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EFFECTS OF OXYGEN ON X-RAY INDUCED SINGLE-STRAND BREAKS IN EPISOMAL DNA AND ON LETHALITY IN Escherichia coli.

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The effects of oxygen on radiation induced cell death were compared with those on intracellular single-strand breaks in DNA. The frequency of x-ray induced DNA single-strand breaks was determined by measuring the production of the first break in closed circular superinfecting phage λ DNA. Under conditions of little repair the anoxic yield is 1.3×10^{-6} breaks per rad per 10^6 daltons, while under full oxygenation the yield increases to 4.4×10^{-6} breaks/rad/10^6. The yields obtained are about 3 fold greater than values previously reported and these differences are probably due to a decreased level of repair in the present experiments. Assuming that the yield of x-ray induced breaks in DNA is the same for the episome and the chromosome it can be calculated that even radiation sensitive mutant strains suffer many DNA breaks per bacterial chromosome per lethal hit. On a molar basis oxygen is 3-4 times more effective in cell killing than in promoting DNA strand breaks. Furthermore, in cell killing oxygen can compete with tetramethyl-piperidinol N-oxyl (TMPN), but in promoting DNA breaks there is no competition between oxygen and TMPN. Taken together, these data suggests that the reactions of oxygen in DNA single-strand breakage are separate from those involved in cell killing. Oxygen promoted DNA single-strand breaks are likely to be a harmless lesion as the rejoining is very rapid under rich growth conditions.

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GENETICALLY FIXED ABILITY TO SYNTHESIZE STEREO-ISOMERIC CAROTENOIDS AS A CONSEQUENCE OF THE HIT OF MYCOBACTERIUM PHLEI GENOME BY UV-RADIATION.

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After UV-irradiation of the non-acid-fast Mycobacterium phlei strain 727, a modification retaining the non-acid-fast character, resistant to streptomycin (10 μg/ml) and exhibiting the usual morphology of orange-red colonies was selected. The cell pigment from this culture was extracted and separated by thin-layer chromatography. The carotenoids isolated were identified spectrophotometrically and by co-chromatography with authentic samples as phytoene (0.5%), β-carotene (45.3%) and chromatographically heterogeneous lycopene (53.9%;7 fractions). Further study of the visible and infrared spectra of the lycopene fractions and the results of the equilibration of these fractions with iodine led to the conclusion that their difference is caused by the geometrical isomerism of the double bonds. The fraction with lowest chromatographic mobility (denominated as Lycopene VII) was identified as all-trans-lycopene, while Lycopene IV could be the symmetrical mono-cis-lycopene. It appears that the molecules of Lycopenes I, II, III, V, and VI contain a small number (1-2) of disubstituted cis-double bonds which are, however, probably located in other parts of the carbon skeleton. These molecules can differ also in the sterical configuration of the trisubstituted double bonds. The occurrence of a single precursor, phytoene, is consistent with the idea that the sterical differentiation of lycopene proceeds only after the C_{40} molecule of the carotene is completed rather than at the level of the smaller building subunits.

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DIFFERENTIAL EFFECT OF IRRADIATION ON BIOSYNTHESIS OF RIBOSOMAL AND MESSENGER RNA IN NORMAL AND REGENERATING RAT LIVER

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The effect of 4000 rad γ-irradiation on rRNA and dRNA synthesis in normal and regenerating rat liver was studied using C^{14}-orotic acid as precursor. In intact animals the irradiation stimulated the synthesis of rRNA, at least up to the 12th hour after treatment. No inhibition of dRNA was observed but rather an enhancement in the early hours after irradiation. Partial hepatectomy alone led to an increased synthesis both of rRNA and dRNA, particularly strong 12 hr after operation. An enhanced synthesis of rRNA was observed also in regenerating liver of irradiated animals while the synthesis of mRNA in this case was inhibited.

The early increase in production of rRNA in response to such different factors as irradiation and partial hepatectomy suggests that this represents a non specific reaction of the cell towards various injuring factors. The inhibited mRNA synthesis in regenerating rat liver considered together with its stimulation in intact liver supports the hypothesis that irradiation does not suppress the transcription per se but rather affects the mechanisms of activation of new genes (cellular reprogramming).

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EFFECT OF γ-IRRADIATION ON THE PROTEIN BIOSYNTHESIS IN THE COURSE OF LIVER REGENERATION

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The in vitro incorporation of C^{14}-leucine by microsomal particles isolated from rat liver in different physiological states: a/ normal liver of addult rats (NL), irradiated liver (IL), liver after partial hepatectomy (RL) and regenerating liver in preirradiated rats (IRL) was studied 2, 5, 12 and 24 hr after the operation.

Beginning from the 5th hour irradiation (4000 rad) caused rise in the incorporating activity, being most pronounced at the 24 hour. The same increase was found after partial hepatectomy, where the incorporation is about two times higher than that of the controls at the 24th hour.

With the combination of the two treatments (IRL) the stimulatory effect at the 5th hour is negligible in comparison with IL and RL, reaching high values at the 12th and 24th hour.

Microsomes from IL, RL and IRL exhibit not only an increased incorporation rate but also an increased longevity of incorporation, this effect being more expressed in the later hours following treatment.

Our results are in agreement with the concept that irradiation stimulates the operating synthetic programme of the cell and inhibits cellular reprogramming.