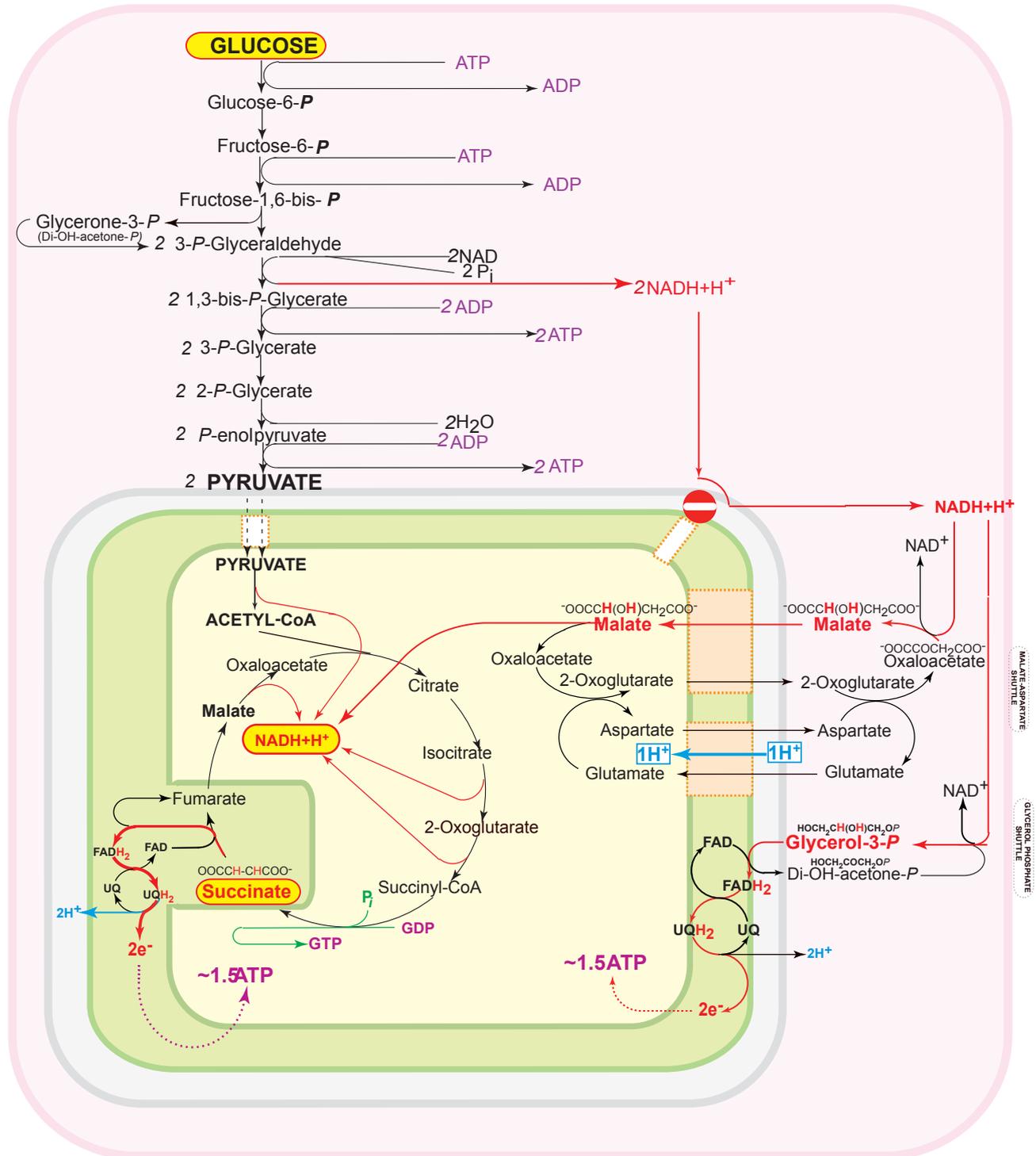


GLYCOLYSIS & TCA CYCLE- SHUTTLES



Malate-Aspartate Shuttle Operates when the NADH/NAD ratio is greater in the cytosol than in the mitochondrial matrix. Electrons are transferred from cytosolic NADH via **malate** across the mitochondrial inner membrane and re-forms NADH in the matrix. This shuttle requires the translocation of 1 proton for each malate

Glycerol-phosphate Shuttle Operates if low ratio NADH/NAD in the cytosol - but at a cost. Electrons are transferred (via **FAD**) to **ubiquinone** at the outer surface of the mitochondrial inner membrane to give **ubiquinol** which remains in the membrane and feeds into the Electron Transport Chain and forms ATP. This is a pathway similar to that in which succinate is aerobically oxidised and they each result in the formation of approximately 1.5 mols of ATP