

# The mitochondrial structure and processes of cellular respiration

# Learning objective

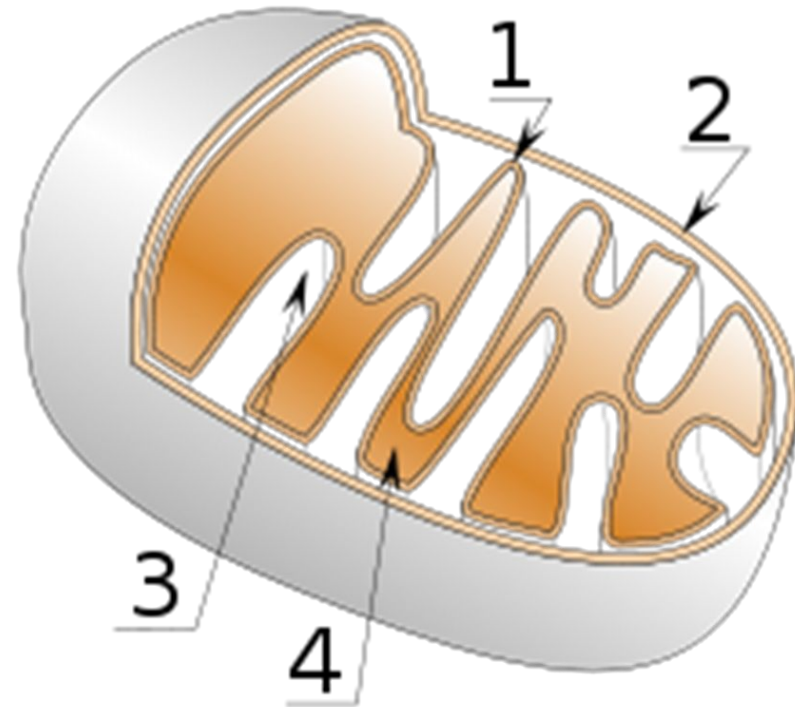
- to establish the relationship of mitochondrial structure and processes of cellular respiration

# Success criteria

1. Knows the structure of mitochondria
2. Describes mitochondrial structures
3. To establish the relationship between the structure of mitochondria and the processes of cellular respiration

# Terminology

- Mitochondria
- Matrix
- Outer and inner membrane
- Inter membrane space
- Cristae
- Ribosome
- Granules
- DNA
- ATP synthase
- Cellular respiration
- Link reaction
- Krebs cycle
- Electron transport chain



# Mitochondria

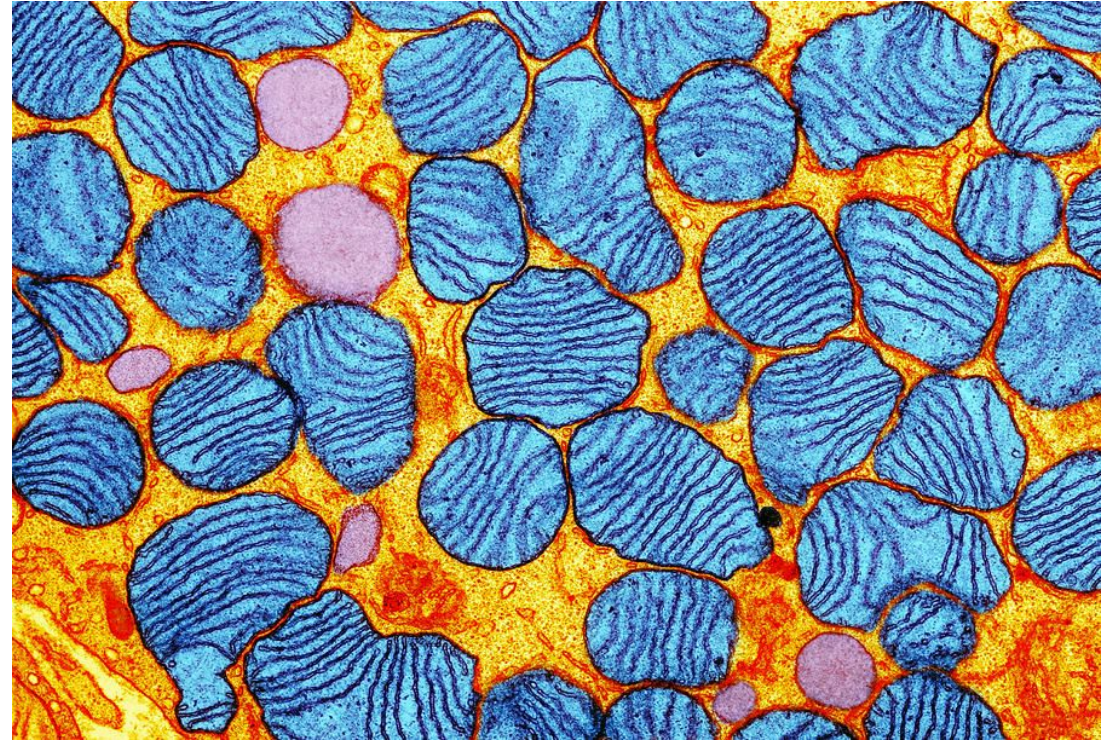
- The mitochondrion (plural mitochondria) is a **double membrane-bound** organelle found in all **eukaryotic organisms**.
- Mitochondria are rod-shaped organelles that can be considered the **power generators** of the cell, converting oxygen and nutrients into **adenosine triphosphate (ATP)**.



