

## NONHUMAN PRIMATE TAXONOMY

### Characteristics Common to NHPs:

<ul style="list-style-type: none"> <li>• Unguiculate: nails or claws</li> <li>• Clavicate: possess a clavicle</li> <li>• Placental mammal</li> <li>• Orbits encircled by bone</li> <li>• Three kinds of teeth</li> <li>• Brain: posterior lobe &amp; calcarine fissure</li> </ul>	<ul style="list-style-type: none"> <li>• Innermost digits opposable</li> <li>• Hallux with flat nail or none at all</li> <li>• Well-marked cecum</li> <li>• Penis pendulous</li> <li>• Testes scrotal</li> <li>• Two pectoral mammæ</li> </ul>
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**Geographic Distribution:** Ranging from 25° north latitude to 30° south latitude. Habitats range from tropical rain forests to semiarid savannas to desert steppes. Primates are indigenous to regions within Africa, Asia, South America, Central America, and extreme southern Europe. Although most species are found primarily in tropical rain forest and savanna habitats, two species, *M. mulatta* and *M. fuscata*, range as far north as Beijing, China, and the island of Honshu in Japan (approximately 41° north latitude).

### Terms Used to Identify NHPs:

<b>Old World monkey and New World monkey</b>	Genera found in <b>Africa and Asia</b> or <b>South and Central America</b> , respectively
<b>Neotropical primate</b>	Interchangeable with <b>New World monkey</b>
<b>Prosimian</b>	All taxa within the suborders <b>Strepsirrhini and Haplorrhini</b> , which include lemurs and tarsiers <i>Prosimian</i> = Latin root word meaning ' <b>before monkeys</b> ,' refers to their phylogenetic position with respect to simian primates Prosimian primates are not considered to be 'monkeys'
<b>Simian</b>	Adjective or noun to describe <b>monkeys and apes</b>
<b>Tarsier</b>	Describes primates of the <b>genus Tarsius</b> that share characteristics of prosimians and simians Like prosimians, tarsiers are <b>nocturnal</b> , have <b>large eyes and mobile ears</b> , have ' <b>toilet claws</b> ' on the foot, and have a two-part mandible. Unlike prosimians, tarsiers <b>lack a naked rhinarium and dental comb</b> Like anthropoids (simians), tarsiers have <b>upright lower incisors and a dry, furry nose</b>
<b>Monkey</b>	Describes all species of nonhuman primates <b>except prosimians and apes</b> . Monkeys are distinguished from apes by the presence of an <b>external tail</b> .
<b>Macaque</b>	Common name for <b>primates belonging to the genus Macaca</b> . This genus includes rhesus monkeys ( <i>M. mulatta</i> ) and cynomolgus monkeys ( <i>M. fascicularis</i> ), two of the most commonly used species in biomedical research.
<b>Baboon</b>	Primates belonging to the <b>genus Papio</b> .
<b>Great ape</b>	Apes within the <b>family Hominidæ</b> . The great apes include <b>chimpanzees, bonobos, gorillas, and orangutans</b> . They are distinguished from monkeys by a number of anatomic features, including <b>lack of tail</b> . They are <b>capable of bipedalism</b> , although <b>quadrupedal locomotion is common</b> .
<b>Lesser ape</b>	Members of the family <b>Hylobatidæ</b> . Lesser apes include those species referred to as <b>gibbons and siamangs</b> . They are smaller than great apes and are almost entirely <b>arboreal</b> , whereas great apes such as chimpanzees and gorillas spend a large part of their time on the ground. They are <b>true brachiators</b> , using their arms to swing from branch to branch as their primary means of locomotion. They also <b>lack an external tail</b> .
<b>Callitrichid</b>	Adjective or noun to describe species in the <b>subfamily Callitrichinæ</b> , which includes marmosets and tamarins.
<b>Marmoset</b>	Common name used to identify <b>New World</b> primates belonging to the <b>genera Callithrix and Callimico</b> within the <b>subfamily Callitrichinæ</b>

