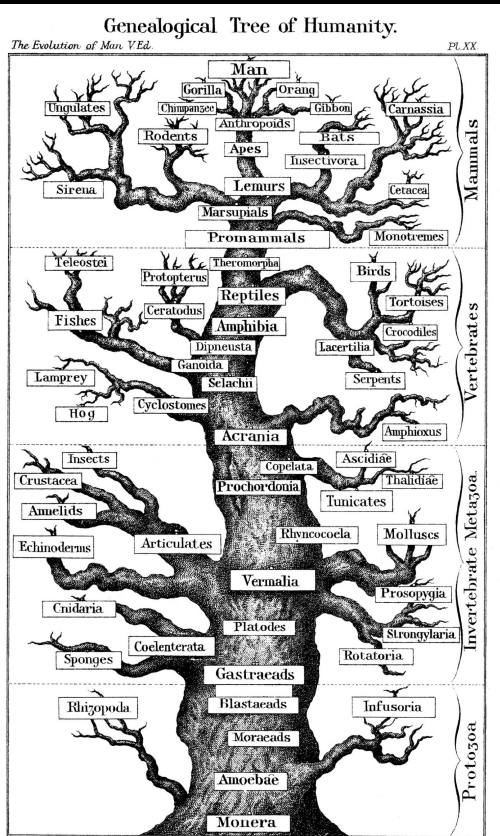


Where does diversity come from?

1. basic mechanisms of evolution produce contemporary biodiversity

Human evolution and diversity

- i. Variation
- ii. selection

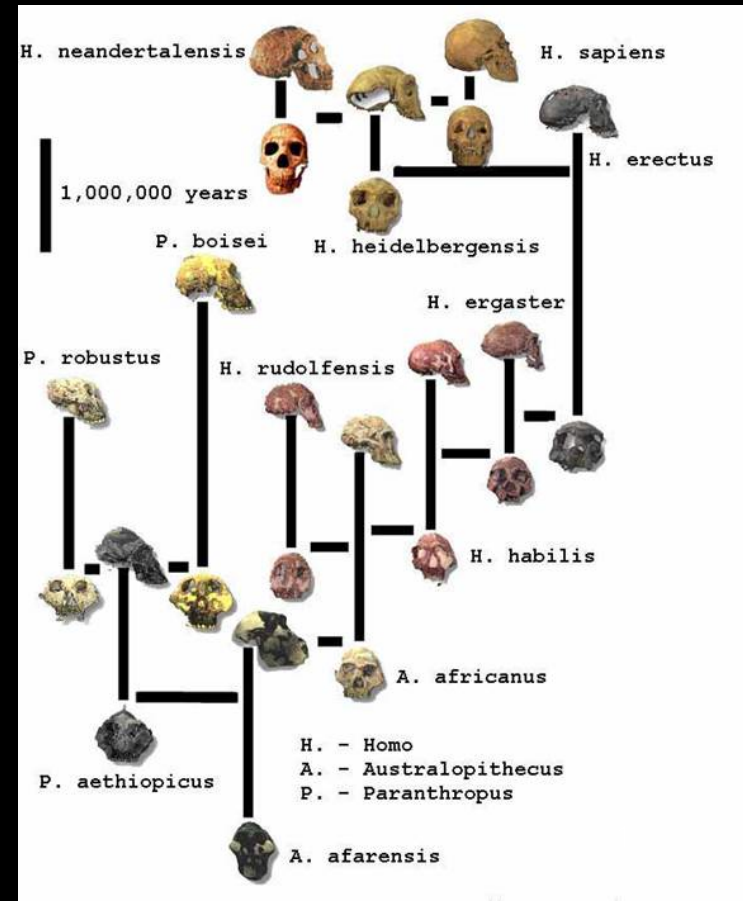


Views of evolution:

Tree
(dated)

versus

bush
(contemporary)

