

SYNOPSIS OF RECENT AMPHIBIANS TO GENUS

[prepared by M. J. Fouquette, Jr., for use in the Herpetology course (BIO 474) at Arizona State University. Diagnostic characteristics of listed amphibian taxa are taken from a variety of sources; spermatological characters of anurans are mostly unpublished. Taxonomic arrangement primarily based on Duellman & Trueb (1986, *Biology of Amphibians*) and Frost (1985, *Amphibian Species of the World*, and online updates), with minor deviations; updated through 1999]

Class AMPHIBIA Linnaeus, 1758

CHARACTERIZATION:

- Tetrapod limbs, with digits, no claws;
- Skull with
 - closed otic notch,
 - large squamosal, usually articulated with parietal,
 - no post-temporal fossa,
 - no ectopterygoid;
- mandible consists of a medial coronoid, and 3 lateral dermal bones;
- 2 occipital condyles (one in some fossils), articulating with atlas;
- heart with 2 atria, 1 ventricle;

Subclass LISSAMPHIBIA Haeckel, 1866

CHARACTERIZATION:

- monospondylous vertebrae (no separate intercentra);
- pedicellate teeth, which are bicuspid (Sirenids are exceptions);
- columella-operculum complex present; columella directed dorsolaterally from oval window;
- papilla amphibiorum in inner ear, to receive low frequency sounds;
- parietals are the only temporal skull roof bones;
- ribs short, not encircling body;
- no post-frontal bone.
- special Green Rods in retina (except caecilians, with reduced eyes);
- *M. levator bulbi*, which uniquely elevates eye, innervated by Trigeminal (V);
- fat bodies present, in association with gonads; develop from germinal ridge;
- 2 kinds of skin glands: 1) mucous; 2) granular (poison);
- skin glandular, with no epidermal scales;
- cutaneous gas exchange, facilitated by mucous glands moisturizing skin;
- lung-breathing facilitated by buccal pump mechanism;
- anamniote eggs; aquatic larvae usually metamorphose into adult form.

Living taxa, totals: 43-47 Families, 439 genera, 5088 species.

(Superorder CAUDATA Opperl, 1811)

(salamanders and caecilians are sometimes united in this superorder, based largely on similarity in vertebral structure; alternatively, Urodela is considered the Order for extant families by some, with fossil taxa combined with Urodeles into this one superorder, leaving caecilians a separate entity)

Order URODELA Dumeril, 1804

CHARACTERIZATION:

- Forelimbs present; hind limbs usually present; latter not conspicuously larger;
- larvae not conspicuously different in form from adult;
- head, trunk, and tail distinct;
- otic notch and middle ear absent;
- columella short, absent in some;
- postfrontal, postparietal, tabular, supratemporal, supraoccipital, basioccipital, and ectopterygoid bones absent;
- ribs present;
- aquatic larvae, when present, have true teeth on both jaws;
- larvae with gill slits and external gills.

CONTENT: 10 Families in 3 Suborders, with 458 species in 61 genera.

Suborder SIRENOIDEA Goodrich, 1930

(characters as for the single family)

Family SIRENIDAE Gray, 1825

CHARACTERIZATION:

- Permanently aquatic neotenic adult; 3 pair permanent external gills;
- lungs and external gills present in adult;
- no maxillae;
- no eyelids;
- angular and prearticular fused;
- nasals in contact medially;
- pectoral girdles with 2 separate centers of ossification; pectoral limbs reduced;
- pelvic girdle and limbs absent;
- teeth absent from premaxilla, dentary; present only on splenial of lower jaw and vomer of palate.
- teeth not pedicellate; both jaws with horny sheath;
- otoglossal muscle absent;
- columella free and cartilaginous;
- vertebrae amphicoelous, very distinctive;
- body elongate, to 950 mm;
- $2n = 46-64$, may be polyploid;
- fertilization apparently external; oviparous.

DISTRIBUTION: coastal plain from Virginia to northeastern Mexico.

CONTENT: 2 Recent genera, 4 living species.

Pseudobranchius Gray, 1825 (2 sp); South Carolina to Florida.

Siren Linnaeus, 1766 (2 spp); range of family.

Suborder CRYPTOBRANCHOIDEA Dunn, 1922

CHARACTERIZATION:

- Angular free, not fused with prearticular;
- premaxillary spine short, not separating nasals;
- columella free, not fused with otic;
- second epibranchial present;
- ribs not forked proximally;
- fertilization external; males without cloacal glands, females without spermatheca;
- $2n = 56$ or more.

CONTENT: 2 Families:

Family HYNOBIIDAE Cope, 1859

CHARACTERIZATION:

- Adults terrestrial, semiaquatic, or aquatic;
- lacrimal and septomaxilla present;
- teeth on premaxilla, maxilla, prevomer;
- prevomerine teeth in transverse series, not parallel to maxillary row;
- aquatic eggs and larvae;
- metamorphosis complete; adult may retain some neotenic features, but no open gill slits in adults;
- adults with eyelids;
- lungs usually present;
- total length 100-250 mm.

DISTRIBUTION: Widespread in Asia, some into Middle East and eastern Europe.

CONTENT: 7 Recent genera, with 38 living species.

Batrachuperus Boulenger, 1878 (7 spp); Tibet, Afghanistan, Iran.

Hynobius Tschudi, 1838 (24 spp); distribution of family.

Liua Zhao & Hu, 1983 (1 sp); China.

Onchodactylus Tschudi, 1838 (2 spp); Korea and Japan.

Pachyhynobius Fei, Ku & Wu, 1983 (1 sp); China.

Ranodon Kessler, 1866 (2 spp); USSR, Chinese Turkestan.

Salamandrella Dybowski, 1870 (1 sp); USSR, Japan, Mongolia, China.

In one species of *Ranodon*, males deposit spermatophores, but females attach egg sacs to them in water (fertilization external). *Onchodactylus* adults are lungless, aquatic in mountain streams. Most species have rather terrestrial adult stage.

Family CRYPTOBRANCHIDAE Fitzinger, 1826

CHARACTERIZATION:

- Large, aquatic salamanders with flattened bodies and fleshy, highly vascular folds of skin;
- permanently aquatic; incomplete metamorphosis, adult loses gills;
- males guard developing eggs;
- lacrimal and septomaxilla absent;
- prevomerine teeth anterior in position, forming a curved row parallel to maxillary row;
- adults without eyelids;
- lungs present, gills absent in adults;
- size to 1.5 meters.

DISTRIBUTION: Eastern North America, Japan, and southeastern Asia.

CONTENT: 2 Recent genera, with 3 living species.

Andrias Tschudi, 1837 (2 spp); China and Japan.

Cryptobranchus Leuckart, 1821 (1 sp); Eastern US.

Suborder SALAMANDROIDEA Sarasin, 1890

CHARACTERIZATION:

- Pedicellate teeth;
- angular and prearticular bones fused;
- premaxillae with long spines separating nasals;
- pterygoid partly to wholly ossified;
- fertilization internal; cloacal glands in male, spermatophores produced; female has spermatheca;
- $2n = 38$ or fewer.

CONTENT: 6 families:

Family PLETHODONTIDAE Gray, 1850

(interpretations differ as to whether this family and its sister family Amphiumidae are the most primitive branch of salamandroids, or whether the Proteidae may be more primitive)

CHARACTERIZATION:

- adults terrestrial, or neotenic aquatic;
- aquatic eggs and larvae, or terrestrial eggs with direct development;

- nasolabial groove present;
- no lungs in any form or stage;
- premaxillae usually paired, but fused in some;
- pterygoid cartilaginous in larvae and neotenes, absent in terrestrial adults;
- lacrimals and ypsiloid cartilage absent;
- operculum absent, functionally replaced by columella foot-plate;
- vertebrae opisthocelous;
- shape and size variable, smallest reach only 27 mm, largest about 325 mm;
- $2n = 26$ or 28 .

DISTRIBUTION: Eastern US and Canada, west coast of North America, central Mexico to Peru and Bolivia; southeastern France, northwestern Italy and Corsica.

CONTENT: 29 Recent genera in 2 subfamilies, including 304 species.

Subfamily DESMOGNATHINAE Cope, 1859

Skull well ossified, strong tendon in *M. temporalis* immobilizes mandible, highly developed *gularis* muscles; aquatic eggs and larvae, semi-terrestrial adults; 4 larval gill slits; 3 Recent genera, 18 living species.

Desmognathus Baird, 1850 (16 spp); eastern US.

Leurognathus Moore, 1899 (1 sp); southern Appalachian Mts. of US.

Phaeognathus Highton, 1961 (1 sp); south-central Alabama.

Desmognathus contains small, mainly streamside forms of eastern 2/3 of US and adjacent Canada; *Leurognathus marmoratus* is monotypic aquatic form in Smoky Mountain area, Virginia, Georgia; *Phaeognathus hubrichti* is a large (monotypic) fossorial form restricted to small region in southern Alabama.

Subfamily PLETHODONTINAE Gray, 1850

Skull usually well-ossified, mandible normal, 3 larval or embryonic gill slits; 286 living species in 3 well-defined tribes:

Tribe PLETHODONTINI Wake, 1966

No aquatic larvae, terrestrial eggs with direct development in most; large ossified 2nd basibranchial; 3 Recent genera with 54 living species.

Aneides Baird, 1849 (6 spp); southern Appalachians; New Mexico; British Columbia to Calif.

Ensatina Gray, 1850 (1 sp); British Columbia to southern California.

Plethodon Tschudi, 1838 (47 spp); eastern US and Canada; west coast of N. Amer. to south-central California; Rocky Mts in Idaho and New Mexico.

Tribe MYCETOGLOSSINI Bonaparte, 1850 (=HEMIDACTYLINAE Wake, 1966)

Aquatic larvae, many obligate neotenes; 8 Recent genera with 25 species.

Eurycea Rafinesque, 1822 (13 spp); eastern US, west to Texas.

Gyrinophilus Cope, 1869 (4 spp); northeast US to southern Appalachians.

Haideotriton Carr, 1939 (1 sp); south Georgia and Florida panhandle.

Hemidactylium Tschudi, 1838 (1 sp); eastern US.

Pseudotriton Tschudi, 1838 (2 spp); eastern US.

Stereocheilus Cope, (1 sp); southwest Virginia to eastern Georgia.

Typhlomolge Stejneger, 1896 (2 spp); central Texas, subterranean waters.

Typhlotriton Stejneger, 1893 (1 sp); Ozark Plateau in south-central US.

Tribe BOLITOGLOSSINI Wake, 1966

No aquatic larvae, terrestrial eggs with direct development; no 2nd basibranchial; 15 Recent genera with 214 living species, arranged by Wake in 3 supergenera:

Supergenus *Batrachoceps*

Batrachoceps Bonaparte, 1839 (15 spp); west coast of N. America.

Supergenus *Hydromantoides*

Hydromantoides Lanza & Vanni, 1981 (3 spp); central California.

Speleomantis Dubois, 1984 (6 spp); France, Italy, Sardinia.

Supergenus *Bolitoglossa* (12 genera, 190 spp)

Bolitoglossa Dumeril, Bibron, Dumeril, 1854 (79 spp); northeastern Mexico to Para, Brazil and northern Bolivia.

Bradytriton Wake & Elias 1983 (1 sp); Guatemala.

Chiropterotriton Taylor, 1944 (12 spp); northeastern Mexico to Costa Rica.

Dendrotriton Wake & Elias, 1983 (5 spp); southern Mexico and western Guatemala.

Ixalotriton Wake & Johnson 1989 (1 sp); southern Mexico.

Lineatriton Tanner, 1950 (1 sp); southeastern Mexico and Guatemala.

Nototriton Wake & Elias, 1983 (16 spp); Guatemala to Costa Rica.

Nyctanolis Wake & Elias, 1983 (1 sp); Guatemala and adjacent Mexico.

Oedipina Keferstein, 1868 (17 spp); northern Central America to northwest Ecuador.

Parvimolge Taylor, 1944 (1 sp); eastern Mexico.

Pseudoeurycea Taylor, 1944 (32 spp); northeast Mexico to Guatemala.

