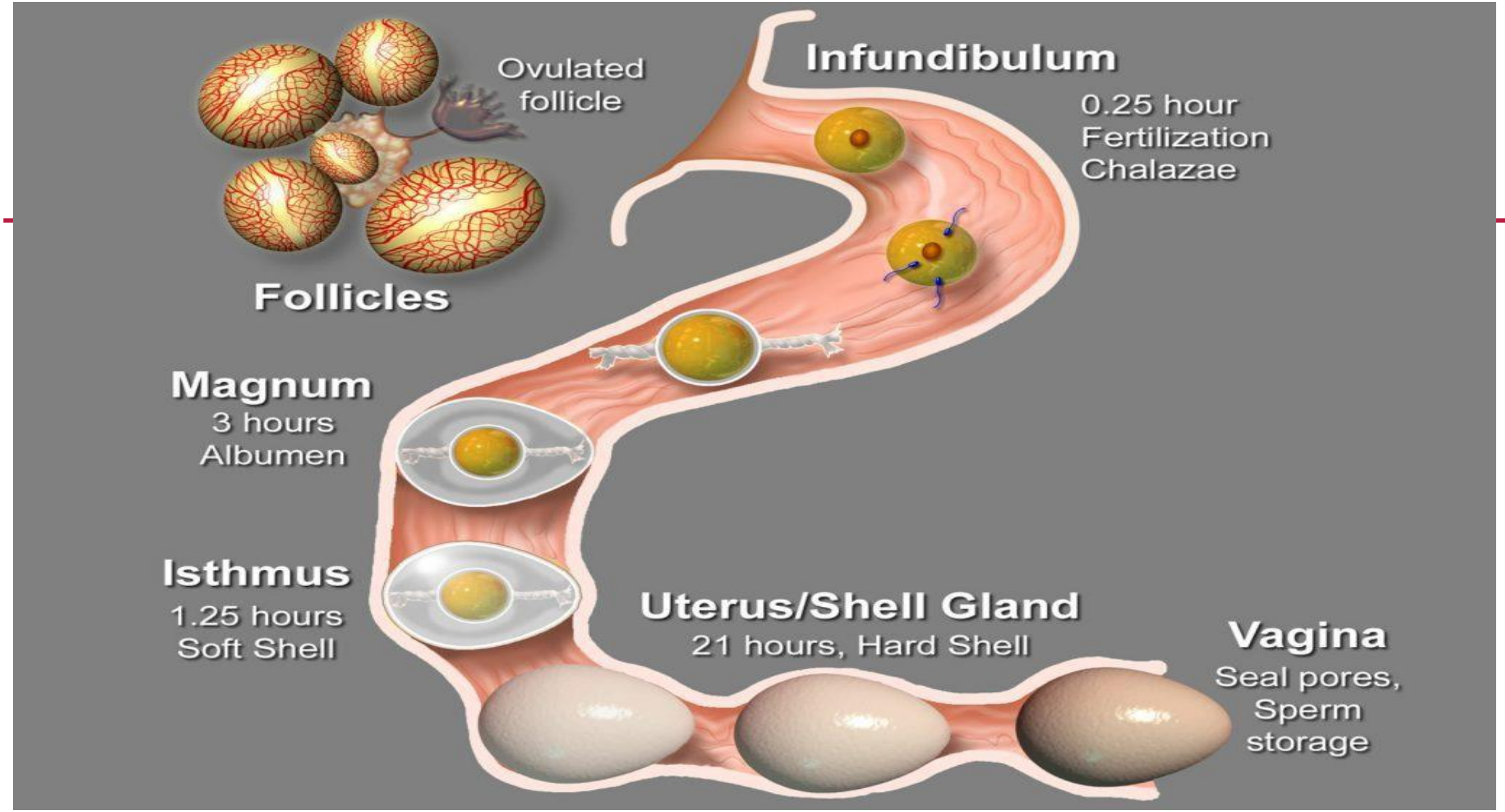
OVIDUCT

- Is a long zig zag tube (25-27 inches long)
- Consist of glandular and muscular part

- Oviduct extend from ovary to cloaca
- 5 parts
- Infundibulum (9cm)
- Magnum (33cm)
- Isthmus (10 cm)
- Uterus (10-12 cm)
- Vagina



Part	Length	Time spend	Function
Infundibulum	9 cm	18 min	Reservoir for spermatozoa and fertilisation
Magnum	33 cm (longest part)	2 hr 54 min	Thick white or albumen is added
Isthmus	10 cm	1hr 15 min	Some albumen and inner and outer shell membrane is added
Uterus or shell gland	10-12 vm	20 hr 40 min	Shell Ca CO3 over egg 47% calcium from her bone , pigment deposition (porphyrin – brown color)
Vagina (muscular part)	12 cm		Cuticle is added help in easy oviposition
Total	74 cm	25-26 hr	