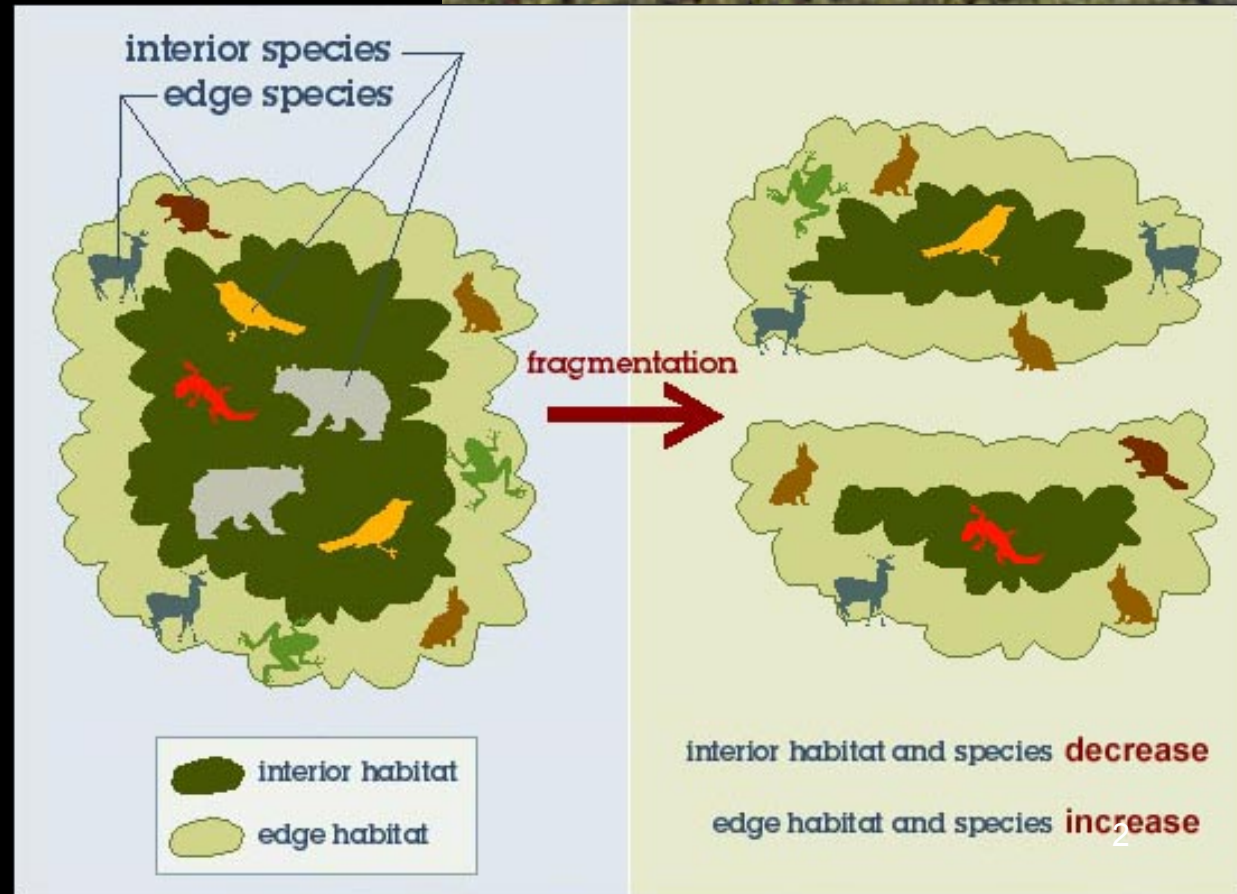


Where does Biodiversity come from?

