B.Sc. Part III
Paper-VI

Cell biology

GOLGI COMPLEX

INTRODUCTION :-

Golgi body, the most controversial structure of the cytological age, was first of all discovered by C. Golgi (1898) in the nerve cells of barn owl. Golgi named it as "internal reticulum apparatus". In the year 1900 HOLMGREN called it 'trophospongium'. By the claim of HOLMGREN it has taken into the cap of confusion. Because of its unfortunate coining by Golgi certain doubt existed in the mind of cytologists. First opposition came from PARATE and PAINCEVE in 1924, who elaborated the vacuum theory proposed by ACCOYER in 1924. They stated that Golgi is an artifact. The greatest blow to PARATE's view come from CATENBY and very soon this theory has to be discovered. But again in 1944 JOHN R. BAKER come out with statement that the Golgi produced by deposition of silver or osmium on the periphery of vacuoles.

All thoughts generated in the keenest mind of the eminent cytologist were responsible for the instability regarding the structure and position of golgi complex. But all these riddles were solved by the discovery made after by the electron microscope.

MORPHOLOGY :-

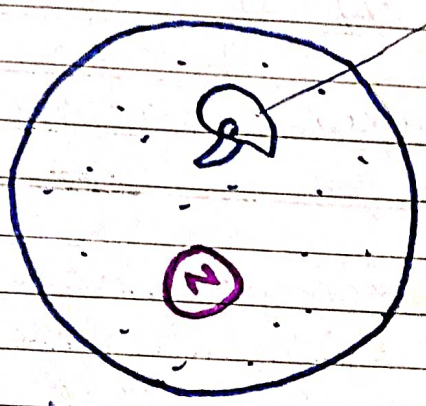
a) POSITION :-

In the exocrinal cells golgi is found between the nucleus and the periphery. In the exocrine gland cells it is found in between nucleus and excretory pore. The endocrine gland cells [thyroid] it is found in the centre of follicle.

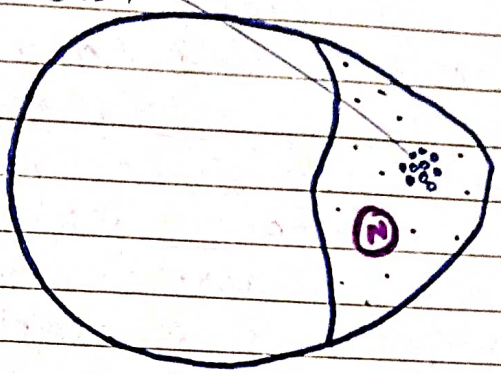
B) SHAPE :-

In some cell it occurs as a dense reticulum consisting often as an irregular ring, hollow spheres in nerve cells. It occurs as a reticulum or wide meshes around the nucleus.

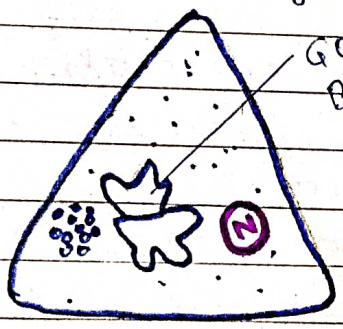
C) SIZE :- It is small in muscle cell but quite large in nerve and gland cells. They appear to be linked to the functional state, for e.g. hypertrophy in hyperfunction.



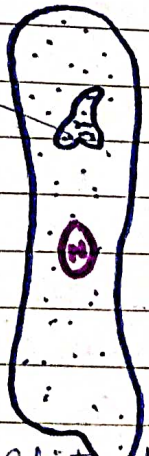
Erythroblast cell of Guinea pig



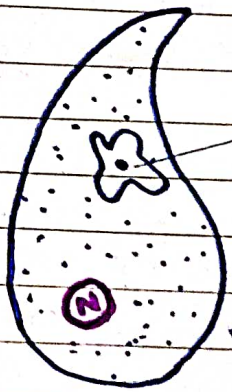
Fat cell from Human skin



Cell from pancreas of Cat



Epithelial cell from prostate gland of Dog



Cartilage cell of Cat

ULTRA STRUCTURE :-

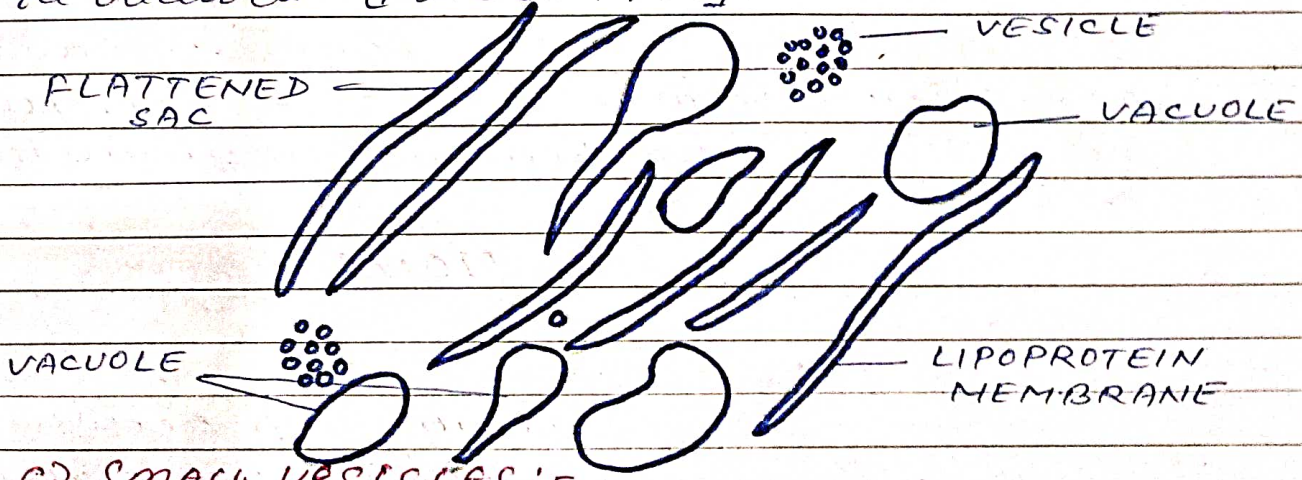
The whole controversy about Golgi complex to have been reconciled now by the studies made with the electron microscope by DALTON and FELIX [1953-57] and by SJOSTERAND. The Golgi contents the following components a) Flattened sac b) Large vacuole c) small vesicles d) Tubules