Ovulated follicle
Infundibulum
0.25 hour
Fertilization
Chalazae
Follicles
Magnum
3 hours
Albumen
Isthmus
1.25 hours
Soft Shell
Uterus/Shell Gland
21 hours, Hard Shell
Vagina
Seal pores,
Sperm
storage

PROCESS OF EGG FORMATION

- Yolk is not true reproductive cell
- When female attain sexual maturity (FSH) mature ovum rapidly inside graffian follicle
- Yolk weight also increases 7 day prior to ovulation due to deposition of yolk material over the ovum in alternate layer of white and yellow

- White layer – night time
- Yellow layer – day time

- The nucleus of infertile egg called as germ spot and nucleus of fertile egg is called as germ disc
- FSH - growth of maturity of grafian follicle
- LH- release ovum by rupturing of graffian follicle (Ovulation)
- Oviposition (broad end first comes out)
- In emu one egg formation required 3 days

- Albumin = magnum
- Inner and outer shell membrane and water = isthmus
- Egg shell Ca CO_3 = uterus
- Tubular gland of uterus add water content to albumin also
- Shell pigment (porphyrin- brown color) are added 5 hour before oviposition
- Laying of egg occur through contraction of uterus
- Oxytocin and vasotocin are required for oviposition

- Complete shell formation takes 24-26 hours to complete
- Hens body temp during egg formation 104-106^0 F
- There is synchronisation between ovulation and oviposition
- Next ovulation occur 30 min after oviposition

Egg structure

- Four major structures from outside to inside
- Shell
- Shell membrane
- Albumen
- Yolk

Egg shell

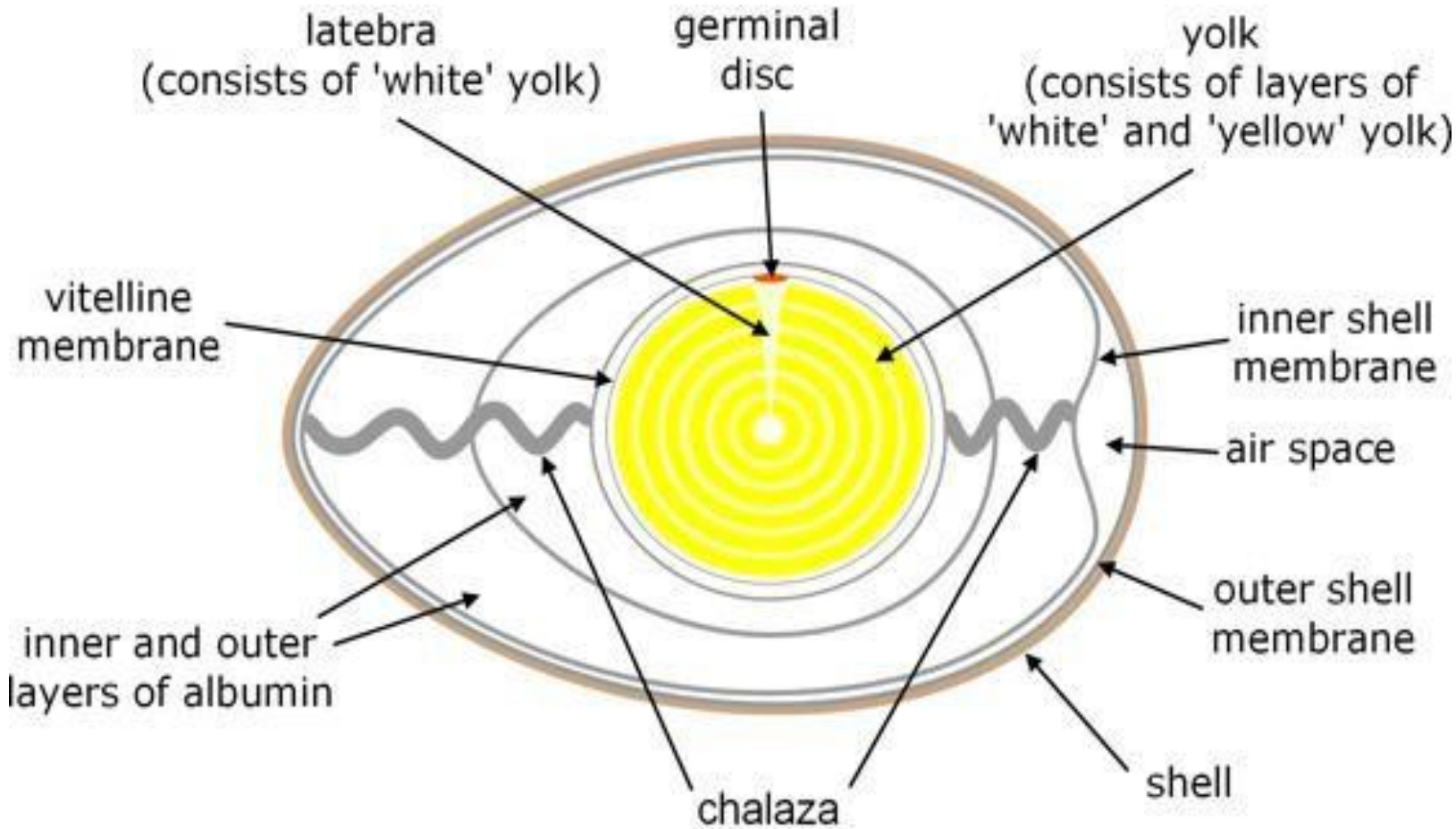
- outer covering of an egg which consist of pores & Constitutes 9-11% of the egg weight.
- The pores in the egg shell allow the exchange of air which allows the embryo to breath.
- There are approximately 7500 pores per egg. The size of the pores is big at the broader end.
- At the time of laying the outer surface of the shell is covered with cuticle which seals the pores. It protects the egg from outside temperature and prevents carbon dioxide to escape from the egg.
- Egg shell has two shell membranes, the outer egg shell membrane and inner shell membrane.
- air cell is formed between the two shell membranes and it is usually present at the broader end of the egg.

