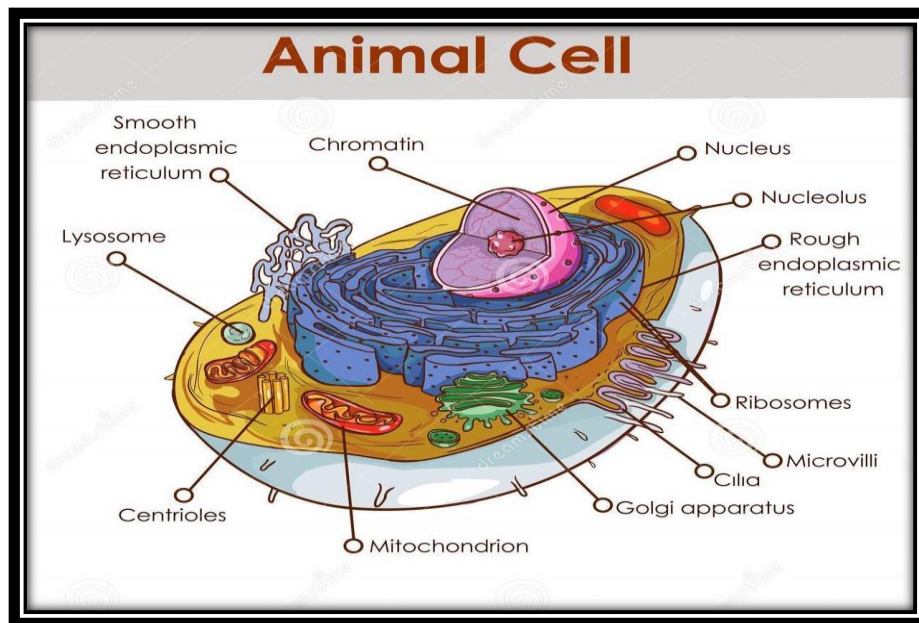




SUBJECT	ZOOLOGY
PaperNo. And Title	V Cell Biology
Module No. and Title	Ultrastructure of Animal cell- Endoplasmic reticulum
Module tag	DAYA-ZOO-ER

Endoplasmic reticulum -Structure & Function



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Learning Outcomes

The course provides a detailed insight into basic concepts of cellular structure and function.

Understand the structure and function of ER

Develop an understanding how protein synthesis occurs.

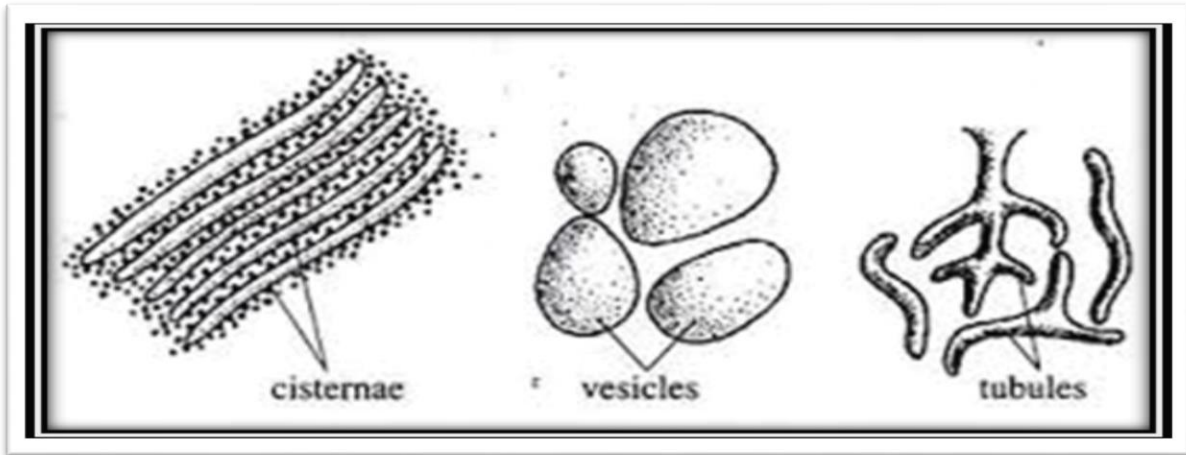
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Endoplasmic Reticulum

Introduction:

- The cytoplasmic matrix contains a complex network of inter-connecting, membrane bound vacuoles and cavities called as endoplasmic reticulum (ER).
- The name Endoplasmic reticulum is derived from the fact that it looks like a “net in the cytoplasm”. The endoplasmic reticulum was firstly observed in 1945 by Porter, Claude and Fullum .
- It occurs in all eukaryotic cells except R.B.Cs. of mammals. Absent in Prokaryotes.
- Morphologically the ER is composed of three types of structures, namely Cisternae, Vesicles and tubules.