<b>Tamarin</b>	Common name used to identify <b>New World</b> primates belonging to the genera <b>Saguinus</b> and <b>Leontopithecus</b> within the <b>subfamily Callitrichinæ</b> .
<b>Prehensile tail</b>	Found in some genera of <b>New World</b> monkeys. The tail has a <b>tactile pad</b> similar to that found on the tactile surface of fingers and palms of hands; it is used as an additional appendage for clinging and hanging from tree limbs. The primate can wrap and constrict its tail in a manner resembling that of an elephant's trunk. Prehensile tails are <b>not found in any Old World</b> monkey taxa.
<b>Pseudoprehensile tail</b>	Found in <b>some</b> genera of <b>New World monkeys</b> . Refers to the ability of the animal to grasp and cling with the tail; however, the tail does not possess a tactile pad.
<b>Cheek pouches</b>	<b>Specialized pouches</b> found in genera within the <b>family Cercopithecidae</b> <b>Extensions of the cheeks</b> that extend below each ramus of the mandible. Cheek pouches allow the animal to quickly store food for eating at a later time.
<b>Ischial callosities</b>	Specialized <b>pads that cover the skin surface of the ischium</b> and <b>facilitate sitting</b> Found in <b>Old World</b> monkeys and <b>lesser apes</b> <b>Not found in New World monkeys</b>
<b>Sex Skin</b>	<b>Thickening and reddening of the skin</b> in some species of <b>Old World</b> monkeys and <b>apes</b> . Areas affected most often are the <b>perineal region and the upper legs</b> , but it can be observed with almost any skin surface Sex skin <b>varies due to seasonality and cyclic hormonal fluctuations</b> .
<b>Perineal tumescence</b>	<b>Large cyclic swelling</b> that occurs in some species of <b>Old World</b> monkeys and <b>apes</b> . Most pronounced during the <b>perioovulatory phase of the menstrual cycle</b> . This swelling can be confused with a pathologic process by those unfamiliar with this natural reproductive process.
<b>Strepsirrhini</b>	<b>Suborder</b> for <b>prosimians</b> describing <b>wet rhinarium with a fissure</b>
<b>Haplorrhini</b>	<b>Suborder</b> describing <b>dry noses</b> . Applies to tarsiers and simians.
<b>Platyrrhini</b>	<b>Parvorder</b> for <b>Simiiformes</b> describing a <b>broad, flat nose with lateral nares</b> . Seen in <b>NWM</b> only.
<b>Catarrhini</b>	<b>Parvorder</b> for <b>Simiiformes</b> describing a <b>narrow nose with downward nares</b> . Seen in <b>OWM</b> only.

### Modern Classification

<ul style="list-style-type: none"> <li>• <b>Life:</b> Non-cellular and <b>Cellular</b></li> <li>• <b>Domains:</b> Bacteria, Archæa, <b>Eucarya</b></li> <li>• Six <b>Kingdoms</b> today <ul style="list-style-type: none"> <li>• Bacteria/Eubacteria</li> <li>• Archæa/Archæabacteria</li> <li>• Protista</li> <li>• Plantæ</li> <li>• Fungi</li> <li>• <b>Animalia</b></li> </ul> </li> </ul>	<p><b>Basic Latin Pronunciation</b></p> <ul style="list-style-type: none"> <li>• Infraorder: “<b>-iformes</b>” = “ih-FOR-mess”</li> <li>• Superfamily: “<b>-oidea</b>” = “OY-dee-ah”</li> <li>• Family: “<b>-idæ</b>” = “ih-dee”</li> <li>• Subfamily*: “<b>-inæ</b>” = “ih-nee” *Only for Simiiformes, not prosimians</li> </ul> <p>“Super <b>idea!</b> = Superfamily “A “<b>dæ</b>” (day) with the Family” = Family name suffix “A day with the <b>n</b>anny” = Subfamily member (-<b>næ</b> suffix)</p>
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### Seven Basic Levels

<b>Level 1</b>	<b>Kingdom:</b> Organisms are distinguished on the basis of cellular organization and methods of nutrition	<b>King</b>
<b>Level 2</b>	<b>Phylum:</b> Organisms have similarities in basic body plan or organization	<b>Phillip</b>
<b>Level 3</b>	<b>Class:</b> Distinguished mostly on the basis of the skeletal system, general environmental adaptation, and reproductive system	<b>Came</b>
<b>Level 4</b>	<b>Order:</b> Further subdivision of Class	<b>Over</b>
<b>Level 5</b>	<b>Family:</b> Groups of organisms whose differences are minor	<b>From</b>
<b>Level 6</b>	<b>Genus:</b> Closely related species grouped together	<b>Germany</b>
<b>Level 7</b>	<b>species:</b> groups of populations that can breed and produce fertile offspring	<b>swimming</b>