Albumen

- Constitutes 58-60% of the egg weight.
- Consist of 4 layer
  - Outer thin albumen layer (23%)
  - Inner thin albumen layer (17%)
  - Outer thick or dense albumen (57%)
  - Chalaza or inner thick albumen (3%)

- It consists of a chalaza which is attached to the chalaziferous layer, around the yolk.

- Chalaza plays an important role in keeping the yolk in a fixed place.


latebra
(consists of 'white' yolk)
germinal
disc
yolk
(consists of layers of
'white' and 'yellow' yolk)
vitelline
membrane
inner shell
membrane
air space
outer shell
membrane
inner and outer
layers of albumin
chalaza
shell

Yolk

- constitutes around 31% of the egg weight
- The yolk consists of the germinal disc,dark yolk layer, light yolk layer, the vitelline membrane (yolk membrane) and the latebra (white yolk).
- The germinal disc is known as the blastoderm in a fertile egg and as blastodisc in an infertile egg.
- The latebra or the white yolk is the structure which connects the germinal disc to the centre of the yolk.
- The germinal disc is located in a cone like portion of the latebra, known as the nucleus of pander. Fertilization of the egg takes place here.

Composition of egg of various species

S. No.	Birds	Egg weight (g)	Yolk (%)	Albumin (%)	Shell (%)
1.	**Chicken**	**50**	**31**	**58**	11
2.	**Quail**	10	32	48	20
3.	**Turkey**	**65**	32	56	12
4.	**Duck**	72	35	53	12
5.	**Pigeon**	18	18	74	8

Composition of an Egg

	%	% Water	% Protein	% Fat	% Ash
Whole Egg	100	65.5	11.8	11.0	11.7
Albumen	58	88	11.0	0.2	0.8
Yolk	31	48	17.5	32.5	2.0

NUTRITIVE VALUE OF EGG

- The white or egg albumen contains more than half the egg's total protein, niacin, riboflavin, chlorine, magnesium, potassium,sodium, and sulfur and all the egg's zinc.
- yolk contains all of the fat in the egg and a little less than half of the protein. It also contains the fat-soluble vitamins A, D, and E.
- Egg yolks are one of the few foods naturally containing vitamin D.
- The yolk also provides vitamin B 12 and folic acid, and the minerals iron, calcium, copper and phosphorus.
- Eggs have biological value of 93.79 %
- Cholestrol content: 210-250mg/egg
- Energy from chicken egg: 143kcal/100gm

Component (Unit)	Amount	Component (Unit)	Amount
Egg shell (%)	10.5	Calcium (mg)	56.0
Egg yolk (%)	31	Magnesium (mg)	12.0
Egg white (%)	58.5	Iron (mg)	2.1
Water (g)	74.5	Phosphorus (µg)	180.0
Energy (Kcal)	162	Zinc (mg)	1.44
Protein (g)	12.1	Thiamine (mg)	0.09
Carbohydrates (g)	0.68	Riboflavin (mg)	0.3
Lipids (g)	12.1	Niacin (mg)	0.1
Saturated fatty acids (g)	3.3	Folic acid (µg)	65.0
Monounsaturated fatty acids (g)	4.9	Cyanocobalamin (µg)	66.0
Polyunsaturated fatty acids (g)	1.8	Pyridoxine (mg)	0.12
Cholesterol (mg)	410	Retinol equivalents (µg)	227.0
Iodine (µg)	12.7	Potassium (mg)	147
Tocopherols (µg)	1.93	Carotenoids (µg)	10
Selenium (µg)	10	Cholecalciferol (µg)	1.8

Quantities represent an edible portion of about 100 g.