1. Cisternae:

- Cisternae or lamellae are long flattened and usually unbranched tubules.
- They are arranged in parallel to each other in bundles.
- The thickness of cisternae varies from 40-50 μm .
- The outer surface of the cisternae has ribosomes.

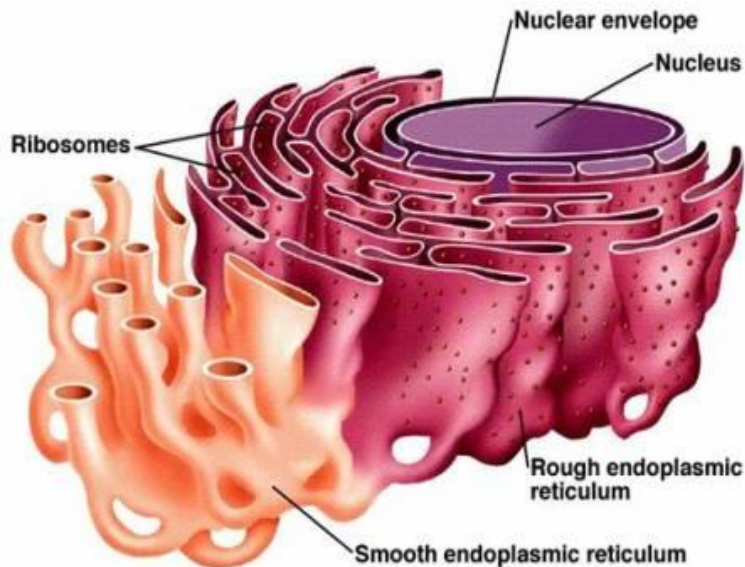
2. Vesicles:

- Vesicles are rounded or oval or irregular sacs observed by Weiss in 1953.
- They have diameter of about 25 o 500 μm .
- They are present in all cells but abundantly found in the cell engaged in the protein synthesis, e.g. Hepatic and Pancreatic cells.
- They form a kind of network near the periphery of the cell.

3. Tubules:

- Tubules are small, smooth -walled, branched tubular spaces.
- They have diameter of about 50 to 190 μm . They are found in the cell which are busy in the synthesis of steroids like cholesterol, glycerides and hormones

Structure of ER



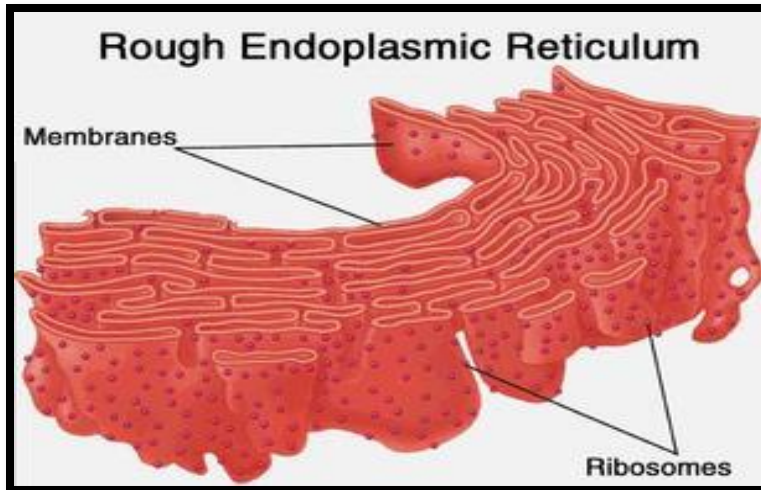
- Cisternae, vesicles and tubules are bounded by thin membrane.
- The membrane of ER is formed by three layers as found in Plasma membrane.
- The ER membrane is continuous with the plasma membrane, nuclear envelope and membrane of Golgi complex.
- The cavity of ER is well defined and it acts as a passage for secretory products.

On the basis of presence and absence of ribosomes, the ER is divided into two types namely, Smooth ER and Rough ER.

i) **Rough Endoplasmic Reticulum:**

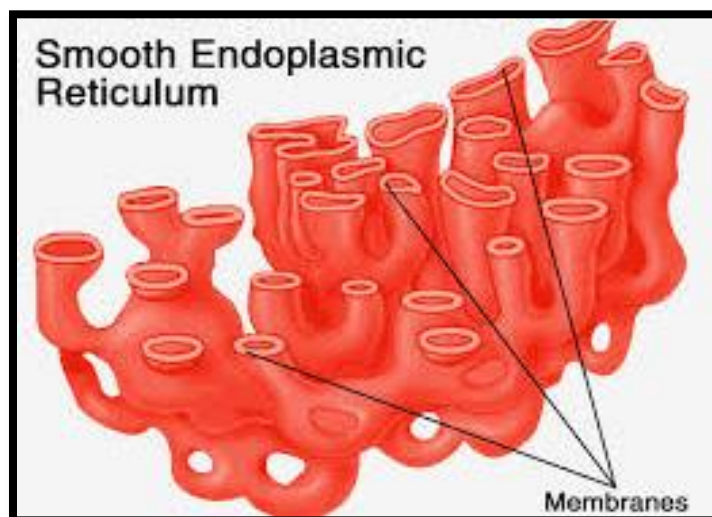
- When the ribosomes are present in large number on the wall of the ER then it is called as rough ER.
- The ribosomes are always present on the outer surface of ER which gives a granular appearance. Therefore, also called as granular ER.