2. Relations *between* species:

- coevolutionary relationships: mutualism, symbiosis,
- Allopathy –

Separation of species



History of biodiversity: 500 Million Years ago: the Cambrian Explosion

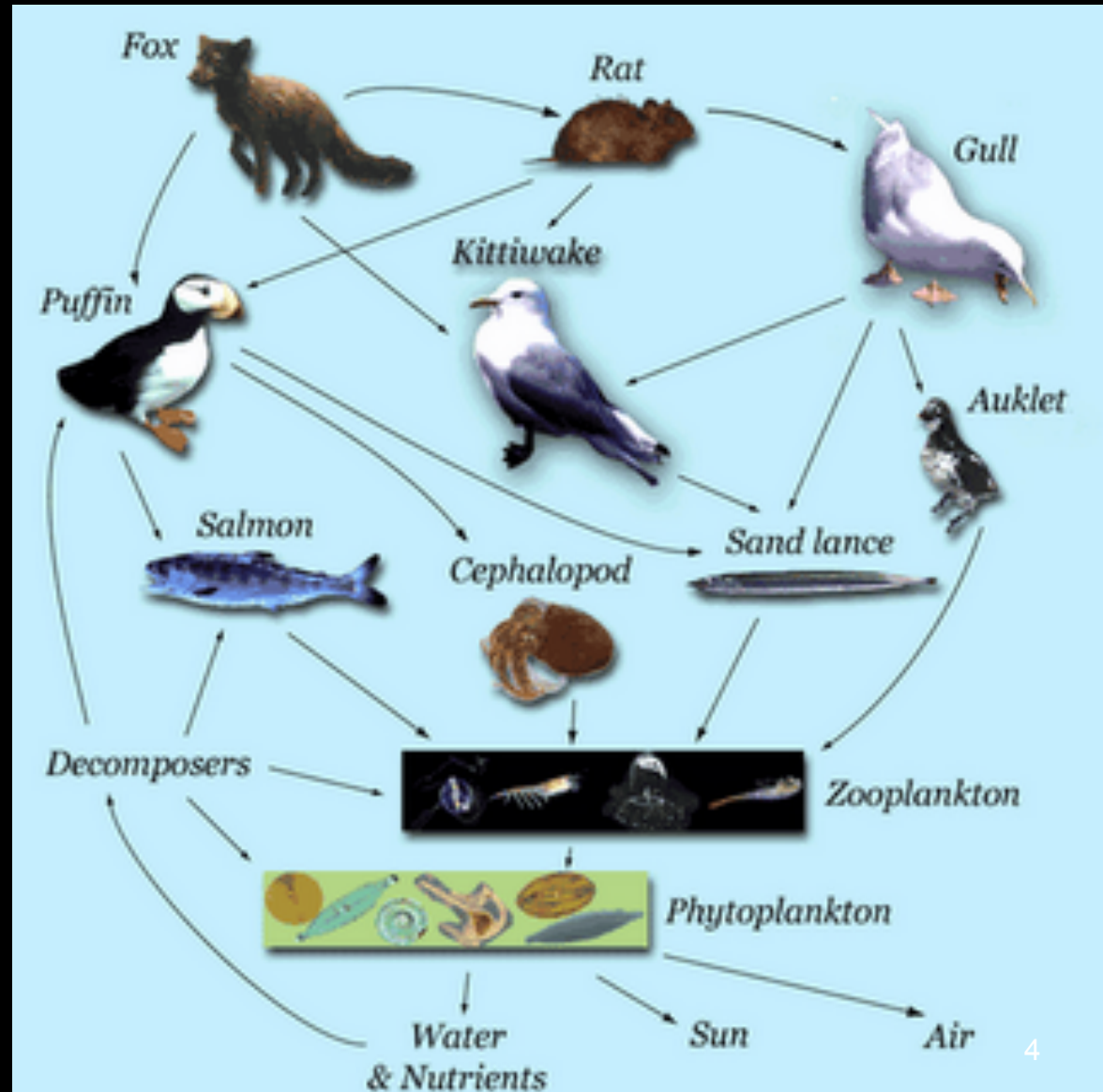


In the image above, trilobites (1) live among many species that are not normally preserved. A typical Cambrian outcrop might produce only trilobites, brachiopods (2), mollusks (3), and crinoids (4). That is a tiny fraction of the full Cambrian biota, better represented by the roster of the Burgess Shale Cambrian Konservat-Lagerstätten. That community includes sponges *Vauxia* (5), *Hazelia* (6), and *Eifellia* (7); brachiopods *Nisusia* (2); priapulid worms *Ottoia* (8); trilobites *Olenoides* (1); other arthropods such as *Sidneyia* (9), *Leanchoilia* (10), *Marella* (11), *Canadaspis* (12), *Helmetia* (13), *Burgessia* (14), *Tegopelte* (15), *Naraoia* (16), *Waptia* (17), *Sanctacaris* (18), and *Odaraia* (19); lobopods *Hallucigenia* (20) and *Aysheala* (21); mollusks *Scenella* (3); echinoderms *Echmatocrinus* (4); and chordates *Pikaia* (22); among other oddities, including *Haplophrentis* (23), *Opabinia* (24), *Dinomischus* (25), *Wiwaxia* (26), *Amiskwia* (27), and *Anomalocaris* (28). ©2002 by S.M. Gon III (composition & linework) & John Wherrill (color rendering)

The original ‘diversity-through-interaction’ symbiosis:
Mitochondria as a symbiotic organism within the genome:

‘powerhouse of the cell’, Separate DNA, Permitted the rise of genetic complexity by allowing mitochondrial simplicity!