**Features of Prosimians**

<b>Geography</b>	Indigenous to Africa, India, and Southeast Asia.
<b>Nose</b>	Possess a naked, moist snout called a rhinarium with a fissured, fixed upper lip resembling the rhinarium of dogs and cats
<b>Diurnal/Nocturnal</b>	All are nocturnal except the genera <i>Lemur</i> , <i>Varecia</i> , <i>Hapalemur</i> , <i>Indri</i> , and <i>Propithecus</i>
<b>Grooming</b>	Possess a 'toilet claw' on the second digit of the foot for grooming.
	Possess a toothcomb for grooming, which is formed from the lower incisors.
	Possess a sublingual structure for cleaning the toothcomb.
<b>Mandible</b>	The mandible is in two parts joined at the midline by cartilage.
<b>Dentition</b>	Dental formula: 4 incisors + 2 canines + 6 premolars + 6 molars x 2 = 36 (except Indriidæ with 30).
<b>Placentation</b>	All have epitheliochorial placentas except Tarsiidæ, which has hemochorial.

**Features of New World Monkeys (Platyrrhini)**

<b>Geography</b>	Indigenous to <b>tropical South and Central America</b>
<b>Nose/face</b>	Muzzle is <b>flattened with broadly spaced, laterally flared nares</b>
<b>Tails</b>	Some species possess <b>prehensile or pseudoprehensile tails</b>
<b>Cheek pouches or ischial callosities</b>	<b>Do not</b> possess cheek pouches or ischial callosities
<b>Vitamin D2 or D3 in diet</b>	<b>Require vitamin D3</b> in their diet; ingested vitamin D <sub>2</sub> is not bioavailable
<b>Estrous or Menstrual Cycle</b>	<b>All have estrous cycles</b> , except <i>Cebus</i> spp., which menstruate
<b>Arboreal or terrestrial</b>	All are <b>arboreal</b>
<b>Diurnal/Nocturnal</b>	All are <b>diurnal except <i>Aotus</i> spp. (the only nocturnal simian primate)</b>
<b>Dentition</b>	Dental formulas: Cebinae: 4 incisors + 2 canines + 6 premolars + 6 molars x 2 = <b>36</b> Callitrichinae: 4 incisors+ 2 canines+ 6 premolars+ 4 molars x 2 = <b>32</b> (except genus <i>Callicebus</i> with 36 as in Cebinae)
<b>Placentation</b>	All have <b>hemochorial</b> placentas

**Features of Old World Monkeys (Catarrhini)**

<b>Geography</b>	Indigenous to <b>Africa, Asia, and extreme southern Europe</b> (introduced to Gibraltar).
<b>Nose/face</b>	Muzzle is <b>elongate</b> (varying in degree among genera) with <b>narrowly spaced, turned-down nares</b>
<b>Tails</b>	On most <b>monkeys, never on apes</b>
<b>Cheek pouches or ischial callosities</b>	<b>Some species possess ischial callosities</b> for sitting. <b>Cheek pouches</b> for storing food are <b>found in some genera of Cercopithecidae</b>
<b>Vitamin D2 or D3 in diet</b>	All can utilize <b>vitamin D2 in their diet</b>
<b>Estrous or Menstrual Cycle</b>	All have <b>menstrual</b> cycles
<b>Arboreal or terrestrial</b>	<b>Both:</b> some species are adapted to terrestrial living while others are primarily arboreal
<b>Diurnal/Nocturnal</b>	All are diurnal.
<b>Dentition</b>	Dental formula: 4 incisors+ 2 canines+ 4 premolars + 6 molars x 2 = <b>32</b>
<b>Placentation</b>	All have <b>hemochorial</b> placentas

## NHP Classification

<b>Level 1</b>	<b>Kingdom: Animalia</b>				
<b>Level 2</b>	<b>Phylum: Chordata</b>				
Level 2b	Subphylum: Vertebrata				
Level 3a	Superclass: Tetrapoda				
<b>Level 3</b>	<b>Class: Mammalia</b>				
Level 3b	Subclass: Theria				
Level 3c	Infraclass: Eutheria				
Level 4a	Superorder: Archonta				
<b>Level 4</b>	<b>Order: Primates</b>				
Level 4a	Suborder				
	<b>Strepsirrhini</b>			<b>Haplorrhini</b>	None
Level 4b	Infraorder				
	Lemuriformes	Chiromyiformes	Lorisiformes	Tarsiformes	Simiformes
Level 4c	Parvorder				
	None			None	<b>Platyrrhini &amp; Catarrhini</b>