a) FLATTENED SACS OR CISTERNAE :-

These are double membrane structure and similar to the smooth surface endoplasmic reticulum. Golgi complex usually consist of four to seven or three to twelve flat, tubular or filamentous cisternae which are closely held in parallel bundle one above the other. Each membrane is about 60-70 A° in thickness and the two membranes together with the space of four are 160-170A°. The space between the two membranes can however vary from 50-200A°. A cisternae is a sac or cavity filled with fluid contents.

b) LARGE VACUOLES :-

They represent modified and expanded flattened sac in which the two membrane of the sac are more wide and the vacuolar space has enlarged. In some cell it may contain dense masses or granules. It is absent in rat liver cell where glycoprotein particles accumulate in the vacuole. (Palade 1959).



c) SMALL VESICLES :-

These small vesicles of about 600A° are intimately associated with cisternae and may show continuity with

them. They arise from fractured sacs by budding or processing off the sacs. These are mainly of two types :- smooth and coated.

In 1956 DALTON and FELIX showed that all these three parts of Golgi reduced the osmium tetroxide or silver.

c) TUBULES :-

From the peripheral area of cisternae arise a complex anastomosing flat network of tubules of 300-500Å diameter [CLOWES and JUNIPER 1969.]

CHEMICAL COMPOSITION :-

In 1925, NATH believed that Golgi is composed of fatty acids, Lipid and Protein. BOURNE [1942-43] claimed the presence of vitamin C and enzymes such as acid or alkaline phosphatase. BAKER found that it contains lecithin and cephalin. BOURNE believed that Golgi contain oxidative enzymes.

Chemical analysis of the Golgi membrane have shown that they have a composition between that of the endoplasmic reticulum and plasma membrane [Leeman and Morre, 1970]

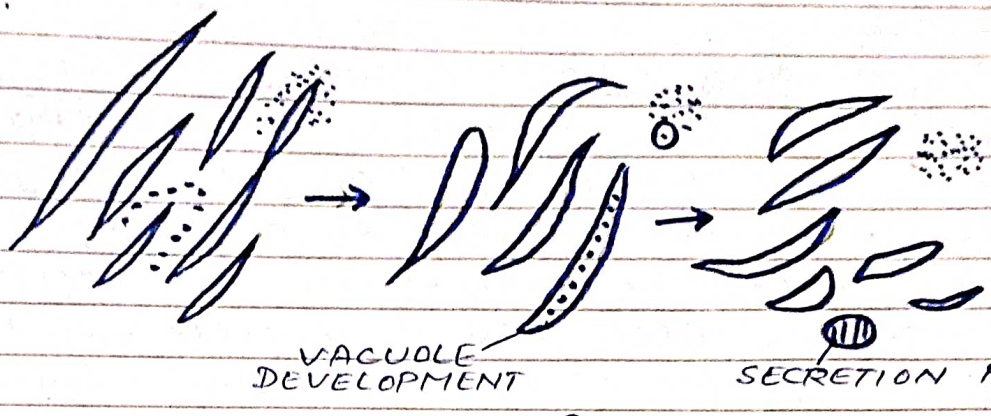
FUNCTIONS

a) SECRETIONS :-

The relationship between the Golgi and secretion was first discovered by CAJAL [1914]. DE ROBERTIS [1954] found that in the locust oocyte one present electronophilic granules in intimate

association of golgi.

Rest cell become either completely surrounded with nodal parts or finally golgi break apart and it has seen that the secretion granules have osmophilic part.



b) According to PALAY (1956) there is a relationship between the golgi and formation of lipid as found on the cells of the sebaceous gla

c) STORAGE OF PROTEIN :-

The VACUOLE and vesicle of golgi are found to store protein.

D) ABSORPTION OF COMPOUND :-

HIRSCH discovered that iron sugar is absorbed on golgi bodies. VANTEEC has shown that golgi bodies absorb copper and gold.

E) ENZYME FORMATION :-

BOWEN shows that golgi is a great intracellular centre of enzyme formation.

F) ACTIVATION OF MITOCHONDRIA :-

Golgi activates the mitochondria to produce the ATP which is utilized in respiratory cycle.

2) PARTICIPATE IN METABOLISM:-

The structure and distribution of golgi material during various physiological phase is a clear evidence that it takes part in metabolism.

3) ACROSOME FORMATION:-

According to Burgos and Fawcett (1956). Golgi play a role in acrosome formation. In the centre of the large vacuoles are present the proacrosomal granules. These vacuoles and granules reach the anterior pole of the nucleus and become adherent to the nuclear membrane. With the elongation of the spermatids, the acrosomal vesicles spread over the nuclear surface and finally coalesce forming the cap material. The acrosome granule becomes the acrosome which lies at the apex of the nucleus and comprises certain enzyme mucoprotein the process of beautification.