The ribosomes are involved in the protein synthesis.



ii) Smooth ER:

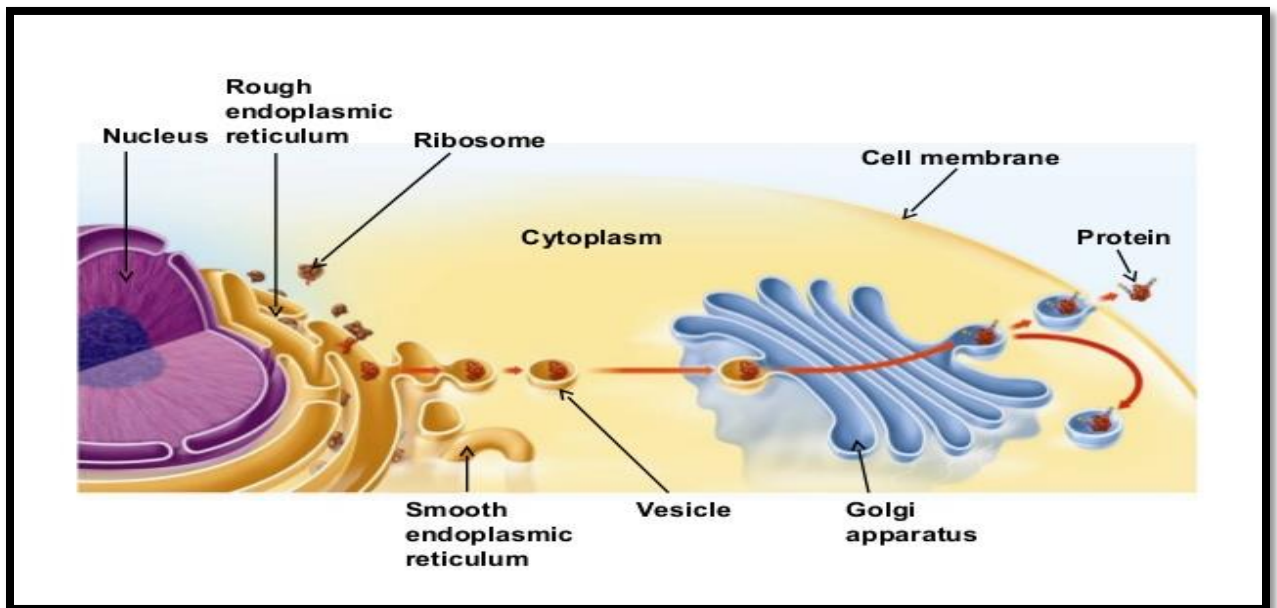
- The ribosomes are absent on the outer surface of ER hence called as smooth ER or agranular ER.
- Smooth ER is found in the cell involved in the synthesis of steroid compounds.
- They are also present in the pigmented epithelial cells of retina and glycogen storing cell of the liver.

