Glycogen synthase (UDP-glucose-glycogen glucosyltransferase) is an enzyme involved in converting glucose to glycogen. It takes short polymers of glucose and converts them into long polymers of glycogen.

It is a glycosyltransferase enzyme (EC 2.4.1.11) that catalyses the reaction of UDP-glucose and (1,4-α-D-glucosyl)n to yield UDP and (1,4-α-D-glucosyl)n+1.

In other words, this enzyme converts excess glucose residues one by one into a polymeric chain for storage as glycogen. Glycogen synthase concentration is highest in the bloodstream 30 to 60 minutes[2] following intense exercise. It is a key enzyme in glycogenesis.