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Competing generic concepts for Blanding's, Pacific and European pond turtles (*Emydoidea, Actinemys* and *Emys*)—Which is best?

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Abstract

We review competing taxonomic classifications and hypotheses for the phylogeny of emydine turtles. The formerly recognized genus *Clemmys* sensu lato clearly is paraphyletic. Two of its former species, now *Glyptemys insculpta* and *G. muhlenbergii*, constitute a well-supported basal clade within the Emydinae. However, the phylogenetic position of the other two species traditionally placed in *Clemmys* remains controversial. Mitochondrial data suggest a clade embracing *Actinemys* (formerly *Clemmys*) *marmorata*, *Emydoidea* and *Emys* and as its sister either another clade (*Clemmys guttata* + *Terrapene*) or *Terrapene* alone. In contrast, nuclear genomic data yield conflicting results, depending on which genes are used. Either *Clemmys guttata* is revealed as sister to ((*Emydoidea* + *Emys*) + *Actinemys*) + *Terrapene* or *Clemmys guttata* is sister to *Actinemys marmorata* and these two species together are the sister group of (*Emydoidea* + *Emys*); *Terrapene* appears then as sister to (*Actinemys marmorata* + *Clemmys guttata*) + (*Emydoidea* + *Emys*). The contradictory branching patterns depending from the selected loci are suggestive of lineage sorting problems. Ignoring the unclear phylogenetic position of *Actinemys marmorata*, one recently proposed classification scheme placed *Actinemys marmorata*, *Emydoidea blandingii*, *Emys orbicularis*, and *Emys trinacris* in one genus (*Emys*), while another classification scheme treats *Actinemys*, *Emydoidea*, and *Emys* as distinct genera. The inclusion of *Actinemys* in the same taxon as *Emydoidea* + *Emys* is unacceptable under a phylogenetic classification framework because there is evidence for the non-monophyly of this clade. Moreover, *Actinemys*, *Emydoidea*, and *Emys* are morphologically highly distinct. Their morphological divergence exceeds by far the differences that typically occur among species of the same genus, so that a continued usage of the distinct genera *Actinemys*, *Emydoidea* and *Emys* is recommended.

Key words: Classification, *Actinemys*, *Clemmys*, Emydidae, Emydinae, *Emydoidea*, *Emys*, *Glyptemys*, Testudines

Prologos

While for many decades the generic arrangement of American emydid turtles was stable (Loveridge & Williams 1957; Ernst & Barbour 1972, 1989; Wermuth & Mertens 1977; Ernst *et al.* 2000), with the notable exception of *Chrysemys*, *Pseudemys* and *Trachemys* (McDowell 1964; Seidel & Smith 1986), the situation changed in recent years with the advent of molecular phylogenetics. In the present paper we review competing phylogenetic hypotheses and the resulting contentious situation for genus delineation of the pond turtle complex (genera *Actinemys*, *Emydoidea*, and *Emys vs.* an expanded genus *Emys*). The problem of generic assignment of these turtles was first addressed by C. H. Ernst in a keynote lecture of a symposium on the former genus *Clemmys* at Pennsylvania State University in 2000 (Ernst 2001).

Parodos

The genus *Emys* (ancient Greek ἑμύς, freshwater turtle) was erected by André Marie Constant Duméril (1806) to comprise a wide variety of freshwater turtles. During the 19th century, about 90 extant and many additional fossil

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