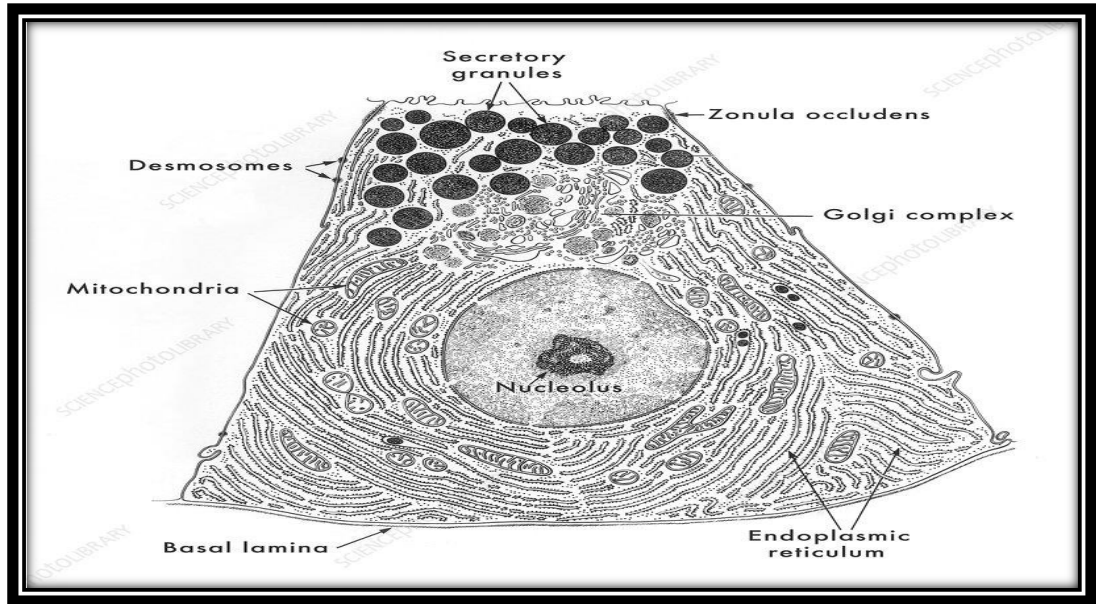


Functions of the Endoplasmic Reticulum

- **Mechanical support:** The ER forms the skeletal framework in the cytoplasm and divides the fluid content of the cells into compartments. Thus it provides the additional mechanical support.
- **Protein synthesis:** Rough ER plays an important role in protein synthesis because the ribosomes are attached to the outer surface. ER helps in the transport of proteins to the outside of the cells.
- **Lipid synthesis and storage:** The triglyceride synthesis occurs in smooth ER while protein and phospholipids are synthesized in rough ER. Thus ER does the function of intracellular transport and storage of lipids.
- **Glycogen synthesis and storage:** The smooth ER plays a role in synthesis of glycogen (Glycogenesis) with help of simple sugars and stored in ER.
- **Synthesis of cholesterol and steroid hormones:** Cholesterol is the important precursor of the steroid hormones and is synthesized in the ER. The microsomes are the fragments of the ER containing ribosomes. They are principle sites of cholesterol forming enzymes. **Formation of microbodies:** Microbodies are small granular structures filled with the dense substance. They are formed as dilations of the ER. They are rich in the enzymes as peroxidase, catalase and D-amino acid oxidase.
- **Detoxification:** The membrane of the smooth ER has several enzyme systems, which act on toxic substances and destroy them.

- Formation of nuclear membrane: the ER is the source of origin of nuclear membrane during cell division.
- Circulation and exchange: The ER acts as intracellular transport system. The exchange of materials between the nucleus and cytoplasm takes place through ER.
- Role in muscle contraction: The smooth ER is involved in the concentration and storage of the calcium ions. When muscle is stimulated by impulse, the calcium ions are released which leads to muscle contraction.





Links

https://docs.google.com/document/d/1QnXllcm1m4PFcSEWeDN7qyA_F3lpJy3FeVjCvIKUirg/edit?usp=sharing

Vedio

<https://drive.google.com/file/d/14Gwzy4g8jkQyRyfdpiCKsp6l8w5YwIOP/view?usp=sharing>

<https://drive.google.com/file/d/14aSVmb4jQLEa2b0mnECLwINN6XCL8cY/view?usp=sharing>

Explore more

1. Karp, G. (2010) Cell and Molecular Biology: Concepts and Experiments (6th edition) John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. (2006) Cell and Molecular Biology (8th edition) Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. (2009) The Cell: A Molecular Approach. (5th edition) ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA
4. Becker, W.M.; Kleinsmith, L.J.; Hardin. J. and Bertoni, G. P. (2009) The World of the Cell. (7th edition) Pearson Benjamin Cummings Publishing, San Francisco.

ASSESSMENT

Module / Topic: CellBiology			
Year: SYBSc-Sem-III			
ILO	Teaching Activity	Assessment Type	Assessment Mode & Tool
1.Students will be able to draw neat labelled diagrams of different components of ER		Strategies Used & drawing the diagram. Showing models and discussing. Ask students to prepare animation PPT's	Assessment type: Draw a chart of the different parts of Cell Give a diagrammatic sketch with arrows and ask them to label the different parts. Sketch & label ER
2. Students will be able to differentiate between RER7&SERO		Strategies Used Quiz, MCQ https://docs.google.com/document/d/1o_8fa3y7FH2f10XdWp0T1esK4-zRnlnj26_PPbuQ5Dk/edit	Assessment type: Grading till they are able to get minimum score of 60%
3.To explain the mechanism & functions of ER		Strategies Used Explanation- Concept map	Give a concept map with blanks in different columns to be filled by the students, Quiz, https://forms.gle/dJ2EJBG5adFU YsPd7 MCQ, Short answers
			MCQ's Class test https://forms.gle/dJ2EJBG5adFU MOODLE LMS has these activities which can be designed

