

Molecular Phylogeny of the Fundulidae (Teleostei, Cyprinodontiformes) Based on the Cytochrome b Gene

GIACOMO BERNARDI

Department of Biology
University of California at Santa Cruz
Santa Cruz, California 95064

I. Introduction

The family Fundulidae has a long and complex taxonomic history. After being included in the cyprinodontid subfamily Fundulinae by Myers (1931), the genera *Adinia*, *Fundulus*, *Lucania*, *Leptolucania*, and *Plancterus* were elevated to family status (Fundulidae) by Parenti (1981) in her major revision of order Cyprinodontiformes. To these extant genera, a few fossils forms, generally attributed to either *Fundulus* or *Parafundulus*, are also added to the family (Eastman, 1917; Miller, 1945; Parenti, 1981). A Central American family, Profundulidae, which includes one genus *Profundulus* with five species, is generally considered a sister clade to fundulids and other cyprinodontoids (Fig. 1). The fundulid genera themselves have been the subject of extensive taxonomic work, with a special emphasis put on the most speciose genus of the family, *Fundulus*. *Fundulus* systematics dates as far back as Linnaeus. The genus was revised several times by researchers including Garman (1895), Jordan and Evermann (1896), Jordan *et al.* (1930), Hubbs (1931), Miller (1955), Farris (1968), Parenti (1981), and Wiley (1986). Allozymic (Cashner *et al.*, 1992, for a review) and DNA (Bernardi and Powers, 1995) data have also been added to the list

of characters used to unravel the phylogenetic relationships among Fundulidae. This chapter gives a general overview of the major phylogenetic issues relevant to the family and presents molecular data that will address some of these issues.

Fundulidae is a relatively large group of cyprinodontiform fishes that live in fresh, brackish, and coastal marine waters. They are distributed over Central and North America, and their tolerance for high salinity probably explains their presence on Cuba and Bermuda (Fig. 1). An introduced population of *F. heteroclitus* is also found in southern Spain (Bernardi *et al.*, 1995). Two species, *F. parvipinnis* and *F. lima*, are isolated on the western part of the North American continent, in California and Baja California (Mexico). Fundulids are oviparous, and their reproduction and egg development have been thoroughly studied (on earth as well as in space!) (Hubbs and Burnside, 1972; Koenig and Livingston, 1976; Taylor *et al.* 1977, Hoffman *et al.*, 1977). Other aspects of fundulid biology have also been studied such as hybridization (Hubbs and Drewry, 1959; Setzer, 1970), behavior (Foster, 1967), and karyology (Chen, 1971; Chen and Ruddle, 1970). *F. heteroclitus* is probably the best-studied fish model for enzyme kinetics and expression. Overall, this group has been

