

КАЗАНСКИЙ  
ГОСУДАРСТВЕННЫЙ  
МЕДИЦИНСКИЙ  
УНИВЕРСИТЕТ



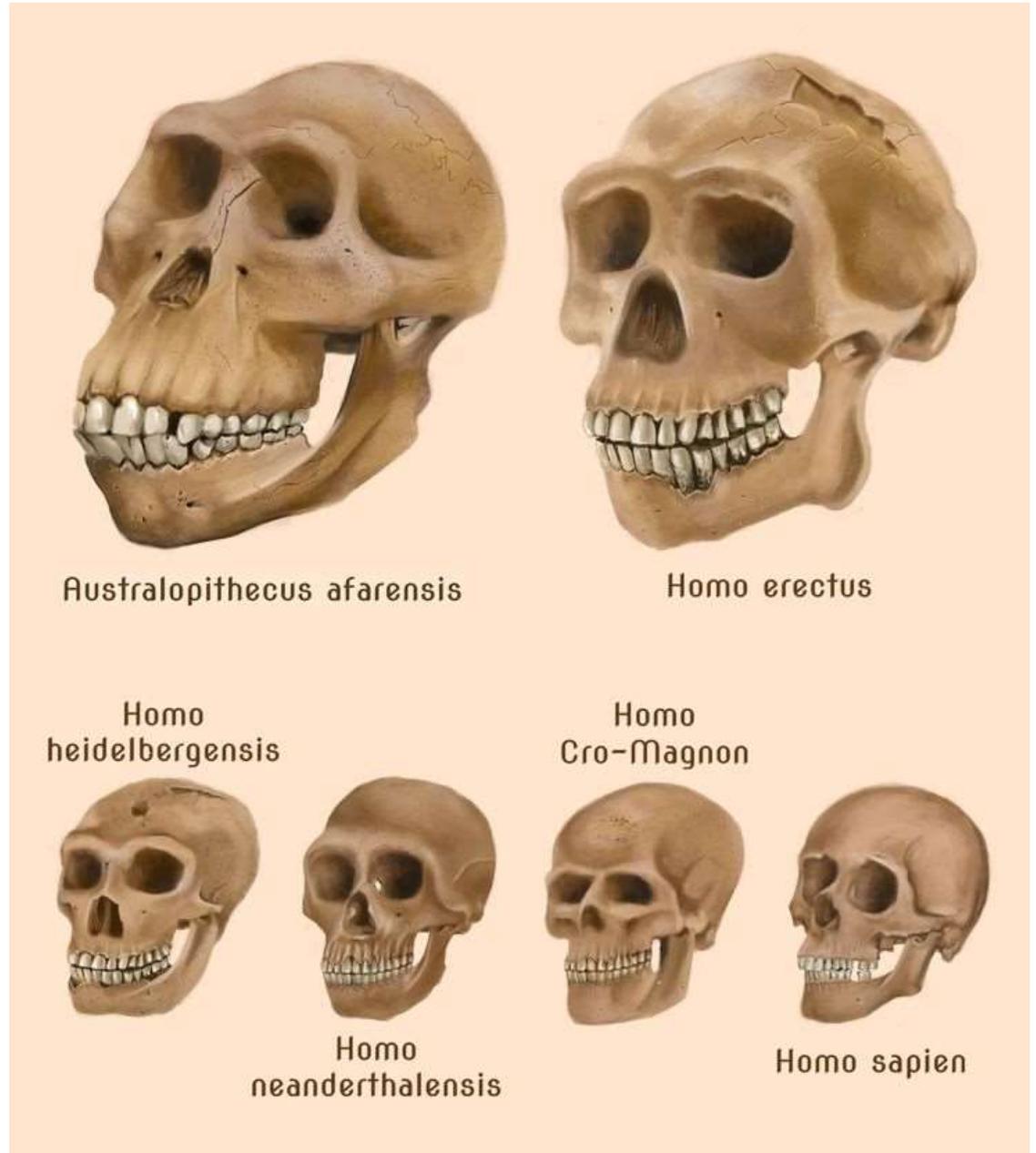
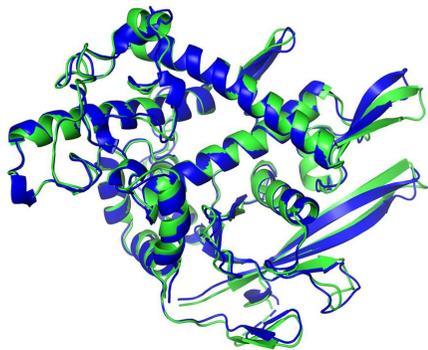
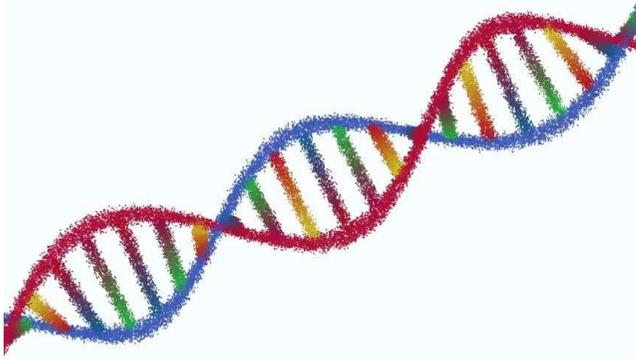
2025г.

## Тема 24. Молекулярная антропология

лекция

Нуруллин Лениз Фаритович  
к.б.н., доцент кафедры  
медицинской биологии и генетики  
КГМУ

