

## THE PRIMATES

*Order Primates*

## ORDER PRIMATES

The ordinal name Primates means the “first” or “primary” ones. Although this name reflects the anthropocentrism of humans, it is of no help in defining the group of mammals included in it.

Primates are mainly arboreal mammals (Fig. 16.1), but terrestrial forms occur in several groups. Examples of these are the ring-tailed lemur, *Lemur catta*; baboons, *Papio*, *Mandrillus*, and *Theropithecus*; the gorilla, *Gorilla gorilla*; and humans, *Homo sapiens*. Humans are the only completely bipedal primates. Most primates are omnivorous, eating a higher percentage of plant than animal material, and usually softer foods, such as fruits, buds, and soft-bodied insects, are favored. The gorilla, the leaf-eating monkeys (Asian langurs, African colobus monkeys, Neotropical howler monkeys) and the Madagascan indrid and megaladapid lemurs are almost entirely herbivorous in the wild. The aye-aye, the galagos, and the tarsiers are largely insectivorous.

Most primates are pentadactyl, although certain fingers are shortened in some Loridae, the thumb is reduced in several brachiating forms, and it is completely absent in the spider monkeys, *Ateles*; some murequins, *Brachyteles arachnoides*; and the African genus *Colobus*. In most primates, the digits are prehensile, and the pollex (thumb) and/or the hallux (big toe) are more or less opposable. Napier and Napier (1967) discussed the opposability of the thumb and gave the following classification:

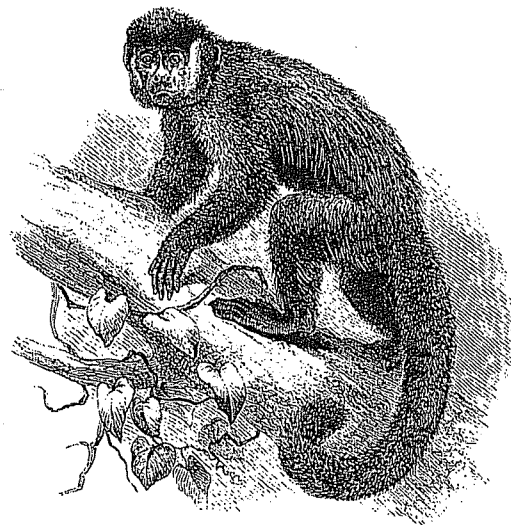
Nonopposable thumb: Tarsiidae, Callitrichidae

Pseudo-opposable thumb: Strepsirhini, Cebidae

Opposable thumb: Catarrhini

These prehensile and opposable digits produce a hand or foot with great dexterity—the animal is better able to grasp and manipulate objects. A prehensile tail is present in some Cebidae but occurs in no other primate family.

In general, the sense of smell in primates becomes less acute as the hand becomes better adapted for manipulation (Napier and Napier 1967), but this should not be interpreted as cause and effect. Along with the loss of olfactory sensitivity, primates have developed very good vision. The field of vision has a large area of overlap between the fields of



**Figure 16.1** A capuchin monkey, *Cebus apella*, Cebidae. (Gray 1865)

the two eyes, resulting in precision in depth perception. Only some nocturnal primates (some lemurs, the Galagonidae, Loridae, Tarsiidae, and the cebid genus *Aotus*) have retinas composed entirely of rods (Napier and Napier 1967). Other primates have both rods and cones in the retinas. Most Strepsirhini and all Tarsii are nocturnal, and most Platyrrhini and all Catarrhini are diurnal.

Primates are eaten in various parts of the world, and the skins of some species (e.g., *Colobus guereza*) are valuable. Some species do a great deal of damage to crops, and some, primarily baboons, can be dangerous to human infants and toddlers (Fiedler et al. 1975). Primates are major attractions at zoos, and many species are kept as pets. The rhesus monkey, *Macaca mulatta*, and several other species are widely used in medical research. Many species are now endangered.

## DISTINGUISHING CHARACTERS

The dentition varies, but the cheek teeth are bunodont and brachydont. The orbits are directed more or less anteriorly, and either a postorbital bar or a postorbital plate is present. In more "advanced" forms, the braincase is large, and the rostrum is usually shortened. The auditory bulla is formed by the petrosal.