Nutrient (unit)	Whole Egg
Weight	60g
Water (percentage)	65-68.5
Calories (kcal)	70
Protein (g)	6.3
Carbohydrate (g)	0.36
Total fat (g)	4.8
Polyunsaturated fat (g)	1
Monounsaturated fat (g)	1.8
Saturated fat (g)	1.6
Cholesterol (mg)	185
Choline (mg)	126
Vitamin A (IU)	270
Vitamin D (IU)	41
Vitamin E (mg)	0.5

EGG PROTEINS

- Ovalbumin: phospho glycoprotein & 55% of the proteins of egg white
- Conalbumin:13% protein of the egg albumin. It binds metals specially iron
- Ovamucoid: It is a glycoprotein & 10% of the egg white proteins
- Ovomucin: This protein is responsible for the jelly like character of egg white and the thickness of the thick albumen. It contains 2% of the egg white.

- Avidin -Avidin is 0.05% of the egg white protein. It binds biotin and makes the vitamin unavailable.
- Ovoglobulin- It is a protein consisting of two components G1 and G2 and both are excellent foaming agents.
- Ovoinhibitor- capable of inhibiting trypsin and chymotrypsin

Anti bacterial factors

- Lysozyme and conalbumen
- Lysozyme causes lysis of cell wall of gram positive bacterias
- Conalbumen chelates Iron and make it unavailable for bacterial growth

Egg quality parameters

- Haugh unit
- Yolk index: gives idea about yolk quality and value for standard egg is 0.5
- Egg shape index (ESI) = Maximum width/ max length *100

  - Chicken egg – 74, Duck egg – 72, Quail egg 78
- Shell Strength: measured by screw gauge (0.3-0.5micron)
- Specific gravity: 1.060-1.090

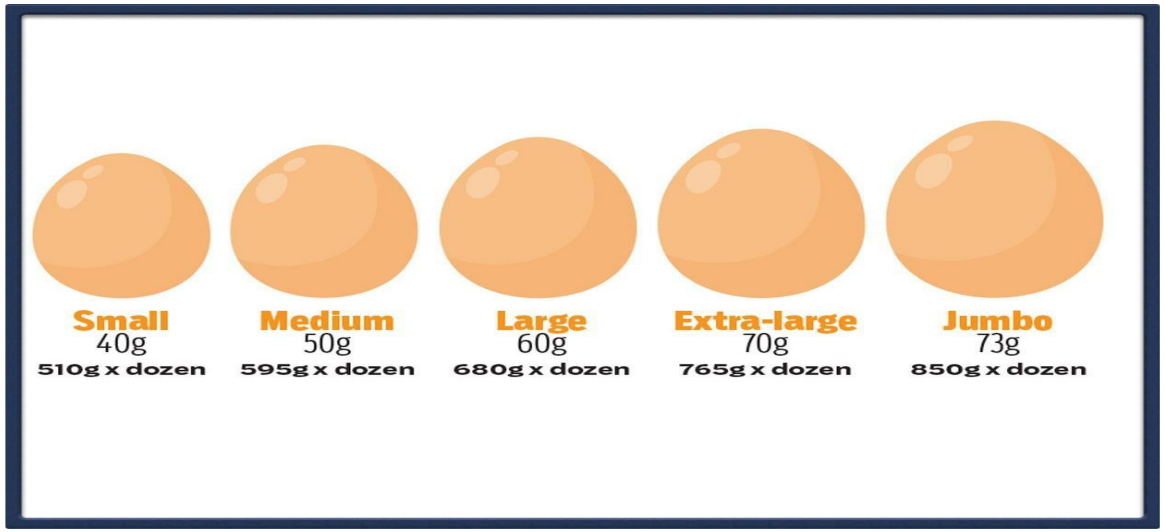
GRADING OF EGG

- The Haugh unit is a measure of the internal quality of an egg.
- It is considered to be one of the most significant measures of egg quality, next to other measures such as eggshell thickness and eggshell strength.
- measure the height of the thick albumen that immediately surrounds the yolk.
- micrometer - determine the height of the thick albumen (egg white).
- The height, correlated with the weight, determines the Haugh unit, or HU, rating.
- $HU = 100 \times \log10 (h - 1.7w_{0.37} + 7.6)$

HAUGH UNIT

- value ranges from 0 – 130
- The higher the number, the better the quality of the egg. Eggs can be ranked according to their HU rating:
- Grade AA: HU unit of 72or more
- Grade A: 71 to 60
- Grade B: 59 to 31
- Grade C: 30 or less

- In India eggs are graded according to the weight.There are 5 grades.



Physico-Chemical properties

- newly Laid Egg: pH Albumen: 7.6-8.5
  pH Yolk: 6.0
- During Storage: pH Albumen: 9.7 (max)
  pH Yolk: 6.4 - 6.9
- pH of albumen and yolk rises due to loss of CO_2 through the egg shell pores.