# Антропология



Australopithecus afarensis

Homo erectus

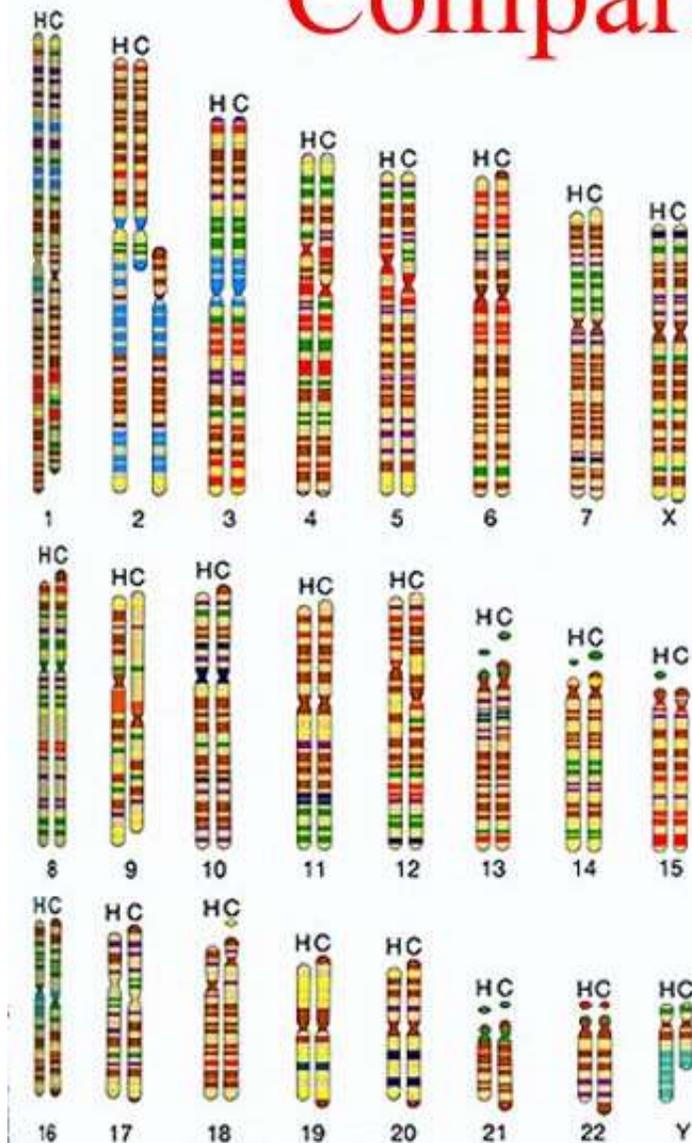
Homo heidelbergensis

Homo Cro-Magnon

Homo neanderthalensis

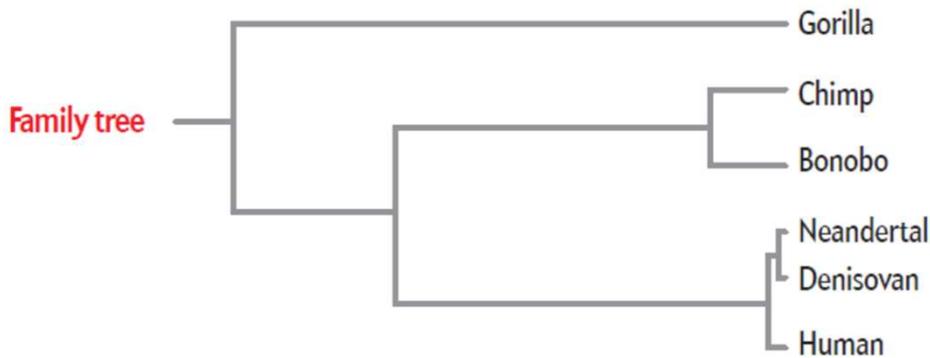
Homo sapien

# Comparing Chromosomes

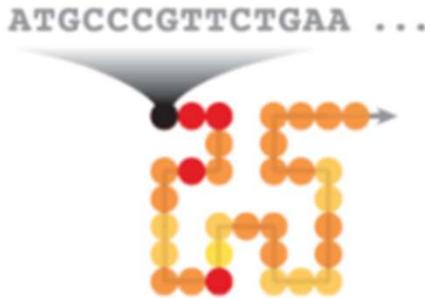


- All apes have 48 chromosomes
- Chromosome bands between human (H) and chimpanzee (C) 99% the same
- Translocation of two ape chromosomes formed human chromosome 2

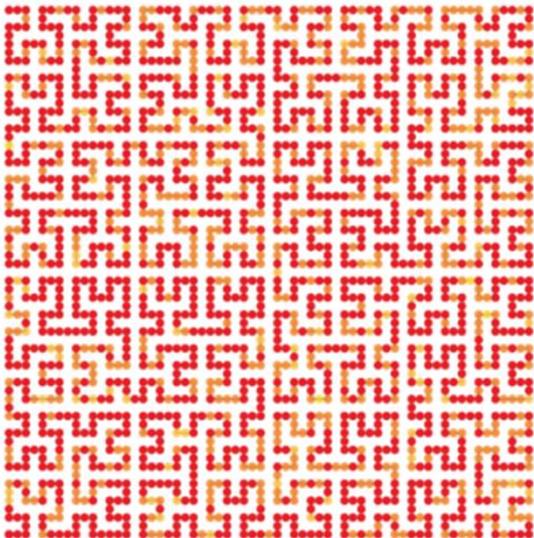
# Сравнение геномов



Each dot represents a sequence of about 500,000 pairs of chemical bases—the A, T, C and G of our genetic code—in the protein-coding portion of the human genome in the order that they appear on our chromosomes.



The color of the dot indicates how well the human sequence matches up with the corresponding sequence in the comparison species, with red signifying a greater difference between the two.



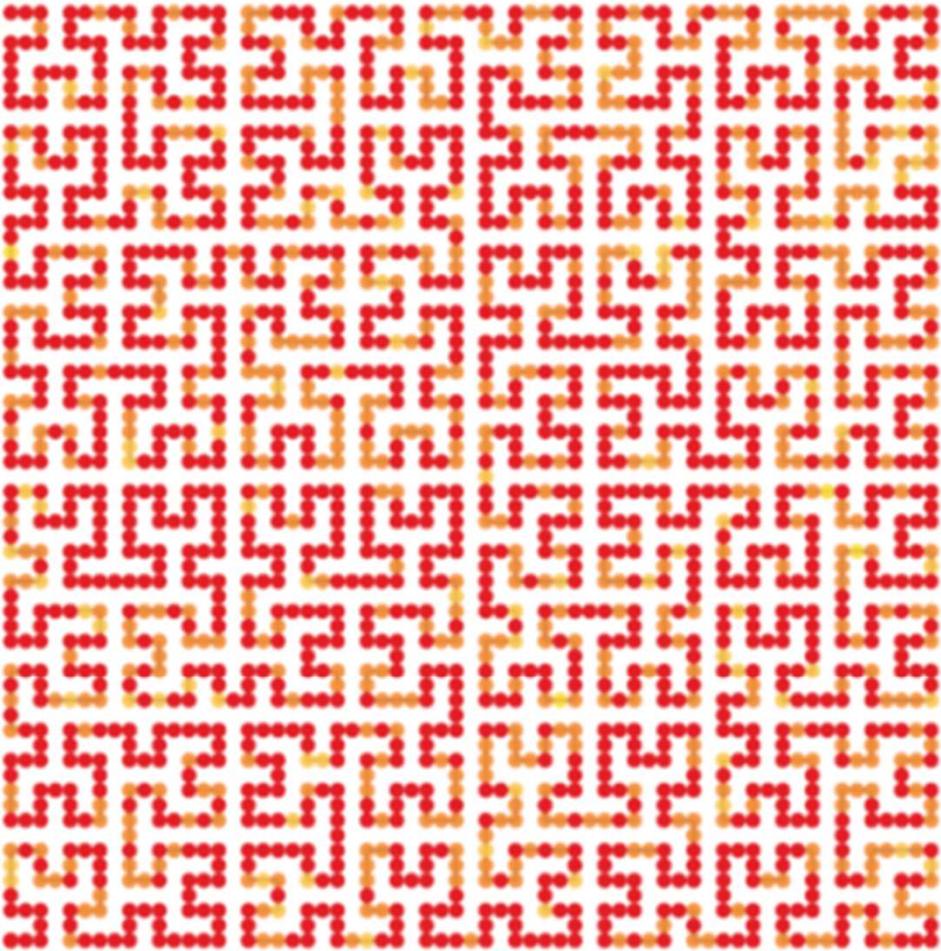
## Gorilla

On the whole, our coding genome differs more from the gorilla's than from the chimp's or the bonobo's, reflecting the fact that we have been evolving along separate trajectories for a longer period. But about 15 percent of the human genome looks more like the gorilla's than the chimp's or the bonobo's.

