Glyceraldehyde-3-phosphate dehydrogenaseis a tetramer catalyzing the reaction of glyceraldehyde-3-phosphate to 1,3 bis-phosphoglycerate. Three unlinked genes, TDH1, TDH2, and TDH3, encode related but not identical polypeptides that form catalytically active homotetramers with different specific activities. Interestingly, these catalytically active enzymes are found in the cytoplasm and cell wall. Tdh2p and Tdh3p are detected in exponentially growing cells whereas Tdh1p is primarily detected during stationary phase. Therefore, it has been suggested, but not confirmed, that Tdh1p may be involved in a process other than glycolysis because it is synthesized by cells in stationary phase.Glyceraldehyde-3-phosphate dehydrogenase activity is also required during gluconeogenesis, which is the process whereby glucose is synthesized from non-carbohydrate precursors, enabling yeast cells to grow on ethanol, glycerol, or peptone.The reactions of gluconeogenesis, shown here, mediate conversion of pyruvate to glucose, which is the opposite of glycolysis, the formation of pyruvate from glucose. While these two pathways have several reactions in common, they are not the exact reverse of each other. As the glycolytic enzymes phosphofructokinaseand pyruvate kinaseonly function in the forward direction, the gluconeogenesis pathway replaces those steps with the enzymes pyruvate carboxylaseand phosphoenolpyruvate carboxykinase-generating oxaloacetate as an intermediate from pyruvate to phosphoenolpyruvate- and also the enzyme fructose-1,6-bisphosphatase. Overall, the gluconeogenic reactions convert two molecules of pyruvate to a molecule of glucose, with the expenditure of six high-energy phosphate bonds, four from ATP and two from GTP.The TDH3 promoter is often referred to as the GPD promoter, which is used in the p4XX series of expression vectors.