### PROSIMIANS

<b>Level 5a</b>	<b>Superfamily (2)</b>				
	Cheirogaloidea	Lemuroidea	None	None	None

<b>Level 5</b>	<b>Family (8)</b>				
	Cheirogaleidæ	Lemuridæ	Daubentoniidæ	Lorisidæ	Tarsiidæ
		Lepilemuridæ		Galagidæ	
		Indriidæ			
<b>Levels 6</b>	<b>Genus (23)</b>				
	n=4	n=9	<i>Daubentonia</i>	n=8	<i>Tarsius</i>

**NO SUBFAMILIES IN PROSIMIANS**

## SIMIANS

Level 4b	<b>Infraorder (1)</b>						
	<b>Simiformes</b>						
Level 4c	<b>Parvorder (2)</b>						
	<b>Platyrrhini</b>				<b>Catarrhini</b>		
	<i>New World Monkeys (NWM)</i>				<i>Old World Monkeys (OWM)</i>		
Level 5a	<b>Superfamily (3)</b>						
	<b>Callithricoidea</b>				<b>Cercopithicoidea</b>		<b>Hominoidea</b>
<b>Level 5</b>	<b>Family</b>						
	Cebidæ	Aotidæ	Pithecidæ	Atelidæ	<b>Cercopithicidæ</b>	Hylobatidæ	<b>Hominidæ</b>

## New World Monkeys (NWM)

<b>Level 5</b>	<b>Family</b>						
	<b>Cebidæ</b>			<b>Aotidæ</b>	Pithecidæ	Atelidæ	
Level 5b	Subfamily						
	<b>Callitrichinæ</b>	Cebinæ	<b>Saimirinæ</b>	None	n =2	n=2	
<b>Level 6</b>	<b>Genus</b>						
	<i>Callithrix</i>	<i>Cebus</i>	<i>Saimiri</i>	<i>Aotus</i>	n=4	n=5	
	<i>Saguinus</i>						

## Old World Monkeys (OWM)

<b>Level 5</b>	<b>Family</b>						
	<b>Cercopithicidæ</b>				Hylobatidæ	<b>Hominidæ</b>	
Level 5b	Subfamily						
	<b>Cercopithicinæ</b>				Colobinæ	None	None
<b>Level 6</b>	<b>Genus</b>						
Level 6b	TRIBE						
	PAPIONI			CERCOPITHECINI			
	<i>Macaca</i>	<i>Papio</i>	<i>Chlorocebus</i>	n=10	n=4	<i>Pan</i>	<i>Gorilla</i>
	<i>Lophocebus</i>	<i>Cercocebus</i>	<i>Erythrocebus</i>			<i>Pongo</i>	<i>Homo</i>
	Others (3)			Others (3)			

**General Information on NHP Taxonomy by Taxa**

1. **Prosimians:** not used in research. Be familiar with above terms and features regarding prosimians.

2. **New World Primates**

**Callitrichinæ Subfamily**

<b>Genera</b>	<i>Callithrix, Mico, Cebuella, Callibella, Saguinus, Leontopithecus, and Callimico</i>	
<b>Research species</b>	<i>Callithrix jacchus</i> 	<i>Saguinus oedipus</i> 
	<b>CITES I marmosets</b>	<i>Callithrix aurita, Callithrix flaviceps</i>
<b>CITES I tamarins</b>	<i>Saguinus leucopus, Saguinus fuscicollis, Saguinus martinsi, Saguinus bicolor</i>	

**Saimirinæ Subfamily: *Saimiri* spp.**

<b>Genus</b>	<i>Saimiri</i>	
<b>Research species</b>	<i>Saimiri sciureus</i> = Gothic Arches 	<i>Saimiri boliviensis</i> = Roman Arches 
	<b>CITES I Squirrel Monkey</b>	<i>Saimiri oerstedii</i> (Black-crowned Central American squirrel monkey)