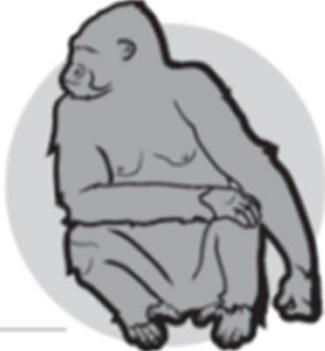
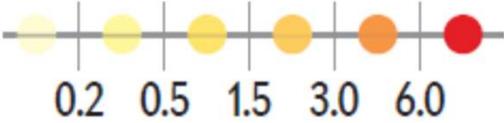
Fraction of different or unaligned bases (%)



# Сравнение геномов



Fraction of different or unaligned bases (%)

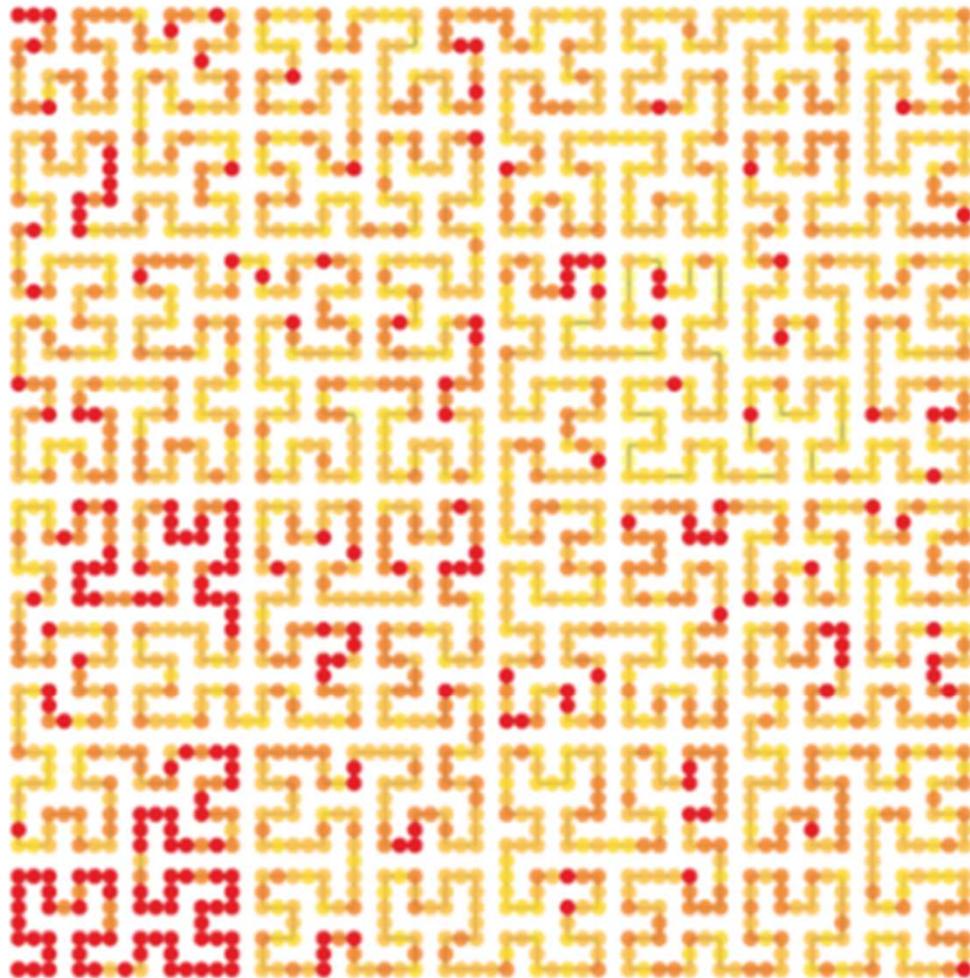


## Gorilla

On the whole, our coding genome differs more from the gorilla's than from the chimp's or the bonobo's, reflecting the fact that we have been evolving along separate trajectories for a longer period. But about 15 percent of the human genome looks more like the gorilla's than the chimp's or the bonobo's.

# Сравнение геномов

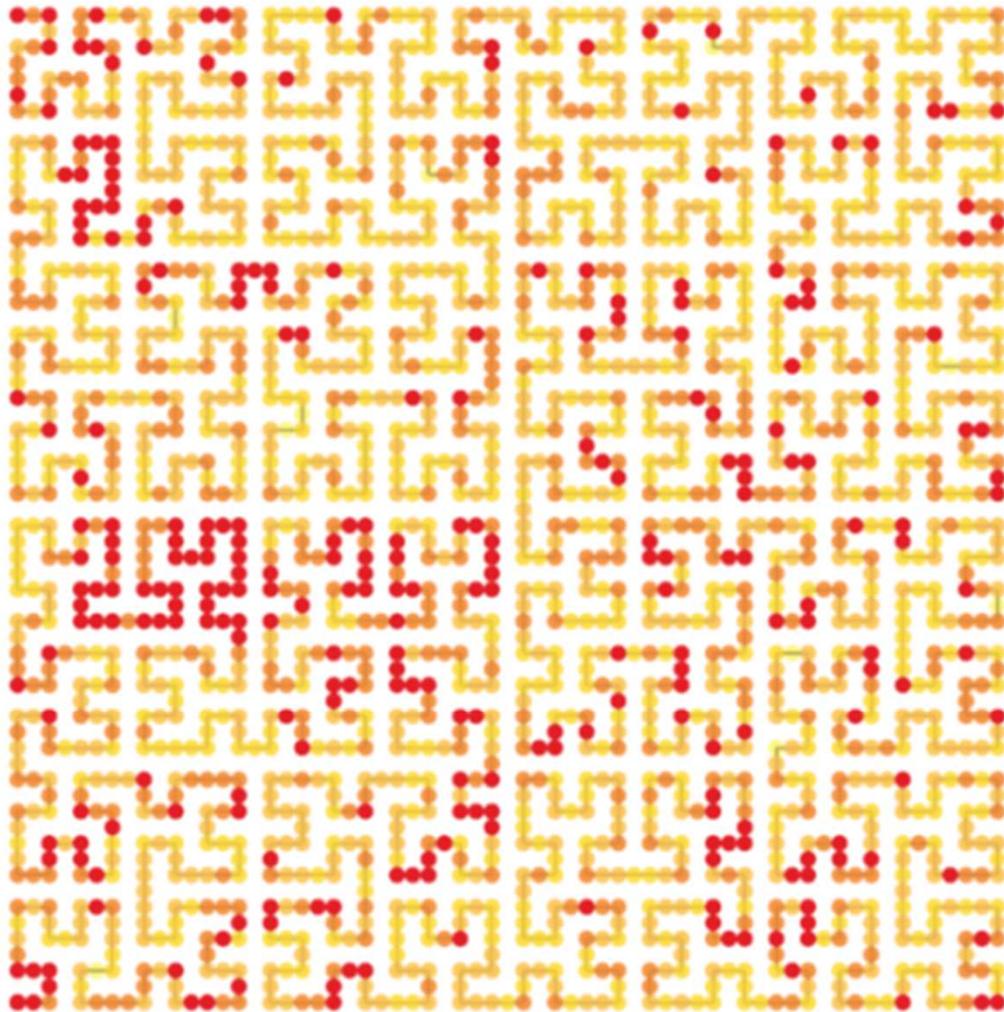
Fraction of different or unaligned bases (%)



## Chimp

Researchers have traditionally considered the chimpanzee, which lives in patriarchal societies, to be our closest living relative and thus the best model for reconstructing the lives of ancient human ancestors. The recent genome-sequencing work calls that view into question, however.

