

# ANTH 42

## Lect 9: Callitrichids, Cebids and others (*and some geometry*)

Maddalena Bearzi will be giving a talk titled, “**Beautiful Minds: The Parallel Lives of Great Apes and Dolphins,**” on Wednesday, in Hubbs Hall (SIO) 4500 from 12:15-1:15PM (Hubbs is just below SIO library).

**Related note: If nobody shows up for my OH before 11:20, I leaving early...**

# Quiz clock

Minutes remaining: **ONE**

30 sec ...

5 4 3 2

“Until fairly recently, callitrichines were regarded as living in either monogamous or extended family units.” [Falk, p. 125]

## Callitrichid mating systems...

Cooperative polyandry.

Why so rare, and why do callitrichids do it?

Why do unrelated (to each other) males help?

Unrelated females?

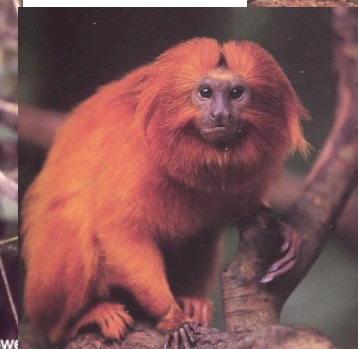
2 pairs twins/year: highest among anthropoids.

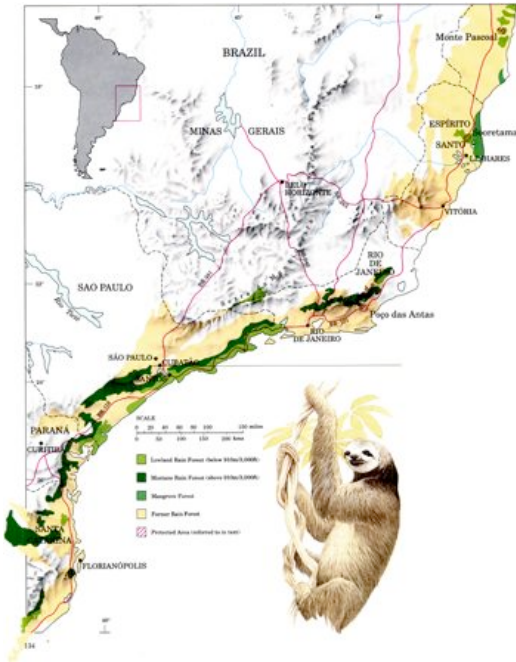


Book presents it as new and surprising.

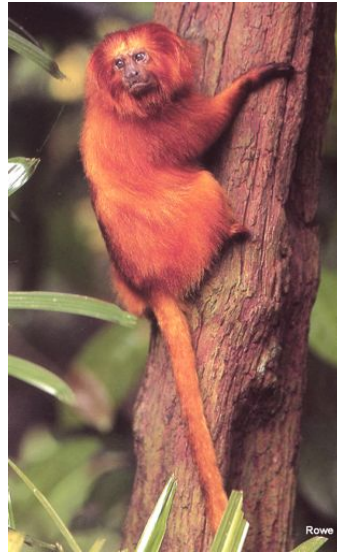
Why was it so late in being recognized?

## Lion tamarins





## The Atlantic Forest, Brazil



57 HIGHER PRIMATES—Anthropoidea  
 59 Neotropical Primates—Platyrrhini/Ceboidea  
 59 Marmosets and Tamarins—Callitrichidae



81 Cebids—Cebidae



85 Titi Monkeys—Callicebinae



93 Capuchins and Squirrel Monkeys—Cebinae



## New World monkeys [NWMs]



107 Howler Monkeys—Alouattinae



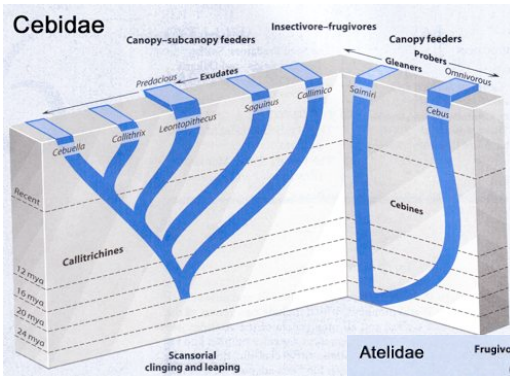
112 Spider Monkeys and Woolly Monkeys—Atelinae



### Ceboidea I

- Aotinae
- Callicebinae
- Cebinae
- Pitheciinae

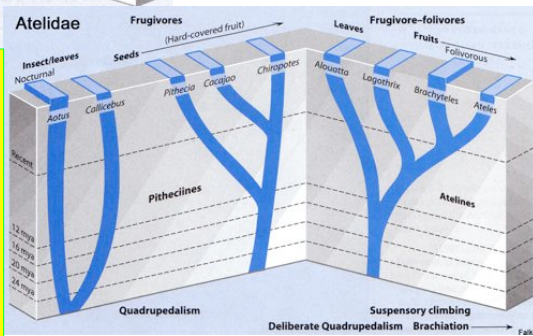
Proving a point, note grouping differs from Falk...



