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Inner and Outer Membrane Functions of Mitochondria

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Opinion Article

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ABOUT THE STUDY

The membranes of mitochondria include proteins called mitochondrial carrier proteins, or mitochondrial membrane transport proteins. They carry molecules and other substances inside and outside of the organelles, including ions. The inner border membrane or intermembrane gap divides the outer and inner membranes of mitochondria. While the inner barrier prevents any molecules from passing through, the outer membrane is porous. The pH and membrane potential of the two membranes also differ. These elements affect how well the transport proteins in the mitochondrial membrane work. Human mitochondrial membrane transporters have been identified in 53 cases, and many more are still unknown.

Outer mitochondrial membrane

The border of the mitochondria with respect to the cellular environment is formed by the outer mitochondrial membrane. The mitochondrial proteins of the outer membrane perform tasks for mitochondrial biosynthesis and integration with the cellular system. Proteins with transmembrane-barrels and proteins with one or more-helical membrane attachments are two types of integral proteins that make up the outer membrane.

TOM complex: The TOM complex, which is a component of the TOM/TIM super complex and has at least 7 distinct subunits, is crucial for the translocase of practically all mitochondrial proteins. Tom20 and Tom70 are the main receptors, while the stable TOM Complex is made up of the subunits Tom40, Tom22, Tom7, Tom6, and Tom5. The receptor proteins Tom70 and Tom20 are responsible for docking incoming hydrophobic protein precursors with cytosolic chaperones, while Tom20 is responsible for recognising precursor proteins of presequence pathways.

SAM complex: The sorting and assembly of beta-barrel proteins from the intermembrane space side into the outer membrane depend on the SAM Complex. The beta-barrel protein Sam50 and the two peripheral subunits Sam35 and Sam37 make up the three subunits that make up the SAM complex. Sam50 belongs to the Omp85 protein family, which is known for its 16-stranded -barrel and various POTRA (Polypeptide Transport-Associated) domain counts. Sam50 is a member of this family.

Inner mitochondrial membrane

The oxidative phosphorylation and ATP generation processes take place at the site of the inner mitochondrial membrane, which is a structure that encloses the mitochondrial matrix and is characterised by numerous folds and compartments that form crista.

Respiratory chain super complex: In the cristae of the inner membrane is where the respiratory chain super complex is found. To promote oxidative phosphorylation and ATP generation, it is made up of a number of complexes that interact with one another. Without the other components of the respiratory super complex, the complexes are unable to operate. Located within the super complex is the mitochondrial electron transport chain.

NADH/ubiquinone oxidoreductase: Complex I, commonly known as NADH/ubiquinone oxidoreductase, is the first and biggest protein in the mitochondrial respiratory chain. It is made up of a matrix arm that protrudes from the inner mitochondrial membrane and a membrane arm that is embedded inside the membrane. Three proton pumps and 78 transmembrane helices are present. NADH is converted to ubiquinol at the intersection of the two arms. Complex III and IV require complex I as a scaffold, and without these other complexes, complex I cannot operate.

CONCLUSION

Numerous illnesses and conditions, including cardiomyopathy, encephalopathy, muscular dystrophy, and epilepsy, neuropathy, and fingernail dysplasia are associated with mutations of the DNA coding for mitochondrial membrane transport proteins. Transporter mutations in mitochondria are typically autosomal recessive. Due to the disruption of oxidative phosphorylation, mutations to transporters within the inner mitochondrial membrane mostly impact high-energy tissues. For instance, heart failure and hypertrophy have both been associated with impaired mitochondrial function. This mitochondrial response results in a change towards glycolysis and lactate generation, which can lead to tumour development and tissue proliferation.