

UNIVERSITY OF SOUTHERN CALIFORNIA
THE GRADUATE SCHOOL

ORAL EXAMINATION

OF

ROY WALLACE McDIARMID
A.B., UNIVERSITY OF SOUTHERN CALIFORNIA, 1961; M.S., 1966

FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY
(BIOLOGY)

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HANCOCK SUITE
ALLAN HANCOCK FOUNDATION

DISSERTATION COMMITTEE

PROFESSOR SAVAGE, *Chairman*
PROFESSOR HYMAN
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OUTLINE OF GRADUATE STUDIES

Major: Biology

Invertebrate Zoology	Zimmer
Ichthyology	Savage
Special Problems in Biology	Savage
Seminar (Zoogeography)	Savage
History of Biology	Mohr
Ornithology	Stager
Seminar (Tropical Biology)	Savage
General Entomology	Hogue
General Embryology	Kluge
Seminar (Vertebrate Speciation)	Savage
Biology of Tropical Vertebrates	Hooper
Evolutionary Osteology	Savage

Supplementary Studies

General Biochemistry	Saltman
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PUBLICATIONS

"A collection of reptiles and amphibians from the highland faunal assemblage of western Mexico," Los Angeles C. Mus. Contrb. Sci., 68, 1-15 (1963).

"Populational variation in the frog genus *Phrynohyas* in Middle America," Los Angeles Co. Mus. Contrb. Sci., 134, 1-25 (1968).

DISSERTATION

COMPARATIVE MORPHOLOGY AND EVOLUTION OF THE NEOTROPICAL FROG GENERA *Atelopus*, *Dendrophryniscus*, *Melanophryniscus*, *Oreophrynella* AND *Brachycephalus*

Atelopodid frogs are one of the most diverse groups of Neotropical Anura. As previously delimited, the group includes approximately 40 species in five genera, *Atelopus*, *Dendrophryniscus*, *Melanophryniscus*, *Oreophrynella* and *Brachycephalus*. Their systematic status and evolutionary history are poorly understood. The purpose of this study was to analyze available knowledge of the morphology and biology of these frogs in order to clarify their evolutionary relationships and history.

Representative specimens of all genera and most species were examined. Information concerning myology, osteology, and reproductive morphology was gathered. All available literature was reviewed and pertinent information was assimilated into this report.

Detailed descriptions of thigh and jaw musculature and osteology of the five genera are presented. Skulls, pectoral girdles, and hyoid apparatuses are described and illustrated. Components of the auditory apparatus, certain aspects of their external morphology, reproductive biology and ecology are described.

Each genus is defined according to 43 characters. Their geographical distributions are stated briefly and their included and referred species are listed. *Atelopus minutus* Melin and *Atelopus proboscideus* Boulenger are placed in the genus *Dendrophryniscus*. *Atelopus rubriventris* Vellard is placed in the genus *Melanophryniscus*.

Brachycephalus is discussed in detail and is shown not to be closely related to the other genera. It is compared with other frog families and shown to be closest to the Leptodactylidae and Dendrobatidae. Arguments are presented for its recognition as a separate family, the Brachycephalidae, which is redefined.

The remaining four genera are discussed and their character states compared. *Melanophryniscus* has the greatest number of primitive states and the least number of advanced states and is probably most similar to the ancestral stock. *Atelopus* also has many primitive states but possesses the greatest number of advanced states. *Atelopus* and *Melanophryniscus* were derived from the same lineage, but *Atelopus* has undergone a significant radiation at the species level and exhibits several advancements not found in the other genera. *Dendrophryniscus* was derived from the *Melanophryniscus* line. *Oreophrynella* has more advanced character states than either *Melanophryniscus* or *Dendrophryniscus* and only one less than *Atelopus*. However, *Oreophrynella* has the highest number of unique states and the lowest number of primitive states. *Oreophrynella* apparently was derived from the ancestral stock at a different time from the *Melanophryniscus-Atelopus-Dendrophryniscus* line and has become greatly specialized, subsequently.

Major evolutionary trends and morphological character shifts apparently are associated with changes in locomotion; others are the result of differential metamorphosis. Biological modifications associated with the loss of the middle ear and the development of aposematic coloration also are important. The familial status of the Atelopodidae is discussed and rejected. The genera *Atelopus*, *Dendrophryniscus*, *Melanophryniscus* and *Oreophrynella* are placed in the family Bufonidae which is redefined.

The ancestral stock from which the four genera were derived probably was present in South America before the Tertiary. The ancestral *Melanophryniscus-Dendrophryniscus-Atelopus* stock probably occurred in a savanna or deciduous forest habitat. *Melanophryniscus* has retained many of the generalized ancestral characteristics and currently is found in the same general type of habitat. *Dendrophryniscus* was derived from the *Melanophryniscus* stock and has adapted to the wet tropical forest of Eastern Brazil and the Amazon Basin. *Atelopus* has adapted to a stream-side habitat and moved into montane areas which became available with the uplift of the Andes in late Cretaceous and early Tertiary. This new habitat has been successfully exploited by *Atelopus* and has been a major factor contributing to their specific radiation. *Oreophrynella* is a very specialized frog that was derived from an old stock. It subsequently became restricted to Mount Roraima, an ancient part of the Guiana Shield.

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- 1940 —Born in Santa Monica, California
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- 1961 —A.B., Zoology, University of Southern California, Los Angeles, California
- 1961-65—Teaching Assistant, Department of Biology, University of Southern California
- 1961-68—Graduate student, University of Southern California
- 1962 —Recipient, Sigma Xi Grant-in-Aid of Research, University of Southern California
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- 1964 —Recipient, National Science Foundation Summer Fellowship, University of Southern California
- 1964-68—Curatorial Assistant, Los Angeles County Museum of Natural History, Los Angeles
- 1965-66—Teaching Associate, Department of Biology, University of Southern California
- 1966 —M.S., Biology, University of Southern California
- 1966 —Recipient, Organization for Tropical Studies, Course Participation Fellowship, University of Costa Rica, San Jose, Costa Rica.
- 1966-67—Teaching Assistant, University of Southern California
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