Viscosity

- On storage, with time, first the viscosity of the albumen increases
- After certain amount of time as the pH of the albumin increases from7.8-9.5 the albumen starts to liquefy and become thin and viscosity decreases

Freezing Point

- The freezing point of egg white is -0.45 °C
- The freezing point of egg yolk is -0.58 °C
- In shell, the egg contents may be cooled to a temperature of -3.0 °C, without becoming frozen.
- Egg is reported to freeze at -6.0 °C

DESIGNER EGGS

- Designer eggs are those in which the content has been modified from the standard egg in terms of high vitamin and minerals, lower cholesterol, high omega fatty acids and added pharmaceutical compounds.
- For this purpose the bird's feed is modified.
- Chromium supplementation to laying hen diets at concentrations of less than 1 ppm have been shown to lower egg cholesterol and also improve egg interior quality.

Egg Spoilage

Type of rot	Changes in egg	Organisms
Green rot	Albumen becomes green	Pseudomonas fluorescens
Black rot type 1	Faecal odor	Proteus
Black rot type 2	Green albumen but black yolk with cabbage odr	Pseudomonas
Red rot	Albumen stained red	Serratia
Fungal rot	Pink spots	Sporotrichum

EGG PRESERVATION

- Recommendation for production of quality egg on farm
- 3 time egg collection daily
- Carefully handling while keeping in filler flats
- Quickly cooling of egg to 50 °F or less @75-85% relative humidity
- Marketing of egg twice a week
- Additionally lose of water content also responsible for spoilage of egg
- Methods are used to counteract it and increase shelf life of egg

METHODS OF PRESERVATION

- Refrigeration/ Cold storage
- Immersion liquids
- Thermo stabilization
- Egg shell treatment
- Overwrapping
- Radiation

Immersion liquids

- Lime water: For Long term storage (2-3 months).
- 0.5 Kg of lime dissolve in 1 litre of boiling water, the solution is kept over night and the supernatant is poured in a jar. In this solution 2.5 litres of cold water is added and the entire solution is then filtered with a muslin cloth.
- NaCl may be added @ 112 gms/litre of the supernatant solution.
- Eggs are kept dipped in this solution for 24 hrs, they are then dried and packed.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WATERGLASS

- For Long term storage.
- 10% sodium silicate solution prepared in hot water.
- Eggs are then immersed in this cooled solution and stored in areas where temperature does not rise above 70 ^{0}F.
- Eggs preserved by this method are usually punctured before boiling so that the shell does not break while boiling and the shell peels of easily.

SHELL SEALING METHOD

- It involves use of oil which seals the egg shell pores, thus preventing the escape of moisture and CO_2 from the egg content.
- Types: Oil Coating & Oil Water Emulsion
- Technique: Dipping or Spraying.
- Using color less odorless oil
- Cotton seed , linseed and ground nut oil are prefered

THERMOSTABLISATION

- Good for fertile egg as it killed embryo
- Known as defertilisation method
- Eggs are immersed in hot water at different time temperature combination
- 130 °F X 15 minutes
- 142 °F X 2 minutes
- 212 °F X 5 seconds

- Remain edible for a month

OVER WARAPPING

- Eggs stored in cartons which are then over wrapped in cellophane
- This technique is effective in maintaining egg albumen quality.
- Reduction in evaporation rate and maintaenace of low albumen pH.
- Over-wrapping cannot replace refrigeration but should be used in conjugation with it.
- Compared to oil coated eggs, eggs stored under plastic overwrap peel easily.

COLD STORAGE

- Best method of storage
- Temp : 30-32°F or 0 °C and 85-90% RH for 5-10 month
- Temp : 50-55 °F and 60-70% RH for 2-3 month

Radiation

-Shell egg irradiation dose starts at 1.0 kGy upto 5.0 kGy

-Radiation destroys the ovomucin protein of the albumin

- The gel-like structure of the albumen is lost on irradiation.

Packaging

- Wooden Boxes, Cardboard Boxes, Plastic Boxes, Plastic Trays
- Aluminum Trays, Paper Boards
- Moulded Pulp Cartons
- Boxes made from Straw/Organic fibres.