Thorius Cope, 1869 (24 spp); mountains of southern Mexico.

Family AMPHIUMIDAE Cope, 1866

CHARACTERIZATION:

- Incomplete metamorphosis; adults permanently aquatic neotenes; no eyelids;
- lungs present in adult, gills lost, single pair of gill slits open;
- no costal or nasolabial grooves;
- prevomer with posterior extensions;
- teeth on maxilla, premaxilla, prevomer; prevomerine row parallels maxillary;
- vertebrae amphicoelous, with neural ridge and paired hypophyses;
- pterygoid ossified; ypsiloid cartilage absent;
- limbs and girdles present, but very reduced;
- columella free; operculum absent;
- rectus abdominis muscles absent;
- body elongate, eel-like, to > 1 m total length;
- 2n = 28.

DISTRIBUTION: Southeastern U.S.

CONTENT: One Recent genus with 3 living species.

Amphiuma Garden, 1821 (3 spp); southeastern US.

Family RHYACOTRITONIDAE Tihen, 1958

- Premaxillae paired; nasals absent;
- pterygoids and ypsiloid cartilage reduced;
- lungs reduced;
- exoccipital, prootic, and opisthotic separate; skull not very solid; conical teeth;
- columella perforate, free from operculum; no operculum or opercularis muscle;
- vertebrae amphicoelous;
- pair of squared-off glands posterior to vent;
- 2n = 26.

DISTRIBUTION: northwestern US.

Rhyacotriton Dunn, 1920 (4 spp).

Family PROTEIDAE Tschudi, 1839

(many features argue this to be the most primitive salamandroid family)

CHARACTERIZATION:

- No metamorphosis; permanently aquatic neotenes; no eyelids;
- adults retain 3 branchial arches bearing external gills and 2 open gill slits;
- maxilla absent; teeth on premaxilla and prevomer, parallel rows;
- vertebrae amphicoelous;
- columella free; operculum absent;
- pterygoid partly ossified; ypsiloid cartilage absent;

- costal grooves present;
- lungs present in adults;
- 2n = 38.

DISTRIBUTION: Southern Europe and eastern U.S.

CONTENT: 2 Recent genera, with 7 living species.

Necturus Rafinesque, 1819 (6 spp); eastern U.S.

Proteus Laurenti, 1768 (1 sp.); Italy, Yugoslavia.

Family SALAMANDRIDAE Grady, 1825

CHARACTERIZATION:

- Complete metamorphosis; typically a terrestrial eft stage and aquatic adult;
- lungs present in adult;
- costal grooves absent or obscure; no nasolabial grooves;
- prevomer with posterior toothed process, forming long row along parasphenoid.
- vertebrae opisthocoelous, usually with neural ridge;
- pterygoid ossified; columella fused to otic, operculum free;
- ypsiloid cartilage present in pelvic girdle;
- otoglossal muscle absent or poorly developed;
- rectus abdominis profundus muscle present in some species;
- newts; rather small, to ca. 225 mm total length;
- 2n = 22 or 24.

DISTRIBUTION: Europe, Middle East, Asia, North America.

CONTENT: 15 Recent genera, 56 species.

Chioglossa Bocage, 1864 (1 sp); southern Europe.

Cynops Tschudi, 1839 (7 spp); China, Japan.

Echinotriton Nussbaum & Brodie, 1982 (3 spp); China.

Euproctus Gene, 1838 (3 spp); Sardinia, Corsica.

Mertensiella Wolterstorff, 1925 (2 spp); Mediterranean area.

Neurergus Cope, 1862 (4 spp); Middle East.

Notophthalmus Rafinesque (3 spp); eastern US and northeastern Mexico.

Pachytriton Boulenger, 1878 (2 sp); southern China.

Paramesotriton Chang, 1935 (6 spp); eastern Asia.

Pleurodeles Michahelles, 1830 (2 spp); Spain, north Africa.

Salamandra Laurenti, 1768 (3 spp); Europe, north Africa, Asia.

Salamandrina Fitzinger, 1826 (1 sp); Italy.

Taricha Gray, 1850 (3 spp); west coast of North America.

Triturus Rafinesque, 1815 (12 spp); Europe, Asia Minor.

Tylotriton Anderson, 1871 (4 spp); eastern Asia.

Family AMBYSTOMATIDAE Hallowell, 1856

CHARACTERIZATION:

- Aquatic eggs and larvae (*A. opacum* has terrestrial eggs);
- adults usually terrestrial, but some neotenic (both obligate and facultative) and aquatic;
- terrestrial adults have lungs; larvae and neotenic adults retains gills;
- premaxillae paired; septomaxillae and pterygoid bones present;
- vertebrae amphicoelous, no neural ridge;
- ypsiloid cartilage present in pelvic girdle;
- prevomer not extending over parasphenoid;
- lacrimal fused with other elements, not an independent bone;
- prootic, opisthotic, and exoccipital fused;
- columella fused with operculum;
- 2n = 28.

DISTRIBUTION: Southeastern Alaska and Labrador, south throughout the US, and into Mexico on the Mexican Plateau.

CONTENT: 1 Recent genus.

Ambystoma Tschudi, 1838 (33 spp); range as for family.

Family DICAMPTODONTIDAE Tihen, 1958

CHARACTERIZATION:

- Premaxillae paired; nasals present;
- septomaxillae, lacrimals, and ypsiloid cartilage well-developed;
- pterygoid prominent;
- exoccipital, prootic, and opisthotic separate; skull rigid; compressed bladelike teeth;
- columella perforate, free from operculum;
- vertebrae amphicoelous;
- $2n = 28$.

DISTRIBUTION: Northwestern US and adjacent Canada.

CONTENT: 1 Recent genus.

Dicamptodon Strauch, 1870 (4 spp); northern Idaho, Pacific coastal California to southern British Columbia.

D. ensatus adults terrestrial and arboreal, reach 29 cm total length. *D. copei* usually permanently aquatic neotenes, but naturally metamorphosed individuals have been found.

Order GYMNOPIHIONA Rafinesque, 1814

CHARACTERIZATION:

- Body elongate, cylindrical, segmented by annular grooves;
- no limbs or limb girdles;
- tail short and pointed, or absent;
- eyes reduced or vestigial, covered by skin or bone;
- protrusile tentacular organ present on side of head;
- left lung very reduced;
- vertebrae amphicoelous;
- skull compact, several fusions;
- columella large or absent;
- curved teeth present on premaxilla, maxillopalatines, vomers, dentaries, splenials;
- ribs present, numerous;
- aquatic larvae, when present, have gill slits but no external gills;
- males have evertible cloaca (phalloseum) for copulation; internal fertilization, oviparous or viviparous.

DISTRIBUTION: Pantropical, with 3 families in southeastern Asia, 2 in tropical Africa (1 endemic), 3 families in tropical America (absent from Australia).

Fossils from Jurassic of Arizona, Cretaceous of Bolivia & Sudan, Paleocene of Brazil.

CONTENT: 5 families, with a total of 35 extant genera, 169 species.

Family RHINATREMATIDAE Nussbaum, 1977

CHARACTERIZATION:

- tail present;
- mouth terminal;
- dermal microscales embedded in skin;
- tentacle adjacent to anterior edge of nostril;
- skull zygotrophic;
- premaxillae separated from nasals;
- septomaxillae and postfrontals present, prefrontals absent;
- squamosals do not articulate with frontal;
- temporal fossa present;
- vomers separated by process of parasphenoid;
- columella perforated, movably articulated with quadrate;
- oviparous, aquatic or mud-dwelling larvae, terrestrial to fossorial adults;
- small; largest to 328 mm.

DISTRIBUTION: Lowland tropical South America; Guianan region, Venezuela to Peru.

CONTENT: 2 Recent genera, with 9 living species.

Epicrinops Boulenger, 1883 (8 spp); northwestern So. Amer.

Rhinatrema Dumeril & Bibron, 1841 (1 sp); northeastern So. Amer.

Family ICHTHYOPHIIDAE Taylor, 1968

CHARACTERIZATION:

- short tail present;
- mouth subterminal;
- 2-4 secondary skin folds per body segment;
- tentacle between eye and nostril;
- dermal microscales present;
- skull stegotrophic;
- prevomer separated from nasals;
- vomers in contact medially;
- septomaxillae, prefrontals and usually postfrontal present;
- squamosal articulates with frontal;
- no temporal fossa;
- oviparous;

- free-swimming aquatic larval stage with 1 or 2 gill slits (embryonic gills absorbed at hatching), adults fossorial;
- moderate size, up to 500 mm.

DISTRIBUTION: Southeastern Asia.

CONTENT: 2 genera with 37 species.

Caudacaecilia Taylor, 1968 (5 spp); Malaya, Sumatra, Borneo, Philippines.

Ichthyophis Fitzinger, 1826 (32 spp); India, Sri Lanka, southeast Asia, southern Philippines, western Indonesia.

Family URAEOTYPHLIDAE Nussbaum, 1979

CHARACTERIZATION:

- short tail present;
- dermal microscales present;
- mouth recessed;
- skull somewhat stegokrotaphic;
- premaxillae separated from nasals;
- septomaxillae, prefrontals, postfrontals present;
- columella unperforated;
- squamosal articulates with frontal;
- small temporal fossa present;
- vomers in contact medially;
- life history unknown, presumably oviparous, possibly with direct development;
- small, usually <300 mm.

DISTRIBUTION: Southern India.

CONTENT: 1 genus.

Uraeotyphlus Peters, 1879 (4 spp); southern India.

Family SCOLECOMORPHIDAE Taylor, 1969

CHARACTERIZATION:

- No tail;
- recessed mouth;
- no secondary skin folds;
- no scales;
- skull modified zygokrotaphic;
- distinct, separate premaxillae, septomaxillae, and nasals;
- columella absent;
- no postfrontals or pterygoid;
- squamosal does not articulate with frontal;
- temporal fossa tiny or absent;
- vomers in contact medially;
- no teeth on splenial;
- eye covered by bone;
- viviparous, no larvae (small adult form born alive); adults fossorial;
- moderately large, to ca. 450 mm total length.

DISTRIBUTION: African region.

CONTENT: 2 Recent genera with 5 species.

Crotaphatrema Nussbaum, 1985 (2 spp); Cameroon (may be oviparous).

Scolecomorphus Boulenger, 1883 (3 spp); east and west central Africa.

Family CAECILIIDAE Gray, 1825

CHARACTERIZATION:

- No tail;
- mouth recessed;
- secondary skin folds absent anteriorly, or entire length in some;
- dermal scales present or absent;
- premaxillae fused with nasals;

- septomaxillae, prefrontals, and usually postfrontals absent;
- no temporal fossa (except in *Geotrypetes*);
- squamosal articulates with frontal;
- pterygoids fused with maxillopalatines;
- vomers usually contact medially (separated by process of parasphenoid in some);
- columella firmly articulates with quadrate; perforated or not;
- oviparous with direct development, or viviparous with or without aquatic larvae (few have life history known); adults fossorial or aquatic;
- some very small (<100 mm), others very large (to > 1.5 m).

DISTRIBUTION: Mexico to South America; India, Africa, and Seychelles Iss.

CONTENT: 29 Recent genera with 95 living species, placed in 3 subfamilies:

Subfamily CAECILIINAE Gray, 1825

Fossorial adults; maxillary and premaxillary teeth enlarged. 4 genera, 48 species.

Caecilia Linnaeus, 1758 (32 spp); Panama and northern So. Amer.

Microcaecilia Taylor, 1968 (5 spp); northern So. Amer.

Oscacaecilia Taylor, 1968 (9 spp); northern So. Amer.

Parvicaecilia Taylor, 1968 (2 spp); northern Colombia.

Subfamily DERMOPHIINAE Taylor, 1969

Fossorial; maxillary and premaxillary teeth not enlarged. 18 Recent genera with 42 living species.

Afrocaecilia Taylor, 1968 (3 spp); east Africa.

Boulengerula Tornier, 1897 (3 sp); east Africa.

Brasilotyphlus Taylor, 1968 (1 sp); Brazil.

Dermophis Peters, 1879 (3 spp); southern Mexico to northwest Colombia.