Collapse due to ecological dependency or species interrelations: how many species may be lost before the web of life begins to collapse?



Companion Species aren't just 'out there' but also 'in here'!

A concern for any environmental course: How to avoid the creation of artificial distinctions between 'the environment' over there and 'humans' in here?

- i. Biodiversity within: the human gut symbiosis of digestion and disease
90% of cells in human body are non-human
play critical role in digestion and disease prevention
- ii. Food, air, allergens, environmental disease
- iii. Over-medication through antibiotics can promote ecological imbalance in the human intestine
- iv. CASE: Fecal transplants—recent research on fecal transplants shows that some diseases may be cured by changing intestinal bacteria: weight-loss, cancer, even autism? (I remain dubious on this one...)

Coevolution

- A relationship develops between two organisms such that, as they interact with each other over time, each exerts a selection pressure on the other.
- Evolution of each becomes interdependent on that interaction
- **reciprocally induced evolutionary change over time between two organisms**

Types of relationships...

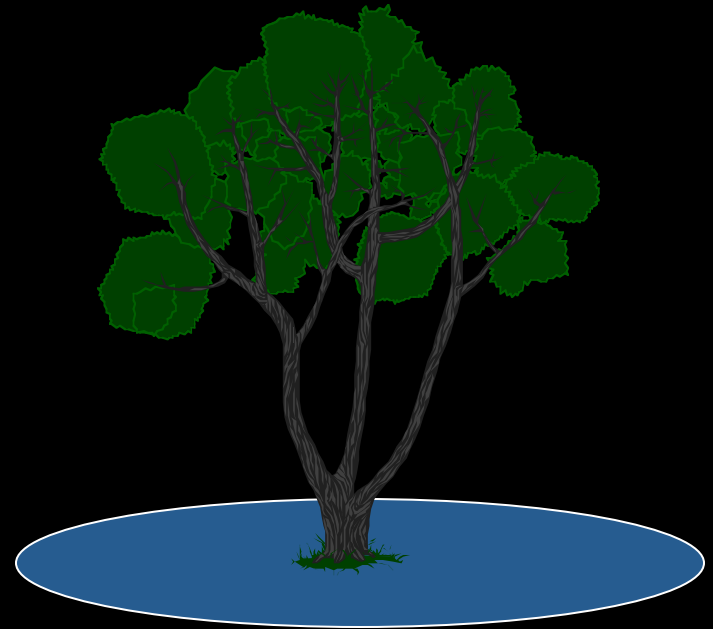
	<i>A</i>	<i>B</i>	
<i>Neutral</i>	0	0	Neither population exerts influence on the other
<i>Mutualism</i>	+	+	Both populations benefit
<i>Commensalism</i>	+	0	One population benefits, other neutral
<i>Predation</i>	+	-	Predator benefits, prey does not
<i>Parasitism</i>	+	-	One benefits, host is affected negatively

Processing technique



Dispersal location

- Not under the tree-tree shadow (why?)
- Lemurs have short gut passage rate (less than 30 minutes)
- So there must be some travel away from parent tree.



Seeds fate?

- Not get eaten by secondary predator (rats)
- Buried or in enough feces to germinate
- Seedling survival (limited- 1 out of 4000 seeds)



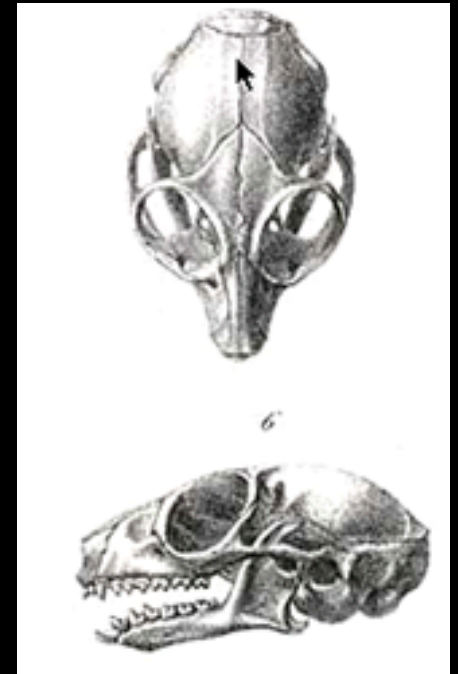
Seed properties

- Should be resistant to chewing
- Oval shape facilitates swallowing whole
- Color attractive to primate (bright?)
- Large to prevent damage