The gait is plantigrade, and the hands/feet are usually pentadactyl. In some forms, the pollex or the second manual digit is reduced or absent. A nail is always present on the pollex, and most species have nails (as opposed to claws) on the other digits.

The uterus is either bicornuate (Strepsirhini and Tarsii) or simplex (Platyrrhini and Catarrhini), and the penis is usually pendant. The testes are scrotal. So far as is known, bacula are lacking in only four cebid species, in the tarsiers, and in humans (Hershkovitz 1977).

## LIVING FAMILIES OF PRIMATES

A list of living families of Primates, and their contents, is given in Table 16.1.

Primates are essentially tropical mammals. Five families are confined to Madagascar (two species also occur on the nearby Comoro Islands), and two are found only in the tropical portions of the Neotropical Region. One family is confined to the tropical portions of the Ethiopian Region, two are confined to the tropical parts of the Oriental Region, and two, plus the great apes, occur in both of these areas. Several species of Cercopithecidae are native to various areas in the southern Palearctic. Humans are worldwide in distribution.

**TABLE 16.1** Living Families of Primates\*

| Family                        | Common Name                             | Number of Genera | Species | Distribution  |
|-------------------------------|---|------------------|---------|---|
| <i>Suborder Strepsirhini</i>  |   |                  |         |   |
| Cheirogaleidae                | Dwarf lemurs, mouse lemurs              | 4                | 7       | Madagascar  |
| Megaladapidae                 | Sportive lemurs                         | 1                | 7       | Madagascar  |
| Lemuridae                     | Lemurs                                  | 4                | 10      | Madagascar, Comoro Islands                              |
| Indridae                      | Indrid lemurs (avahi, sifakas, indri)   | 3                | 5       | Madagascar  |
| Daubentoniidae                | Aye-aye                                 | 1                | 1       | Madagascar  |
| Loridae                       | Lorises, potto, angwantibos             | 5                | 7       | Oriental, Ethiopian                                     |
| Galagonidae                   | Galagos or bushbabies                   | 4                | 11      | Ethiopian   |
| <i>Suborder Haplorhini</i>    |   |                  |         |   |
| <i>Infraorder Tarsii</i>      |   |                  |         |   |
| Tarsiidae                     | Tarsiers                                | 1                | 5       | Indonesia, Philippines                                  |
| <i>Infraorder Platyrrhini</i> |   |                  |         |   |
| Callitrichidae                | Marmosets, tamarins                     | 4                | 26      | Neotropical   |
| Cebidae                       | New World monkeys                       | 11               | 58      | Neotropical   |
| <i>Infraorder Catarrhini</i>  |   |                  |         |   |
| Cercopithecidae               | Old World monkeys                       | 18               | 81      | Ethiopian, Oriental, southern Palearctic                |
| Hylobatidae                   | Gibbons                                 | 1                | 11      | Oriental  |
| Hominidae                     | Gorilla, chimpanzees, orangutan, humans | 4                | 5       | Central Ethiopian, Sumatra, Borneo, humans cosmopolitan |

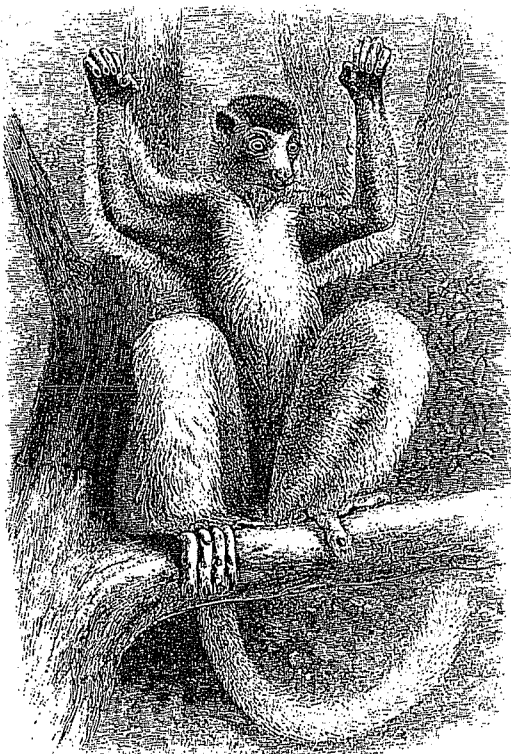
\*Numbers of genera and species based on Groves (1993), except numbers for Loridae based on Nowak (1999).