## NWM monkeys

**Today: 3 groups**

- Cebine generalists (*Saimiri*, *Cebus*)
- Pitheciine seed predators (*Pithecia*, *Cacajao*, *Chiropotes*)
- The other ones (*Aotus*, *Callicebus*)



NWM are all about arboreal. What does that entail? Some issues about living in trees. You've heard lots about importance of grasping hands in trees; how do you account for the sun bear?

BBC Life of Mammals: *Life in the Trees*





White-throated capuchins  
(*Cebus capucinus*)

Illustrates advantages of large brain to a generalist primate.

BBC Life of Mammals:  
*Social Climbers*

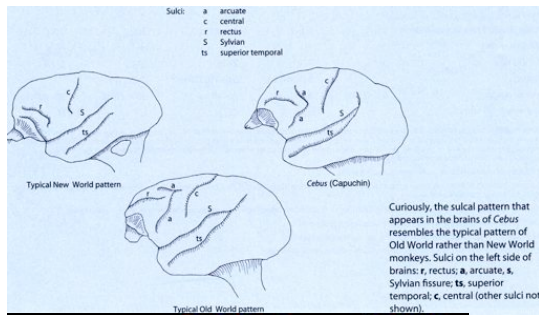


White-throated capuchins  
(*Cebus capucinus*)

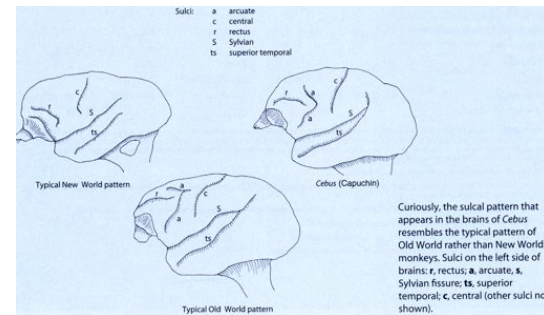
Remember the stoned lemur? Is this similar? Think about proximate and ultimate explanations...

Clear up brain story...

BBC Life of Mammals:  
*Social Climbers*

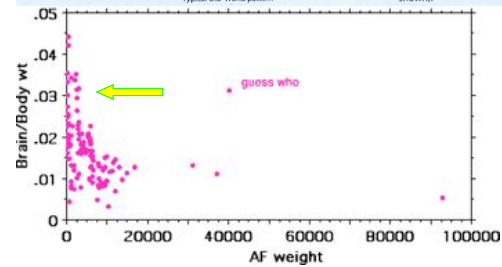


### Cebus brains

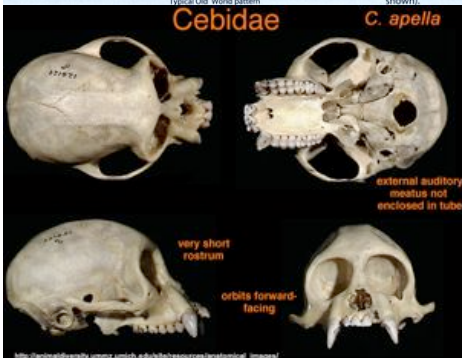


### Cebus brains

Bigger bodies tend to have bigger brains



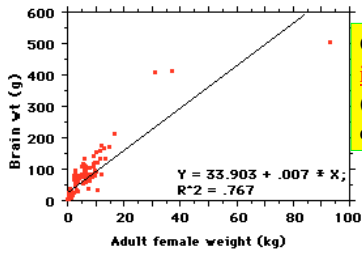
You'd think brain/body weight ratio would factor that out, but ...