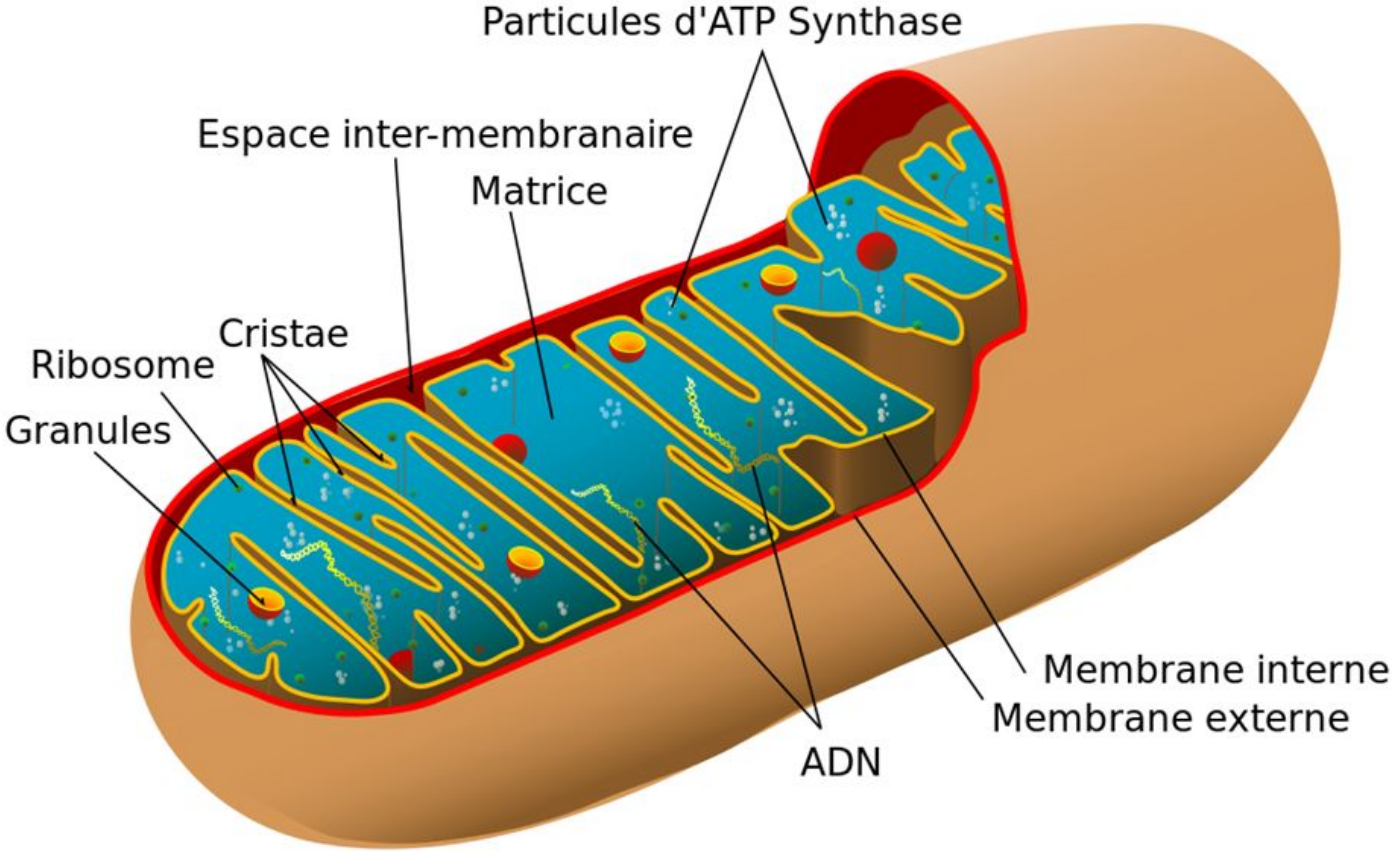


# Mitochondria

- Mitochondria are commonly between **0.75 and 3  $\mu\text{m}$**  in diameter, but vary considerably in size and structure. Unless specifically stained, they **are not visible**.



