

THE STRUCTURE AND ULTRASTRUCTURE OF THE INTESTINAL ARTERY AND VEIN IN
Squalus acanthias

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Our present knowledge of the structure and ultrastructure of arteries and veins is based largely on analyses in mammals. Therefore, in order to obtain a broader basis of understanding elasmobranchial vasculature, particularly in support of the above abstracted investigation of the splenic circulation in the dogfish, the intestinal large artery and vein of the Squalus acanthias were preserved for electron microscopic analysis. Perfusion of these vessels by the fixative was first tried but proved to be unsuccessful, since the normal distension of the vessels could not be maintained until the vessel was properly fixed. Instead, lengths of one centimeter were clamped with hemostats, tied off with catgut, excised as a "sausage" and fixed as such for about an hour before they were cut open and continued in the fixative for another hour. This procedure of fixation preserved the vessel in its original state of distension and a shortening of the piece of vessel was not observed. Specimens are now being analyzed by electron microscopy.

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THE EFFECT OF ULTRAVIOLET RADIATION ON DIVISION RELATED PROTEIN SYNTHESIS IN SAND DOLLAR (Echinarachnius parma) ZYGOTES

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The sequence of synthetic and metabolic processes that are determinants for cytokinesis and early development are of great biological interest. We have been using ultraviolet (UV) to interfere with the normal timing of events to learn at what points in the cell cycle changes in sensitivity occur. Young has indicated (Bull. MDIBL 8:63, 1968) that "division related" proteins for S_2 were synthesized about 20-35 min post-fertilization at a time nearly coincident with S_1 . We have previously shown that UV induced cleavage delay is reversible by photoreactivation (PR), therefore we attempted to determine how UV may affect the "division related" protein synthesis and how this may be related to the UV lesion and its reversal.

Zygotes were irradiated 55-60 min post-fertilization with 5.45×10^5 ergs/cm² at 254 nm, which is a dose that permits continued cell division but is about 75-80% lethal for normal morphogenesis after morula stages. Aliquots from non-irradiated zygotes, those irradiated and kept in PR light (daylight fluorescent), and those irradiated but subsequently kept in the dark, were placed at 5 min intervals into cycloheximide (1.01 μ g/ml) which inhibits protein synthesis by more than 97%. If the UV affected protein synthesis to produce a delay in the "division related" proteins, then the inhibiting action of cycloheximide would be effective longer in the irradiated series than in the non-irradiated. This is what actually occurred as noted in the upper part of Figure 1. Those zygotes kept in light subsequent to exposure had only a slight extension of the time they could be

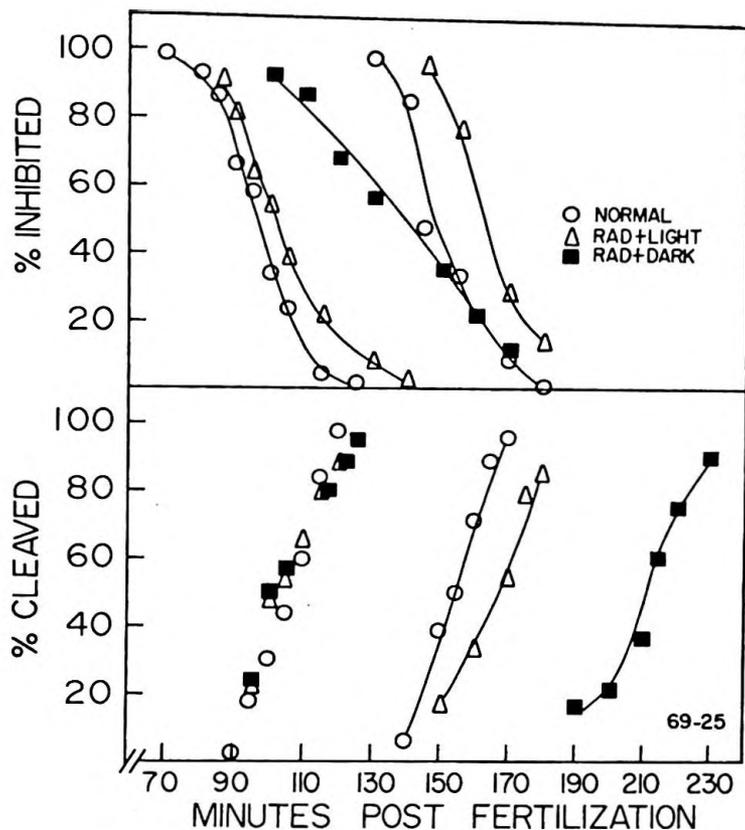


Figure 1.

inhibited, whereas, those kept in the dark had a substantially extended period during which the cycloheximide could inhibit proteins necessary for second cleavage. Comparing the lower with the upper aspect of Figure 1 indicates that the time at which 50% inhibition can be achieved is nearly coincident with the time 50% cleavage normally occurs. This indicates that the "division related" protein synthesis for second cleavage and S_3 are nearly coincident with first cleavage. UV did not affect first cleavage even though it preceded it by about 45 min, which suggests that the protein synthesis for the first cleavage occurred before the time of radiation.

To learn whether the UV effect could be measured in a given synthetic system, incorporation of ^3H -thymidine and ^{14}C -valine into the acid insoluble fraction of the same population of zygotes was done in which non-radiated were compared with zygotes exposed at 55 min post fertilization. As seen in Figure 2 ^3H -thymidine incorporation was identical in both situations until S_3 when there was a delay. The ^{14}C -valine incorporation did not show such a clear delay, but indicated a decreased rate of synthesis post radiation. There is, however, very good agreement in the time of delay in the three events measured. About 30 min delay occurred in cleavage, as it did in S_3 , and also it took 30 min longer to achieve the same dpm's in ^{14}C -valine incorporation.

The above data does not delineate precisely the affected determinant in the UV produced delay. The results from Figure 1, however, show clearly that cycloheximide can inhibit for a longer time post fertilization in radiated zygotes than in normal. This indicates that the necessary protein synthesis for the next cleavage and DNA synthesis has been delayed. In addition, it is noted that the extension of inhibition capability is much longer in those zygotes kept in dark-

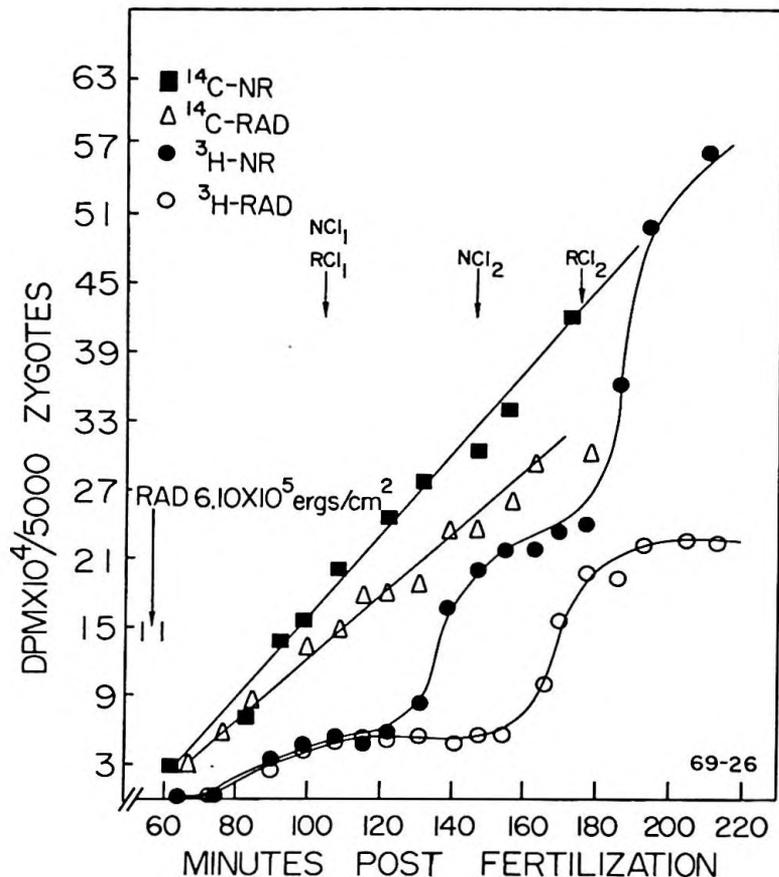


Figure 2.

ness as compared to the PR population. Thus, the PR has the capacity to reverse the UV lesion, which from all known evidence is a cyclobutane type pyrimidine dimer in DNA. This suggests that the "division related" protein synthesis is linked to DNA.

In separate experiments we have shown that the pyrimidine dimers are produced in *E. parva* zygotes at the same dose levels used in the above experiments and that these can be removed by PR. What the causal relationship between the studied synthetic events and the production of dimers actually is cannot be ascertained with the present information.

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OXYGEN CONSUMPTION DURING DIVING IN THE HARBER SEAL WITH SPECIAL REFERENCE TO A PARADOX OF INTERNAL GAS EXCHANGE

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During a prolonged dive, blood flow to all organs except brain, heart and central nervous system ceases. This permits all of the O₂ stores present in the circulating blood volume to be