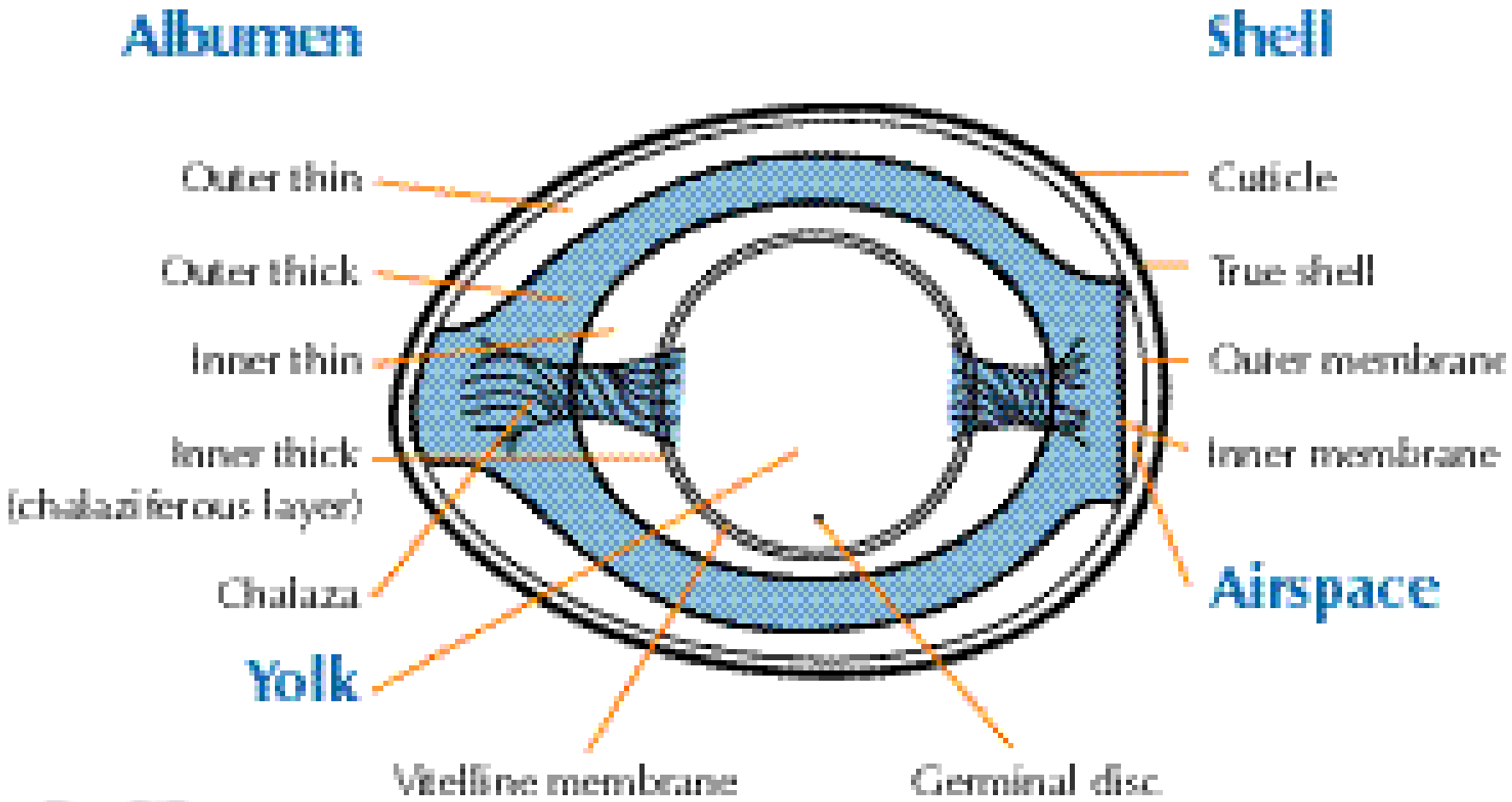
Animal and animal products

MODULE NO. 24: Structure of egg

Structure of egg



The yolk

- *Consists of letebra ,germinal disc, concentric rings of yolk material, vertilline membrane.*
- *Rich in fat ,vitamin mineral and protein.*
- vitalline membrane surrounds the yolk .
- *Germ cell is the site of cell division*

- Color of yolk may vary from source to source
- Color is mainly influenced by diet feed to laying source
- Color has nothing to do with nutrition