Gegeniophis Peters, 1879 (3 spp); southern India.

Geotrypetes Peters, 1880 (3 spp); tropical western Africa.

Grandisonia Taylor, 1968 (5 spp); Seychelles Iss.

Gymnopsis Peters, 1874 (2 spp); Honduras to Panama.

Herpele Peters, 1879 (2 spp); tropical west Africa.

Hypogeophis Peters, 1879 (1 sp); Seychelles Iss.

Idiocranium Parker, 1936 (1 sp); Nigeria.

Indotyphlus Taylor, 1960 (1 sp); India.

Leutenotyphlus Taylor, 1968 (1 sp); southeast Brazil.

Mimosiphonops Taylor, 1968 (2 sp); southeast Brazil.

Praslinia Boulenger, 1909 (1 sp); Seychelles Iss.

Schistometopum Parker, 1941 (4 spp); tropical Africa.

Siphonops Wagler, 1830 (5 spp); tropical So. Amer. east of the Andes.

Sylvacaecilia M. Wake, 1987 (1 sp.); tropical West Africa.

Subfamily TYPHLONECTINAE Taylor, 1968

Teeth not enlarged; aquatic adults and larvae, posterior body laterally compressed; choanae valvular; no dermal scales; temporal fossa present; vomers in contact medially; columella imperforate, rigidly attached to quadrate; viviparous; gill slits close before birth. Five recent genera with 17 species in tropical South American freshwater.

Atretochoana Nussbaum & Wilkinson, 1995 (1 sp); South America.

Chthonerpeton Peters, 1879 (7 spp); southern Brazil, Uruguay and northern Argentina.

Nectocaecilia Taylor, 1968 (3 spp); South America north of Amazon.

Potomotyphlus Taylor, 1968 (1 sp); northern South America.

Typhlonectes Peters, 1879 (5 spp); northern South America.

Superorder SALIENTIA Laurenti, 1768

CHARACTERIZATION:

- Trunk short, fused with head (no neck);
- 2 pairs of limbs present in adult, pelvics generally much larger than pectorals;
- 15 or fewer presacral vertebrae;
- teeth absent from dentary (except one living species);
- lacrimal, postorbital, jugal, postfrontal, postparietal, tabular, supratemporal, supraoccipital, basioccipital, and ectopterygoid absent;
- aquatic larvae, when present, without true teeth; usually internal gills with branchial baskets.

CONTENT: 1 living Order, plus one fossil order (Proanura) with one family (Protobatrachidae) and a single monotypic genus (*Triadobatrachus*), from early Triassic of Madagascar.

Order ANURA Rafinesque, 1815

CHARACTERIZATION:

- No tail in adult;
- astragalus and calcaneum (tarsals) elongated, at least partly fused;
- 5 to 9 presacral vertebrae;
- urostyle present (fusion of some post-sacral vertebrae);
- fertilization external (except in a few specialized species); usually aquatic eggs and larvae, but with many exceptions.

DISTRIBUTION: Generally cosmopolitan except for extreme north and south polar areas, some oceanic islands, and certain very xeric desert areas. Greatest radiation and diversity in tropical regions. South America has 13 families, 10 occur in Africa proper, 4 in Madagascar, 7 in tropical Asia/Indonesia, 7 in temperate North America, 6 in temperate Eurasia, 4 in Australian region; 1 is endemic to the Seychelles Iss.

CONTENT: 24-28 Recent families, including 343 Recent genera with 4461 living species.

(there are several formal arrangements of anurans in suborders and/or superfamilies, but all seem paraphyletic; this follows Duellman and Trueb, 1986, in listing the families in approximate phylogenetic sequence, without any supra-familial groupings. The more modern families seem to form a monophyletic clade, Neobatrachia; the more primitive ones may be called Archaeobatrachia, with intermediate families sometimes called Mesobatrachia, but such an assemblage is probably polyphyletic)

“Archaeobatrachia”

Family LEIOPELMATIDAE Mivart, 1869

CHARACTERIZATION:

- 9 amphicoelous, ectochordal, presacral vertebrae, separated by undivided intervertebral elements; persistent notochord;
- sternum cartilaginous; omosternum present;
- urostyle with one condyle;
- arciferal pectoral girdle;
- clavicle does not overlie scapula;
- maxillary and premaxillary teeth;
- astragalus and calcaneum fused only at ends;
- a pair of “tail-wagging” muscles present in adult;
- *sartorius* muscle not separate from *semitendinosus*;
- pupil vertically elliptical;
- oviparous, eggs terrestrial; development direct;
- adults terrestrial or semi-aquatic; average size ca. 35 mm SVL;
- $2n = 22$ to 30 (11 pairs macrochromosome, 0-8 pairs microchromosomes);
- sperm with 3 tail filaments (unique).

DISTRIBUTION: New Zealand (the only frogs native there).

CONTENT: 1 genus and 3 living species.

Leiopelma Fitzinger, 1861 (3 spp); New Zealand (3 additional subfossil species described from Holocene of New Zealand).

Family ASCAPHIDAE Fejervary, 1923

CHARACTERIZATION:

- 9 presacral, ectochordal vertebrae, separated by undivided intervertebral elements; amphicoelous with persistent notochord;
- sternum cartilaginous; omosternum present;
- free ribs present;
- urostyle with one condyle;
- pectoral girdle arciferal;
- clavicle overlies scapula;
- maxillae and premaxillae bear teeth;
- astragalus and calcaneum fused at ends only;
- a pair of “tail-wagging” muscles in adult;
- *sartorius* not a separate muscle (fused with *semitendinosus*);
- aquatic larvae (Type III), with adhesive pad on head;
- pupil of eye vertically elliptical;
- internal fertilization (male uses permanently everted cloaca for copulation); adults semi-terrestrial near fast, cool montane streams;
- $2n = 46$ (5 pair macrochromosomes, 18 pair microchromosomes);
- Sperm head elongate, slightly helical; 2 tail filaments, very long.

DISTRIBUTION: northwestern US and adjacent Canada.

CONTENT: One Recent genus and species.

Ascaphus Stejneger, 1899 (1 sp., *A. truei*); distribution as for family.

The “Bell Toad” or “Tailed Frog.” Male appears tailed; has permanently everted cloaca. No advertisement call; male swims about, find female and amplexes. Female deposits eggs under rocks in stream near shore. Tolerate low temperatures (mid 30's to upper 40's F; die above 60 F or so).

While *Ascaphus* and *Leiopelma* share a number of primitive characters, there are no derived characters in common, and the geographic ranges are extremely separated. In spite of this, many workers (followed by both Frost, 1985, and Duellman & Trueb, 1986) place them together in one family (Leiopelmatidae), based on the presence of 2 fossil species (placed in different genera) from the Jurassic of Argentina. These fossils share the same primitive characters, leading to the interpretation of a single family of widespread primitive frogs. This synopsis recognizes separate families based on lack of any apomorphies, and lack of sufficient fossils to connect the northern and southern hemisphere forms.

“Mesobatrachia”

Family DISCOGLOSSIDAE Günther, 1859

CHARACTERIZATION:

- 8 (rarely 9) opisthocoelous, stegochordal presacral vertebrae;
- cartilaginous sternum tri-radiate; cartilaginous omosternum, very reduced in some;
- ribs present, free, in larvae; fused with vertebrae in adult;
- urostyle with 1 or 2 condyles;
- arciferal pectoral girdle; clavicle partly overlies scapula;
- astragalus and calcaneum fused only at ends;
- teeth on premaxilla and maxilla;
- palatines absent;
- no “tail-wagging” muscles in adult;
- *sartorius* not a separate muscle from *semitendinosus*;
- pupil triangular or vertically elliptical;
- tongue definitive but attached all around (“disc-tongue”);
- external fertilization; aquatic eggs and larvae (Type III); adults essentially terrestrial;
- $2n = 22$ to 38 (22-28 macrochromosomes; one with 8 pairs of microchromosomes);
- sperm may have acrosomal filament; 2 tail filaments, in some tail applied to head and sweeps back along side (unique).

DISTRIBUTION: Widespread, with disjunct distribution in Eurasia, plus Philippines and Borneo.

CONTENT: 5 Recent genera with 18 living species (also 11 extinct species described for 8 fossil genera).

Alytes Wagler, 1830 (3 spp); Europe and northwest Africa. *A. obstetricans* is the “Midwife Toad.”

Baleaphryne Sanchiz and Alcover, 1977 (1 sp); Spain. Some consider a subgenus of *Alytes*.

Barbourula Taylor & Noble, 1924 (2 spp); large aquatic sp. in Philippines, another species in Borneo.

Bombina Oken, 1816 (6 spp); eastern Asia.

Discoglossus Otth, 1837 (6 spp); southern Europe, northwest Africa, Syria, Israel.

Bombina and *Alytes* share immunological characters, differing strongly from *Discoglossus*; a separate family (Bombinidae) has been proposed for *Bombina* and *Alytes*, leaving the others in Discoglossidae, pending further study. An alternative proposal retains the single family, with *Discoglossus*, *Baleaphryne* and *Alytes* in one subfamily (Discoglossinae) and the other genera in another subfamily (Bombinatorinae).

Family PELOBATIDAE Bonaparte, 1850

CHARACTERIZATION:

- 8 procoelous, stegochordal presacral vertebrae; notochord persistent in some;
- urostyle fused to sacrum;
- ribs absent;
- pectoral girdle arciferal;
- sternum ossified; omosternum cartilaginous;
- only ends of astragalus and calcaneum fused;
- teeth on maxilla and premaxilla;
- no separate *sartorius*, distinct from *semitendinosus*;
- pupil vertically elliptical;
- aquatic larvae (Type IV), complete metamorphosis, adults terrestrial or fossorial;
- $2n = 26$;
- sperm head usually twisted, tail appears as single filament but some actually 2 filaments (flagellae).

DISTRIBUTION: Southern US and Mexico; Eurasia and western Indo-Australian area.

CONTENT: 3 Recent genera with 11 living species (4 fossil genera with 13 species; *Scaphiopus* and *Spea* also have 8 fossil species).

Pelobates Wagler, 1830 (3 spp); Europe, western Asia, northwest Africa (“European Spadefoot Toads”).

Scaphiopus Holbrook, 1836 (3 spp); southwest US and north Mexico.

Spea Cope, 1866 (5 spp, 1 not yet named); western North America.

European spadefoots are terrestrial burrowers as adults; larvae hatch as immature embryos, 1/8 inch, without tail or gills, then tail and external gills develop, gills become internal, normal development continues to metamorphosis at about 3 months. American spadefoots are fossorial as adults; larva has accelerated development, especially in *Spea*.

Family MEGOPHRYIDAE Noble, 1931

(this family has been alternatively considered a subfamily of Pelobatidae, or separate family, many times in recent history; it is treated as a separate family here)

CHARACTERIZATION:

- 8 procoelous, stegochordal presacral vertebrae; notochord persistent in adults;
- urostyle usually free, with one condyle;
- ribs absent;
- pectoral girdle arciferal;
- sternum ossified; omosternum cartilaginous;
- only ends of astragalus and calcaneum fused;
- teeth on maxilla and premaxilla;
- no separate *sartorius*, distinct from *semitendinosus*;
- pupil vertically elliptical;
- aquatic larvae (Type IV), complete metamorphosis, adults terrestrial;
- $2n = 26$ (24 in one species);
- sperm head usually twisted, tail appears as single filament but some actually 2 filaments (flagellae).

DISTRIBUTION: India, China, Burma south to Vietnam and Malaysia.

CONTENT: 10 Recent genera with 89 living species in Asia and Indonesia.

Atympnanophrys Tian & Hu, 1983 (1 sp); China.

Brachytarsophrys Tian & Hu, 1983 (1 sp); China, Burma, Thailand.

Leptobranchella Smith, 1931 (7 spp); Borneo and adjacent islands.

Leptobranchium Tschudi, 1838 (6 spp); China, Viet Nam, Philippines, Indoaustralian archipelago south to Bali.

Leptolalax Dubois, 1980 (8 spp); southern China to Malaya and Borneo.