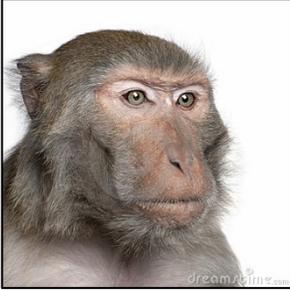
- Precise identification requires phenotypic and karyotypic exams
- 44 csms (diploid) for all
  - Vary in acrocentric autosomes
- Karyotypic variations seen dt inbreeding Peruvian, Bolivian, and Guyanese yielding pericentric inversions
  - Those +/- for inversion: nonviable gametes
- Five species
  - Eight subspecies
- Based on shape of nonpigmented hair above eyes
- Gothic v. Roman arches

**Aotidae family: *Aotus* spp.**

<b>Genus</b>	<i>Aotus</i>	
<b>Research species</b>	Use karyotype to distinguish. All eleven species may be used.	
<b>Red-necked group</b>	<i>A. azarac</i> <i>A. miconax</i> <i>A. nancymaae</i> <i>A. nigriceps</i>	
<b>Grey-necked group</b>	<i>A. brumbacki</i> <i>A. griseimembra</i> <i>A. jorgehernandezi</i> <i>A. lemuringus</i> <i>A. trivirgatus</i> <i>A. vociferan</i> <i>A. zonalis</i>	
	No subfamily Common names: Owl or Night Monkey Wide variation in diploid chromosome # 46-56	Two phenotypic groups Nine allopatric species All CITES II

**3. Old World Primates**

**Cercopithicinae Subfamily: *Macaca***

<b>Principal research species</b>	<i>M. mulatta</i> (Rhesus monkey) 	<i>M. fascicularis</i> (Cynomolgus monkey) 
	<b>CITES</b> All CITES II except <i>M. silenus</i> = CITES I	
<b>Species groups</b>	<b>Bold</b> indicates used in research	
M. SYLVANUS GROUP	<i>M. sylvanus</i>	
M. NEMESTRINA GROUP	<b><i>M. nemestrina</i></b> <i>M. leonina</i>	<i>M. silenus</i> <i>M. pagensis</i>
SULAWESI GROUP	<i>M. maura</i> <i>M. ochreata</i> <i>M. tonkeana</i>	<i>M. hecki</i> <i>M. nigrescens</i> <b><i>M. nigra</i></b>
M. FASCICULARIS GROUP	<b><i>M. fascicularis</i></b>	<b><i>M. arctoides</i></b>
M. MULATTA GROUP	<b><i>M. mulatta</i></b> <i>M. cyclopis</i>	<b><i>M. fuscata</i></b>
M. SINICA GROUP	<i>M. sinica</i> <b><i>M. radiata</i></b>	<i>M. assamensis</i> <i>M. thibetana</i>
<b><i>M. mulatta</i> subspecies</b>	Six subspecies	
<b>Indian Origin</b>	<i>M. m. mulatta</i> , <i>M. m. villosa</i>	
<b>Chinese Origin</b>	<i>M. m. vestita</i> <i>M. m. lasiota</i>	<i>M. m. sanctijohannis</i> <i>M. m. brevicauda</i>
<b>Importance</b>	Rhesus macaques of Chinese origin are more resistant to SIV infection than those of Indian origin.	

<b>SNP</b>	Single nucleotide polymorphisms = able to differentiate Indian from Chinese
<b><i>M. fascicularis</i> subspecies</b>	Ten subspecies

**Cercopithecinæ Subfamily: *Papio***

<b>Savanna Baboons</b>	<i>P. anubis, P. cynocephalus, P. papio, P. ursinus</i>	
<b>Desert Baboon</b>	<i>P. hamadryas</i>	
<b>Principal research species</b>	Olive Baboon ( <i>Papio anubis</i> )	
<b>CITES</b>	All CITES II	

**Cercopithecinæ: *Chlorocebus***

<b>Six species</b>	<i>C. sabaues, C. aethiops, C. djamdjamensis, C. tantalus, C. pygerythrus, C. cynosuroides</i>	
<b>Principal research species</b>	<i>C. aethiops</i> (African Green monkey)	
<b>CITES</b>	All CITES II	

*Chlorocebus* was separated from *Cercopithecus*

**Hominidæ family: *Pan***

<b>Two species</b>	<i>P. troglodytes, P. paniscus</i>	
<b><i>P. troglodytes</i> subspecies</b>	<i>P. t. troglodytes, P. t. verus, P. t. schweinfurthii, P. t. ellioti</i>	
<b>Principal research species</b>	<i>P. troglodytes</i>	
<b>CITES</b>	All CITES I	