

FISH PHYSIOLOGY: QUO VADIS?

David Randall
Department of Zoology, University of British Columbia
6270 University Blvd., Vancouver, BC
V6T 2G3, Canada
tel: (604) 822-5709; fax: (604) 822-2416

Most vertebrates are fish, most vertebrate species are fish species. Despite this fact it is only in the last fifty years that we have started to develop a comprehensive understanding of the physiology of fish. Studies of mammalian physiology, with a much longer and intensive history, are valuable to understanding fish because mammals and fish consist of similar building blocks. Initially, however, much of the work on fish was dominated by an anthropomorphic viewpoint supported by a much more extensive knowledge of mammals and the egocentric nature of human thought. This resulted in such terms as "lower" and "higher" vertebrates and the notion that extant fish species are somehow our antecedents. Fortunately this view is on the wane as we have begun to understand some of the problems faced by vertebrates living in water.

Knowledge of fish physiology is still very spotty, we know a great deal about trout, salmon, carp and stickleback but almost nothing of the 2400 species of fish in the Amazon and even less about the physiology of deep sea fishes. There are technical limitations to deep sea studies that are only now being overcome; the absence of knowledge of tropical fishes is more to do with an absence of will and, therefore, effort rather than any technical limitation.

What will happen in the future? One hopes that our understanding of fish will continue on a broad front and that we will begin to know more about Amazonian species as well as deep sea fish. This will take dedication and effort by a large number of people. Dr Adalberto Val and others including myself have developed the ADVANCE project to encourage people to work in the Amazon. Dr Val is situated in Instituto Nacional de Pesquisas da Amazonia in Manaus, Brazil and is the co-ordinator of this project. We hope to produce a volume of Fish Physiology devoted to Deep Sea Fishes in the next few years and your advice would be most welcome.

In terms of predicting the future I am even more convinced that this is a pointless exercise both from an

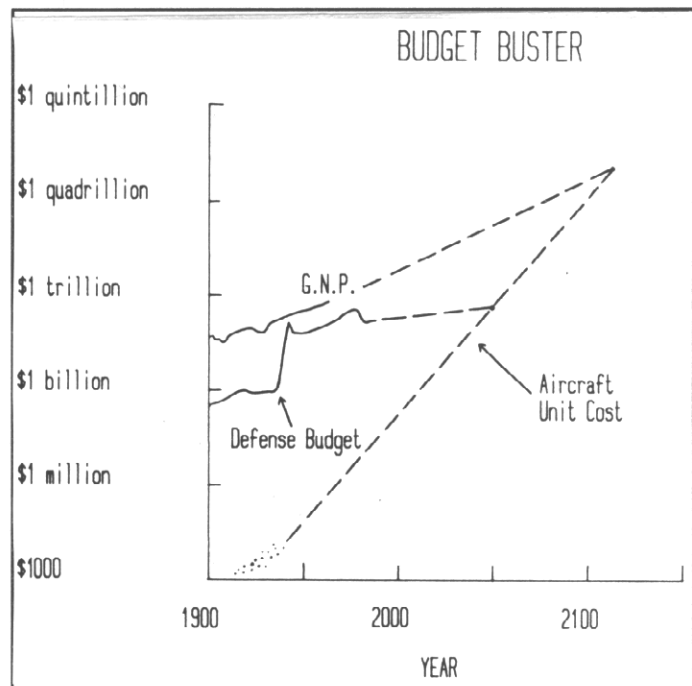


Fig. 1. Unit cost of tactical aircraft versus U.S. gross national product and the defense department budget. (Modified from Augustine 1986).

intellectual and a practical point of view. As I stated in Randall (1987) "general trends are often self-evident, specific predictions are often wrong" I then presented figure 1 to illustrate the obvious dangers of extrapolation and table 1, which lists predictions that were proven wrong!

One obvious trend that has gained momentum is the practice of studying problems at many levels of organization involving individuals from many disciplines. The tremendous growth and application of molecular techniques must now be integrated with systems at the organ, individual and population, as well as cellular and subcellular levels. We have been investigating the transfer of various substances across fish gills and have been assisted in this endeavour by, for example, chemists in Bozeman, Montana and pharmacologists in Milan, Italy. We have been given rabbit polyclonal antibodies against the 70 kDa subunit of clathrin-coated vesicle H⁺-ATPase from bovine brain by Dr Stone, Department of Internal Medicine, The University of Texas Health Science Centre of Dallas and, working with Dr Vogl and other scientists in the Medical school at UBC, have shown that this antibody reacts with the trout gill. I think we all agree that this type of collaboration is useful. The question is how to promote this type of collaboration!

It is my experience that there is good-will amongst scientists and that collaboration, when needed, will occur unless impeded by administrative help. Such help whether from granting agencies or administrations is often well intentioned but seldom useful. Goodwill between participants is the most important factor for successful collaboration. This can best be achieved by not confining the participants to a variety of rules for collaboration.

The individuals who should and will decide the future of a subject, including fish physiology, are the people doing the work. To limit the thinking of these individuals by placing them in straight-jackets of approved directions and guidelines will be to the detriment of the subject. We live in an increasingly bureaucratic world, perhaps as suggested by Umberto Eco, as a consequence of the loss of empire and, therefore, general purpose. Thus the practice of science (and Universities) may change (or have changed) into bureaucracies, rather like the church following the collapse of the Roman Empire, extracting money by promising favours. The only difference may be that, today, change seems to occur at a more rapid pace and involves the entire planet.

Table 1. Predictions that were proven incorrect

"Everything that can be invented has been invented." Charles H. Duell, Director of U.S. Patent Office, 1899

"There is no likelihood man can ever tap the power of the atom." Robert Milikan, Nobel Prize in Physics, 1923.

"Heavier than air flying machines are impossible." Lord Kelvin, President, Royal Society, ca. 1895.

"Ruth made a big mistake when he gave up pitching." Tris Speaker, 1921.