# The structure of mitochondria





**3 Lamellæ**

**3.1 Inner membrane**

3.11 Inner boundary membrane

3.12 Cristal membrane

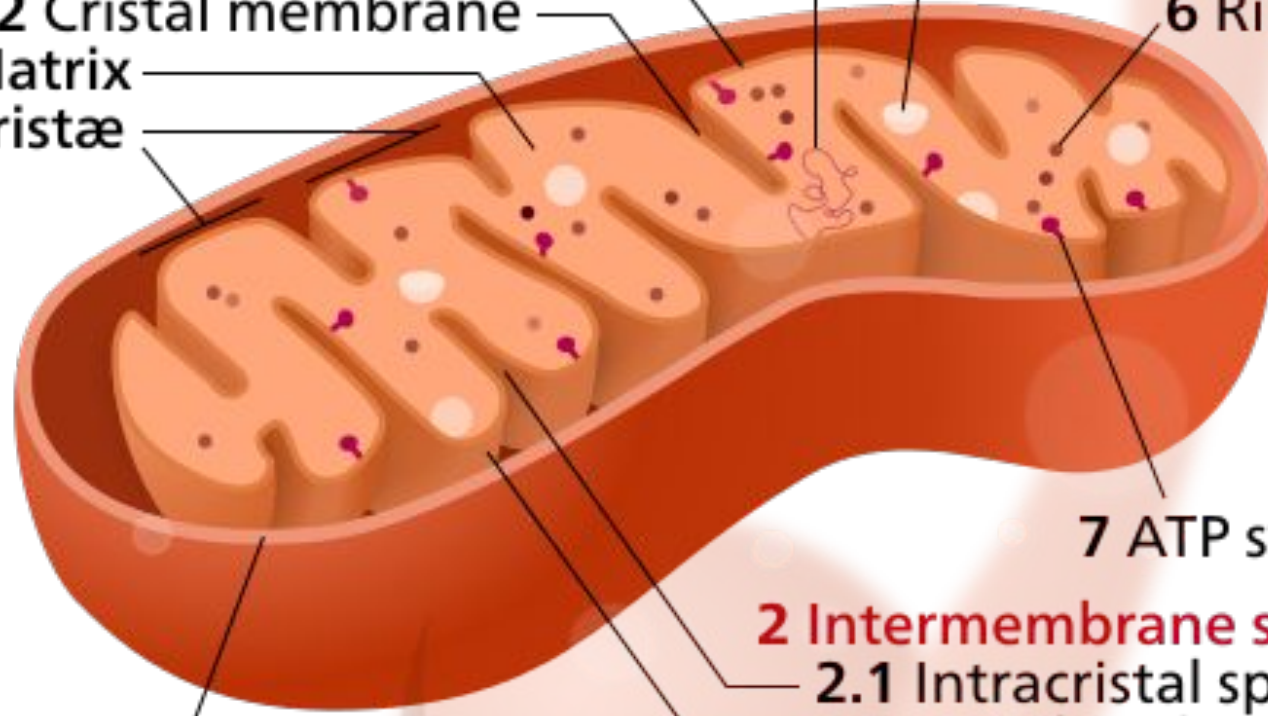
3.2 Matrix

3.3 Cristæ

4 Mitochondrial DNA

5 Matrix granule

6 Ribosome



7 ATP synthase

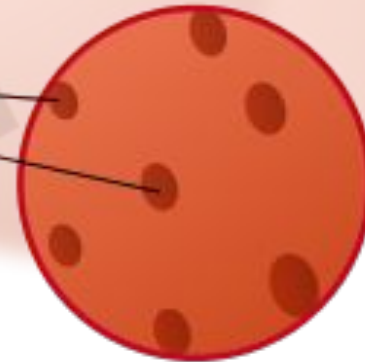
**2 Intermembrane space**

2.1 Intracristal space

2.2 Peripheral space

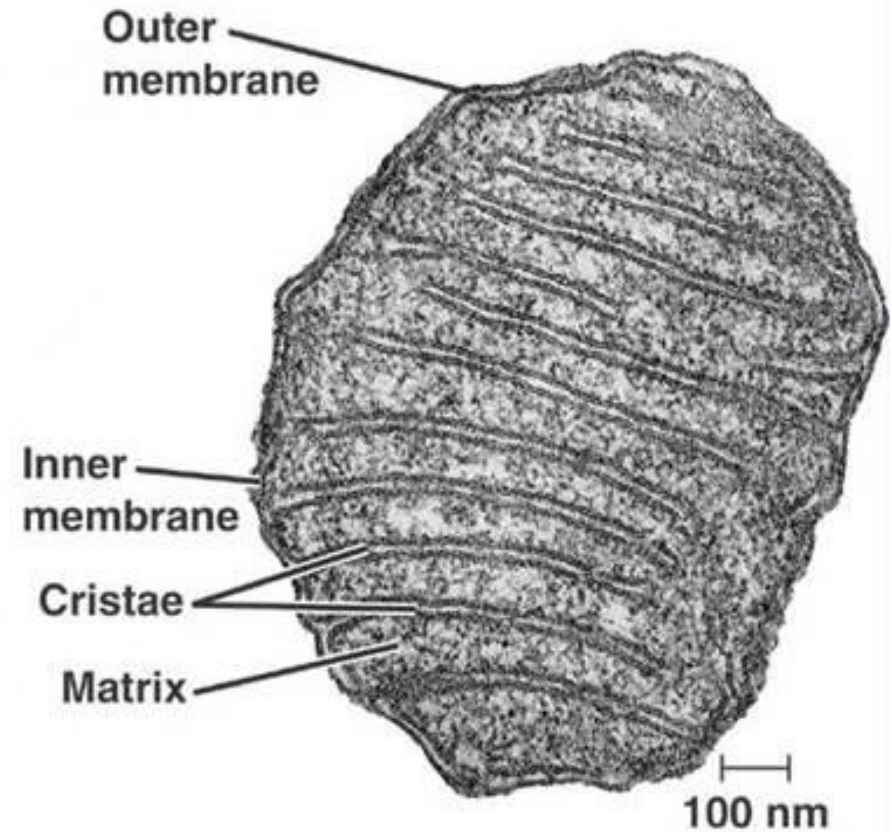