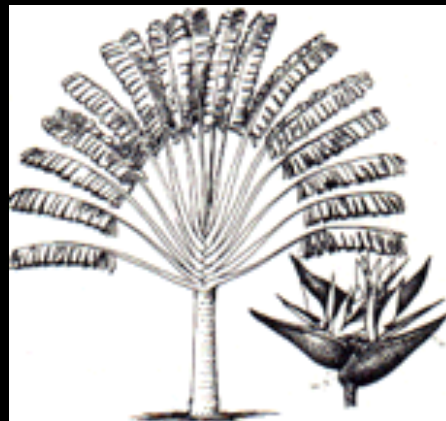
Morphology

- Muzzle length
- Tongue (lemur picture)

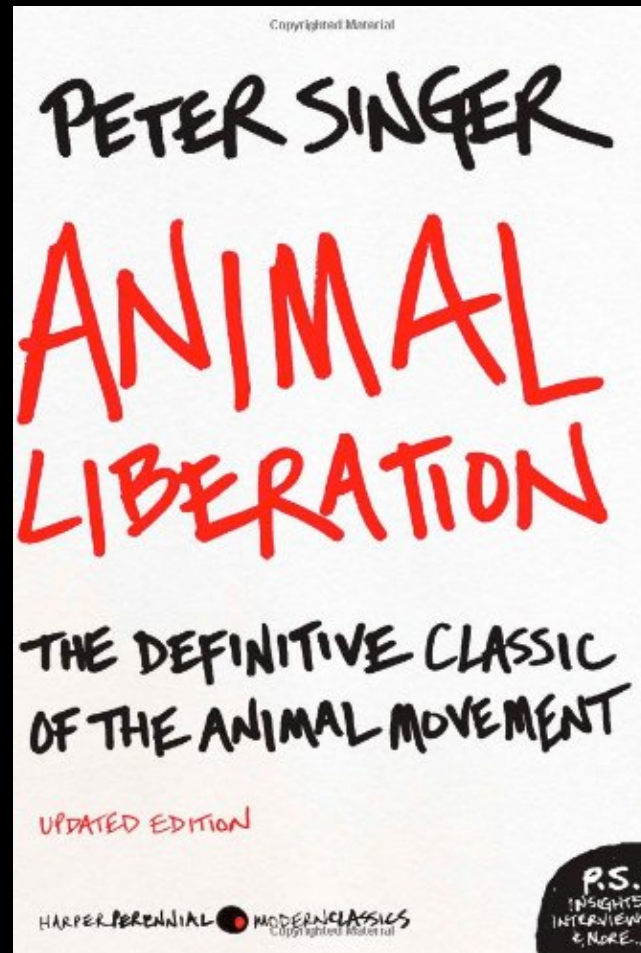


Flower morphology

- **Large flowers**
- **Tough petals**
- **Produce copious nectar**
- **Brightly colored**
- **Smell strongly**



Singer: All Animals Are Equal



Singer: Animal Equality

“Each to count for one and none for more than one.’ In other words, the interests of every being affected by an action are to be taken into account and given the same weight as the like interests of any other being.” (p. 279)

Singer's: **Principle of Equality (POE)**

SPECIESISM IS A BIAS IN FAVOR OF ONE'S OWN SPECIES, LIKE RACISM AND SEXISM

MATTERS MORE IN EVERY CASE?

HUMAN	DOG
OUCH	OUCH
OUCH	OUCH
OUCH	OUCH

JUST SENTIENT CREATURES?

“The capacity for suffering and enjoyment is a *prerequisite for having any interests at all*, a condition that must be satisfied before we can speak of interests in a meaningful way.” (p. 281)

Principle of equality applies to all animals that feel pain

Singer: Animal Liberation

<https://www.youtube.com/watch?v=T0de66wOE4Y>

Singer: p27/28

IMPLICATIONS

Vegetarianism

Should rarely use animals in medical experiments

Should stop using leather, etc.

Should avoid zoos, circuses, aquariums, rodeos

These implications and many others are worked out in ANIMAL LIBERATION.