KEY TO LIVING FAMILIES OF PRIMATES

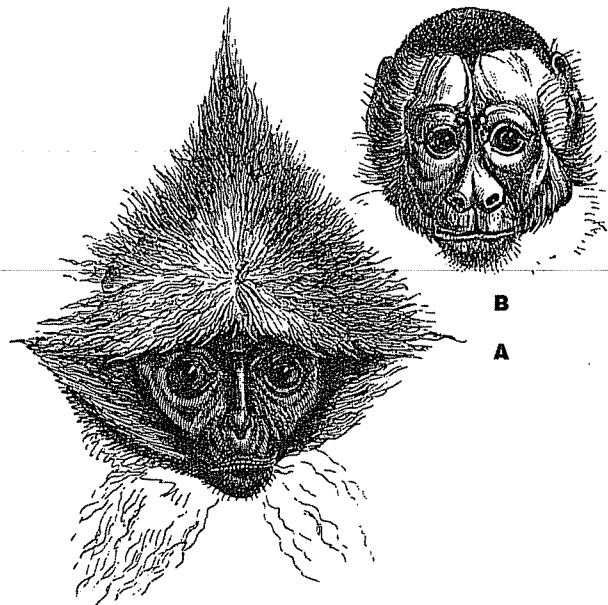
- 1 Postorbital bar present,<sup>1</sup> orbit and temporal fossa broadly confluent; some digits with nails and others with claws; nostrils are crescentic lateral slits associated with a moist glandular "nose" or rhinarium (Fig. 16.2) ..... 2
- 1' Postorbital plate present,\* orbit and temporal fossa completely or mostly separated; all digits with nails or some digits with nails and others with claws; nostrils less slitlike, no moist rhinarium (Fig. 16.3) ..... 7

- 2 (1) Teeth number 18 to 20; incisors 1/1, large and similar to those of a rodent, with enamel on only anterior surfaces; canines absent (Fig. 16.4); third manual digit much more slender than adjacent digits (Fig. 16.5); hallux with a nail, other digits with claws; tail long and bushy .....  
 ..... **Daubentoniidae**  
 the aye-aye, *Daubentonia madagascariensis*
- 2' Teeth number 30 or more; incisors never 1/1, and never resemble those of a rodent; C<sup>1</sup> present, C<sub>1</sub> usually present; third manual digit not appreciably more slender than other digits; distribution of nails and claws varies; tails of various sorts ..... 3

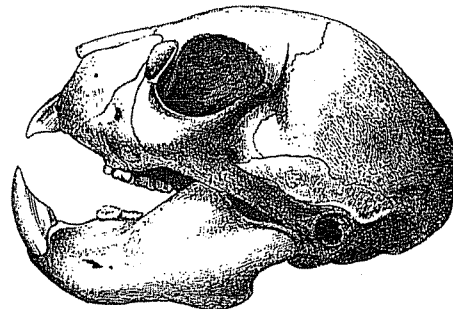
<sup>1</sup>The skulls of Tarsiidae could be interpreted by the student as having either a postorbital bar or a postorbital plate. Therefore, the key is constructed to allow Tarsiidae to be keyed to by either selection in this couplet. However, the nostrils and "nose" of Tarsiidae are consistent only with the condition described in 1'.