1 Outer membrane

1.1 Porins

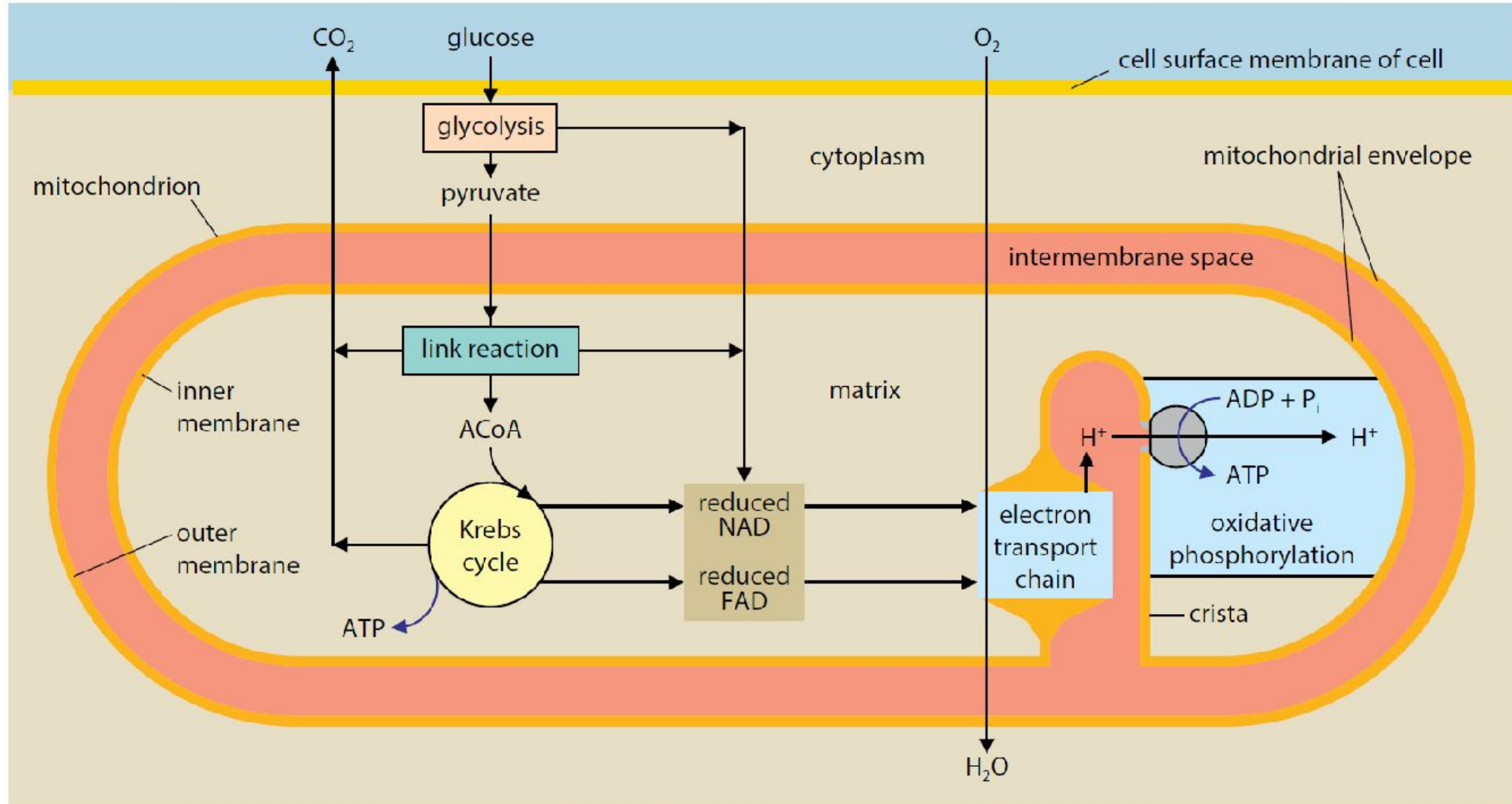


# The structure of mitochondria

- the **outer mitochondrial membrane**,
- the **intermembrane space** (the space between the outer and inner membranes),
- the **inner mitochondrial membrane**,
- the **cristae space** (formed by infoldings of the inner membrane), and
- the **matrix** (space within the inner membrane).