Megophrys Kuhn & van Hasselt, 1822 (22 spp); southeast Asia and Indoaustralian archipelago south to Borneo.

Ophryophryne Boulenger, 1903 (3 spp); north Vietnam, southern China.

Oreolalax Myers & Leviton, 1962 (16 spp); China. Some consider a subgenus of *Scutigera*.

Scutigera Theobald, 1868 (14 spp); China to India.

Vibrissaphora Liu, 1945 (4 spp); China.

Family PELODYTIDAE Bonaparte, 1850

(Some workers include Pelodytids as a subfamily of Pelobatidae; other evidence suggests they may not be closely related.)

CHARACTERIZATION:

- 8 procoelous, stegochordal presacral vertebrae, first 2 fused;
- ribs absent;
- pectoral girdle arciferal;
- sternum ossified; omosternum cartilaginous;
- urostyle free, 1 condyle;
- astragalus and calcaneum fused for entire length;
- teeth on maxilla and premaxilla;
- no separate *sartorius*, distinct from *semitendinosus*;
- pupil vertically elliptical;
- aquatic larvae (Type IV), complete metamorphosis, adults terrestrial or fossorial;
- $2n = 24$;
- sperm with long, needle-like acrosome, slightly spiral nucleus, 2 tail filaments.

DISTRIBUTION: Western Europe and southwest Asia, disjunct.

CONTENT: 1 Recent genus with 2 living species (also 2 monotypic fossil genera).

Pelodytes Fitzinger, in Bonaparte, 1838 (2 spp); range as for family.

Family RHINOPHRYNIDAE Günther, 1859

CHARACTERIZATION:

- 8 modified opisthocoelous, ectochordal presacral vertebrae;
- no ribs;
- urostyle with 2 condyles;
- pectoral girdle arciferal; no sternum or omosternum;
- clavicle partly overlies scapula; clavicle short, less than 2X scapula length;
- maxillae and premaxillae toothed; no palatines;
- astragalus and calcaneum fused only at ends;
- *sartorius* is a distinct muscle; no tail-wagging muscles in adult;
- tongue moderately well developed;
- pupil vertical;
- external fertilization; aquatic eggs, aquatic larva with 5 pairs of barbels around mouth;
- adults with tiny head, short limbs, fossorial; SVL ca. 75 mm;
- short sperm with twisted head; tail appears single;
- $2n = 22$.

DISTRIBUTION: lowlands from extreme southern Texas south to Costa Rica (fossils known from Eocene of Wyoming and Oligocene of southwest Canada).

CONTENT: 1 Recent genus with 1 living species (a second fossil species, plus a fossil genus and species).

Rhinophrynus Dumeril & Bibron, 1841 (1 sp); range as for family.

R. dorsalis is a peculiar burrowing toad. Like North American Spadefoot Toads, the “Mexican Burrowing Toad” is on the surface only after liberal rains; opportunistic, explosive breeders, found in huge numbers in temporary rain water, otherwise rarely seen; aestivates for long periods of drought.

Family PIPIDAE Gray, 1825

CHARACTERIZATION:

- 6 to 8 opisthocoelous, stegochordal presacral vertebrae;
- free ribs in larva and young adults, fuse to vertebrae in mature adults;
- pectoral girdle pseudofirmisternal;
- clavicle overlies end of scapula (*Pipa*), or fused to scapula in others;
- expanded cartilaginous sternum, no omosternum;
- urostyle fused to sacrum;
- no palatines;
- non-pedicellate teeth on maxilla and premaxilla in some, teeth absent in others;
- *sartorius* not distinct from *semitendinosus* muscle;
- no definitive tongue (“tongueless frogs”), unique;
- aquatic larva (Type I) has one pair of barbels;
- adults aquatic; eyelids absent or very reduced (pupil round), retain lateral line organs, extensive digital webbing;
- $2n = 20, 22, 24, 30$; some species of *Xenopus* are polyploid, up to $12n = 108$;
- sperm with short, helical head, single tail filament.

DISTRIBUTION: South America and Africa.

CONTENT: 5 Recent genera with 28 living species (plus 5 fossil genera with 6 species, and 6 fossil species of *Xenopus* and *Silurana*). Sometimes divided into 2 subfamilies, with *Pipa* in the Pipinae and the others in Xenopodinae, but this seems artificial. More recent study subdivides family into Xenopodinae (*Xenopus*), Siluraninae (*Silurana*), and Pipinae (all others).

Hymenochirus Boulenger, 1896 (4 spp); tropical west Africa.

Pipa Laurenti, 1768 (7 spp); eastern Panama to northern South America.

Pseudohymenochirus Chabanaud, 1920 (1 sp); west Africa.

Silurana Gray, 1864 (2 spp); sub-saharan Africa (2 fossil species from South America).

Xenopus Wagler, 1827 (14 spp); sub-saharan Africa.

Pipa (Surinam toads) deposit 3-5 eggs at a time, male rolls them up female's back with his belly, presses them into “pits” on her back; these “heal” over, later froglets (direct development) break through skin. One species sometimes placed in a separate genus (*Protopipa*).

Best known species is *Xenopus laevis* (“clawed frog”). All except *Pipa* have claw-like keratinized epidermal digit tips on 2 or 3 toes. *X. laevis* was first human pregnancy test animal; also used in embryological research because eggs non-pigmented. Importation of this and other large species now banned, at least in California and Arizona; escapees apparently feed on native fish and frog fauna, and their eggs, threatening the native forms.

“Neobatrachia”

(the first 11 families of neobatrachians are often called BUFONOIDEA, which is probably monophyletic; the first 8 are often called the LEPTODACTYLOIDEA)

Family ALLOPHRYNIDAE Goin, Goin & Zug, 1978

CHARACTERIZATION:

- 8 procoelous, holochordal presacral vertebrae, all free;
- ribs absent;
- urostyle free with 2 condyles;
- pectoral girdle arciferal;
- sternum cartilaginous, omosternum absent;
- clavicle does not overlie scapula;
- palatines usually present;
- teeth absent;
- intercalary element between penultimate and terminal phalanx of each digit;
- *sartorius* muscle separate and distinct;
- pupil horizontal;
- aquatic larvae (Type IV);
- adults with small digital pads, arboreal.

DISTRIBUTION: Guianan region of South America.
CONTENT: monotypic.
Allophryne Gaige, 1926 (1 sp); distributed as for family.

Family MYOBATRACHIDAE Schlegel, 1850

CHARACTERIZATION:

- 8 procoelous, ectochordal presacral vertebrae, with fusion of first 2 in some; larvae and young adults have intervertebral elements free (amphicoelous), procoelous in mature adults by fusion of intervertebral disc to posterior centrum;
- notochord persists in adults;
- pectoral girdle arciferous;
- clavicle does not overlie scapula;
- ribs absent;
- urostyle free with 2 condyles;
- sternum cartilaginous; cartilaginous omosternum usually present;
- palatines present;
- teeth usually present on maxilla and premaxilla;
- astragalus and calcaneum fused only at ends;
- *sartorius* muscle usually distinct;
- pupil usually horizontal, but vertical in 4 genera;
- life histories broadly variable, most have aquatic larva (Type IV);
- $2n = 24$ (22 in a few species);
- sperm with 2 tail filaments, a thinner one undulating about a thicker axial one.

DISTRIBUTION: Australia and New Guinea.

CONTENT: 21 Recent genera with 116 living species in 2 subfamilies; there is evidence that while the two subfamilies are monophyletic, the family may not be, so they might better be treated as separate families.

Subfamily LIMNODYNASTINAE Lynch, 1971

First 2 vertebrae usually fused; vomer well-developed, with teeth; omosternum usually present; aquatic eggs and larvae, one is gastric brooder. 11 Recent genera with 51 living species.

Adelotus Ogilby, 1907 (1 sp); Australia.

Heleioporus Gray, 1841 (6 spp); Australia.

Kyarranus Moore, 1958 (3 spp); Australia.

Lechriodus Boulenger, 1882 (5 spp); Australia, New Guinea.

Limnodynastes Fitzinger, 1843 (12 spp); Australia, Tasmania, New Guinea.

Megistolotis Tyler, Martin & Davies, 1979 (1 sp); Australia.

Mixopyhyes Günther, 1864 (6 spp); Australia and New Guinea.

Neobatrachus Peters, 1863 (11 spp); Australia.

Notaden Günther, (4 spp); Australia.

Philoria Spencer, 1901 (1 sp); Australia.

Rheobatrachus Liem, 1973 (2 spp); Australia.

Subfamily MYOBATRACHINAE Schlegel, 1850

All vertebrae free; vomer usually reduced; omosternum absent in some; most with aquatic larvae, although some have direct development. 10 Recent genera with 65 living species.

Arenophryne Tyler, 1976 (1 sp); Australia.

Assa Tyler, 1972 (1 sp); Australia.

Crinia Tschudi, 1838 (14 spp); Australia, Tasmania, New Guinea. Some spp. often separated into a genus *Ranidella*.

Geocrinia Blake, 1973 (6 spp); Australia, Tasmania.

Metacrinia Parker, 1940 (1 sp); southwestern Australia.

Myobatrachus Schlegel, 1850 (1 sp); Australia.

Paracrinia Heyer & Liem, 1976 (1 sp); Australia.

Pseudophryne Fitzinger, 1843 (10 spp); Australia, Tasmania.

Taudactylus Straughan & Lee, 1966 (6 spp); Australia.

Uperoleia Gray, 1841 (22 spp); Australia, New Guinea.

Family HELEOPHRYNIDAE Noble, 1931

CHARACTERIZATION:

- 8 ectochordal presacral vertebrae, separate cartilaginous intervertebral disks;
- notochord persistent;
- ribs absent;
- urostyle free with 2 condyles;
- pectoral girdle arciferal;
- cartilaginous sternum and omosternum present;
- clavicle does not overlie scapula;
- palatines present;
- teeth on maxilla and premaxilla;
- astragalus and calcaneum fused at ends only;
- *sartorius* is a distinct muscle;
- pupil vertically elliptical;
- aquatic larvae (Type IV), lack a horny beak;
- $2n = 26$;
- sperm head long and thin, with 2 closely applied tail filaments.

DISTRIBUTION: South Africa.

CONTENT: 1 Recent genus with 5 living species.
Heleophryne Sclater, 1898 (5 spp); South Africa.

Family SOOGLOSSIDAE Noble, 1931

CHARACTERIZATION:

- 8 procoelous, ectochordal presacral vertebrae; persistent notochord; in larvae and young adults vertebrae are amphicoelous with free intervertebral elements which fuse with centra in mature adults to give procoelous.
- ribs absent;
- urostyle free with one condyle;
- pectoral girdle arciferal;
- bony sternum and cartilaginous omosternum;
- clavicle does not overlie scapula;
- palatines present;
- teeth on maxilla and premaxilla;
- astragalus and calcaneum fused only at ends;
- *sartorius* muscle separate and distinct;
- pupil horizontal;
- no intercalary phalanges;
- terrestrial eggs, development direct, or from non-feeding larvae carried on male back;
- $2n = 26$;
- sperm head in circular coil, single tail filament.

DISTRIBUTION: Seychelles Islands.

CONTENT: 2 Recent genera with 3 living species.

Nesomantis Boulenger, 1909 (1 sp); Mahe and Silhouette.

Sooglossus Boulenger, 1906 (2 spp); Mahe and Silhouette.

These genera have been included in the Ranidae, as a subfamily of Ranids, as a family of Ranoids, as Pelobatids, or most recently as a separate family derived from Myobatrachids. Their relationships are still controversial.

Family LEPTODACTYLIDAE Werner, 1896

CHARACTERIZATION:

- 8 procoelous, holochordal presacral vertebrae (rarely stegochordal);
- first 2 vertebrae free (fused in one genus);
- ribs absent;
- urostyle free, with 2 condyles;
- pectoral girdle arciferal (rarely pseudofirmisternal);
- sternum cartilaginous; cartilaginous omosternum present in most;
- clavicle does not overlie scapula;

- palatines present;
- teeth usually present on maxilla and premaxilla;
- astragalus and calcaneum fused only at ends (except completely fused in *Geobatrachus*);
- no intercalary phalanges;
- *sartorius* is distinct and separate;
- pupil mostly horizontal, but vertical in some;
- typically with aquatic larvae (Type IV), but direct development in some;
- $2n = 18$ to 36 ; some species are polyploids;
- sperm form varies with taxa.

