polymerase-α , a major enzyme required for long patch repair synthesis of DNA, occurs just prior to S phase initiation in eukaryotic cells (10). This cell cycle phase closely follows increased LDL binding to cell membranes (11), which preceeds intracellular concentration increases of cholesterol, triglycerides, and phospholipids noted just prior to the initiation of S phase. These findings support the suggestion by Curtis (12-14) that lipoproteins, specifically LDL, are required for the initiation of DNA synthesis preceeding mitosis in mitogen stimulated lymphocytes. While the biochemical relationship between lipoproteins and the enzymes of DNA synthesis has not been clearly established, manipulation of LDL availability to cells appears to represent a mechanism by which DNA polymerase-α activation might be studied.

GM1915 cells, a diploid human fibroblast cell line derived from a female patient with hypercholesterolemia, is deficient for apolipoprotein B receptor, exhibits decreased internalization of low density lipoprotein (15), and inefficiently repairs ultraviolet light type (long patch repair) DNA lesions. To assess the relative differences in activity of DNA polymerases α and β in normal (WI38) and repair deficient (GM1915) human diploid fibroblasts, cells were treated with varying concentrations of mutagens and incorporation of ^{3}H-Tdr as a measure of DNA excision repair was determined. Methyl methanesulfonate (MMS) initiates short-patch DNA repair requiring DNA polymerase-β . Both GM1915 and WI38 cells exhibit DNA polymerase-β activity (Figure 1). Equivalent levels of ^{3}H-Tdr incorporation into DNA in the two cell lines (Figure 1) differ from data seen in Figure 2 showing that BPDE-initiated DNA damage results in significantly more ^{3}H-Tdr incorporation in WI38 cells than in GM1915 cells. BPDE, a reactive metabolite of benzo(a)pyrene, is similar to ultraviolet light in that it initiates long patch excision repair utilizing DNA polymerase-α for the major repolymerization of excised nucleotides. The maximal ^{3}H-Tdr incorporation observed for GM1915 cells was about 20% of that seen for WI38 cells, and was initiated by treatment with BPDE at 100 ng/ml. Since the reduced level of ^{3}H-Tdr incorporation in GM1915 fibroblasts might be the result of variations in thymidine pool size, the relative Tdr pools in WI38 and GM1915 cells were examined and found comparable, being 1.06 and 1.0 respectively.

Data shown in Figures 1 and 2 suggest that WI38 and GM1915 cells have active DNA polymerase-β , but that cells from these two lines do not exhibit equivalent levels of