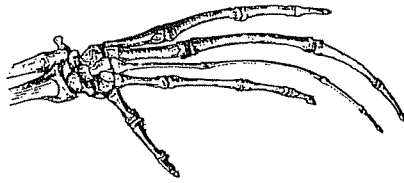
**Figure 16.2** A sifaka, *Propithecus verreauxi coronatus*, Indridae.  
 (Flower and Lydekker 1891)



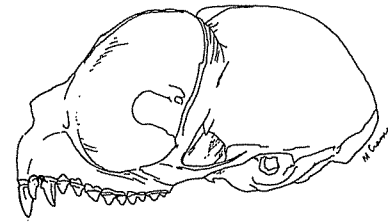
**Figure 16.3** Faces of a catarrhine monkey (A) and a platyrrhine monkey (B).  
 (Duncan 1877)



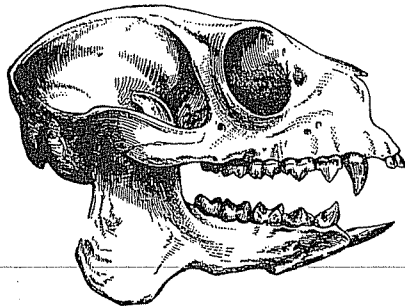
**Figure 16.4** Skull of an aye-aye, *Daubentonia madagascariensis*, Daubentoniidae.  
 (Flower and Lydekker 1891)



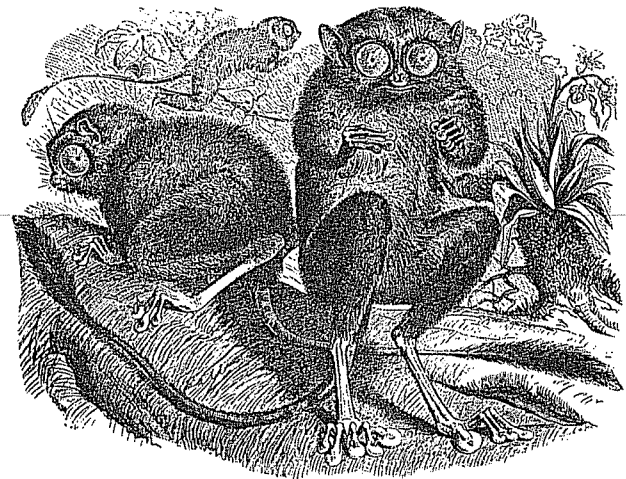
**Figure 16.5** Skeleton of the left manus of an aye-aye, *Daubentonia madagascariensis*, Daubentoniidae. (Duncan 1877)



**Figure 16.7** Skull of the Philippine tarsier, *Tarsius syrichta*, Tarsiidae. (Mary Ann Cramer)

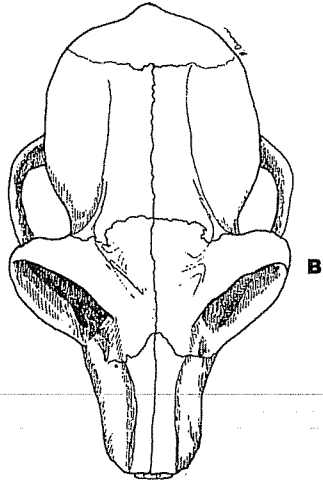
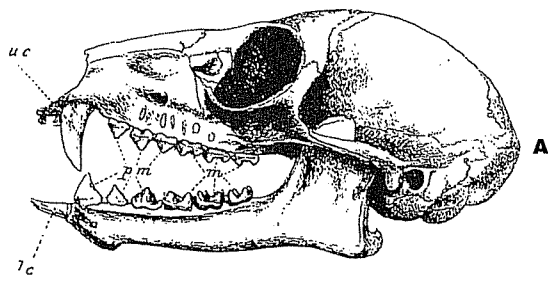