# Сравнение геномов



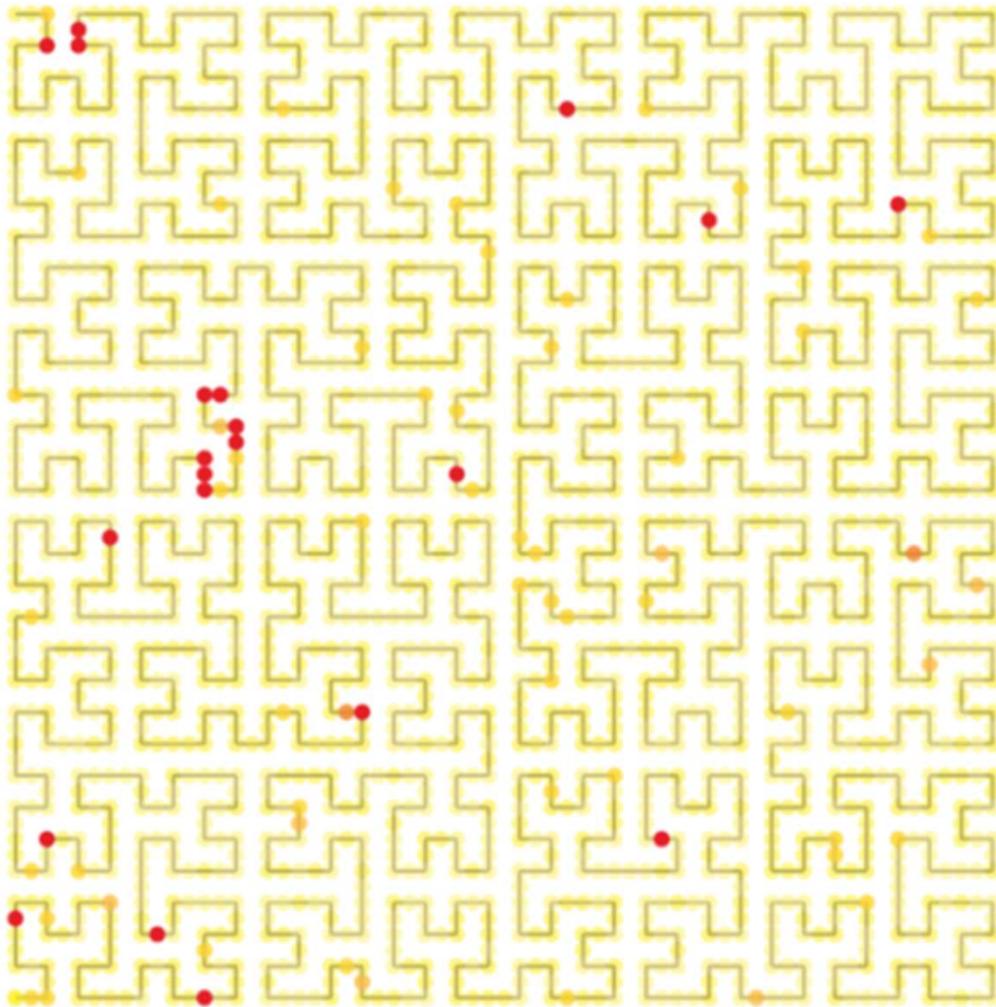
Fraction of different or unaligned bases (%)



## Bonobo

The genome of the bonobo—which has a social structure centered on females—shows it to be just as closely related to us as chimps are, although we differ from the two species in distinctive ways. These findings may force scientists to reconsider how our long-ago forerunners lived.

# Сравнение геномов



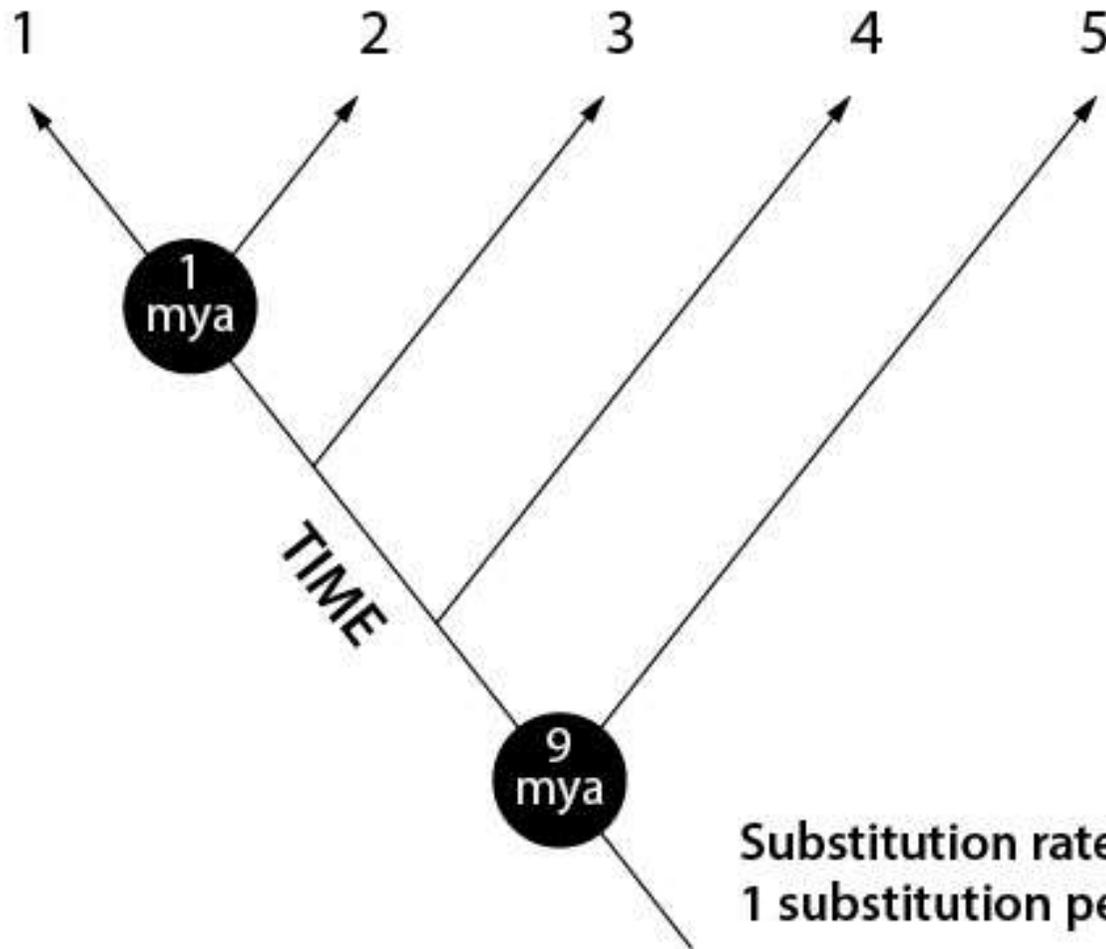
Fraction of different or unaligned bases (%)