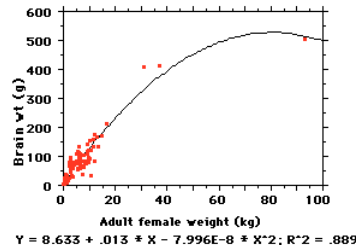
Two issues (maybe):  
Size  
Morphology

# Allometry (Allo - metry)

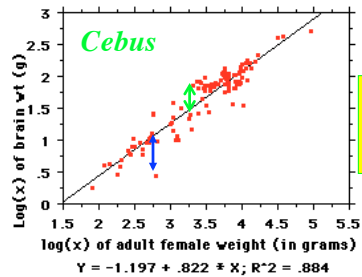
Form of relationship; applied here to relative brain size



Can see **isometric** line ( $y=mx + b$ ) doesn't fit



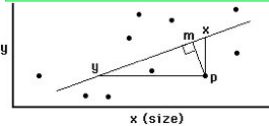
2<sup>nd</sup> order ( $y=mx + zx^2 + b$ ) good, but messy.  $x^2$  **not iso-metric**.



Converting to log-log gets back to  $y=mx + b$  form

Residual = "encephalization"

Different forms of regression: minimize m-p; minimize area of ypx... just FYI



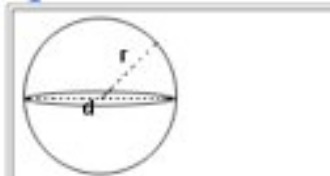
For shape, need to look at size again...



**Q: Are big brains just larger brains?**

To answer, need some basic geometry...

## Sphere



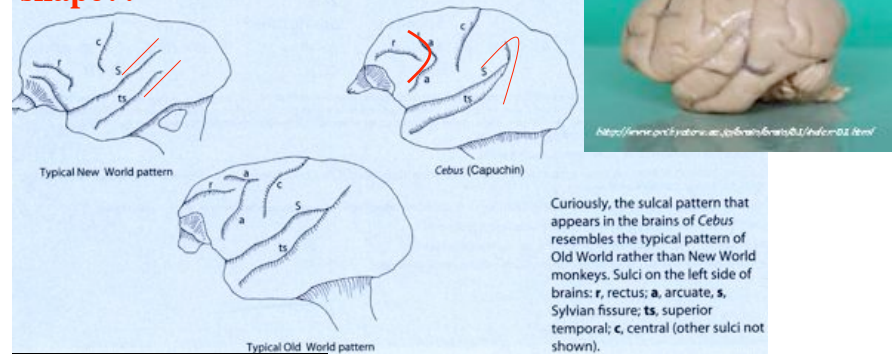
Surface Area =  $4 \pi r^2$   
 Volume =  $4/3 \pi r^3$   
 $d = 2r$



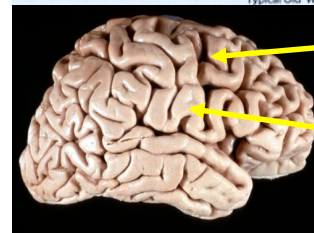
That was size; shape??

Sulci: a arcuate, c central, r rectus, s Sylvian, ts superior temporal

Cebus

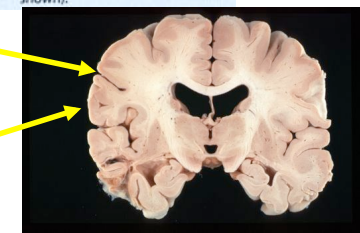


Curiously, the sulcal pattern that appears in the brains of Cebus resembles the typical pattern of Old World rather than New World monkeys. Sulci on the left side of brains: r, rectus; a, arcuate; s, Sylvian fissure; ts, superior temporal; c, central (other sulci not shown).

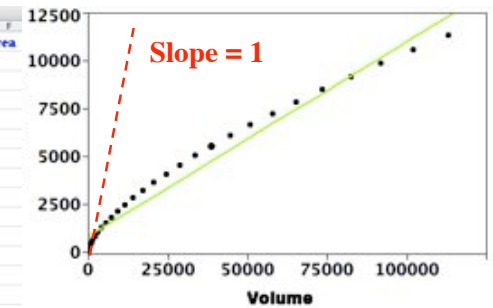


Sulcus (sulci)

Gyrus (gyri)