**Figure 16.6** Skull of an indrid lemur, the indri, *Indri indri*, Indridae. (Duncan 1877)

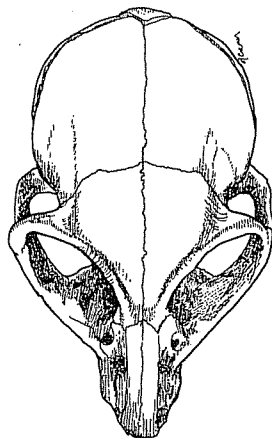


**Figure 16.8** Tarsiers, *Tarsius spectrum*, Tarsiidae. (Kingsley 1884)

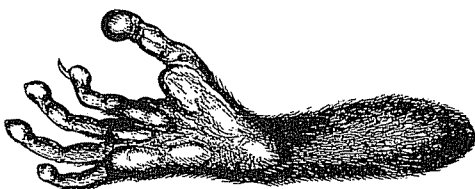
- 3 (2') Dental formula  $2/1 \ 1/1 \ 2/2 \ 3/3 = 30$ ;  $P_1$  canini-form (Fig. 16.6); basal portion of toes at least partly webbed ..... **Indridae**  
indrid lemurs
- 3' Teeth number 32 or more;  $P_1$  varies; toes never webbed ..... 4
- 4 (3') Dental formula  $2/1 \ 1/1 \ 3/3 \ 3/3 = 34$ ;  $I^1$  considerably larger than  $I^2$  (Fig. 16.7); rhinarium absent, area around nostrils haired; tail long and naked or only sparsely haired for most of its length (Fig. 16.8) ..... **Tarsiidae**  
tarsiers
- 4' Dental formula  $0-2/3 \ 1/1 \ 3/3 \ 3/2-3 = 32-36$ ;  $I^1$  and  $I^2$ , if present, essentially equal in size; rhinarium present, area around nostrils naked; tail short, or if long, well-haired ..... 5
- 5 (4') Upper incisors 0 or 2; rostrum long, braincase elongate (Fig. 16.9B); ventral surface of pes naked with coarsely ridged pads ..... 14
- 5' Upper incisors 1 or 2; rostrum short, braincase essentially spherical (Fig. 16.10); ventral surface of pes haired at heel (Fig. 16.11) ..... 6
- 6 (5') Skull with prominent temporal ridges (Fig. 16.12); tail short or absent (Fig. 16.13) ..... **Loridae**  
lorises, potto, angwantibos
- 6' Skull without temporal ridges (Fig. 16.10); tail long and bushy (Fig. 16.14) ..... **Galagonidae**  
galagos or bushbabies
- 7 (1') Dental formula  $2/1 \ 1/1 \ 3/3 \ 3/3 = 34$ ; orbit and temporal fossa confluent ventrally (Fig. 16.7); two tarsal bones greatly elongated, tips of digits with large circular pads (Fig. 16.8) ..... **Tarsiidae**  
tarsiers
- 7' Dental formula  $2/2 \ 1/1 \ 2-3/2-3 \ 2-3/2-3 = 32$  or 36; orbit and temporal fossa separated ventrally by postorbital plate (Fig. 16.15); no tarsal bones elongated; tips of digits without enlarged pads.. ..... 8



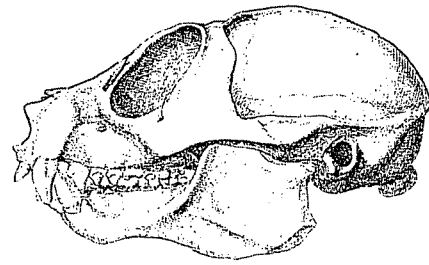
**Figure 16.9** Skull of a ring-tailed lemur, *Lemur catta*, Lemuridae.  
(Lateral view, Flower and Lydekker 1891; dorsal view, Mary Ann Cramer)



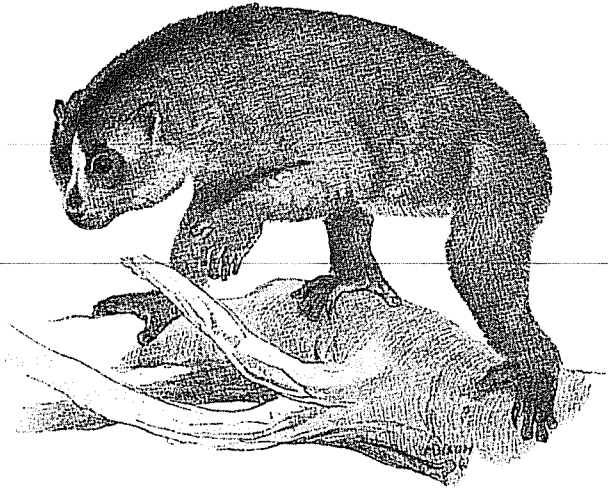
**Figure 16.10** Skull of a greater bushbaby, *Otolemur crassicaudatus*, Galagonidae.  
(Mary Ann Cramer)



**Figure 16.11** Plantar view of right pes of a greater bushbaby, *Otolemur crassicaudatus*, Galagonidae.  
(Duncan 1877)