DISTRIBUTION: Neotropical; primary radiation in South America, extending north through Middle America, a few entering southern US.

CONTENT: 50 Recent genera with 983 species, in 4 subfamilies (recent studies indicate that this family as currently constituted may be paraphyletic, or even polyphyletic; some subfamilies recognized here may be paraphyletic).

Subfamily CERATOPHRYINAE Tschudi, 1838

A few long, pointed maxillary teeth (non-pedicellate); large head, huge mouth, adults often cannibalistic; aquatic eggs and larvae; $2n = 26$, some polyploid; sperm with 2 unequal tail filaments. 2 Recent genera (plus 1 fossil genus), with 10 living species.

Ceratophrys Wied, 1824 (7 spp); discontinuous in tropical and subtropical South America.

Lepidobatrachus Budgett, 1899 (3 spp); Paraguay and Argentina.

Subfamily TELMATOBIINAE Fitzinger, 1843

Maxillary teeth pedicellate or absent; sternum elements entirely cartilaginous; some with aquatic eggs and larvae, others with terrestrial eggs and direct development. 34 Recent genera with 802 species, arranged in 6 tribes (this arrangement is tenuous):

Tribe TELMATOBIINI

Large omosternum; massive clavicles; aquatic eggs and larvae; $2n = 26$ (rarely 22 or 30); 11 Recent genera with 72 living species in western So. Amer.

Alsodes Bell, 1843 (12 spp); Argentina, Chile.

Atelognathus Lynch, 1978 (8 spp); Argentina, Chile.

Batrachophrynus Peters, 1873 (1 sp); Peru.

Eupsophus Fitzinger, 1843 (8 spp); Argentina, Chile.

Hylorina Bell, 1843 (1 sp); Chile.

Insuetophrynus Barrio, 1970 (1 sp); Chile.

Lynchophrys Laurent, 1984 (1 sp); Peru.

Somuncuria Lynch, 1978 (1 sp); Argentina.

Telmasodes Diaz, 1989 (2 spp); Chile.

Telmatobius Wiegmann, 1835 (45 spp); Ecuador to Argentina and Chile.

Telmatobufo Schmidt, 1952 (3 spp); Chile.

Tribe ELEUTHERODACTYLINI

Maxillary teeth usually present; direct development, usually terrestrial eggs (few, large). 13 Recent genera, 661 spp, in neotropics with a few ranging into southern US.

Adelophryne Hoogmoed & Lescure, 1984 (5 spp); Guiana shield, northeastern So. Amer.

Atopophrynus Lynch & Ruiz-Carrana, 1982 (1 sp); Colombia.

Barycholos Heyer, 1969 (2 spp); Ecuador, central Brazil.

Dischidodactylus Lynch, 1979 (2 spp); Venezuela.

Eleutherodactylus Dumeril & Bibron (608 spp); Mexico to Argentina, West Indies, introduced into Florida. (includes former separate *Syrrhophus* and *Tomodactylus*)

Euparkella Griffiths, 1959 (4 sp); southeast Brazil.

Geobatrachus Ruthven, 1915 (1 sp); northern Colombia.

Holoaden Miranda-Ribeiro, 1920 (2 spp); southeast Brazil.

Hylactophryne Lynch, 1968 (3 spp); southwestern US and Mexico.

Ischnocnema Reinhardt & Lutken, 1862 (5 spp); Brazil.
Ladailadne Dubois, 1987 (1 sp); Puerto Rico. (formerly in *Eleutherodactylus*)
Phrynopus Peters, 1874 (22 spp); Colombia to Bolivia.
Phyllonastes Heyer, 1977 (5 spp); upper Amazon Basin.
Phyzelaphryne Heyer, 1977 (1 sp); Brazil.

Tribe CYCLORAMPHINI (=GRYPISCINI)

Maxillary teeth present; eggs and larvae in moist terrestrial sites; $2n = 26$. 3 Recent genera with 30 living species in Brazil.

Crossodactylodes Cochran, 1938 (3 spp); southeast Brazil.
Cycloramphus Tschudi, 1838 (24 spp); southeast Brazil.
Zachaenus Cope, 1866 (3 spp); southeast Brazil.

Tribe BATRACHYLINI

2 Recent genera with 11 living species.

Batrachyla Bell, 1843 (6 spp); Argentina, Chile.
Thoropa Cope, 1865 (5 spp); southeast Brazil.

Tribe CALYPTOCEPHALELLINI (Monotypic)

Caudiverbera Laurenti, 1768 (1 sp); Chile.

Tribe ODONTOPHRYNINI

No omosternum; maxillary teeth; aquatic eggs and larvae; $2n = 22$, some species tetraploid or octoploid. 3 Recent genera with 26 living species.

Macrogenioglottus Carvalho, 1946 (1 sp); eastern Brazil.
Odontophrynus Reinhardt & Lutken, 1862 (9 spp); Brazil, Argentina, Bolivia, Paraguay.
Proceratophrys Miranda-Ribeiro, 1920 (16 spp); Brazil, Argentina.

Uncertain Tribe:

Scythrophrys Lynch, 1971 (1 sp); southeast Brazil.

Subfamily HYLODINAE Günther, 1859

Sternal elements all cartilage; maxillary teeth pointed, pedicellate; toes fringed; eggs deposited on land or in water; aquatic larvae with umbrella mouth; $2n = 26$; 3 Recent genera with 35 living species.

Crossodactylus Dumeril & Bibron, 1841 (12 spp); Brazil, Argentina.
Hylodes Fitzinger, 1826 (17 spp); southeast Brazil.
Megaelosia Miranda-Ribeiro, 1923 (6 spp); southeast Brazil.

Subfamily LEPTODACTYLINAE Werner, 1896

Bony elements in sternum; maxillary teeth usually present, pedicellate; foam nests; larvae aquatic or terrestrial; $2n = 18, 20, 22, 26$, one tetraploid species; sperm with 2 tail filaments. 11 Recent genera with 136 species.

Adenomera Steindachner, 1867 (6 spp); tropical So. America.
Edalorhina Jimenez de la Espada, 1870 (2 spp); western Amazon Basin.
Hydrolaetare Gallardo, 1963 (1 sp); Amazon Basin.
Leptodactylus Fitzinger, 1826 (50 spp); south Texas to Argentina, Hispaniola, Lesser Antilles.
Limnomedusa Fitzinger, 1843 (1 sp); Brazil, Argentina.
Lithodytes Fitzinger, 1843 (1 sp); Amazon basin and Guianan region.
Paratelmatobius Lutz & Carvalho, 1958 (3 spp); southeast Brazil.
Physalaemus Fitzinger, 1826 (41 spp); Mexico to Argentina.
Pleurodema Tschudi, 1838 (12 spp); Panama to southern Chile.
Pseudopaludicola Miranda-Ribeiro, 1926 (11 spp); tropical So. Amer.
Vanzolinius Heyer, 1974 (1 sp); upper Amazon basin.

Family BUFONIDAE Gray, 1825

CHARACTERIZATION:

- 5 to 8 procoelous, holochordal presacral vertebrae (less than 8 due to fusions);
- ribs absent;
- urostyle usually free with 2 condyles, but some have 1 condyle, or fused with sacrum;
- pectoral girdle usually arciferous, pseudofirmisternal in some;
- sternum bony, omosternum usually absent;
- clavicle does not overlie scapula;
- no intercalary phalanges;
- palatines present in most;
- no teeth on maxilla or premaxilla;
- astragalus and calcaneum fused only at ends;
- *sartorius* muscle distinct and separate;
- pupil horizontal;
- Bidder's Organ present, except in *Dendrophryniscus*;
- skin thick and glandular, often with pustular "warts";
- skull highly ossified, usually head skin co-ossified with skull;
- fertilization external in most (few have internal); most have aquatic eggs and larvae, some direct development and/or viviparous;
- $2n = 22$ (20 in some);
- sperm rather uniform, curved head, tail of 2 equal filaments.

DISTRIBUTION: Cosmopolitan except absent from Australia and Indo-Australian archipelago and Madagascar (one neotropical species, *B. marinus*, introduced and established in Australia, Japan, and several islands, including Hawaii, and also Florida).

CONTENT: 34 Recent genera with 427 living species.

Altiphrynoides Dubois, 1987 (1 sp); Ethiopia (formerly in *Nectophrynoides*).

Andinophryne Hoogmoed, 1985 (3 spp); Ecuador, Colombia.

Ansonia Stoliczka, 1870 (20 spp); India, Malay peninsula, Borneo, Philippines.

Atelophryniscus McCranie, Wilson & Williams, 1989 (1 sp); Honduras.

Atelopus Dumeril & Bibron, 1841 (68 spp); Costa Rica to Bolivia, Guianan region, eastern Brazil.

Bufo Laurenti, 1768 (225 spp); range as for family.

Bufoides Pillai & Yazdani, 1973 (1 sp); India.

Capensibufo Grandison, 1980 (2 spp); South Africa.

Crepidophryne Cope, 1889 (1 sp); Panama, Costa Rica.

Dendrophryniscus Jimenez de la Espada, 1871 (7 spp); Guianas to Brazil.

Didynamipus Andersson, 1903 (1 sp); Cameroon (Africa).

Frostius Cannatella, 1986 (1 sp); eastern Brazil.

Laurentophryne Tihen, 1960 (1 sp); Zaire (Africa).

Leptophryne Fitzinger, 1843 (2 spp); Malay region.

Melanophryniscus Gallardo, 1961 (11 spp); Brazil, Uruguay, Paraguay, Argentina.

Mertensophryne Tihen, 1960 (2 spp); central Africa.

Metaphryniscus Señaris, Ayarzagüena & Corzula, 1994 (1 sp); Venezuela.

Nectophryne Buchholz & Peters, 1875 (2 spp); western Africa.

Nectophrynoides Noble, 1926 (5 spp); central Africa.

Nimbaphrynoides Dubois, 1987 (2 spp); east Africa.

Oreophrynella Boulenger, 1895 (5 spp); Guyana, Venezuela.

Osornophryne Ruiz & Hernandez, 1976 (6 spp); Colombia, Ecuador.

Pedostibes Günther, 1875 (6 spp); Malaya, Sumatra, Borneo.

Pelophryne Barbour, 1938 (8 spp); China, Borneo, Philippines.

Peltophryne Fitzinger, 1843 (9 spp); Greater Antilles.

Pseudobufo Tschudi, 1838 (1 sp); Malaya, Sumatra, Borneo.

Rhamphophryne Trueb, 1971 (9 spp); Panama to Ecuador, northeast Brazil.

Schismaderma Smith, 1849 (1 sp); Zaire and Tanzania to South Africa.

Spinophrynoides Dubois, 1987 (1 sp); Africa.

Stephopaedes Channing, 1978 (2 spp); southeast Africa.

Truebella Graybeal & Cannatella, 1995 (2 spp); Peru.
Werneria Posch, 1903 (4 spp); west Africa.
Wolterstorffina Mertens, 1939 (2 spp); west Africa.

Family BRACHYCEPHALIDAE Günther, 1859

CHARACTERIZATION:

- 7 procoelous, holochordal presacral vertebrae (first 2 fused);
- ribs absent;
- urostyle free with 2 condyles;
- pectoral girdle arciferal;
- sternum and omosternum absent;
- clavicle does not overlie scapula;
- no intercalary phalanges;
- palatines and prevomers absent;
- no teeth on maxilla or premaxilla;
- astragalus and calcaneum fused only at ends;
- *sartorius* muscle separate and distinct;
- pupil horizontal;
- no Bidder's Organ;
- terrestrial eggs; aquatic larvae not known, presumably direct development;
- functional digits 2/3;
- 2n = 22;
- adults terrestrial, tiny (max SVL = 16 mm).

DISTRIBUTION: Coastal southeastern Brazil.

CONTENT: 2 Recent genera, with 5 living species.