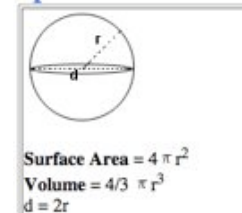


Radius	Volume	Surface area	Log Vol	Log surface area
1	4.2	12.6	1.43	2.53
2	33.5	50.2	3.51	3.92
3	113.0	113.0	4.73	4.73
4	267.9	201.0	5.89	5.3
5	523.3	314.0	6.26	5.75
6	904.3	452.2	6.81	6.11
7	1436.0	615.4	7.27	6.42
8	2143.6	803.8	7.67	6.69
9	3052.1	1017.4	8.02	6.92
10	4186.7	1256.0	8.34	7.14
11	5572.5	1519.8	8.63	7.33
12	7234.6	1808.6	8.89	7.5
13	9198.1	2122.6	9.13	7.66
14	11488.2	2461.8	9.35	7.81
15	14130.0	2826.0	9.56	7.95
16	17148.6	3215.4	9.75	8.08
17	20569.1	3629.8	9.93	8.2
18	24416.6	4069.4	10.1	8.31
19	28716.3	4534.2	10.27	8.42
20	33493.3	5024.0	10.42	8.52
21	38772.7	5539.0	10.57	8.62
22	44579.6	6079.0	10.71	8.71
23	50939.2	6644.2	10.84	8.8
24	57876.5	7234.6	10.97	8.89
25	65416.7	7850.0	11.09	8.97
26	73584.9	8490.6	11.21	9.05
27	82406.2	9156.2	11.32	9.12
28	91905.7	9847.0	11.43	9.19
29	102108.6	10563.0	11.53	9.27
30	113040.0	11304.0	11.64	9.33



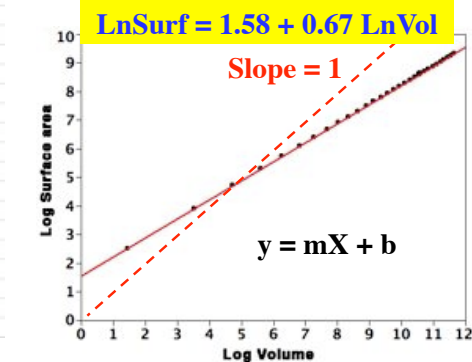
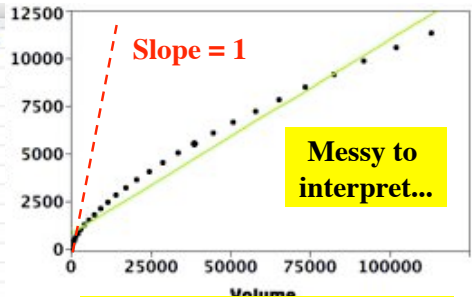
Volumes and surface areas for a series of spheres

## Sphere





1	Radius	Volume	Surface are	Log Vol	Log surface area
2	1	4.2	12.6	1.43	2.53
3	2	33.5	50.2	3.51	3.92
4	3	113.0	113.0	4.73	4.73
5	4	267.9	201.0	5.59	5.3
6	5	523.3	314.0	6.26	5.75
7	6	904.3	452.2	6.81	6.11
8	7	1436.0	615.4	7.27	6.42
9	8	2143.6	803.8	7.67	6.69
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17	16	17148.6	3215.4	9.75	8.08
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19	18	24416.6	4069.4	10.1	8.31
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22	21	38772.7	5539.0	10.57	8.62
23	22	44579.6	6079.0	10.71	8.71
24	23	50939.2	6644.2	10.84	8.8
25	24	57876.5	7234.6	10.97	8.89
26	25	65416.7	7850.0	11.09	8.97
27	26	73584.9	8490.6	11.21	9.05
28	27	82406.2	9156.2	11.32	9.12
29	28	91905.7	9847.0	11.43	9.19
30	29	102108.6	10563.0	11.53	9.27
31	30	113040.0	11304.0	11.64	9.33



$\text{LnSurf} = 1.58 + 0.67 \text{LnVol}$

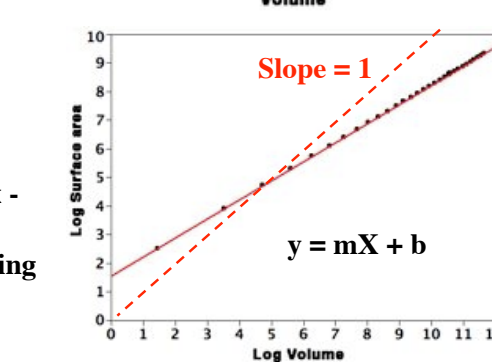
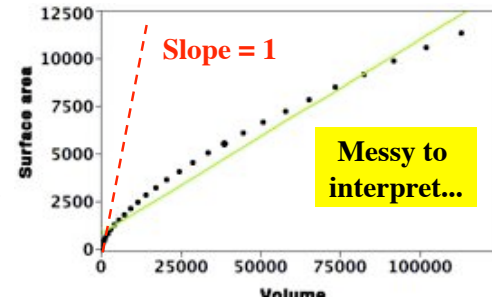
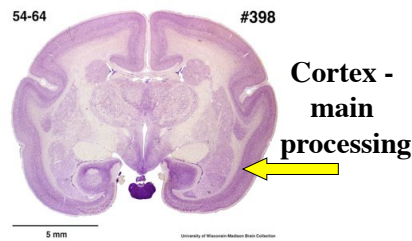
The slope is 0.67 (2/3)

This has various implications ignored for now.