The Albumen

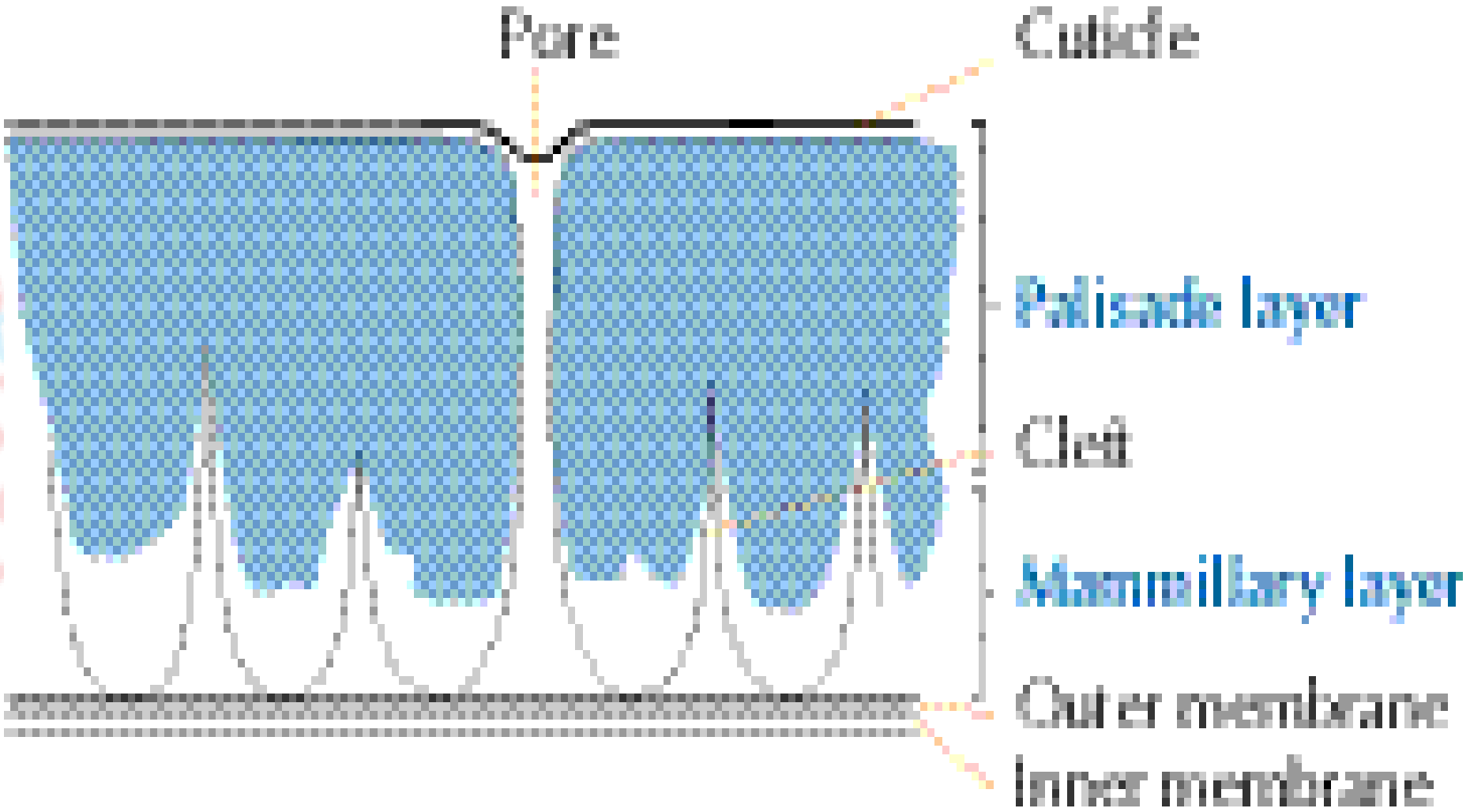
- Consists of four distinct layers
- The chalaziferous layer immediately surrounds the yolk and is continuous with the chalazae
- Egg albumen is rich in protein and vitamins and it contains substances which protect the egg from micro-organisms.
- The structure of the albumen is designed to provide support and protection to the yolk, holding it centrally inside the egg.