Brachycephalus Fitzinger, 1826 (3 spp); range as for family.

Psyllophryne Izecksohn, 1971 (2 spp); forested Rio de Janeiro and São Paulo states.

Family RHINODERMATIDAE Bonaparte, 1850

CHARACTERIZATION:

- 8 procoelous, holochordal presacral vertebrae, first 2 partly fused;
- ribs absent;
- urostyle free with 2 condyles;
- pectoral girdle pseudofirmisternal;
- sternum and omosternum cartilaginous;
- clavicle does not overlie scapula;
- palatines absent;
- no teeth on maxilla or premaxilla;
- astragalus and calcaneum fused only at ends;
- no intercalary phalanges;
- *sartorius* muscle separate and distinct;
- pupil horizontal;
- eggs terrestrial;
- in *R. darwini*, eggs picked up and brooded in vocal sac (direct development); in *R. rufum* eggs are picked up and carried to water where aquatic larvae (Type IV) develop;
- adults with a fleshy proboscis; small (to 30 mm SVL).

DISTRIBUTION: Southern Chile and Argentina.

CONTENT: 1 genus with 2 species.

Rhinoderma Dumeril & Bibron, 1841 (2 spp); range as for family.

(the next several families are considered informally as the HYLOID families: PSEUDIDAE, HYLIDAE, and CENTROLENIDAE. They seem to represent a monophyletic suprafamilial derivative of Leptodactyloids/ Bufonoids)

Family HYLIDAE Rafinesque, 1815

CHARACTERIZATION:

- 8 procoelous, holochordal presacral vertebrae, all free;
- ribs absent;
- urostyle free with 2 condyles;
- pectoral girdle arciferal;
- sternum and omosternum cartilaginous (omosternum absent in *Allophryne*);
- clavicle does not overlie scapula;
- palatines usually present;
- teeth on maxilla and premaxilla (except teeth absent in *Allophryne*);
- astragalus and calcaneum fused only at ends;
- cartilaginous penultimate intercalary phalanges in each digit (may be ossified or absent in *Cyclorana*);
- *sartorius* muscle separate and distinct;
- pupil horizontal in most (vertically elliptical in Phyllomedusinae and *Nyctimystes*);
- most have aquatic larvae (Type IV), but some brooded by female with direct development;
- $2n = 22$ to 34 (commonly 24);
- sperm with single tail filament in most, but variable;
- adults typically have well-developed digital pads, basically arboreally adapted.

DISTRIBUTION: Temperate and tropical Americas, Australian region, temperate Eurasia, northern Africa.

CONTENT: 44 Recent genera with 786 living species (plus 2 monotypic fossil genera).

Subfamily PELODRYADINAE Günther, 1859

Intermandibularis muscle differentiated, apical element present; pupil horizontal (except vertical in *Nyctimystes*); aquatic eggs and larvae with few exceptions; $2n = 22, 26, \text{ or } 30$; sperm with 2 tail filaments. 4 Recent genera with 149 species in the Australian region. Sometimes considered a separate family. *Cyclorana* Steindachner, 1867 (12 spp); Australia. Until recently considered a genus of Myobatrachidae. *Litoria* Tschudi, 1838 (110 spp); Australia, New Guinea, Tasmania and associated islands; recently introduced to New Zealand and New Caledonia.

Nyctimystes Stejneger, 1916 (24 spp); New Guinea, northern Australia.

Pelodryas Günther, 1859 (3 spp); New Guinea, Australia (introduced to New Zealand).

Subfamily PHYLLOMEDUSINAE Günther, 1859

Mandibularis muscle not differentiated (no distinct *intermandibularis*) in most; no apical element if differentiated; pupil vertically elliptical; thumb tends to be opposable; arboreal egg deposition with aquatic larvae; dermis of skull sometimes co-ossified; $2n = 26$; sperm distinctive with 2 unequal tail filaments. 6 Recent genera with 48 living species in tropical America.

Agalychnis Cope, 1864 (8 spp); Mexico to Ecuador.

Hylomantis Peters, 1872 (2 spp); Brazil.

Pachymedusa Duellman, 1968 (1 sp); Pacific lowland Mexico.

Phasmohyla Goncalvez da Cruz, 1990 (4 spp); Brazil.

Phrynomedusa Miranda-Ribeiro, 1923 (5 spp); Brazil.

Phyllomedusa Wagler, 1830 (28 spp); tropical South America to Costa Rica.

Subfamily HEMIPHRACTINAE Peters, 1862

Mandibularis muscle not differentiated; pupil horizontal; thumbs normal; skull highly ossified, some with triangular helmet, dermis co-ossified in some; eggs carried on back of female, direct development; palatine teeth present, mandible with teeth in some; sperm with 2 equal tail filaments, or single in some. 6 Recent genera with 70 living species in South America.

Amphignathodon Boulenger, 1882 (1 sp); Colombia, Ecuador.

Cryptobatrachus Ruthven, 1916 (3 spp); Colombia.

Flectonotus Miranda-Ribeiro, 1926 (5 spp); Venezuela, Trinidad, Tobago.

Gastrotheca Fitzinger, 1843 (49 spp); Panama, Venezuela to Argentina, Brazil.

Hemiphractus Wagler, 1830 (5 spp); Panama, northwestern South America.

Stefania Rivero, 1968 (7 spp); Guianan highlands of South America.

Subfamily HYLINAE Rafinesque, 1815

Mandibularis not differentiated, or if so no apical element; pupil horizontal; $2n = 24$ or 30 (rarely 18 or 22); more generalized treefrogs, range as for family; sperm with single tail filament except in *Sphaenorhynchus* and *Scinax*. Probably not a natural (monophyletic) unit. 28 Recent genera with 519 living species (plus a monotypic fossil genus).

Acris Dumeril & Bibron, 1841 (2 spp); eastern US.

Anotheca Smith, 1939 (1 sp); Middle America.

Aparasphenodon Miranda-Ribeiro, 1920 (3 spp); Venezuela, Brazil.

Aplastodiscus Lutz, 1950 (1 sp); Brazil.

Argenteohyla Trueb, 1970 (1 sp); Argentina, Uruguay.

Calyptahyla Trueb & Tyler, 1974 (1 sp); Jamaica.

Corythomantis Boulenger, 1896 (1 sp); northeastern Brazil.

Duellmanohyla Campbell & Smith, 1992 (8 spp); Guatemala.

Hyla Laurenti, 1758 (309 spp); range as for family.

Nyctimantis Boulenger, 1882 (1 sp); Ecuador.

Osteocephalus Steindachner, 1862 (9 spp); tropical So. America east of Andes.

Osteopilus Fitzinger, 1843 (3 spp); Greater Antilles, Bahamas, Florida.

Phrynohyas Fitzinger, 1843 (5 spp); Mexico to Argentina.

Phyllodytes Wagler, 1830 (7 spp); Brazil, Trinidad.

Plectrohyla Brocchi, 1877 (20 spp); Central America.

Pseudacris Fitzinger, 1843 (13 spp); North America; includes former *Limnaoedus* and some former *Hyla*.

Pternohyla Boulenger, 1882 (2 spp); Arizona, western Mexico.

Ptychohyla Taylor, 1944 (10 spp); Middle America.

Scarhyla Duellman & de Sa, 1988 (1 sp); Peru.

Scinax Wagler, 1830 (85 spp); Mexico to Argentina and southeast Brazil (formerly *Ololygon*).

Smilisca Cope, 1865 (6 spp); southern Texas to northern South America.

Sphaenorhynchus Tschudi, 1838 (11 spp); tropical So. Amer. east of Andes.

Tepuihyla Ayarzagüire, Señaris & Gorzula, 1993 (6 spp); Venezuela and Guyana.

Trachycephalus Tschudi, 1838 (3 spp); northwestern So. Amer. and Brazil.

Triprion Cope, 1866 (2 spp); Mexico and Guatemala.

Xenohyla Izeckson 1998 (2 spp); Brazil: Bahia.

Family PSEUDIDAE Fitzinger, 1843

CHARACTERIZATION:

- 8 procoelous, holochordal vertebrae, all free;
- ribs absent;
- urostyle free with 2 condyles;
- pectoral girdle arciferal;
- sternum and omosternum cartilaginous;
- clavicle does not overlie scapula;
- palatines present;
- teeth present on maxilla and premaxilla;
- astragalus and calcaneum fused only at ends;
- bony intercalary phalanges;
- *sartorius* is distinct and separate;
- pupil horizontal;
- eggs and larvae (Type IV) aquatic; larvae very large (to 250 mm total);
- adults semiaquatic (fully webbed toes), up to 70 mm SVL;
- $2n = 24$;
- sperm have single tail filament.

DISTRIBUTION: Tropical lowlands east of the Andes, plus Magdalena Valley of Colombia.

CONTENT: 2 genera with 7 species (no fossil record).

Lysapsus Cope, 1862 (3 spp); range as for family.

Pseudis Wagler, 1830 (4 spp); range as for family.

Family CENTROLENIDAE Taylor, 1951

CHARACTERIZATION:

- 8 procoelous, holochordal presacral vertebrae, all free;
- ribs absent;
- urostyle free with 2 condyles;
- pectoral girdle arciferal;
- sternum bony, no omosternum;
- clavicle does not overlie scapula;
- palatines present;
- teeth present on maxilla and premaxilla;
- astragalus and calcaneum fused for entire length;
- cartilaginous penultimate phalanx in each digit;
- terminal phalanges T-shaped;
- *sartorius* muscle separate and distinct;
- pupil horizontal;
- eggs deposited arboreally, aquatic larvae (Type IV);
- $2n = 20$;
- sperm with 2 tail filaments;
- adults mostly small (<30 mm), but one to 77 mm;
- skin and body wall of venter usually transparent (“Glass Frogs”).

DISTRIBUTION: Southern Mexico to northwestern South America, plus northeastern Argentina.

CONTENT: 3 Recent genera with 147 living species (no fossil record); generic assignments have recently been revised.

Centrolene Jimenez de la Espada, 1872 (43 sp); Nicaragua to Venezuela and Peru.

Cochranella Taylor, 1951 (61 spp); Nicaragua to northern South America.

Hyalinobatrachium Ruiz-C & Lynch, 1991 (46 spp); Mexico through Brazil to Argentina.

(the remaining families are often referred to as the RANOIDEA; some or all may be monophyletic; relationship of Dendrobatids has been suggested to be closer to Leptodactyloids; families other than Dendrobatidae and Microhylidae are in a state of taxonomic flux; Microhylidae seems more distantly related and is often referred to as MICROHYLOIDEA)

Family DENDROBATIDAE Cope 1865

CHARACTERIZATION:

- 8 procoelous, holochordal presacral vertebrae, 8th fused to sacrum in some;
- ribs absent;
- urostyle free with 2 condyles;
- pectoral girdle firmisternal;
- sternum bony, omosternum cartilaginous;
- clavicle does not overlie scapula;
- palatines present or absent;
- maxilla and premaxilla toothed in some, not others;
- astragalus and calcaneum fused only at ends;
- no intercalary phalanges;
- *sartorius* muscle separate and distinct;
- pupil horizontal;
- terrestrial or arboreal eggs, parent carries larvae on back to water, aquatic larvae (Type IV);
- $2n = 18, 20, \text{ or } 24$;
- dermal glandular pad atop digital pad;
- some have highly toxic skin secretions (“Poison-dart Frogs”) and brightly colored;
- adults small (<50 mm), most diurnally active.

DISTRIBUTION: Nicaragua to Brazil.

CONTENT: 8 genera with 187 species (no fossil record).

Aromobates Myers, Paolillo & Daly, 1991 (1 sp); Andes of Venezuela.

Colostethus Cope, 1866 (100 spp); Costa Rica to Bolivia and southeast Brazil.

Dendrobates Wagler, 1830 (28 spp); Nicaragua to Brazil.

Epipedobates Myers, 1987 (31 spp); Nicaragua to Bolivia and Brazil.
Mannophryne La Marca, 1992 (8 spp); Venezuela, Trinidad, Tobago.
Minyobates Myers, 1987 (9 spp); Central and South America.
Nephelobates La Marca, 1994 (6 spp); Venezuela.
Phyllobates Bibron, 1841 (5 spp); Costa Rica to Colombia.

