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JOURNAL ARTICLE

Human glyceraldehyde 3-phosphate dehydrogenase-2 gene is expressed specifically in spermatogenic cells

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Although the process of glycolysis is highly conserved in eukaryotes, several glycolytic enzymes have unique structural or functional features in spermatogenic cells. We previously identified and characterized the mouse complementary DNA (cDNA) and a gene for 1 of these enzymes, glyceraldehyde 3-phosphate dehydrogenase-s (Gapds). This gene is expressed only in spermatids. The enzyme appears to have an essential role in energy production required for fertilization, and it is reported to be susceptible to inhibition by certain environmental chemicals. We have now cloned and sequenced the cDNA for the human homologue of glyceraldehyde 3-phosphate dehydrogenase (GAPD2) and determined the structure of the gene. The messenger RNA (mRNA) was detected in testis, but not in 15 other human tissues analyzed by Northern blot technique. The deduced GAPD2 protein contains 408 amino acids and is 68% identical with somatic cell GAPD. GAPD2 has a 72-amino acid segment at the amino terminal end that is not present in somatic cell GAPD. This segment is proline-rich but contains smaller stretches of polyproline and is 30 amino acids shorter than the comparable segment of mouse GAPDS. The structure of the human GAPD2 gene was determined by polymerase chain reaction (PCR) to identify exon-intron junctions in a genomic clone and in total genomic DNA. The locations of these junctions in the GAPD2 gene corresponded precisely to those of the 11 exon-intron junctions in the mouse Gapds gene. Immunohistochemical studies found that GAPD2 is located in the principal piece of the flagellum of human spermatozoa, as are GAPDS in mouse and rat spermatozoa. GAPD2 extracted from human spermatozoa and analyzed by Western blot technique migrated with an apparent molecular weight of approximately 56,000, although the calculated molecular weight is 44 501. The conserved nature of the mouse, rat, and human enzymes suggests that they serve similar roles in these and other mammalian species.

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