**Figure 16.12** Skull of a slender loris, *Loris tardigradus*, Loridae.  
(Giebel and Leche 1874)



**Figure 16.13** A slow loris, *Nycticebus coucang*, Loridae.  
(Beddard 1902)

8 (7') Dental formula  $2/2 \ 1/1 \ 3/3 \ 2/2 = 32$ ; third post-canine tooth more like second than fourth in shape and size; second incisors pointed (Fig. 16.15); tail long; hallux with a nail, other digits clawed; pollex present but not opposable .....  
..... **Callitrichidae** (in part)  
..... marmosets, tamarins

8' Dental formula  $2/2 \ 1/1 \ 3/3 \ 3/3 = 36$ , or  $2/2 \ 1/1 \ 2/2 \ 3/3 = 32$ ; if postcanine teeth number five, then third postcanine tooth more like fourth than second in shape and size; second incisors chisel-shaped or pointed; tails of various sorts; all digits with nails; pollex absent or, if present, at least partly opposable; or if claws and pollex as in 8 above, then with six postcanine teeth ..... **9**

- 9 (8') Dental formula  $2/2 \ 1/1 \ 3/3 \ 3/3 = 36$ ; nostrils laterally directed (Fig. 16.3B); tail present, sometimes prehensile ..... 10
- 9' Dental formula  $2/2 \ 1/1 \ 2/2 \ 3/3 = 32$ ; nostrils open forward or down (Fig. 16.3A); tail present or absent, never prehensile ..... 11

- 10 (9) Suture between maxilla and premaxilla well-defined; hallux with a nail, all other digits clawed, pollex unopposable; tail not prehensile; color black ..... **Callitrichidae** (in part)  
Goeldi's monkey, *Callimico goeldii*

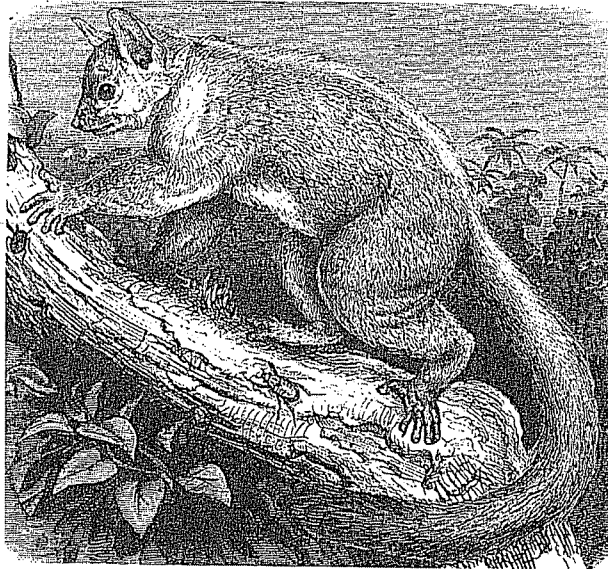
- 10' Maxilla and premaxilla fused in adults, suture not distinguishable; all digits with nails; pollex absent or, if present, at least partly opposable; tails of various sorts, sometimes prehensile (Fig. 16.1); color varies .....  
..... **Cebidae**  
New World monkeys

- 11 (9') Greatest length of skull less than 150 mm ..... 12

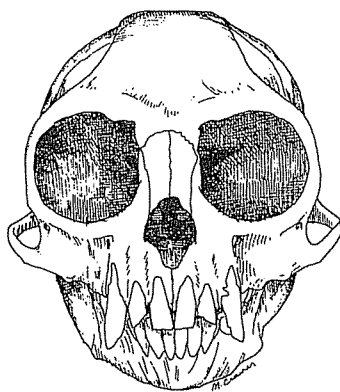
- 11' Greatest length of skull more than 150 mm .... 13

- 12 (11) Anterior root of  $P_1$  sloping forward into dentary and exposed for much of its length (Fig. 16.16), wears against upper canine in occlusion;  $P_1$  distinctly different from  $P_2$ ; tail present or absent; pollex variable .....  
..... **Cercopithecidae** (in part)  
most Old World monkeys

