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BIOENERGETIC AND HYDRODYNAMIC ASPECTS OF DOLPHIN SWIMMING

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To obtain optimum solutions for certain technical problems, scientists and construction engineers have on many occasions carried out investigations with various animals which had become adapted to their external environment in the evolutionary process. Thus, when the need arose for rapid and economical submarines and surface vessels, intense studies were undertaken on the swimming mechanisms of aquatic animals. Obviously, the mechanisms of swimming of living organisms frequently differ qualitatively from the mechanisms of navigation of manmade objects. Nevertheless, the translocation of both types of objects should be governed by the same general laws of hydromechanics.

Consequently, in order to establish the natural principles responsible for optimum swimming capabilities of aquatic animals for purposes of their eventual technical application, due consideration must be given not only to biological principles, but also to hydromechanics.

Today, special attention is paid to studies on such rapidly swimming animals as the cetaceans, especially the dolphins. This is largely due to the fact that they adapt readily to captivity, are friendly toward man, and can easily be trained.

The cetaceans came to the attention of investigators as a result of their hydrodynamic properties in the 1930's, when the so-called "Gray's paradox" received wide publicity in biological literature.

The essence of this paradox lies in the fact that when swimming at a given speed the muscle system of the dolphin may develop a power output which, according to Gray's calculations, is sevenfold lower than that required to tow an equivalent hard body at the same velocity. It is believed that in the process of evolution the cetaceans had undergone adaptations which decreased their hydrodynamic drag.