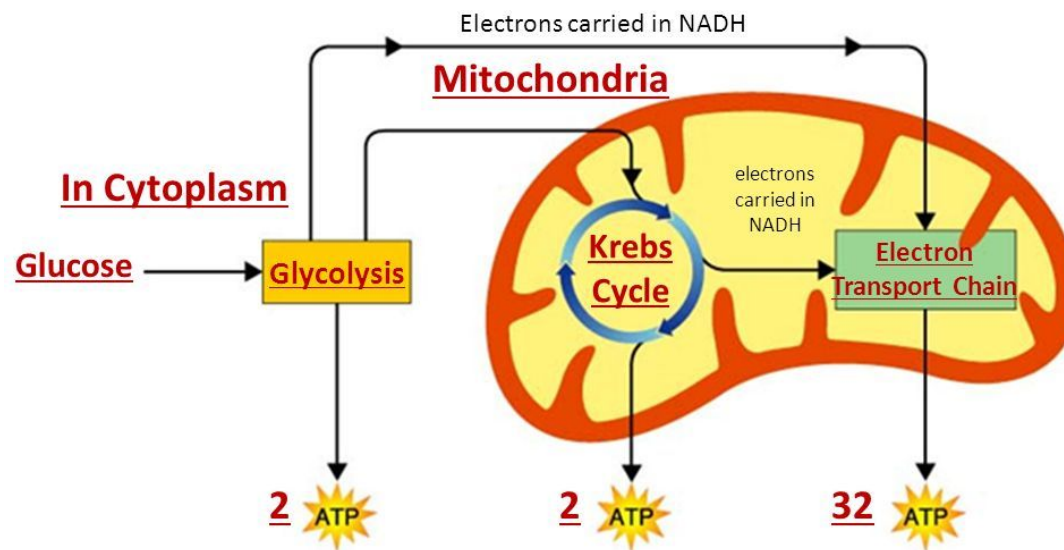
# Structure and function



# Structure and function

- In eukaryotic organisms, the mitochondrion is the site of the **Krebs cycle** and the **electron transport chain**.
- Each mitochondrion is surrounded by an **envelope of two phospholipid membranes**.
- The outer membrane is **smooth**, but the **inner** is much folded inwards to form **cristae** (singular: crista).

