Error prone DNA-polymerase α species

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We have isolated from calf thymus three different DNA-polymerase α subspecies sedimenting at 9 S, 7 S , and 5.7 S. The 9 S enzyme consists of four subunits with molecular weights of 148000, 59000, 55000, and 48000 dalton (1), and is most probably the polymerase species active in DNA replication. The degradation of the 9 S - polymerase yields the 7 S and the 5.7 S - species (2).

We have compared the fidelity of in vitro DNA synthesis catalysed by the three different subspecies. The frequency of misincorporation of dGTP using a poly(dA)*oligo(dT) - template-primer system is less than 1 : 100000 for the 9 S enzyme, 1 : 14000 for the 7 S enzyme and 1 : 3000 for the 5.7 S subspecies. As any interference of the terminal deoxynucleotidyl transferase (TdT) with the fidelity assay was excluded, the smaller subspecies have to be considered as error prone DNA-polymerases. Since the three α-polymerases do not contain an error correcting exonuclease function, it is concluded that other factors than Watson-Crick base pairing contribute to the high fidelity of the replicative eukaryotic DNA-polymerase. The more error prone subspecies may be involved in SOS-repair processes (3), carcinogenesis (4), and cell senescence (5).

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