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THE MICROCIRCULATION IN THE TAIL FIN OF Fundulus heteroclitus

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The morphology of the microcirculation of fishes has not been investigated previously by combining the techniques of light and electron microscopy. Since our own experience relates to the mammalian microcirculation studied in the subdermal vessels of the rabbit skin utilizing a combination of observing initially the live circulation under the light microscope and subsequently fixing the vasculature in situ and sectioning it longitudinally for both light and electron microscopy, we decided to extend our studies to fishes and to apply the same techniques here also.

The first part of the project dealt with the design of a support for the fish and a search for the best location for studying a microvascular area. A lucite cradle was designed so that an eight to nine centimeter long Fundulus heteroclitus could be put down on its side and secured to the support by three pins, two through the tail muscles and one through the jaw. The tail fin was spread out and kept down in this position by clamps on a flat and transparent part of the cradle so that the vasculature between the rays of the fin could be observed directly under the light microscope. The fin was kept moist by a constant dripping of seawater, and at least half the fish was submerged, including the gills on one side. In this position, and by our way of recording, the respiratory movements, the heart beat, and the circulation remained unchanged for up to five hours.

The second part of the summer project concerned itself with the detailed study of the vessels. The architecture of the microvasculature of the fin was thus observed in black and white still photography. A detailed account of our findings will appear elsewhere, but in summary, it was noticed that in the web between two fin rays, there were two arteries, each traveling near a ray, and one vein in the center of the web draining the area. Interconnecting the two systems were numerous capillaries, arterioles and venules. Each capillary could easily be traced from its arterial origin to its venous termination.

The third part of the project dealt with the fixation and the preservation of the intact microcirculation thus observed. Considerable time and effort went into this, since it was discovered that local application of fixative on the fish tail would not arrest the circulation quickly enough to preserve the intact state and diameters of the microvessels. Therefore, it became necessary to perfuse intra-arterially. For perfusion through the aorta, the fish was transferred to another cradle at a 45° inclination, the left operculum removed, the pericardial sac opened and part of the ventro-lateral thoracic wall removed. With the entire heart thus exposed, the ventricle was pinched by a tweezer, a 25 gauge needle inserted into the aortic bulbus, and the slow injection of either glutaraldehyde or osmic acid started immediately and continued for about five minutes. By observing simultaneously the gills, one could see the rapid blanching with glutaraldehyde or blackening with osmic acid if the perfusion was successful. The perfusate returned quickly through the pinched ventricular wall, indicating the completion of the perfusion. Subsequently, the fish was returned to its original cradle and the vessels again observed through the light microscope, now preserved in their original state of dilatation and contraction. The entire tail fin was then processed for later study by phase contrast and electron microscopy.

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QUANTITATIVE STUDIES ON THE ULTRAVIOLET SENSITIVITY OF SAND DOLLAR SPERMATOZOA

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Frequent references are made in the literature regarding the extremely high sensitivity of sperm to ultraviolet (U.V.) irradiation. However, the damage is most usually measured by cleavage delay or abnormal development produced when irradiated sperm are used to fertilize normal non-irradiated eggs. These methods give no indication of the lethality of any given exposure.

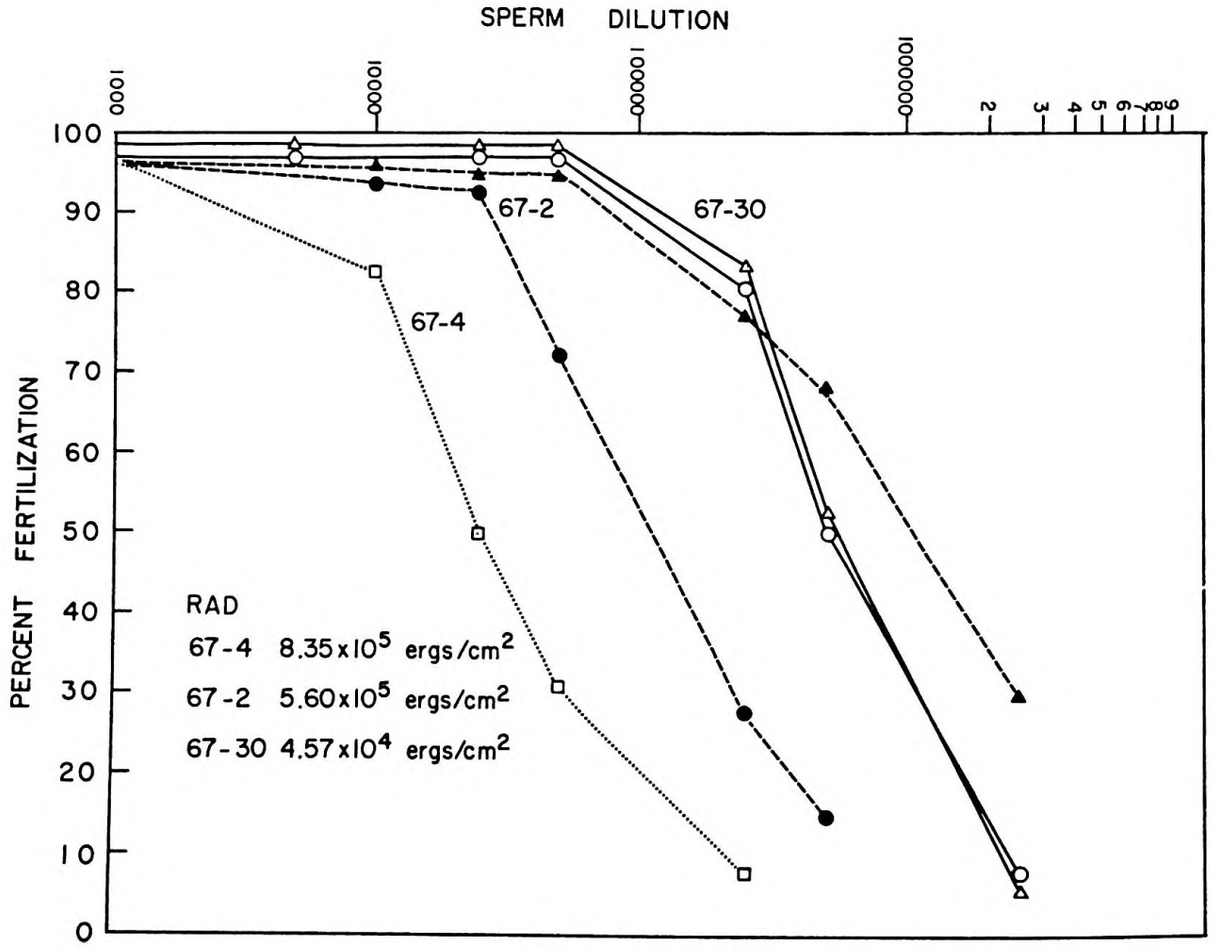

Figure 1

A variety of dilutions of Echinarachnius parma sperm were exposed to U.V. of wave length 2537 Å at various dose levels ranging from 0.145 to 1.12 x 10^6 ergs/mm^2. The effect of the irradiation on fertilization capacity was measured by mixing serial dilutions of control or exposed