

RNA Polymerase Activity in Liver Nuclei of Intact and Adrenalectomized γ -Irradiated Mice

Following whole-body ionizing radiation, there is a marked shift from light to heavier polyribosome species in the liver of both intact rats¹ and guinea-pigs². Recently, CAMMARANO et al.³ have reported that adrenalectomy does not modify the observed shift. Unaware of the findings of CAMMARANO et al.³, I have reported opposite results: adrenalectomy interdicts the action of radiation on rat liver polyribosome distribution⁴. Additional evidence is presented here, using a different parameter: RNA polymerase activity in mouse liver nuclei of intact and adrenalectomized mice, which supports the contention that the action of radiation on liver RNA metabolism is mediated, at least to a significant extent, via the adrenal gland.

Two-month-old female C3H/HEJ mice, either intact or used 3 days after bilateral adrenalectomy, were exposed to whole-body doses of gamma rays (10,000 R at 1800 R/min) in a ¹³⁷cesium irradiator. At various times after irradiation, the mice were killed by decapitation, the livers removed and the nuclei collected⁵ and frozen for subsequent RNA polymerase assay by the method of MACGREGOR and MAHLER⁶. The nuclei were incubated for 15 min in a 37°C shaking water-bath using ³H-ATP (Schwartz BioResearch Corp.) as the labeling agent of RNA.

The Figure shows the time curve of the response of ³H-ATP radioactivity incorporated into RNA per mg of nuclear DNA of intact mice (curve A) and of bilaterally adrenalectomized mice (curve B). As can be seen, 3 h after radiation, there was an increase in RNA polymerase activity of intact irradiated mice which reaches a peak of more than 100% above the control value in 6 h and is still significantly elevated 18 h after irradiation.

In contrast, however, in adrenalectomized mice, there was no increase in the RNA polymerizing ability of the nuclei at any time after irradiation. In fact, if anything, there appeared to be a drop in activity with time after irradiation.

In a study with rat liver, OMATA et al.⁷ obtained similar results, noting a 40% increase in nuclear RNA polymerase activity 24 h after 650 R in intact but not in adrenalectomized animals. BARNABIE et al.⁸ also observed a slight but not significant increase in RNA polymerase activity of

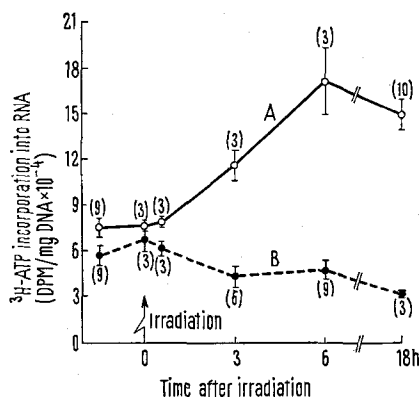
liver nuclei from intact rats 48 h after irradiation after a dose of 6000 R. A time which, according to our results, is long past the peak level of RNA polymerase activity in liver of irradiated animals.

Although one might attempt to explain the divergent results obtained by OMATA et al.⁷ and CAMMARANO et al.³ in measuring radiation effects on liver RNA metabolism by postulating that RNA polymerase activity in adrenalectomized rats peaks earlier than in intact animals, then rapidly returns to control levels, our data covering the time periods from immediately after irradiation to 18 h – times very similar to those studied by CAMMARANO et al.³ but not considered by OMATA et al.⁷ – invalidates such a postulate. We found no enhancement of RNA polymerase activity in adrenalectomized mice at any of the times studied. A more convincing postulate, we believe, is that the similarity of responses obtained in intact and adrenalectomized rats by CAMMARANO et al.³ resulted from the presence of accessory adrenal tissue in his adrenalectomized animals. It is known that such accessory tissue is common in some strains of white rats after adrenalectomy^{9,10}. Baeyens and Goutier (personal communication) found a good correlation between X-ray induced liver polyribosome shifts and the presence of histologically identifiable accessory adrenal tissue in bilaterally adrenalectomized rats^{11,12}.

Résumé. L'activité de la RNA polymérase des noyaux de foie de souris normales ou adrénaléctomisées a été examinée après irradiation gamma de l'animal entier. L'irradiation provoque une augmentation significative de l'activité enzymatique chez les animaux normaux. Cette augmentation n'est pas observée sur les souris adrénaléctomisées.

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Relative in vitro synthesis of RNA by mouse liver nuclei at various times after irradiation. Curve A depicts the values for intact irradiated mice, and curve B of mice irradiated 3 days after bilateral adrenalectomy. The figures in parenthesis are the number of animals used to obtain the mean at each point. Vertical bars are the standard deviation.

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