## Denisovan

The Denisovans—a group of archaic humans closely related to the Neandertals—show far fewer sequence differences from us than any of the African apes do, having shared a common ancestor with *H. sapiens* in the much more recent past, around 400,000 years ago.

# Молекулярные часы



Sequence of species 1 to 5:

1) ...atccgattattgcacgatat...

2) ...atccgattttgcacgatat...

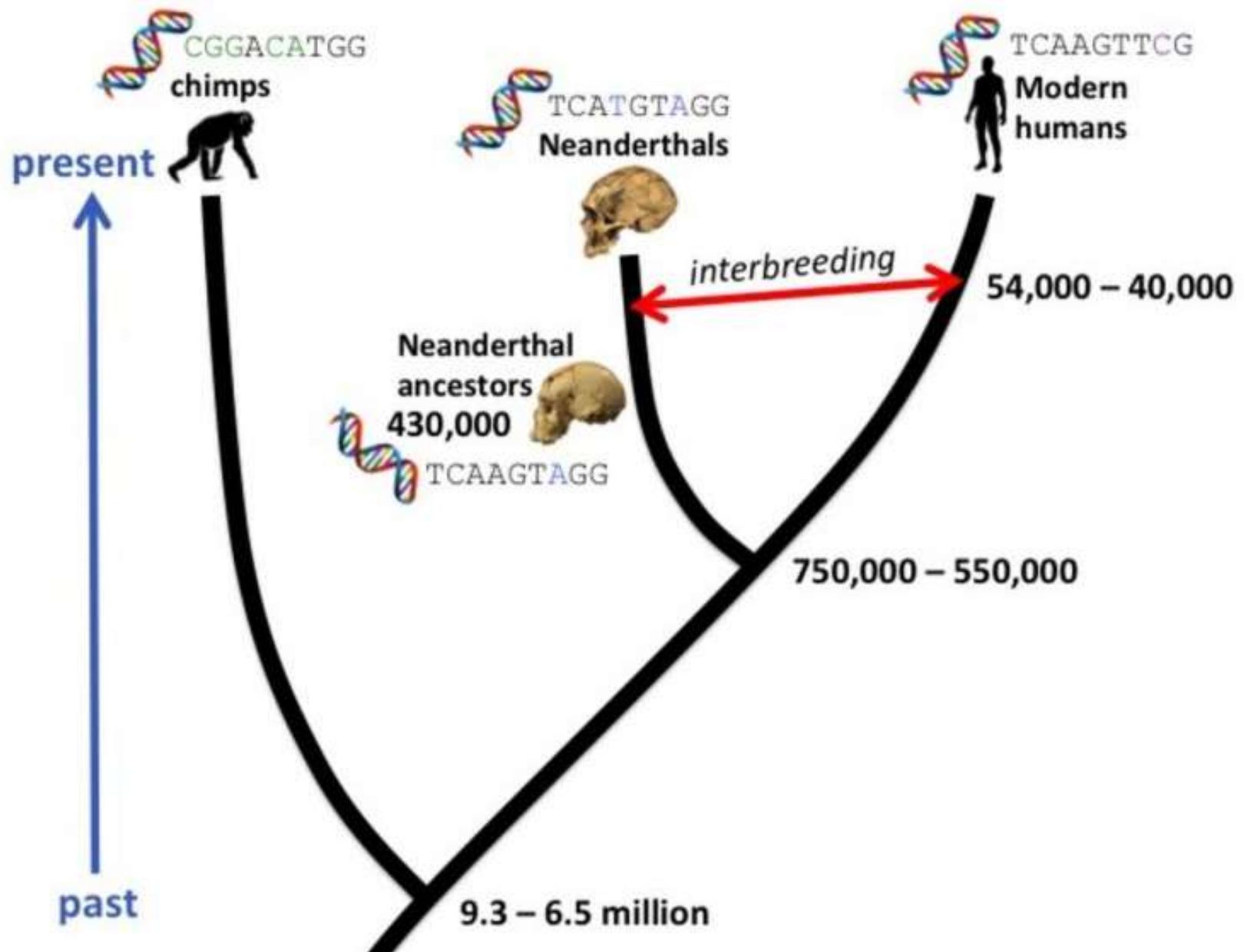
3) ...atccattttgctcgatat...

4) ...ttccaatttgctcgatat...

5) ...ttccaattacctgcatat...