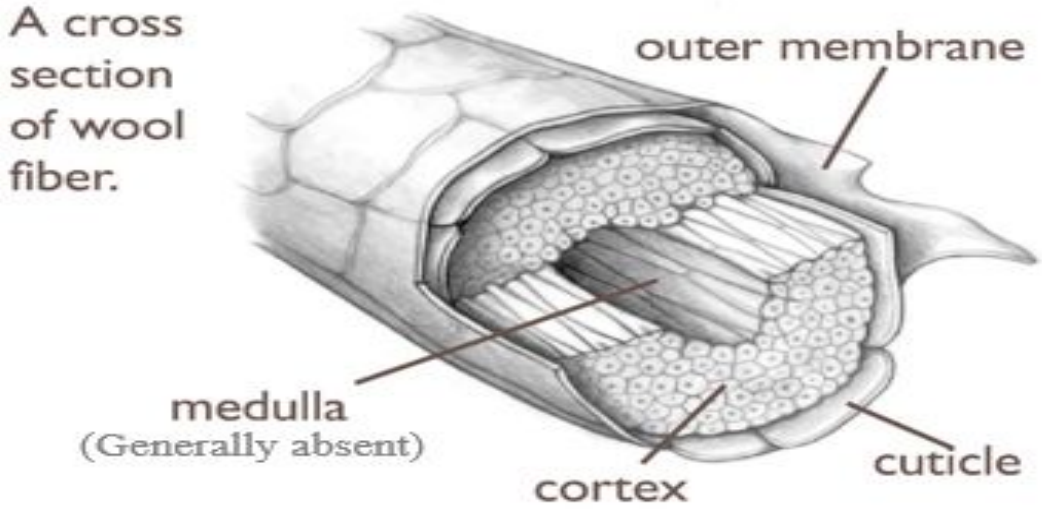
Filler trays

- Filler trays are made up of wood pulp or cardboard or plastic.
- They are moulded/constructed in such a way that they can be stacked one on top of the other and they can also be placed in boxes for transport.
- A standard tray carries 36 eggs. A standard box carries 5 trays hence carrying 180 units of egg.

National Egg Coordination Committee

- Founder(s)Dr. Banda Vasudev Rao
- Established: May 1982
- NECC's role in the Indian egg industry mainly focuses on egg pricing.
- After fulfilling its original purpose, NECC expanded its scope of activities to achieve the following
- Determining egg price based on fair return for farmer, decent margin for middleman, and reasonable cost for customer.
- Monitoring, managing and, regulating the stocks from surplus to deficit regions.
- Market intervention through Agrocorpex India Limited.
- Having a dependable and close network of marketeers that use multi level marketing to sell the products.
- Promoting egg trade, egg farm, and egg exports.
- Making technology and information available for increased production of eggs.

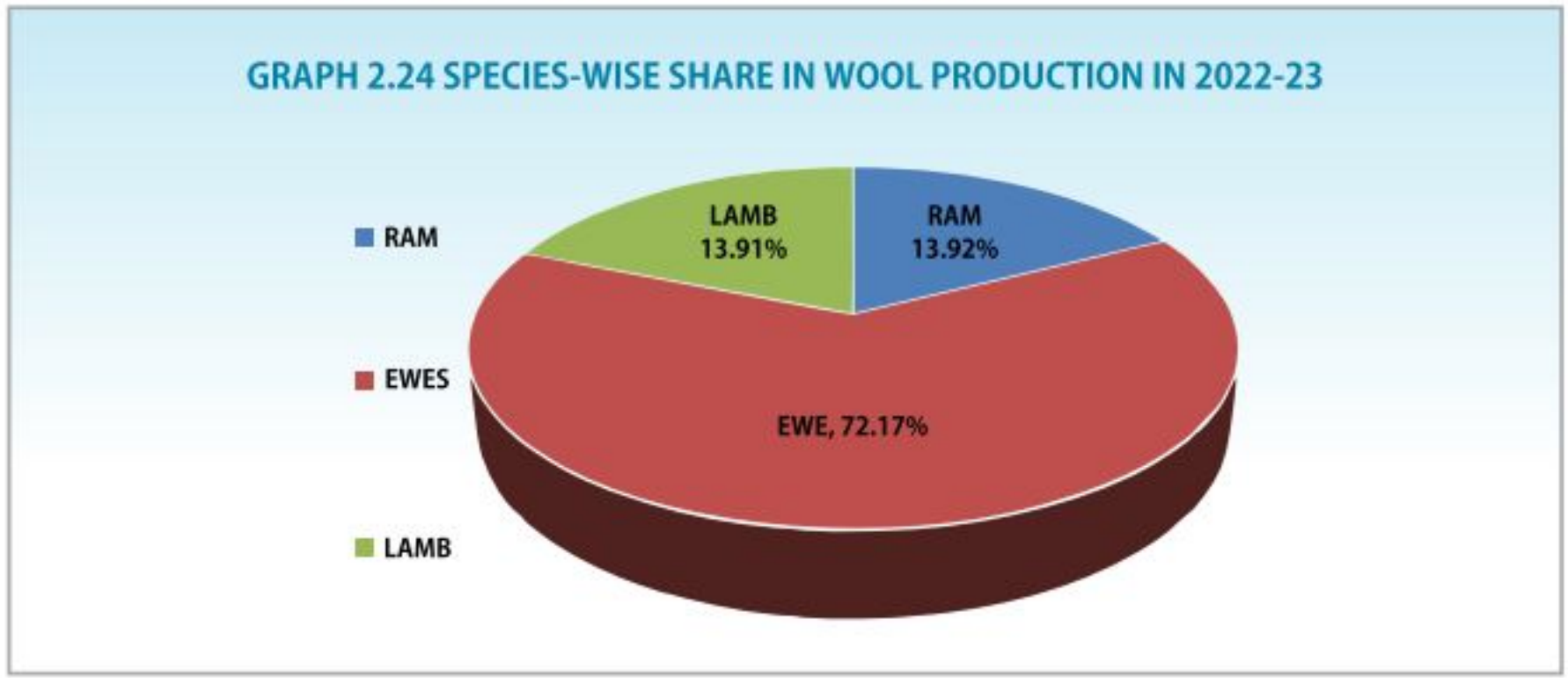
Wool science



MAJOR HIGHLIGHTS OF WOOL PRODUCTION

- The total wool production in the country is 33.61 million Kgs.
- The Wool production has increased by 2.12% as compared to previous year.
- The top 5 wool producing States are Rajasthan (47.98%), Jammu & Kashmir (22.55%), Gujarat (6.01%), Maharashtra (4.73%) and Himachal Pradesh (4.27%). They contribute 85.54% of total wool production in the country.

