The Saccharomyces cerevisiae SOL protein family includes Sol1p, Sol2p, Sol3p, and Sol4p, and is unusual in that its individual members are biochemically distinct and spatially dispersed. Sol1p and Sol2p appear to function in tRNA nuclear export, as determined by mutant studies. Sol3p and Sol4p both exhibit 6-phosphogluconolactonase activityand function in the pentose phosphate pathway. Although different analyses have produced slightly different results, Sol1p appears to localize mostly within the nucleus whereas Sol2p, Sol3p and Sol4p localize predominantly in the cytosol. SOL1 is an efficient multi-copy suppressor of the loss of nonsense suppression defect displayed by los1 mutants, as is SOL2, although to a lesser extent. In contrast, Sol3p is only a very weak multi-copy suppressor of los1 mutations and Sol4p does not function in this capacity at all. Null mutants in any or all of the four SOL genes are viable. Nulls in sol1 or sol2 display normal levels of 6-phosphogluconolactonase activity, but possess elevated levels of nuclear tRNA, indicating a defect in tRNA export from the nucleus. Null mutants in either sol3 or sol4 display reduced levels of 6-phosphogluconolactonase activity but possess normal levels of nuclear tRNA. The viability of quadruple null mutants in sol1-4 indicates that this gene family is not essential, but these mutants display no detectable 6-phosphogluconolactonase activity and do possess elevated levels of nuclear tRNA. Sol1p, Sol2p, Sol3p and Sol4p have similarity to each other, and to Candida albicans Sol1p, Schizosaccharomyces pombe Sol1p, human PGLS which is associated with 6-phosphogluconolactonase deficiency, and human H6PD which is associated with cortisone reductase deficiency. Sol1p, Sol2p, Sol3p and Sol4p are also similar to the 6-phosphogluconolactonases in bacteriaand eukaryotes, to the glucose-6-phosphate dehydrogenase enzymes from bacteriaand eukaryotes, and have regions of similarity to proteins of the Nag family, including human GNPI and Escherichia coli NagB.