

## SENSITIVITY OF EARLY DEVELOPMENTAL PROCESSES TO GRADED DOSES OF ULTRAVIOLET IRRADIATION\*

A. F. Rieck, Marquette University, Milwaukee, Wis.

Unfertilized eggs of Echinarachnius parma were irradiated at a variety of doses of ultraviolet and kept in the dark to study the effect on early developmental processes. The source of ultraviolet was a Hanovia high pressure mercury arc with an interposed Vicor filter cutting out wavelengths shorter than 260 m $\mu$ . Delay of the cleavage interval was the most sensitive process, being the only detectable effect at doses of  $1.42 \times 10^5$  ergs/cm<sup>2</sup> and lower. Energy levels of  $6.16 \times 10^6$  ergs/cm<sup>2</sup> were required for 80% killing, which was measured by the capacity of the irradiated eggs to be fertilized and to cleave. Of those eggs that divided, none progressed further than the 4-cell stage. Fertilization membranes were not elevated when eggs were exposed to  $3.13 \times 10^6$  ergs/cm<sup>2</sup>, but 70% of the eggs could be fertilized and would cleave, although none developed beyond the 16-cell stage. These divisions were not the result of ultraviolet activation, since none of the irradiated eggs would divide unless sperm was added. At doses between  $0.569$  and  $2.28 \times 10^6$  ergs/cm<sup>2</sup>, 100% fertilization and early cleavage would occur. However, the lower dose was considered an approximate LD<sub>50</sub> since only 50% of the zygotes developed to the early prism stage. At the LD<sub>50</sub> level the development appeared normal, but was delayed, to the early gastrula stage. This was the critical period, about 50% failing to undergo normal gastrulation. As doses were increased the percentage failing to gastrulate increased so that at  $1.14 \times 10^6$  ergs/cm<sup>2</sup> less than one per cent completed gastrulation, even though 50% were normal late blastulae. In addition, as doses increased above the LD<sub>50</sub> the number of abnormal cleavages increased. At  $2.28 \times 10^6$  ergs/cm<sup>2</sup> only 50% achieved the early blastula stage, because after the second cleavage the divisions became unequal. The above effects, except for the initial killing, were dramatically reduced under conditions of maximum photorecovery. As an example, at  $1.14 \times 10^6$  ergs/cm<sup>2</sup> with photorecovery, 75-80% would develop and gastrulate compared to less than one per cent under dark conditions. These results indicate that development can be substantially affected at gastrulation even though cell division and morphogenesis proceeded normally, but delayed, until this period. This suggests that the lesion which causes failure in gastrulation is separate from the photo-lesion, which results only in a delay in cell division.

LD<sub>50</sub> doses to unfertilized eggs kept in the dark, inhibited C<sup>14</sup>-valine incorporation about 50%. The degree of uptake at the first cleavage, however, was the same in the irradiated eggs and the non-irradiated controls but substantially delayed. Under conditions of maximum photorecovery the uptake was inhibited early during the cleavage cycle but was essentially at the same rate as in controls after the first cleavage.

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