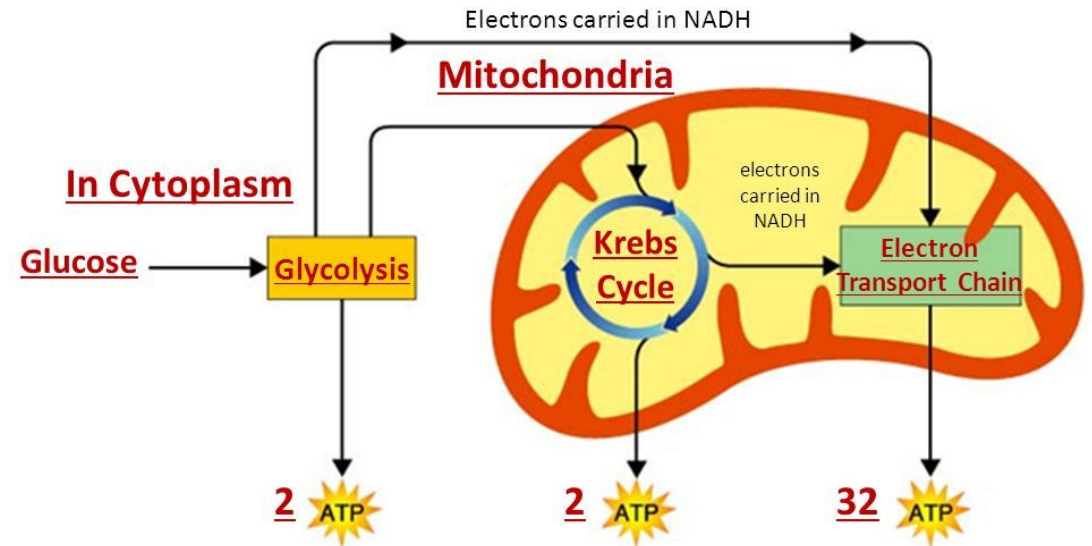
- Diagram - Cellular Respiration



# ATP synthase

- The inner membrane is studded with **tiny spheres**, about **9 nm** in diameter, which are attached to the inner membrane by stalks.
- The spheres are the enzyme **ATP synthase**.
- The inner membrane is the **site of the electron transport chain** and contains the proteins necessary for this.