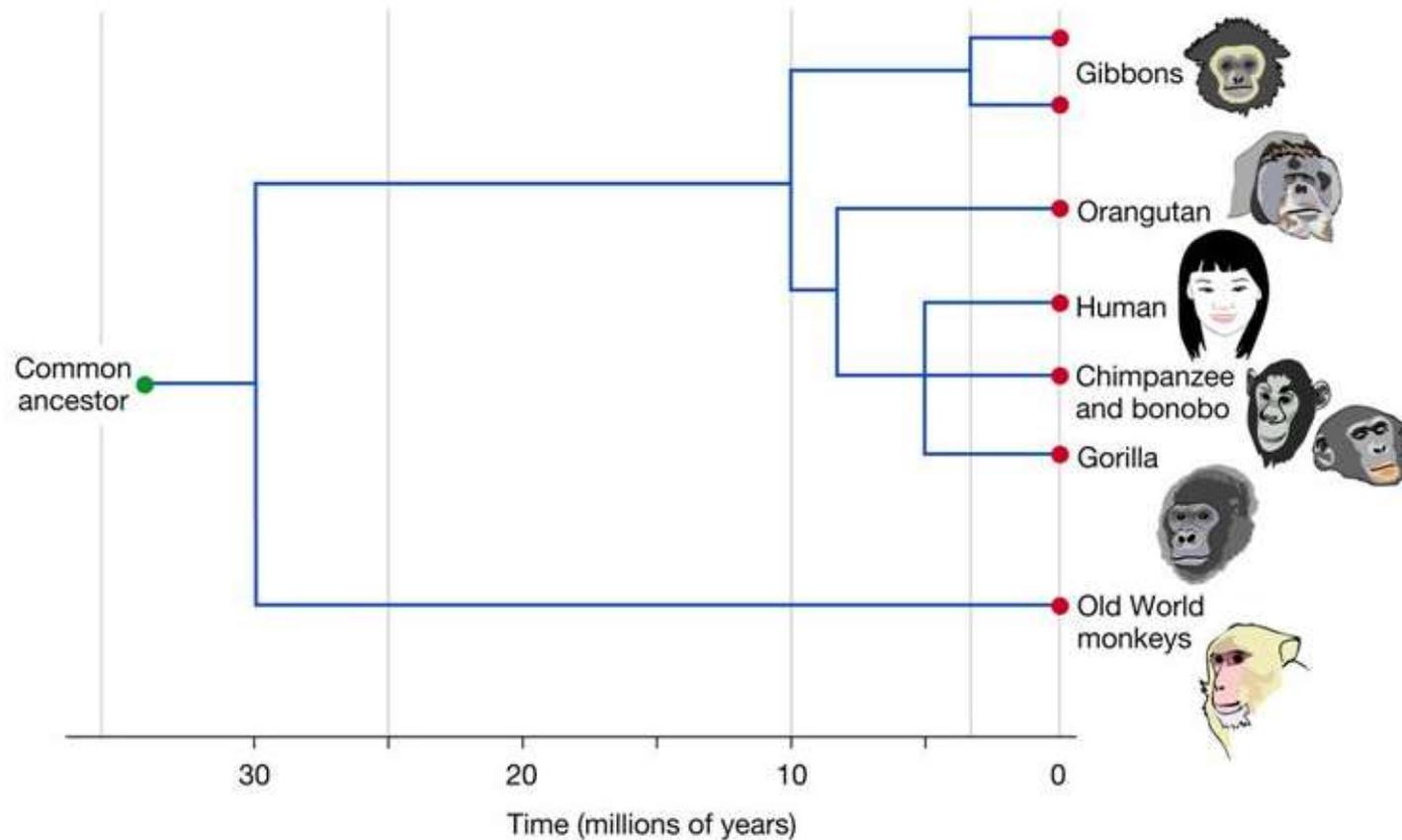
Substitution rate:

1 substitution per 20 nucleotides in 1 million years

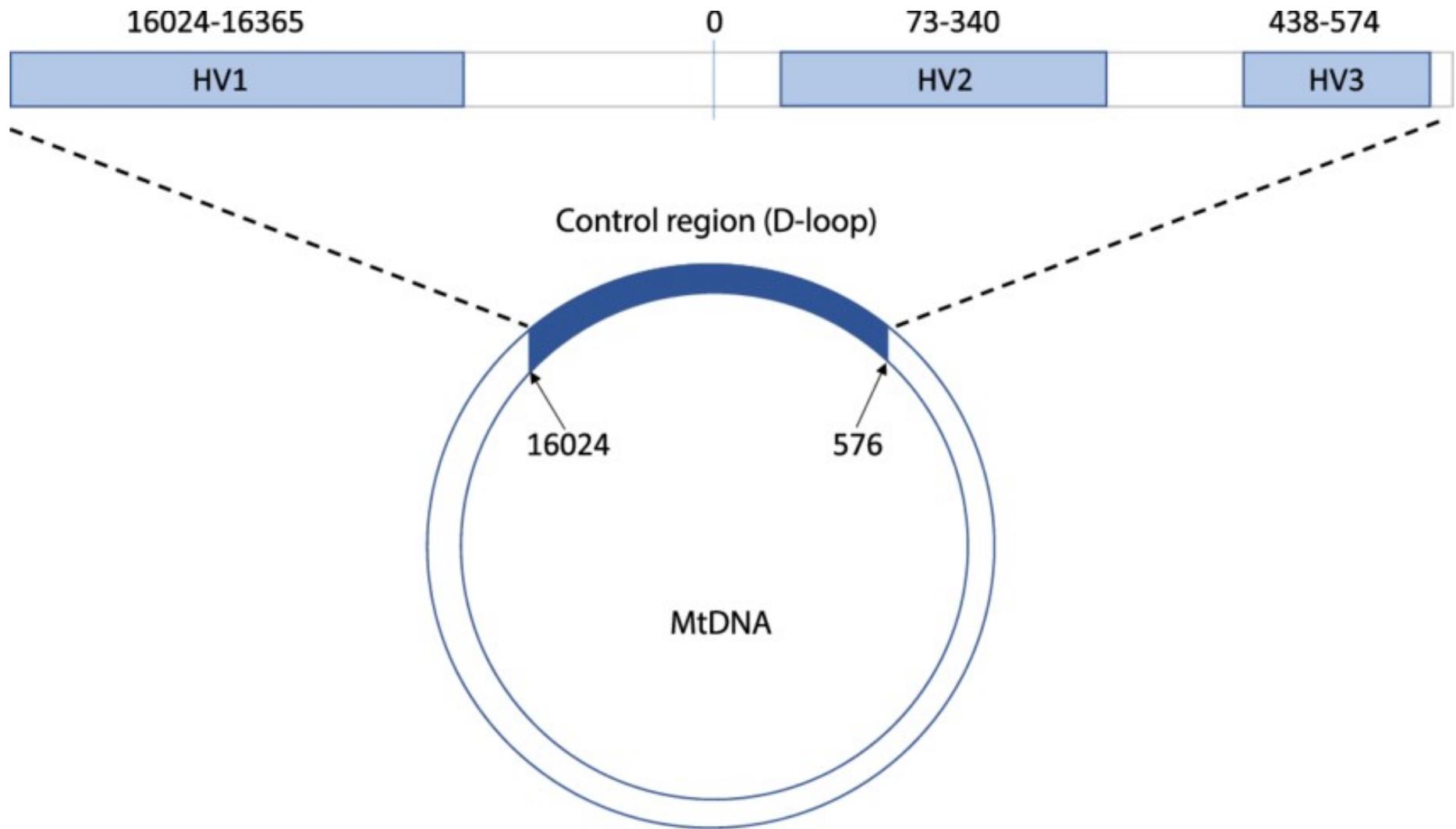


# Иммунологическая дистанция

The phylogeny of apes based on immunological distance as proposed by Sarich and Wilson (1967) (Fig. 19.2)