The Egg Shell

- Consists of the inner and outer shell membranes the true shell and the cuticle
- The inner membrane is thinner than the outer, and together they are only about 24 ten-thousandths of an inch (0.00609 mm) thick
- Contains small quantities of proteins and other minerals.
- The pores present in shell allow gases to move between the contents of the egg and the surroundings

- Next to mammalian layer is spongy layer and cuticle
- Pores connect the surface and the mammilla.
- The two shell membranes have a dense structure which inhibits the movement of micro-organisms into the egg.
- The true shell is built in columns of calcium carbonate from individual 'seeding sites' on the membranes

Transverse section of egg shell



Chemical composition

- Egg white consists of 60% of the total egg weight.
- Total solids content of albumen: 11-12%, yolk: 30-33% of the total egg weight composed of vitelline membrane and yolk.
- Minor variations do occur due to factors such as breed, age of bird, nutrition and disease in composition of egg

Table 1:Approximate physical Composition

S,no	Component	Percentage
		11%
1	Shell	97
2	True Shell	3
3	Membranes	**100**
4	Albumen	58%
	Chalazae	3
5	Inner Thin	17
	Outer Thick	57
	Outer Thin	23
		100
	Yolk	31%

Table 2

Ch. constituent	Component	Component	Component
	Whole Egg	Albumen	Yolk
Water (g)	75.1	88.3	51.0
Protein (g)	12.5	9.0	16.1
Fat (g)	10.8	Trace	30.5
Carbohydrate(g)	Trace	Trace	Trace
EnergyValue(kJ)	612	153	1402

Lipid and Protein Components of Egg Yolk

- Neutral Lipids (65%)
- Phospholipids (30%)
- - PC (83%)
- - PE (14%)

- Sphingomyelin (2.5%)
- Phosphatidylinositol (0.5%)
- Xantophylls (lutein, zeaxanthin)
- Cholestrol (5%)

Yolk pigments

- Includes riboflavin and carotenes and 0.02 on dry bases
- Carotenes are responsible for color of yolk
- The hen's feed is responsible for carotene content and the color of the egg yolk.
- Egg yolk carotenes are classified as xanthophilsand carotenes.
- Lutein, zeaxanthin and cryptoxanthinbelong to the xanthophilgroup.

Proteins of Egg White

protein	amount	M wt(Kda)	pI	characteristics
ovaalbumin	54	45	4.5	
ovotransferin	12-13	77.7	6.0	Binds iron and other metal
ovomucoids	11	28	4.1	Inhibits serine proteinases
lysozyme	3.4-3.5	14.3	10.7	Lysis of bacterial cell wall
ovomucin	1.5	220-270000	4.5	Interact with lysozyme
G2 ovaglobulin	1.0	47	4.9	
G2 ovaglubulin	1.0	50	4.8	
ovoflavoprotein	0.8	32	4.0	Binds riboflavin
ovastatin	0.5	760	4.5	
cystatin	0.05	12	5.1	Inhibits cystein proteinase
Avidin	0.05	68.3	10.0	Binds biotin
Thaimine		28		Binds thaimin

Lysozyme

- Lysozyme constitutes approximately 3.5% of hen egg white.

- Also known as muramidase and N-acetylmuramic-hydrolase
- Lysozyme is one of the simplest ubiquitous enzymes.

- The lysozyme content of a laying hen's blood is 10-fold higher than in mammals
- Highly stable in acidic solution and heating at 100 C for 1-2 minutes

- Catalyzes the hydrolysis of the (1-4)glycosidic linkage

Ovamucin

- Ovomucin comprises 1.5-3.5% of the total egg white solids, consists of an a-subunit

- The β-subunit from ovomucin was shown to have a cytotoxic effect
- Ovomucin is a glycoprotein that contributes the gel-like structure of thick white.
- It is heat resistant.

- Thinning of thick albumen is caused partly by the interaction of ovomucin with lysozyme when the pH rises to around 9.0

Avaidin

- Avidin is a trace component (0.05%) of egg white
- Avidin binds with 4 biotin molecules.
- Avidin is irreversibly denatured at 70 C, but the avidin-biotin complex is stable to 100 C
- he high affinity constant of avidin for biotin has been widely used in molecular biology affinity chromatography

Ovoglobulins

- Excellent foaming agents in egg white, composed of ovoglobulins
- Ovoglobin G1 and G2 contribute to foming
- Molecular weights of 36 and 45 kDa, respectively.

Flavoprotein

- All riboflavin in egg albumen is bound in the flavoprotein
- It ensures transfer of the riboflavin from the blood serum to the albumen in the egg white
- One mole of apoprotein binds one mole of riboflavin
- binding ability is lost when the protein is exposed to a pH below its isoelectric pH.

Cystatin

- A family of cysteine protease inhibitors with homology to chicken cystatin

- A proteinase inhibitor in egg white (also called ficin-papain inhibitor), inhibits sulphydryl proteinases activity

- Potential application: antimicrobial, antiviral and insecticidal agent

Suggested readings

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