- Diagram - Cellular Respiration

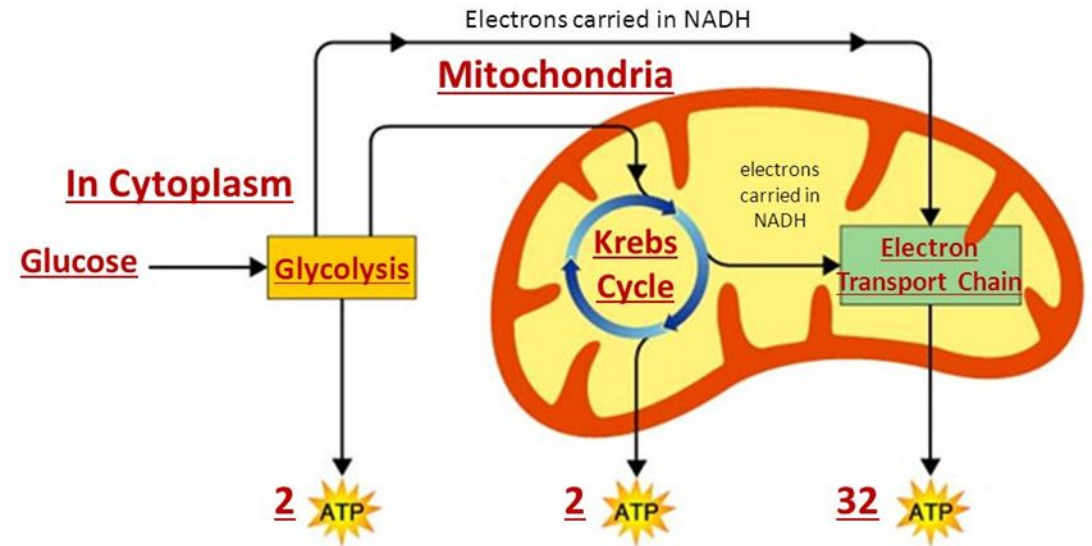




# Matrix

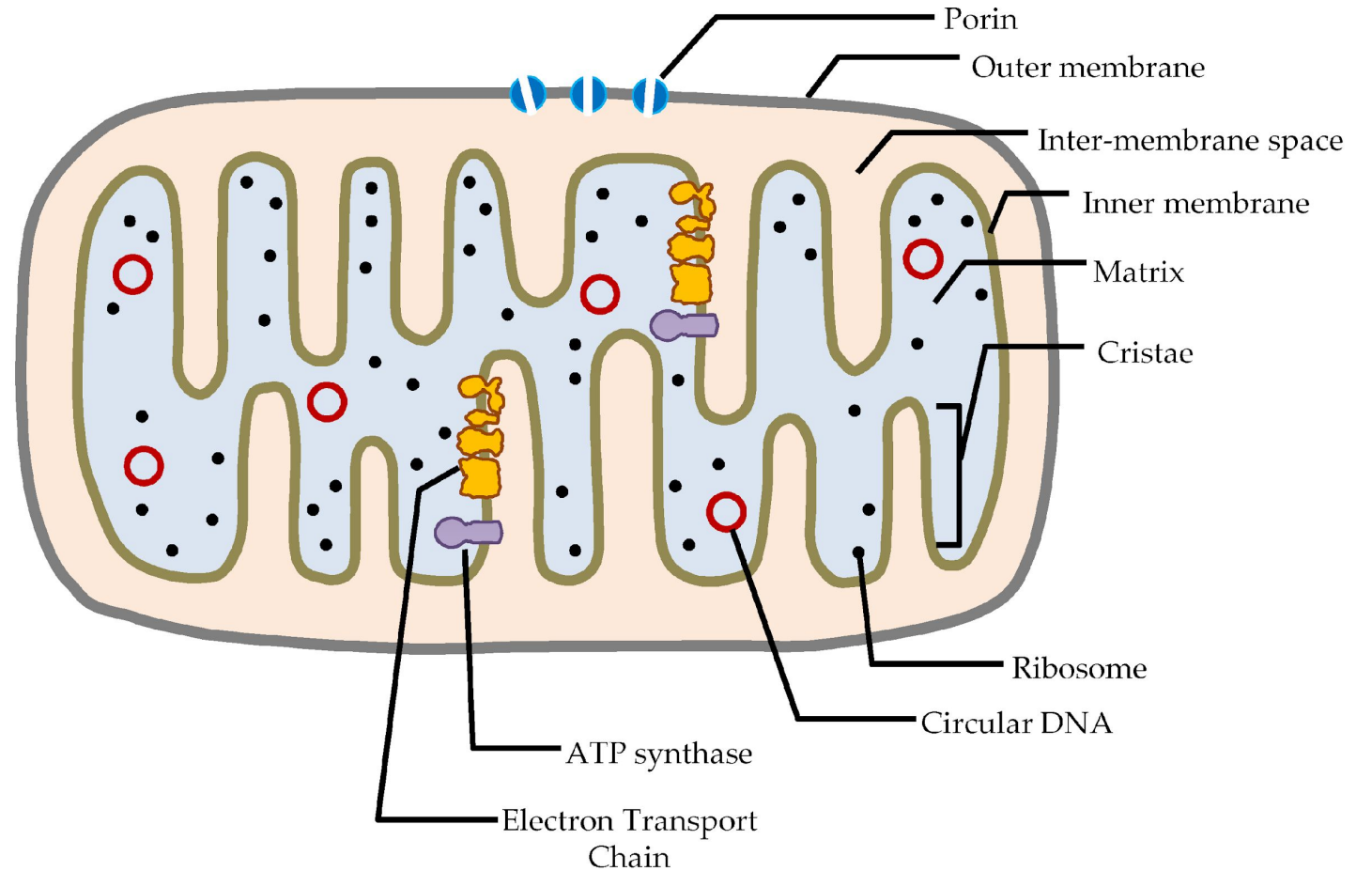
- The matrix of the mitochondrion is the **site of the link reaction and the Krebs cycle**, and contains the enzymes needed for these reactions.