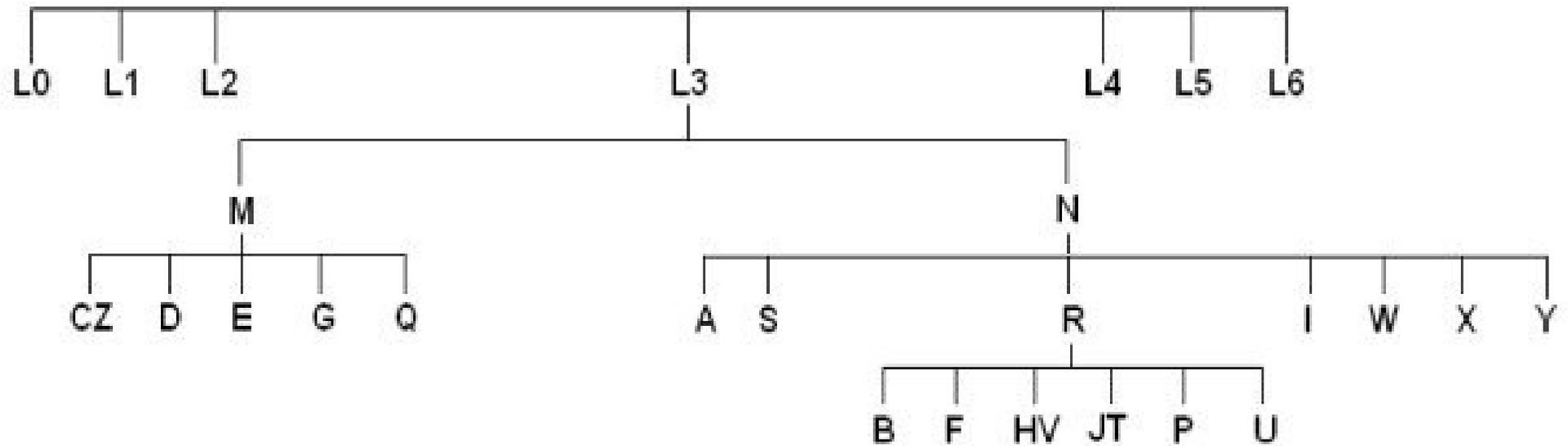


# Митохондриальная ДНК

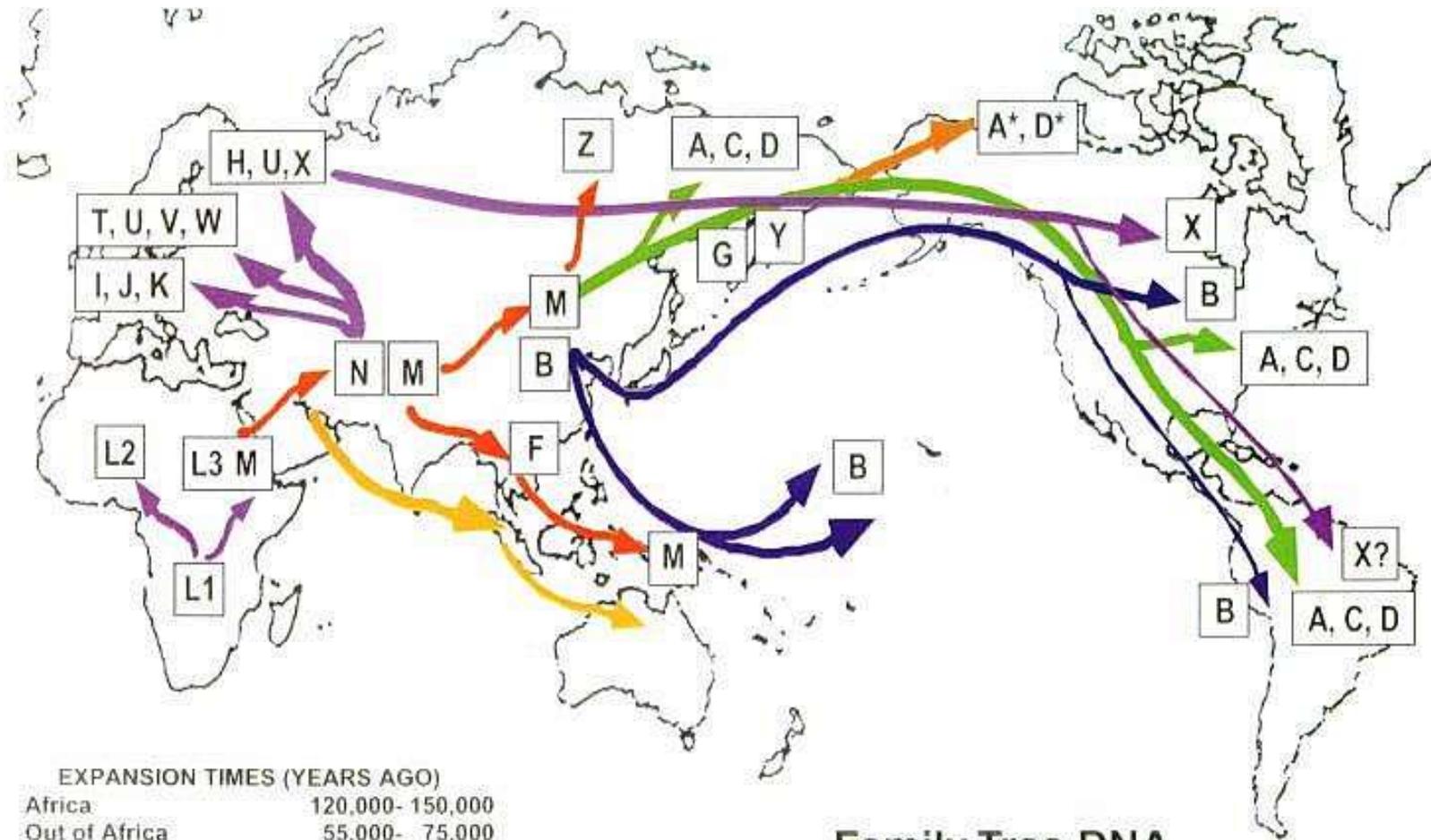


# Митохондриальная Ева

## Mitochondrial DNA Eve



# Гаплогруппы мтДНК

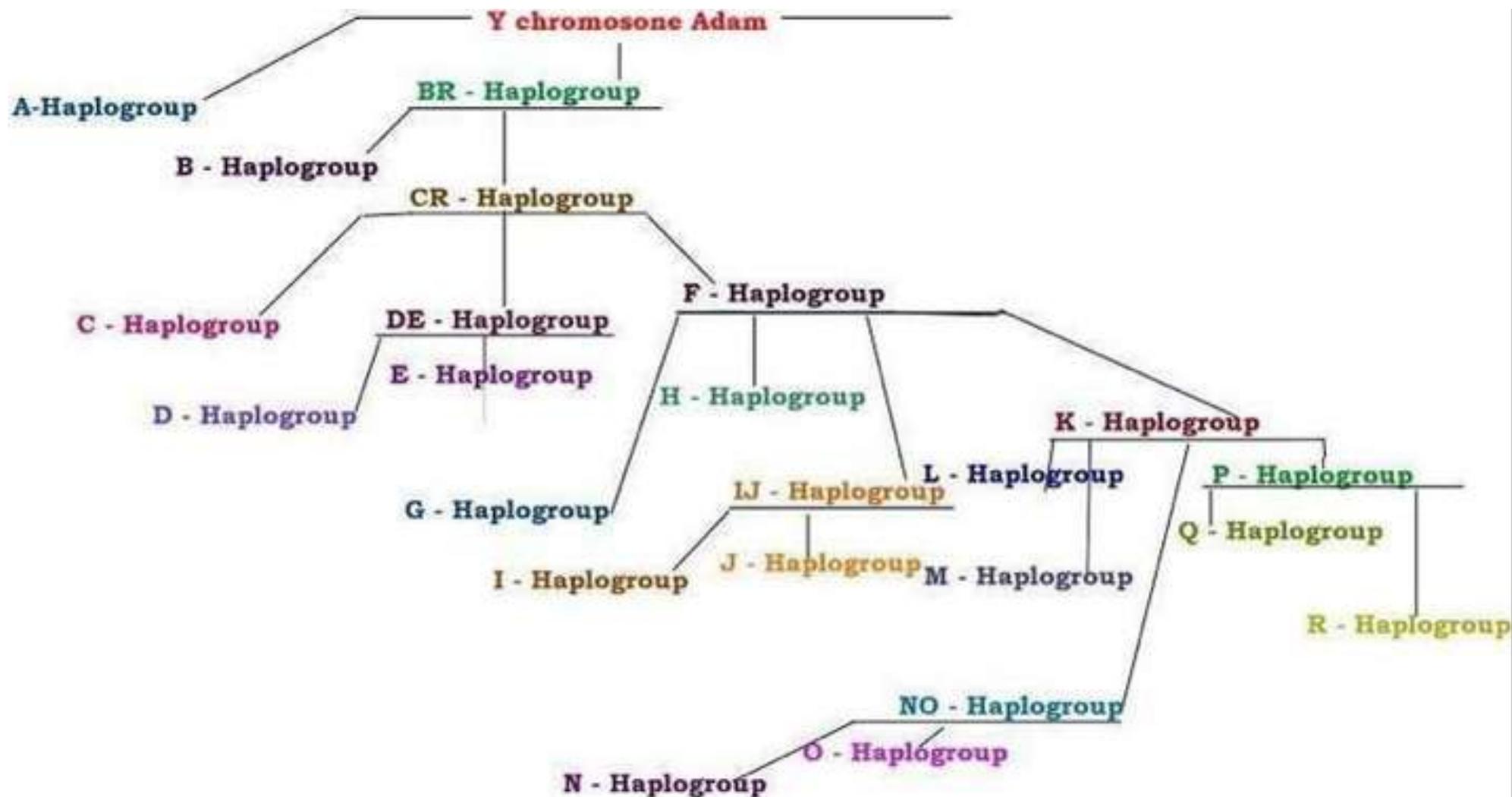


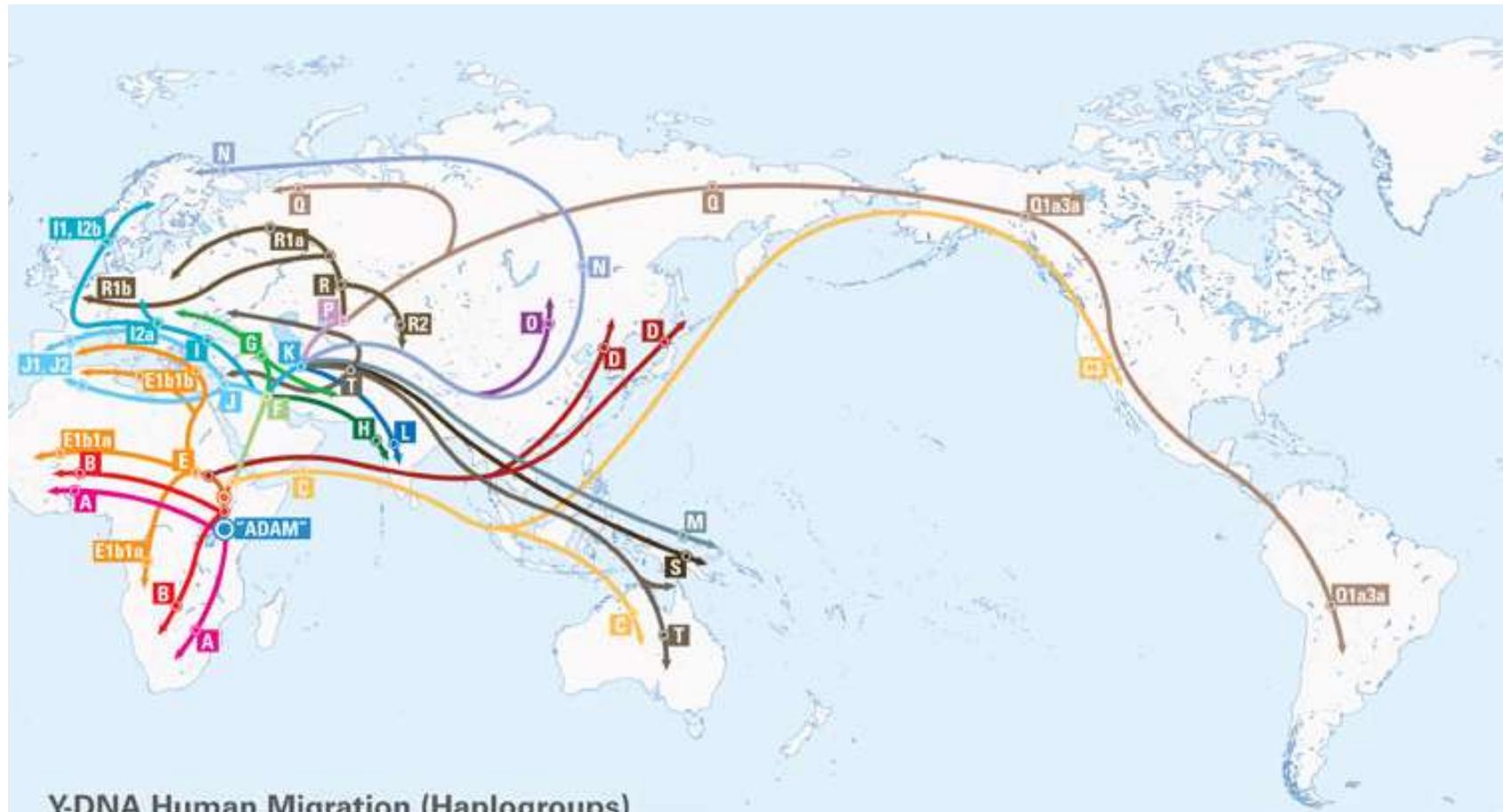
**EXPANSION TIMES (YEARS AGO)**

Africa	120,000- 150,000
Out of Africa	55,000- 75,000
Asia	40,000- 70,000
Australia/PNG	40,000- 60,000
Europe	35,000- 50,000
Americas	15,000- 35,000
Na-Dene/Esk/Aleuts	8,000- 10,000

**Family Tree DNA  
mtDNA Migrations Map**

# Y-хромосомный Адам





### Y-DNA Human Migration (Haplogroups)

Thousands of Years Ago

A	60	G	20	O3	35
B	50	H	30	P	35
CT	50	I	25	Q	20
D	50	J	25	Q1a3a	10
E	50	K	40	R	30
E1b1a	20	L	30	R1a	10
E1b1b	20	M	10	R1b	25
C	50	N	10	S	10
F	45	O	35	T	10



Благодарю  
за внимание!