2.4.1 SPECIES-WISE SHARE OF WOOL PRODUCTION



- **Wool:** is a natural fibre of animal origin consists of a cortex and cuticle, it is devoid of a medulla & Obtained from sheep, goat, yak, camel, etc.
- **Hair**: tend to be sleeker, straighter, more diameter and less crimpy than the wool fibers. consists of cuticle, cortex and medulla.
- **Mohair:** Natural fibre obtained from Angora goats and has high lustre and sheen, devoid of medulla and less developed scales unlike wool.
- **Fur**/pelage: A synonym for non-human hair (similar to hair); consists of cuticle, cortex and medulla.

Structure of Wool

- Fibrous Protein: keratin (Cysteine links, Ionic links, Hydrogen bonds)
- Sulphur containing AA: cysteine.
- **Cuticle:** Outer most protective layer of scales.
- **Cortex:** Internal cells of fibre, contributes 90% of the fibre.
- **Medulla:** hollow central core found in coarse and medium wool fibre consist of cells separated by gaps of air.

Wool development

Follicles appear in the second month of gestation

Primary follicles: developed earlier coarse fibres

Secondary follicles : developed later fine fibre Merino – majority

- S:P ratio of follicles determine types of fleece produced

Properties of Wool

- Flexible
- Resilience: restore their original shape after removing the external loading
- Elastic: stretch up to 30% of its normal length
- Crimpiness: 2-12/cm curliness
- Hygroscopic: 18-50% of own weight
- Specifc gravity: 1.304 and refractive index: 1.553- 5.00
- Water proof and non-inflammable

Wool processing

1. **Sorting**: Raw wool bought to the mill and is sorted
2. **Opening & Dusting**: Clumps are opened
3. **Scouring**: removal of impurities hot water (45°C-120°C) and soap/sodium carbonate
4. **Burr picking**: **carbonization**: Vegetable content is removed ((NaOH solution)
5. **Oiling**: lubrication with oil to reduce breakage and maximise cohesion.
6. **Carding**: wool fibers are untangled and aligned in one direction. The wool fibre are bundled into strips known as "Roving/Sliver".

5. **Spinning**: twisting to give yarn strength and size.
6. **Weaving**: intertwining the yarns into desired product
9. **Dyeing** : permanent colour into the wool fibres.
10. **Finishing**: improves the appearance. Steps involved:
    - ✔ **Milling**: Shrinkage of the fabric to the required degree in order to thicken it and give it a desired appearance.
    - ✔ **Carbonization**: Chemically burr is removed by treating the finished product with dilute acid at high temperature.
    - ✔ **Raising**: lifting out of wool from the body of the fabric.
    - ✔ **Shearing**: levelling of raised out wool fibres.
11. **Testing**: assesses the quality, value, defect and other characteristics of the end product.

Wool Quality Parameters

1. **Fibre-fineness**
2. **Length (cm):** Determines spin-ability of the fibre
3. **Crimp frequency**- crimps per unit length of the fibre (Merino: up to 100 crimps per inch)
4. **Moisture Content:** % proportion of water absorbed in undried specimen
5. **Medullation Percentage:** Volume occupied by medulla in a fibre: 5%-99%.

Medullated fibres are hollow & cause serious problems in dying process hocks and briskets of sheep.

6. **Scouring Yield:** The process of cleaning of wool is called scouring.
7. **Burr Content:** Types: Low Burr 3%; Medium Burr: 3-5%; Heavy Burr >5%
8. **Colour:** near white to shades of cream and yellow. Intense yellow discoloration **canary stain**: fleece under the influence of moisture, temperature and bacterial activity.
9. **Lustre:** coarse wools have higher lustre than fine types.

Wool Glossary/ Terminology

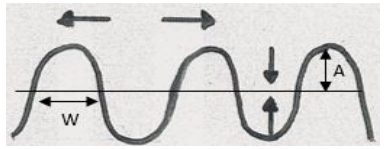
1. Fleece: Fibre coat that covers a sheep
2. Lock: A group of fibres clinging together in fleece
3. Suint: natural greasy substance in sheep's wool Secretions of sudoriferous glands.
4. Lanolin/ Wool wax: Secretions of the sebaceous glands of the skin.
5. Greasy wool: Shorn wool with grease and wax before removal of impurities.
6. Wool Yolk: Wool wax with suint in raw wool is known as yolk.
7. Kemp: A coarse, weak and brittle wool fibre with irregular medulla
8. Crimp: Natural waviness/curliness of a wool fibre.
9. Staple Length: Length of a wool fibre without disturbing its natural waviness.

