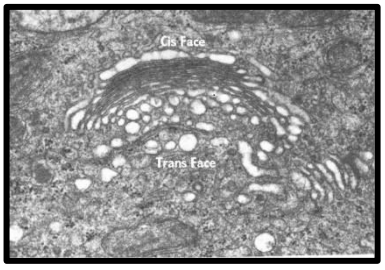
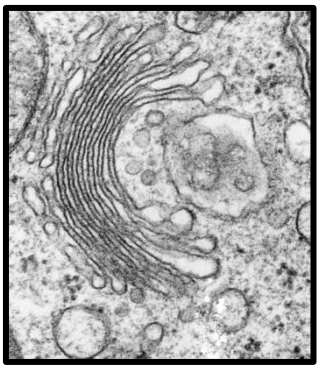
The Golgi Apparatus, Mitochondria, Lysosomes and Peroxisomes

- The Golgi apparatus, discovered by **Camillo Golgi** in **1897**, is present in each eukaryotic cell
  - It is a collection of flattened discs/stacks that make up two main large networks:
    - **The *cis* Golgi network (CGN)**
      - The CGN is a collection of flattened, membrane-bound discs known as **cisternae** (singular: **cisterna**). This is the **entry into the Golgi network** for proteins
        - The proteins can either be sent through the stack, or if they contain an **ER retention signal**, be sent back to the ER
        - There are **usually 40 to 100 stacks in a mammalian cell**
        - **Between 3 and 20 cisternae are usually present in a stack**
          - In protists, however, there can be up to 60 in a stack
          - Each stack has two distinct faces:
            - **A *cis* face, adjacent to the ER**
            - **A *trans* face, pointing towards the plasma membrane**
        - The proteins are **passed from cisterna to cisterna by the formation of vesicles**, called budding, and then the fusing of these vesicles by exocytosis
          - In each stack, a different set of enzymes is present. This is how the proteins are modified
            - For example, an oligosaccharide chain could be added
    - **The *trans* Golgi network (TGN) is at the end of the Golgi stacks** and is where proteins bud off from the Golgi all together
      - The proteins can then either be destined for the **plasma membrane or for a lysosome**
        - They can be sent to the plasma membrane:
          - When being sent to the plasma membrane, the proteins are packaged and bud off in vesicles to **accumulate around the membrane and wait for an extracellular signal** to cause them to fuse with the membrane
            - This is known as **constitutive secretion** as they are sent automatically
          - **Regulated secretion** is for when proteins are made and then stored for later release
            - **These proteins have special surface properties that cause them to aggregate together under the ionic conditions** (acidic and high Ca^{2+}) that are prevalent in the TGN. These are then taken to the plasma membrane
        - They can also be sent to lysosomes:
          - Enzymes, for example, may need to be transported to a lysosome rather than the plasma membrane
            - Proteins destined for a lysosome carry a special phosphorylated sugar group, the **Mannose 6-Phosphate** group
            - They are packaged in special vesicles called **endosomes** which are taken to the lysosome

- The following are some EM's of the Golgi apparatus:





- The **mitochondria** (singular: