

Ultraviolet Induced Cleavage Delay And Its Photorecovery In *Echinarachnius parma*

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Effects of ultraviolet light and photorecovery were studied on eggs and sperm of *Echinarachnius parma*. Time to fifty percent cleavage of a sample was used as the index of effect using Blum's method I. Cleavage delay increased as the dose of ultraviolet increased. Total dose was more important than dose-rate. No dark reaction was observed when radiation was given as intermittent flashes. Photorecovery was never complete, even though exposure to visible light was continuous. Exposure to 15 min. intervals of visible light at varying times after fertilization showed photorecovery to be greatest immediately post fertilization, and decreased until the 75-90 min. interval when the zygotes were refractory to visible light. Slight photorecovery occurred subsequent to this. It was also observed that 5 min. irradiated sperm plus normal eggs were delayed 50 min.; 15 min. irradiated eggs plus normal sperm were delayed 27 min.; and 5 min. irradiated sperm plus 15 min. irradiated eggs were delayed 45 min. Thus the effect was not cumulative.

Relation Of Ultraviolet Induced Cleavage Delay To The Mitotic Cycle

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Ultraviolet (UV) irradiated sperm or eggs (or zygotes) of *Echinarachnius parma* when fertilized with their normal counterpart exhibit delay in cleavage for a few divisions. When irradiated eggs (or zygotes) are given visible light (VL) before fertilization with a normal sperm (or after fertilization), there is less cleavage delay (photoreactivation, PR). Complete recovery or 100% PR is never obtained. Recent studies have indicated that DNA synthesis is affected by UV and that isolated irradiated DNA can be reactivated in the presence of VL and an extract from bakers' yeast. With this in mind the effects of UV on mitosis and DNA synthesis were studied.

The properties of PR were investigated by observing three sets of gamete combinations: 1) normal eggs plus irradiated sperm, 2) irradiated eggs plus normal sperm, and 3) the same irradiated eggs plus the same irradiated sperm. It was found that the "doubly" irradiated zygote did not acquire the combined effect, nor did it show less PR than the others after all had received a constant amount of VL post fertilization.

Since irradiated sperm are not capable of PR outside an egg, it was thought that irradiated sperm in the presence of VL and an egg homogenate might show PR. Unfortunately this could not be demonstrated.

Work on bacterial survival has shown that the visible light reduces the UV effect to where it would be at a lower dose of UV (dose reduction factor, DRF). It was felt that cleavage delay might also show a constant DRF. From the limited successful experiments, this does appear to be the case.

Different combinations of cells treated with UV, VL and short pulses of tritiated thymidine (TdRH^3) and normal cells were collected to study 1) the normal mitotic schedule, 2) the phase of mitosis most affected by UV, and 3) the effect of UV on the incorporation of TdRH^3 .

The Mechanism Of Diamox Effect On Acid-Base Relations

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Maren and co-workers have demonstrated that carbonic anhydrase inhibition leads to the development of extracellular respiratory acidosis. The rise in bicarbonate concentration seen under these circumstances is a compensatory mechanism. To what extent the uncatalyzed reaction is capable of permitting normal cellular gas exchange generally is not established. Maren holds that the carbonic anhydrase catalyzed reaction is only decisive in certain special areas (gill, kidneys). If this hypothesis is correct, then Diamox administration should lead to parallel changes in extracellular and intracellular pH. Whereas if the catalyzed reaction is critical in most cells, administration of Diamox should lead to relative intracellular acidosis as compared with pH changes occurring in extracellular fluid.

To test this hypothesis, simultaneous measurements of extracellular and mean whole body intracellular pH were performed in the dogfish under control circumstances and following the intravascular injection of 100 mg. of Diamox.

Following Diamox administration in five experiments, plasma pH fell from 7.59 to 7.36 with a ΔpH of -0.38. Intracellular pH fell from 6.98 to 6.63 with a ΔpH of -0.32. Since Diamox does not produce relative intracellular acidosis, it appears that generally cellular gas exchange is relatively independent of carbonic anhydrase.

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Hydrogen Ion Metabolism In The Dogfish

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It has been shown that urinary pH in the dogfish is essentially independent of extracellular pH. This suggests that renal mechanisms are relatively unimportant in the regulation of acid-base balance in this animal.