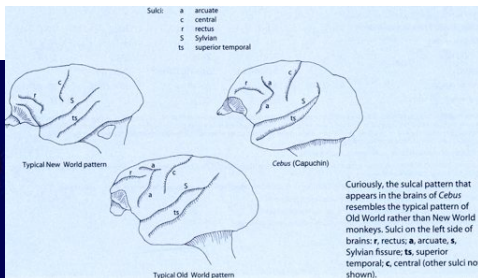
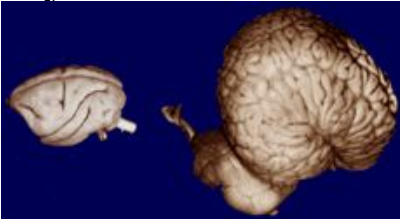
Simplest is just that  $2/3 < 1$

Volume of a sphere increases faster than surface area.

54-64 #398



## Gyri and size



Back to original question.  
More surface, need fold.

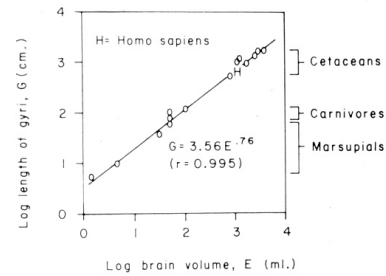
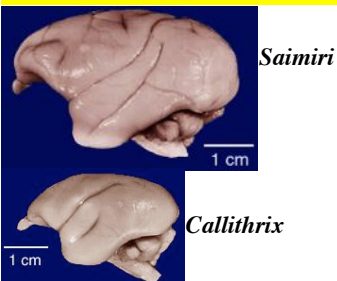
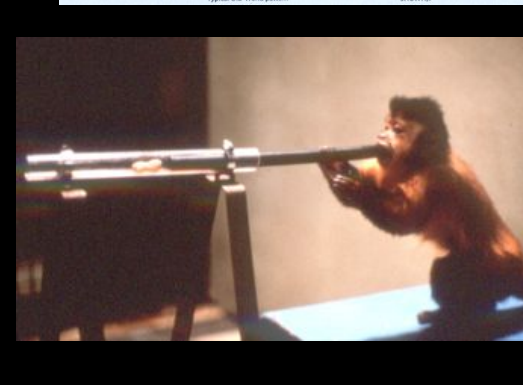
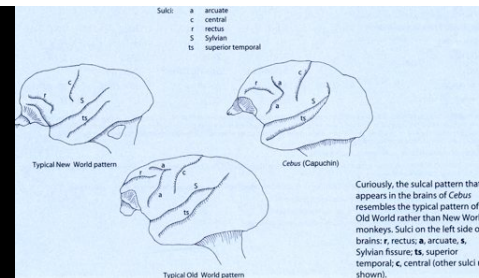


FIG. 4. Length of "external" gyri and brain size. "External" gyri are those visible at the surface of the undissected brain and correspond to gyri visible in fossil endocasts. (Data from Elias and Schwartz, 1971; graph modified from Jerison, 1982, copyright Plenum Press, New York.)

Cebus has relatively large brain, is clearly very smart.

Allometry suggests that in order to pack more processing in without HUGE brain, need more folds.

Does not make clear why folds converge on OWM pattern though. Fun!





## Saimiri

*S. oerstedii* in Central America,

others S. America



Figure 7.2 Distribution map of *Saimiri* (B. Lenz, adapted from Boinski 1999).

**“Fattening” - *S. oerstedii* and *S. boliviensis* males gain to 22% body weight; mainly water. Related to testosterone, & biggest wins.**



**Saimiri: socioecology in a nutshell.**

*S. o.* female disperse; *S. b.* do not (and collectively dominate males).

*S. o.* - dispersed fruit, no group defense of patchy resources

*S. b.* - large fruit trees, defended, natal females



Titi monkeys (*Callicebus*)

≥ 13 species, some with overlapping ranges.  
Monogamous, cryptic.

*What's with the tails?*