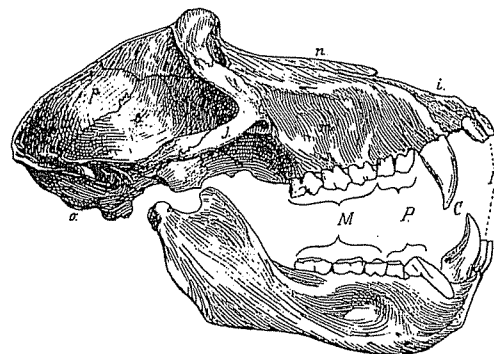
- 12' Anterior root of  $P_1$  entering dentary vertically or at only a slight anterior angle and unexposed or barely exposed (Fig. 16.17),  $P_1$  similar to  $P_2$ ; tail absent; pollex reduced .....  
..... **Hylobatidae**  
gibbons



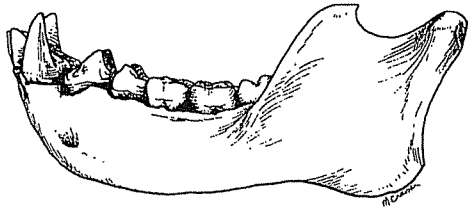
**Figure 16.14** A greater bushbaby, *Otolemur crassicaudatus*, Galagonidae. (Duncan 1877)



**Figure 16.15** Skull of a marmoset, *Callithrix humeralifer*, Callitrichidae. (Mary Ann Cramer)



**Figure 16.16** Skull of a baboon, *Papio hamadryas*, Cercopithecidae, showing the distinctive lower premolar. (Weber 1928)



**Figure 16.17** The mandible of the siamang gibbon, *Hylobates syndactylus*, Hylobatidae, showing a first lower premolar characteristic of this family and of Hominidae. (Mary Ann Cramer)

- 13 (11') Anterior root of P<sub>1</sub> sloping forward into dentary and exposed for much of its length (Fig. 16.16); longitudinal groove frequently present on anterior surface of C<sup>1</sup>; ischial callosities present ..... **Cercopithecidae** (in part) baboons
- 13 Anterior root of P<sub>1</sub> entering dentary vertically (Fig. 16.17) or at only a slight anterior angle, unexposed or only barely exposed; canine never grooved; ischial callosities absent ..... **Hominidae** great apes, humans

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- 14 (5) Upper incisors absent in adults; head plus body length 300–350 mm; never with definite markings or bold color pattern ..... **Megaladapidae** sportive lemurs
- 14' Upper incisors present in adults; head plus body length 125–460 mm; sometimes with definite markings or bold color patterns ..... **15**
- 15 (14') Upper incisors small and peglike (Fig. 16.9), first upper incisors separated by a wide space; head plus body length 280–460 mm; sometimes with definite markings or bold color patterns .. ..... **Lemuridae** lemurs

- 15' Upper incisors not small and peglike, first upper incisors not separated by a wide space; head plus body length 125–285 mm; without definite markings or bold color patterns unless with middorsal stripe that splits in two anteriorly to pass across dorsum of head and then reunite at rhinarium ..... **Cheirogaleidae** mouse lemurs, dwarf lemurs

### COMMENTS AND SUGGESTIONS ON IDENTIFICATION

Primates as an order are distinctive. Some of the smaller forms may at first glance be confused with marsupials, carnivores, or rodents, but close examination should reveal their correct placement. Most primate families are rather homogeneous in basic characteristics, though they may include a large size range. Some possible sources of confusion are listed here.

The skulls of Daubentoniidae resemble those of rodents. Check for a postorbital bar and examine the animal externally.

The marsupials that resemble the smallest primates can be told from them by means of such characters as dental formulas, ventral naked strips on the tail, syndactyly, and clawless/nailless pollex. The rodents that resemble these small primates will have typical rodent dentition, shorter legs, and will generally lack an opposable pollex and/or hallux.

To tell cebids from cercopithecids, check the tooth number, geographic origin, and characteristics of the nose, third postcanine tooth, and P<sub>1</sub>. All prehensile-tailed monkeys are members of the family Cebidae, but only about half of the species of Cebidae have prehensile tails.