- Diagram - Cellular Respiration



# Ribosome and DNA

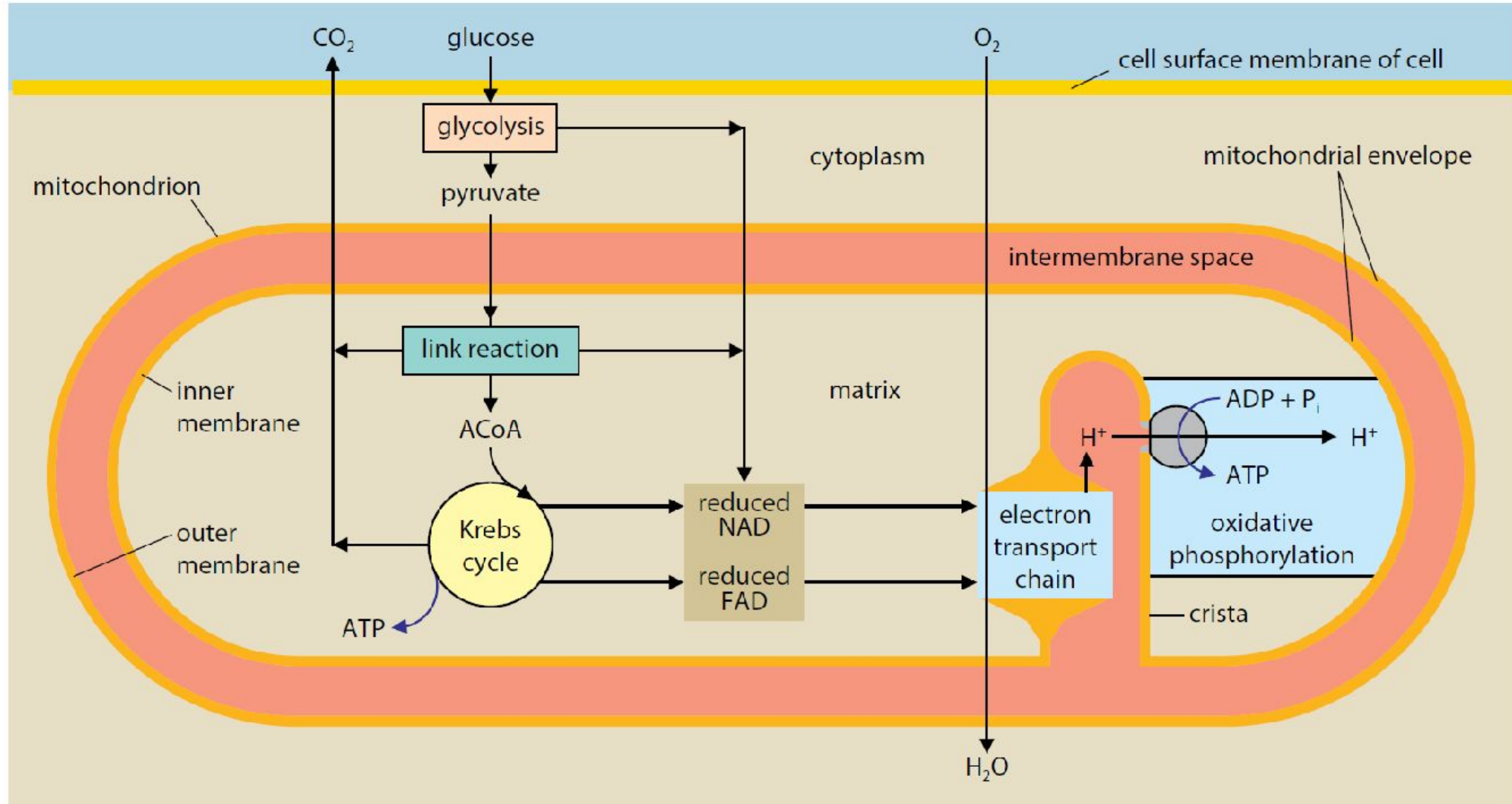
- contains small **(70 S) ribosomes** and several identical copies of **looped mitochondrial DNA**.



# The mitochondria and the processes of cellular respiration

- **ATP is formed in the matrix by the activity of ATP synthase on the cristae.** The energy for the production of ATP comes from **the proton gradient between the intermembrane space and the matrix.** The ATP can be used for all the energy-requiring reactions of the cell, both inside and outside the mitochondrion.

# Structure and function



# MITOCHONDRIA

## □ Structure

- Double membrane
- Have own DNA
- Very numerous in high requirement cells (muscles)

## □ Function

- Powerhouse of the cell (energy)
- Transfers energy into ATP to be used as energy for life functions

## □ Cell Type

- Eukaryotic Cells
- Plant and Animal Cells

## Mitochondria Structural Features

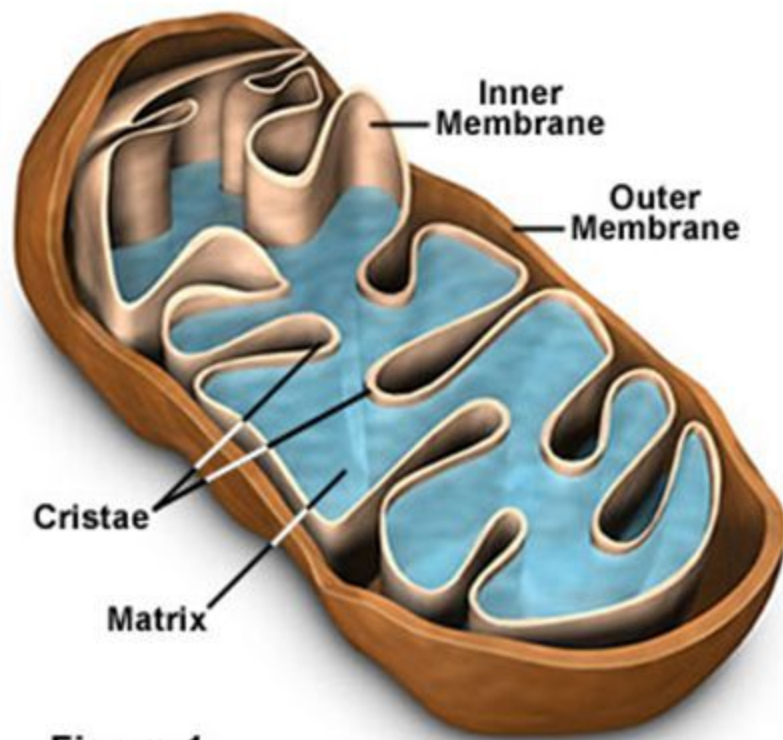


Figure 1



# Success criteria

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