Family ARTHROLEPTIDAE Mivart, 1869

(some consider this a subfamily of Ranidae or Hyperoliidae)

CHARACTERIZATION:

- 8 procoelous, holochordal presacral vertebrae, free (except first 2 fused in *Hemisus*); most have 8th vertebra amphicoelous with sacrum biconvex (= diplasiocoelous);
- ribs absent;
- urostyle free with 2 condyles;
- pectoral girdle firmisternal;
- clavicle does not overlie scapula;
- palatines present;
- sternum bony with cartilaginous post-zonal elements, omosternum bony;
- premaxilla and maxilla with or without teeth, no vomerine teeth;
- astragalus and calcaneum fused only at ends;
- no intercalary phalanges;
- *sartorius* distinct and separate muscle;
- pupil horizontal;
- aquatic larvae (Type IV);
- expanded digital discs with dermal pads on top.

DISTRIBUTION: sub-Saharan Africa.

CONTENT: 3 genera with 49 living species.

Arthroleptis Smith, 1849 (12 spp); sub-Saharan Africa.

Cardioglossa Boulenger, 1900 (16 spp); central and west Africa.

Shoutedenella DeWitte, 1921 (21 spp); Africa south of the Sahara.

Family ASTYLOSTERNIDAE Noble, 1927

(this is often considered a subfamily of Arthroleptidae, Ranidae, or Hyperoliidae)

CHARACTERIZATION:

- 8 procoelous, holochordal presacral vertebrae, free (except first 2 fused in *Hemisus*); most have 8th vertebra amphicoelous with sacrum biconvex (= diplasiocoelous);
- ribs absent;
- urostyle free with 2 condyles;
- pectoral girdle firmisternal;
- clavicle does not overlie scapula;
- palatines present;
- sternum bony with cartilaginous post-zonal elements, omosternum bony and forked;
- premaxilla and maxilla with teeth;
- astragalus and calcaneum fused only at ends;
- no intercalary phalanges;
- *sartorius* distinct and separate muscle;
- pupil vertical;
- aquatic larvae (Type IV);
- digits not expanded.

DISTRIBUTION: sub-Saharan Africa.

CONTENT: 4 Recent genera with 25 living species.

Astylosternus Werner, 1898 (12 spp); west Africa.

Leptodactylon Andersson, 1903 (11 spp); west Africa.

Scotolepis Boulenger, 1900 (1 sp); Nigeria to Zaire.

Trichobatrachus Boulenger, 1900 (1 sp); Nigeria to Zaire.

Family HEMISOTIDAE Cope, 1867

(sometimes placed as a subfamily of Ranidae)

CHARACTERIZATION:

- first 2 vertebrae fused, other 6 presacrals procoelous, holochordal; usually 8th vertebra amphicoelous with sacrum biconvex (= diplasiocoelous);
- ribs absent;
- urostyle free with 2 condyles;
- pectoral girdle firmisternal;
- clavicle does not overlie scapula;
- palatines present;
- sternum cartilaginous, no post-zonal elements;
- no teeth on jaws or palate;
- astragalus and calcaneum fused only at ends;
- no intercalary phalanges;
- *sartorius* distinct and separate muscle;
- pupil horizontal;
- aquatic larvae (Type IV);
- digits not expanded;
- adults fossorial.

DISTRIBUTION: sub-Saharan Africa.

CONTENT: 1 genus with 8 species.

Hemisus Günther, 1859 (8 spp); range as for family.

Family PETROPEDETIDAE Noble, 1931

CHARACTERIZATION:

- 8 procoelous, holochordal presacral vertebrae, free; most have 8th vertebra amphicoelous with sacrum biconvex (= diplasiocoelous);
- ribs absent;
- urostyle free with 2 condyles;
- pectoral girdle firmisternal;
- clavicle does not overlie scapula;
- palatines present;
- sternum usually cartilaginous with bony post-zonal elements;
- premaxilla and maxilla with teeth;
- astragalus and calcaneum fused only at ends;
- no intercalary phalanges;
- *sartorius* distinct and separate muscle;
- pupil horizontal;
- digits not expanded;
- direct development in some, others with Type IV aquatic larvae.

DISTRIBUTION: sub-Saharan Africa.

CONTENT: 13 genera with 98 living species.

Anhydrophryne Hewitt, 1919 (1 sp); South Africa.

Arthroleptella Hewitt, 1926 (6 spp); South Africa.

Arthroleptides Nieden, 1910 (2 spp); Kenya, Tanzania.

Cacosternum Boulenger, 1887 (7 spp); eastern & southern Africa.

Dimorphognathus Boulenger, 1906 (1 sp); west Africa.

Ericabatrachus Largen, 1991 (1 sp); Ethiopia.

Microbatrachella Hewitt, 1926 (1 sp); South Africa.

Natalobatrachus Hewitt & Methuen, 1913 (1 sp); South Africa.

Nothophryne Poynton, 1963 (1 sp); Malawi, Mozambique.

Petropedetes Reichenow, 1874 (7 spp); Sierra Leon to Cameroon.

Phrynobatrachus Günther, 1862 (68 spp); sub-Saharan Africa.

Phrynodon Parker, 1935 (1 sp); Cameroon.

Poyntonina Channing & Boycott, 1989 (1 sp); South Africa.

Family RANIDAE Gray, 1825

There are several different proposals separating various genera into separate subfamilies, or subdividing into tribes; some of these are noted below.

CHARACTERIZATION:

- 8 procoelous, holochordal presacral vertebrae, free; most have 8th vertebra amphicoelous with sacrum biconvex (= diplasiocoelous);
- ribs absent;
- urostyle free with 2 condyles;
- pectoral girdle firmisternal;
- clavicle does not overlie scapula;
- palatines present;
- sternum bony with bony post-zonal elements;
- premaxilla and maxilla with teeth;
- astragalus and calcaneum fused only at ends;
- no intercalary phalanges;
- *sartorius* distinct and separate muscle;
- pupil horizontal;
- digits not expanded.
- $2n = 14$ to 54 ; some species are polyploids;
- sperm vary, but typically a fusiform head, rounded acrosome deeply invading nucleus, and a single tail filament.

DISTRIBUTION: Cosmopolitan, except absent from southern South America, the Australian region, West Indies and most oceanic islands.

CONTENT: 31 Recent genera with 577 living species.

Amolops Cope, 1865 (29 spp); India, Nepal, China.

Aubria Boulenger, 1917 (2 spp); west Africa. Subfamily Pyxicephalinae.

Batrachylodes Boulenger, 1887 (8 spp); Solomon Is.

Ceratobatrachus Boulenger 1884 (1 sp); Solomon Is. Subfamily Dicroglossinae.

Chaparana Bourret, 1939 (6 spp); India to southeast Asia. Raninae, Tribe Paini.

Conraua Nieden, 1908 (6 spp); tropical sub-Saharan Africa.

Discodeles Boulenger, 1918 (5 spp); Admiralty, Bismarck, Solomon Is. Subfamily Dicroglossinae.

Elachyglossa Andersson, 1916 (1 sp); Thailand.

Euphlictis Fitzinger, 1843 (3 spp); northwest Africa to India, Nepal, Malaya, Sri Lanka. Subfamily Dicroglossinae.

Hildebrandtia Nieden, 1907 (3 spp); sub-Saharan Africa. Subfam. Ptychadeninae.

Hoplobatrachus Peters, 1863 (5 spp); sub-Saharan Africa, India to southeast Asia. Subfamily Dicroglossinae.

Huia Yang Datong, 1991 (4 spp); southeast Asia and Indonesia.

Indirana Laurent, 1986 (9 spp); India, Malaya. Raninae, Tribe Ranixalini.

Ingerana Dubois, 1987 (9 spp); China, Burma, Thailand, Malaysia, Philippines, Borneo. Subfamily Dicroglossinae.

Lanzarana Clarke, 1983 (1 sp); Somalia.

Limnonectes Fitzinger 1843 (70 spp); central Africa, southeast Asia, Indonesia.

Meristogenys Yang Datong, 1991 (8 spp); Borneo.

Micrixalus Boulenger, 1888 (7 spp); India, Sri Lanka, Philippines, Borneo.

Nannophrys Günther, 1869 (3 spp); Sri Lanka. Raninae, Tribe Ranixalini.

Nanorana Günther, 1896 (3 spp); China.

Nyctibatrachus Boulenger, 1882 (10 spp); India. Raninae, Tribe Ranixalini.

Occidozyga Kuhl & van Hasselt, 1822 (11 spp); China, India to Ethiopia. Subfamily Dicroglossinae.

Paa Dubois, 1975 (27); India to China, southeast Asia. Raninae, Tribe Paini.

Palmatorappia Ahl, 1927 (1 sp); Solomon Is. Subfamily Dicroglossinae.

Platymantis Günther, 1859 (47 spp); New Guinea, Philippines, Bismarck, Fiji, Solomon Is, much of Indonesia. Subfamily Dicroglossinae.

Ptychadena Boulenger, 1917 (46 spp); sub-Saharan Africa; introduced to Madagascar, Seychelles Is. Subfamily Ptychadeninae.

Pyxicephalus Tschudi, 1838 (3 spp); sub-Saharan Africa. Subfamily Pyxicephalinae.

Rana Linnaeus, 1768 (230 spp); range as for family. About 50 fossil species also.
Staurois Cope, 1865 (3 spp); Borneo, Philippines.
Taylorana Dubois, 1987 (2 spp); India, southeast Asia, Indonesia. Subfamily Dicroglossinae.
Tomopterna Dumeril & Bibron, 1841 (15 spp); sub-Saharan Africa, Madagascar, India.

Family HYPEROLIIDAE Laurent, 1943

Often treated as a subfamily of Ranidae or Rhacophoridae

CHARACTERIZATION:

- 8 procoelous, holochordal presacral vertebrae, 8th biconcave (=diplasiocoelous; except 2 species), all free;
- ribs absent;
- urostyle free with 2 condyles;
- pectoral girdle firmisternal;
- sternum and omosternum present (bony or cartilaginous);
- clavicle does not overlie scapula;
- palatines present;
- teeth on maxilla and premaxilla;
- astragalus and calcaneum fused only at ends;
- cartilaginous intercalary penultimate phalanges in all digits;
- *sartorius* separate and distinct muscle;
- pupil vertical in most, horizontal or round in some;
- gular glands present in all but one genus;
- eggs aquatic, terrestrial, or arboreal; aquatic larvae (Type IV);
- $2n = 22, 24, \text{ or } 30$;
- adults small (15 to 80 mm SVL), with toe discs; mostly arboreal but some secondarily terrestrial.

DISTRIBUTION: Sub-Saharan Africa, Madagascar, Seychelles Islands.

CONTENT: 19 Recent genera with 232 species, arranged in 4 subfamilies; no fossil record.

Subfamily HYPEROLIINAE Laurent, 1943

Characters not available. 12 genera with 163 species in Africa, Madagascar, Cameroon.

Acanthixalus Laurent, 1944 (1 sp); Nigeria and Cameroon, to Zaire.

Afrixalus Laurent, 1944 (30 spp); sub-Saharan Africa.

Alexteroon Perret, 1988 (1 sp); Cameroon.

Arlequinus Perret, 1988 (1 sp); Cameroon.

Callixalus Laurent, 1950 (1 sp); Zaire, Rwanda.

Chlorolius Perret, 1988 (1 sp); Cameroon.

Chrysobatrachus Laurent, 1951 (1 sp); Zaire.

Cryptothylax Laurent & Combaz, 1950 (2 spp); Cameroon to Zaire.

Heterixalus Laurent, 1944 (9 spp); Madagascar.

Hyperolius Rapp, 1842 (113 spp); sub-Saharan Africa.

Kassinoula Laurent, 1940 (1 sp); Zaire, Zambia.

Nesionixalus Perret, 1976 (2 sp); São Tomé Is., Gulf of Guinea.

Subfamily KASSININAE Laurent, 1972

Characters not available. 5 genera with 19 species in Africa.