Thirsty Us + Dog

- Our class is on a lifeboat with a dog. Trip to shore takes 2 hours, our lives are not threatened.
- We're painfully thirsty and have a limited supply of water.
- Singer: we must avoid sexism, racism and **speciesism**; we should apply principle of equality

Lifeboat Problems

- (Singer's analysis)



**Dog's pain matters as much as ours;
should share water with dog**

Life and Death: Us + Dog

- Our class is on a lifeboat with a dog. Our weight is excessive, we're starting to sink.
- Someone must be thrown overboard or we'll all die.
- Singer: must avoid sexism, racism, ; should apply principle of equality
- Singer:



Haraway: Companion Species

1. Dogs: History
2. Dogs: Companion Species
3. Dogs: Biocapital
4. Chickens:

Members of the Family Canidae

Jackal
(Black-backed jackal)



Fox
(Kit fox, Red fox)



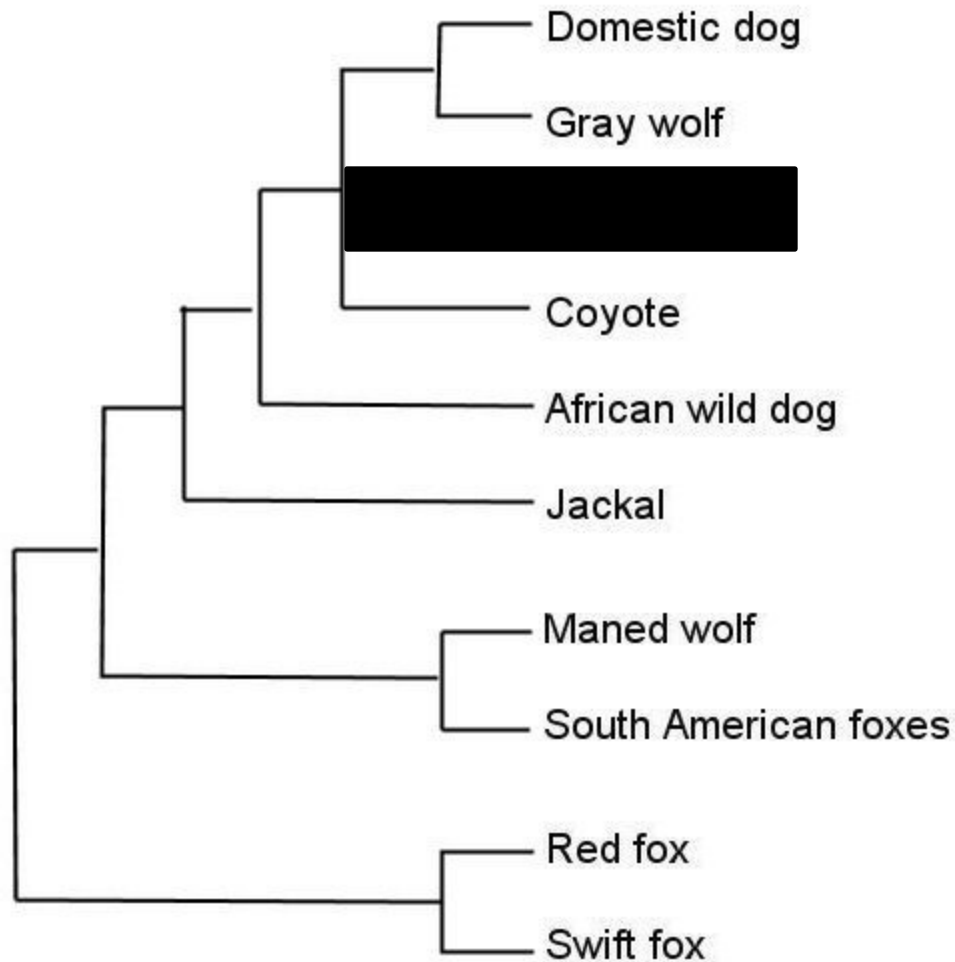
Wolf
(Gray wolf)



**African wild
dog**



Canid Phylogeny



Redrawn from Wayne, 1993. Molecular evolution of the dog family

What did humans give dogs?

- Easy access to high-quality food.
- A safe “home” to raise pups.
- What else...



- Molecular data suggest multiple “domestications” in multiple areas.
- Canids artificially selected for tameness also showed characteristics common to domestic dogs:
 - Curled tails, Mottled coats, Floppy ears
 - Ability to share ‘gaze’ with humans, canids are after all social animals
- Russian Experiments on foxes showed similar connections between floppy ears and domesticity

