Ynk1p is a nucleoside diphosphate kinasewith broad substrate specificity that is involved in both DNA and RNA metabolism, and catalyzes the phosphorylation of nucleoside diphosphates into the corresponding triphosphates. Further, it is important for maintaining the intracellular levels of all nucleotide triphosphates, except ATP. Ynk1p displays different relative activities for the various nucleoside diphosphatesas phosphate acceptors, and different relative activities for various triphosphatedonors. Ynk1p also binds Cdc8p, and this complex may facilitate nucleotide channeling in the cell. Ynk1p is a predominantly cytoplasmic homo-oligomeric protein that can rapidly phosphorylate itself in vitro, and its abundance does not appear to be cell-cycle regulated. Approximately 40-50% of Ynk1p activity appears to be associated with the cell membrane, approximately 3% of Ynk1p activity is found in mitochondrial fractions, and less than 1% of total activity can be detected in the nuclear fraction. The mitochondrial fraction of Ynk1p specifically localizes to the intermembrane space, and this localization may occur through the targeting of Ynk1p intermediates to the mitochondrial IMS by Tom40p, and subsequent trapping there by folding and oligomerization. This scenario is suggested by in vitro studies demonstrating that Tom40p recognizes only denatured, not native, Ynk1p, and this recognition of denatured Ynk1p by Tom40p is inhibited by autophosphorylation. The mitochondrial fraction of Ynk1p may be required to supply GTP for various mitochondrial processes. ynk1 null mutants are viable and display normal sporulation, mating, morphology, and growth rates. Nucleoside diphosphate kinases are ubiquitous, highly-conserved enzymes, and have been suggested to serve as signaling molecules in a variety of species due to their involvement in development, cell differentiation, proliferation, cell motility, tumor metastasis, and apoptosis. Ynk1p displays similarity to E. coli NDPK, Myxococcus xanthus NDPK, Dictyostelium discoideum NDPK, Schizosaccharomyces pombe Ndk1p, Drosophila melanogaster awd, pigeon NDPK, rat NDPK alpha and beta, mouse Nm23, and human NME4, NME2, NME3, and NME1, which is associated with inhibition of the tumor metastatic process.