Kassina Girard, 1853 (11 spp); sub-Saharan Africa.

Opisthothylax Perret, 1966 (1 sp); Nigeria to Gabon and Zaire.

Paracassina Peracca, 1907 (2 spp); Ethiopia.

Phlyctimantis Laurent & Combaz, 1950 (4 spp); tropical Africa.

Semnodactylus Hoffman, 1939 (1); South Africa.

Subfamily LEPTOPELINAE Laurent, 1972

Characters not available. One genus in Africa.

Leptopelis Günther, 1859 (49 spp); sub-Saharan Africa.

Subfamily TACHYCNEMINAE Channing, 1989

Characters not available. Monotypic.

Tachycnemis Fitzinger, 1843 (1 sp); Seychelles Iss.

Family RHACOPHORIDAE Hoffman, 1932

CHARACTERIZATION:

- 8 procoelous, holochordal presacral vertebrae, all free; diplasiocoely in some;
- ribs absent;
- urostyle free with 2 condyles;
- pectoral girdle firmisternal;
- sternum, omosternum, and post-zonal elements bony;
- clavicle does not overlie scapula;
- palatines present;
- teeth on maxilla and premaxilla;
- astragalus and calcaneum fused only at ends;
- cartilaginous penultimate intercalary phalanges in each digit;
- toe discs present, with extensive webbing;
- *sartorius* distinct and separate muscle;
- pupil horizontal;
- eggs mostly arboreal, some aquatic; aquatic larvae (Type IV), or abbreviated non-feeding larva in a few;
- adults mostly arboreal, but some terrestrial; size varies, ca. 15 to 120 mm SVL;
- $2n = 26$;
- sperm have complex thick tail, with 2 flagellae surrounded by a fibrous sheath.

DISTRIBUTION: Old World tropics.

CONTENT: 12 Recent genera with 319 species; no fossil record.

Subfamily BUERGERIINAE Channing, 1989

Characters not available. One Recent genus with 5 species.

Buergeria Tschudi, 1838 (5 spp); Japan to Taiwan.

Subfamily MANTELLINAE Laurent, 1946

Sometimes treated as a subfamily of Ranidae. Sternum bony with bony post-zonal plates; cartilaginous penultimate intercalary phalanx in each digit; teeth absent; pupil horizontal; 2 genera with 75 species in Madagascar.

Mantella Boulenger, 1882 (11 spp); Madagascar.

Mantidactylus Boulenger, 1895 (64 spp); Madagascar.

Subfamily RHACOPHORINAE Hoffman, 1932

Characters as for family. Probably not monophyletic as presently constituted. 9 Recent genera with 239 species.

Aglyptodactylus Boulenger, 1919 (3 sp); Madagascar. Also placed in Raninae or Mantellinae.

Boophis Tschudi, 1838 (41 spp); Madagascar.

Chirixalus Boulenger, 1893 (10 spp); southeast Asia.

Chiromantis Peters, 1863 (3 spp); tropical Africa.

Nyctixalus Boulenger, 1882 (3 spp); India, Malaya, Philippines.

Philautus Gistel, 1848 (89 spp); China, Sri Lanka, India; Philippines. Sometimes placed in a separate subfamily.

Polypedates Tschudi, 1838 (25 spp); tropical Asia, Java, Borneo, Philippines.

Rhacophorus Kuhl & van Hasselt, 1822 (55 spp); India, China, Japan.

Theloderma Tschudi, 1838 (10 spp); China, Burma, Malaya, Sumatra.

Family MICROHYLIDAE Günther, 1859

CHARACTERIZATION:

- 8 procoelous, holochordal presacral vertebrae, all free; diplasiocoely in all but 2 subfamilies;
- ribs absent;
- urostyle usually free (fused in one subfamily), with 2 condyles;
- pectoral girdle firmisternal;
- sternum cartilaginous, omosternum absent in most;
- clavicle reduced or absent in most; not overlying scapula;
- palatines reduced or absent in most;
- teeth absent from maxilla or premaxilla (present in some genera of 2 subfamilies);
- astragalus and calcaneum fused only at ends;
- no intercalary phalanges except in one subfamily;
- *sartorius* separate and distinct muscle;
- pupil usually horizontal or round, but vertical in one subfamily;
- aquatic or terrestrial eggs; direct development in many, or aquatic larvae (Type II) in some;
- $2n = 22-28$;
- adults have 2 or 3 glandular folds on palate;
- mostly small, terrestrial, but a few up to 100 mm SVL, some arboreal;
- sperm vary, often similar to typical Ranid condition.

DISTRIBUTION: Widely distributed in tropical, subtropical, and temperate regions, except Palearctic, most of Australia, and oceanic islands.

CONTENT: 64 Recent genera with 331 species, in 9 or 10 diverse subfamilies; fossils of 1 Recent genus.

Subfamily SCAPHIOPHRYNINAE Laurent, 1943

Aquatic larvae have beaks and denticles. 2 genera with 9 species, all endemic to Madagascar.

Paradoxophyla Blommers-Schösser & Blanc, 1991 (1 sp).

Scaphiophryne Boulenger, 1882 (8 spp). Includes several species previously in *Pseudohemisus*.

Subfamily DYSCOPHINAE Boulenger, 1882

Omosternum present in some; teeth on maxilla, premaxilla, and vomer; ear developed; pupil vertically elliptical; 2 genera with 9 species in southeast Asia and Madagascar.

Calluela Stoliczka, 1872 (6 spp); southeast Asia, Malay archipelago to Borneo.

Dyscophus Grandidier, 1872 (3 spp); Madagascar.

Subfamily COPHYLINAE Cope, 1889

All vertebrae procoelous; omosternum present; teeth usually present on maxilla and premaxilla; 7 genera with 35 species, all endemic to Madagascar.

Anodonthyla Muller, 1892 (4 spp).

Cophyla Boettger, 1880 (1 sp).

Madecassophryne Guibe, 1974 (1 sp).

Platypelis Boulenger, 1882 (9 spp).

Plethodontohyla Boulenger, 1882 (13 spp).

Rhombophryne Boettger, 1880 (1 sp).

Stumpffia Boettger, 1880 (6 spp).

Subfamily ASTEROPHRYINAE Günther, 1859

No teeth; no omosternum; large prevomer; ear developed; direct development, terrestrial adults. 8 genera with 52 species in New Guinea and nearby islands.

Asterophrys Tschudi, 1838 (2 sp); New Guinea.

Barygenys Parker, 1936 (7 spp); Papua New Guinea.

Callulops Boulenger, 1888 (15 spp); New Guinea and associated islands. Previously *Phrynomantis*.

Hylophorbis Macleay, 1878 (1 sp); New Guinea and associated islands.

Mantophryne Boulenger, 1898 (3 spp); New Guinea and nearby islands.

Pherohapsis Zweifel, 1972 (1 sp); Papua New Guinea.
Xenobatrachus Peters & Doria, 1878 (17 spp); New Guinea.
Xenorhina Peters, 1863 (6 spp); New Guinea.

Subfamily GENYOPHRYNINAE Boulenger, 1890

All vertebrae procoelous; no omosternum; mostly toothless, a few with vestigial maxillary teeth; terrestrial eggs, direct development; 7 genera with 82 species in New Guinea, Philippines, Australia.

Aphantophryne Fry, 1917 (3 spp); Papua New Guinea.
Choerophryne van Kampen, 1915 (1 sp); New Guinea.
Cophixalus Boettger, 1892 (30 spp); New Guinea, northern Australia.
Copiula Mehely, 1901 (5 spp); New Guinea.
Genyophryne Boulenger, 1890 (1 sp); New Guinea.
Oreophryne Boettger, 1895 (24 spp); Philippines to New Guinea.
Sphenophryne Peters & Doria, 1878 (18 spp); New Guinea to northern Australia.

Subfamily BREVICIPITINAE Bonaparte, 1850

Toothless; urostyle fused with sacrum in some; omosternum present; clavicles present; no aquatic larvae, terrestrial eggs with abbreviated larval stage; adults terrestrial or fossorial; 5 genera with 19 species in Africa.

Balebreviceps Largen & Drewes, 1989 (1 spp); Ethiopia.
Breviceps Merrem, 1820 (13 spp); southern Africa.
Callulina Nieden, 1910 (1 sp); Tanzania.
Probreviceps Parker, 1931 (3 spp); east Africa.
Spelaeophryne Ahl, 1924 (1 sp); Tanzania.

Subfamily MELANOBATRACHINAE Noble, 1931

Adults toothless; omosternum present; small prevomer; aquatic larvae; 3 genera with 4 species in India and Africa.

Hoplophryne Barbour & Loveridge, 1928 (2 spp); Tanzania.
Melanobatrachus Beddome, 1878 (1 sp); India.
Parhoplophryne Barbour & Loveridge, 1928 (1 sp); Tanzania.

Subfamily PHRYNOMERINAE Noble, 1931

Adults toothless; cartilaginous penultimate intercalary phalanges; eggs and larvae aquatic. Mostly arboreal, with expanded toe discs. 1 genus with 5 species in Africa.

Phrynomantis Peters, 1867 (5 spp); sub-Saharan Africa. Previously called *Phrynomerus*.

Subfamily MICROHYLINAE Günther, 1859

Adults toothless; prevomer reduced; ear developed; aquatic eggs and larvae in most, but terrestrial eggs with direct development in some; 28 genera with 330 species in southeast Asia and America.

Adelastes Zweifel, 1987 (1 sp); Venezuela.
Altigius Wild, 1995 (1 sp.); Peru.
Arcovomer Carvalho, 1954 (1 sp); Brazil.
Chaperina Mocquard, 1892 (1 sp); Malay peninsula, Borneo, Philippines.
Chiasmocleis Mehely, 1904 (14 spp); Panama, South America.
Ctenophryne Mocquard, 1904 (2 spp); northern South America.
Dasytops Miranda-Ribeiro, 1924 (2 sp); Brazil.
Dermatonotus Mehely, 1904 (1 sp); Brazil, Argentina, Bolivia.
Elachistocleis Parker, 1927 (5 spp); Panama, South America.
Gastrophryne Fitzinger, 1843 (5 spp); southern US to Costa Rica.
Gastrophrynoides Noble, 1926 (1 sp); Borneo.
Glyphoglossus Günther, 1868 (1 sp); southeast Asia.
Hamptophryne Carvalho, 1954 (1 sp); Amazon basin of South America.
Hyophryne Carvalho, 1954 (1 sp); Brazil.
Hypopachus Keferstein, 1867 (2 spp); southern Texas to Costa Rica.

Kalophrynus Tschudi, 1838 (12 spp); China to Borneo, Philippines.
Kaloula Gray, 1831 (11 spp); Korea, China to Philippines, Sri Lanka.
Metaphrynella Parker, 1934 (2 spp); Malay peninsula, Borneo.
Microhyla Tschudi, 1838 (24 spp); China, India, southeast Asia, to Sri Lanka, Bali.
Micryletta Dubois, 1989 (2 spp); China, Malaya, Borneo, Sumatra.
Myersiella Carvalho, 1954 (1 sp); Brazil.
Nelsonophryne Frost, 1987 (2 spp); Costa Rica to Ecuador. Formerly *Glossostoma*.
Phrynella Boulenger, 1887 (1 sp); Malay peninsula, Sumatra.
Ramanella Rao & Ramanna, 1925 (8 spp); India, Sri Lanka.
Relictivomer Carvalho, 1954 (1 sp); Panama, Colombia.
Stereocyclops Cope, 1870 (1 sp); Brazil.
Synapturanus Carvalho, 1954 (3 spp); Colombia to Brazil.
Syncope Walker, 1973 (3 spp); Ecuador, Peru.
Uperodon Dumeril & Bibron, 1841 (2 spp); India, Sri Lanka.

Subfamily OTOPHRYNINAE Wasserzug & Pyburn, 1987

Similar to Microhylinae, but larvae unique in possessing an elongate sinistral siphon plus beak and denticles in larvae; a single monotypic genus in the Guianan region of South America. Recently returned to Microhylinae.

Otophryne Boulenger, 1900 (1 sp). Range as for subfamily.