10. Fibre Length: Length of the fibre in stretched condition.
11. Burr: Vegetable matter present in wool
12. Scouring: removal of impurities detergent (sodium carbonate)
13. Carbonization: removal of burr with chemical treatment of wool
14. Shearing/ Clipping: Removal of fleece from body of sheep
15. Skirting: Removal of objectionable parts and stains from body of fleece after shearing
16. Pelt: undressed skin along with it's hair/wool/fur.
17. Sweating: process of removal of wool by bacterial digestion (proteolytic enz.) of pre-keratinous region of fibre root or by application of depilatory agent to the under surface of pelt.

18. Rooing: Plucking of fleece of indigenous sheep having double coat under going loosening of the fibre. Natural break in the growth of the wool in spring. This causes the fleece to begin to peel away from the body, and it may then be plucked by hand without cutting.
19. Fellmongering: removal of wool from sheep skin through use of chemical applications (sodium sulphide or thallium).
20. Felting: ability of textile material to undergo irreversible increase in bulk density when subjected to friction and pressure under suitable physical conditions.
21. Yarn: thread made from wool in the form of a loosely twisted collection of fibers
22. Count: It is an index of thickness or diameter of yarn.
23. Hank: a coiled or wrapped unit of yarn

24. Warp: longitudinal section of fabrics arranged in form of sheet
25. Weft/ woof: transverse section of fabrics
26. Weaving: technology in which two distinct sets of yarns/threads are interlaced at right angles to form a fabric or cloth
27. Scale: A cuticle of flattened cells protecting the cortex of fibres.
28. Keratinization: Hardening of previously soft plastic fibrous protein.

29. Gare: Partially medullated mohair fibre which at sometimes also arise from some secondary follicles.
30. Crimp width: The distance between the mid point of the successive valleys of the projected crimp wave image.
31. Crimp amplitude: It refers to crimp wave and is half the total depth from crest to trough.



32. Rise in wool: Seasonal increase in flow of wax.
33. Hunger Finess: Wool of under nourished sheep as of nutritional scarcity producing lighter but finer fleece.

Wool grading

1. **Blood system of grading:** based on the percentage of Merino blood e.g. fine, 1/2-blood, 3/8-blood, 1/4-blood, low 1/4-blood followed in USA
2. **Numerical system:** based on no. of yarns made from one pound of scoured wool
3. **Based on the length and diameter of the wool grading is done.**
   a. Fine
   b. Medium
   c. Long
   d. Cross bread
   e. Mixed

S.no.	Grading	Length (cm)	Diameter (micron)	Count
1	Fine	3.2-10	10-30	60^s-90^s
2	Medium	5-20	20-40	40^s-60^s
3	Long	12.5-35.5	35-50	35^s-50^s
4	Cross bread	7.5-15.5	20-40	50^s-60^s
5	Mixed	Different Wools are mixed		

- **Coarse wool** fibre: (25–70 μm diameter): carpets
- **Fine** merino fibre: (10–25 μm): apparels

- The Carbonisation of wool refers to
- (1) Grading of wool
- (2) Removal of vegetable matter from wool
- (3) Drying and baking of wool
- (4) Shearing

- Eggs can be commercially stored at the temperature of:
- (a) 0°C
- (b) +0.5°C
- (c) -0.5°C
- (d) -1.5°C

- Green rot in egg is caused by:
- (a) Proteus
- (b) Pseudomonas
- (c) Cladosporium
- (d) Aspergillus

- supplementation of laying hen diets at concentration of less than 1 ppm, lowers egg cholesterol and also improve egg interior quality, leading to Designer egg.
- (1) Cobalt (2) Zinc (3) Chromium (4) Selenium

- What is the normal value of shape index for chicken egg ?
- (1) 54 (2) 64
- (3) 74 (4) 84

- As per ICMR (Indian Council of Medical Research) recommendation how many eggs should be consumed per person per day ?
- (1) 1/2
- (2) 1
- (3) 1 1/2
- (4) 2

- Which organization regulates wholesale price of eggs in most of the states and towns of the country ?
- (1) NAFED (2) NE CC (3) PFI (4) PDMC

- In which year the National Egg Co-ordination Committee (NECC) was established ?
- (1) 1972 (2) 1982 (3) 1992 (4) 2002

- What is the energy content of an average sized (58g) chicken egg ?
- (1) 70 kcal (2) 90 kcal (3) 110 kcal (4) 130 kcal

- Sheep wool fibres contain high content of following amino acid:
- Alanine
- Glycine
- Cystine
- Aspartic acid

- Mohair wool is obtained from
- Angora goat
- Angora rabbit
- Pashmina
- Fur wool