In *Euglena gracilis*, pyruvate:$NADP^+$ oxidoreductase, in addition to the pyruvate dehydrogenase complex, functions for the oxidative decarboxylation of pyruvate in the mitochondria. Furthermore, the 2-oxoglutarate dehydrogenase complex is absent, and instead 2-oxoglutarate decarboxylase is found in the mitochondria. To elucidate the central carbon and energy metabolisms in *Euglena* under aerobic and anaerobic conditions, physiological significances of these enzymes involved in 2-oxoacid metabolism were examined by gene silencing experiments. The pyruvate dehydrogenase complex was indispensable for aerobic cell growth in a glucose medium, although its activity was less than 1% of that of pyruvate:$NADP^+$ oxidoreductase. In contrast, pyruvate:$NADP^+$ oxidoreductase was only involved in the anaerobic energy metabolism (wax ester fermentation). Aerobic cell growth was almost completely suppressed when the 2-oxoglutarate decarboxylase gene was silenced, suggesting that the tricarboxylic acid cycle is modified in *Euglena* and 2-oxoglutarate decarboxylase takes the place of the 2-oxoglutarate dehydrogenase complex in the aerobic respiratory metabolism.